



Beyond the Beaver Dam

The Success of the NHDES Aquatic Resource Mitigation Fund

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Cover: West Hill Conservation Parcel, Lower Connecticut River watershed
Left: Beaver pond in Merrimack River watershed



Improving the Effectiveness of Wetland Mitigation in New Hampshire: Aquatic Resource Mitigation Fund

By Thomas S. Burack, NHDES Commissioner

New Hampshire has always valued wetland areas – those areas many call swamps, lowlands and marshes. In fact, New Hampshire was among the first states in the nation to pass its own legislation to protect wetlands. The statute has been revised over the years, but the principal goals and focus still remain: to protect these very vulnerable and important features of the landscape that “quietly” provide numerous benefits to people and wildlife.

New Hampshire’s wetlands permitting laws and regulations require parties seeking to construct projects that will have an impact on wetlands to take all reasonable measures to avoid such impacts, to minimize unavoidable impacts, and to provide mitigation for the remaining unavoidable impacts. The regulatory approach is structured in this way because the filling or draining of wetlands results in a permanent loss of important functions provided by these aquatic resources, such as wildlife habitat, water quality improvements and flood storage. Since the late 1990s, protection of upland areas surrounding wetland areas that have significant habitat value has been the preferred form of mitigation for wetland loss, and this approach has increased in importance over time. Other mitigation options include wetland creation, restoration and enhancement, but suitable sites for these types of approaches are not easy to locate and are often not sustainable in the long term. Yet another strategy has been to direct unavoidable development impacts toward lower quality wetlands, in combination with placing greater focus on protection of high value wetland areas, thereby maintaining critical habitat features in the landscape.

As a fourth option for compensating wetland losses, in lieu of the traditional forms of mitigation, NHDES adopted a payment option for applicants unable to find other meaningful mitigation. In 2006, the Aquatic Resource Mitigation (ARM) Fund was established to provide wetland permit applicants the opportunity to make a payment into a watershed account; payments are aggregated on a watershed basis and are then disbursed to significant restoration or land conservation projects through a competitive application process. The ARM Fund program has been very helpful for permit applicants and has resulted in many significant wetland preservation and restoration projects across the state.

Over the past ten years since the ARM Fund was established, 136 applicants have used this form of mitigation and these funds have been used to support projects that restore, enhance and preserve aquatic resources and upland buffers. The program has collected and distributed some \$13,748,100 to 57 different projects, resulting in approximately 12,275 acres of land conservation, 100 acres of wetland restoration, and over 45 miles of stream passage improvements.

The ARM Fund recognizes the potential for long-term, positive environmental results from wetland mitigation that considers watershed goals, assists conservation efforts in recognizing green infrastructure plans of a town or region, and has the ability to target important and vulnerable wetlands in a region for protection. The in-lieu fee program offers something for everyone: a mechanism for developers to proceed with projects once not viable because no compensatory mitigation was practicable; a chance for municipalities to accomplish high priority local conservation goals; and an opportunity for the state to accomplish projects with greater conservation value than can be achieved through conventional compensatory wetland mitigation. Overall, the ARM Fund presents an opportunity to achieve large-scale wetland restoration and land conservation goals that help to sustain a vibrant New Hampshire economy.

“The problem we face is the extension of the social conscience from people to land. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends to do otherwise.”

– Aldo Starker Leopold, 1949



Connecticut River, Upper Connecticut River watershed

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Aquatic Resource Mitigation Fund: Program Success with Funding Habitat Restoration and Protection

Introduction

Since the ARM Fund was established in 2006, 136 applicants have received funding to support projects that restore, enhance and preserve aquatic resources and upland buffers. The program has been very successful for grant applicants and has resulted in approximately 12,275 acres of land conservation, 100 acres of wetland restoration, and over 45 miles of stream passage improvements. This book highlights some of these projects.

The ARM Fund program is rooted in the New Hampshire Department of Environmental Services (NHDES) wetlands permitting process. In New Hampshire, a wetland permit is required for any proposed project that involves excavating, removing, filling, dredging or constructing structures within jurisdictional areas including wetlands, such as forested, scrub-shrub, emergent wetlands, marshes, wet meadows and bogs; surface waters, including the beds and banks of streams, rivers, lakes, ponds and tidal areas; the tidal buffer zone; and sand dunes. Before NHDES will issue a wetland permit, applicants must show that the proposed project will avoid adverse impacts to wetlands and will minimize and mitigate those wetland impacts that are unavoidable. When the impacts are significant, the permittee is required to compensate for the loss of the functions and values of that wetland. NHDES requires that certain projects mitigate the impacts by conducting one (or more) of the following activities.

1. Restoring a previously existing wetland;
2. Preserving land (at least 50% upland) to protect the values of the adjacent wetlands or water resource; or
3. Creating a new wetland in appropriate locations.

The purpose of mitigation is to achieve no net loss of wetland functions and values from development projects. An evaluation of the wetland is conducted to determine the functions and values it performs within the context of the broader landscape. This helps determine what would be lost in a project and compensatory mitigation can be provided to achieve the replacement or protection of similar functions and values.

Improving the effectiveness of mitigation efforts was the goal behind the 2006 legislative changes that created the ARM fund, which allowed developers in certain circumstances to pay a fee to the state of New Hampshire in lieu of performing other forms of mitigation. The in lieu fee program is not a substitute for the requirement to avoid or minimize impacts to wetlands. Where NHDES requires compensatory wetland mitigation, the applicant must still evaluate available opportunities for upland buffer preservation and wetland restoration and creation. Under the in lieu fee program, developers have another option. When an applicant can show to NHDES that compensatory wetland mitigation is impracticable, the applicant may pay a fee in lieu of performing compensatory wetland mitigation. So long as the applicant satisfies certain other criteria, NHDES may grant the wetland permit upon payment of the in lieu fee.

The ARM Fund payments are collected according to nine watershed areas and are advertised as grants for projects to restore wetland and streams, purchase land with high habitat value, and other aquatic resource habitat improvement efforts.

Collaboration of Partners

The ARM Fund program is composed of an eight-member Site Selection Committee (SSC) and overseen by the Army Corps of Engineers with assistance from the U.S. Environmental Protection Agency, Natural Resources Conservation Service and U.S. Fish and Wildlife Service. State agency designees are from NHDES, New Hampshire Fish and Game Department (NHFG), New Hampshire Nature Heritage Bureau (NHB) and the Office of Energy and Planning. Four non-governmental agencies include a member from the New Hampshire Association of Natural Resource Scientists, New Hampshire Association of Conservation Commissions, the Society for the Protection of New Hampshire Forests (SPNHF), and The Nature Conservancy. The available funds are announced in March with a pre-proposal due at end of April. Those proposals are reviewed by the SSC and high-quality projects are invited to submit a full application due

at the end of August. The SSC and federal agencies over several months evaluate the projects, perform field visits to assess the sites, review if there are any NHB species present, determine what connectivity to other protected lands are present and assess the length of stream miles that may be free flowing if the work involves culvert/dam removals.

Once the SSC convenes and develops funding recommendations these are presented to the Wetland Council for final review. Awards are generally announced in late November.

Achieving Success

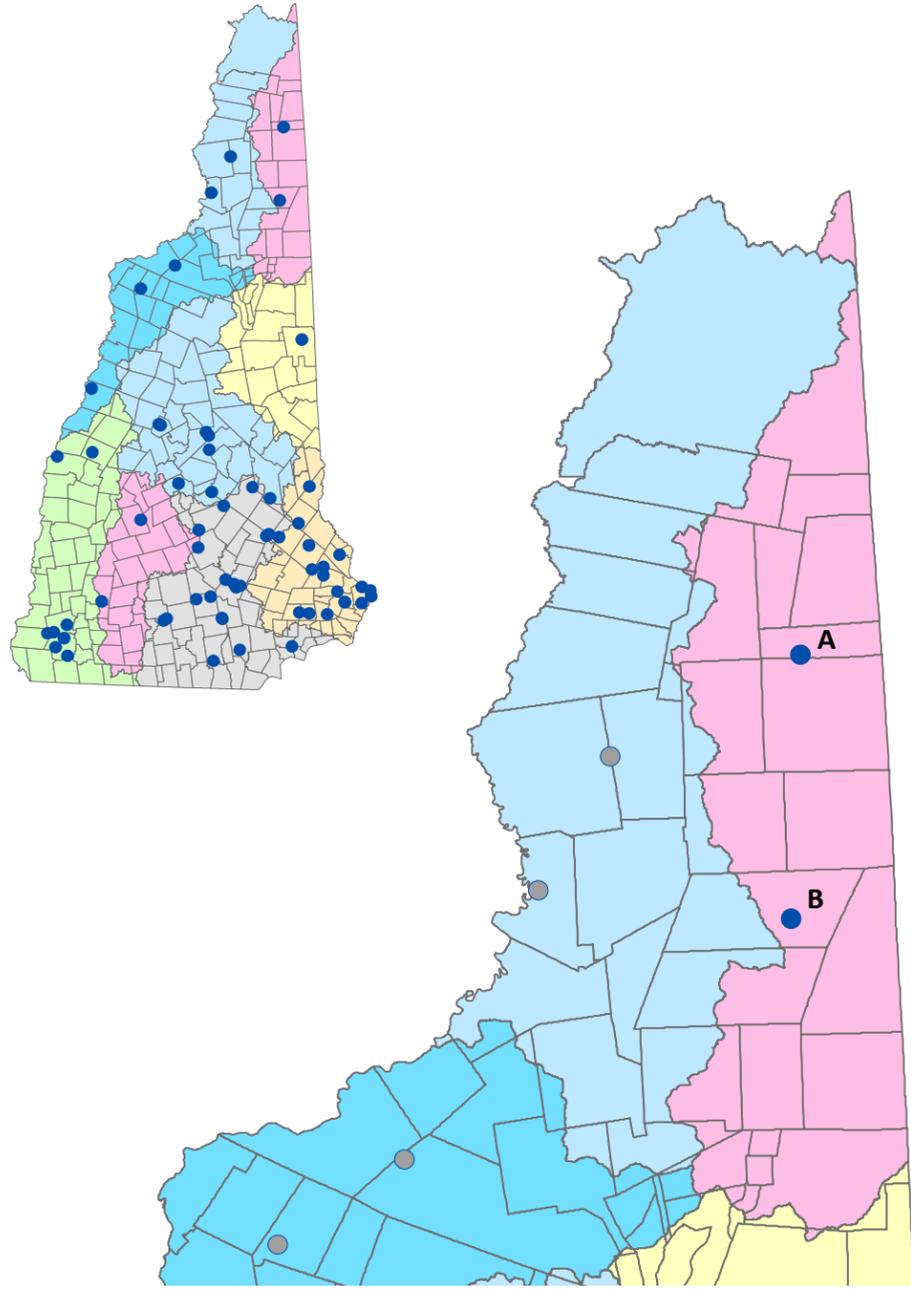
One key component to complete a project is often finding multiple funding sources and to not rely solely on ARM grants. The funds collected since the program was established totals \$13,748,100, which has gone to fund 57 projects.

An ideal project would provide resource restoration within the context of a conservation proposal. The key to success is the long-term protection of those wetland functions that are restored or enhanced. Reviewers will favor proposals that clearly demonstrate how the project's wetland protection, restoration, enhancement and/or creation will be sustainable over the long-term. Where project scores are comparable, preference will be given to those projects that provide long-term protection of the project area and its buffer or provide long-term management to ensure the greatest environmental benefit from funds available. Details of the mitigation program and towns included in the service area can be found at <http://des.nh.gov/organization/divisions/water/wetlands/wmp/index.htm>.

Timing is Everything

During the development stages of the ARM Fund in 2005, the U.S. Fish and Wildlife Service approved New Hampshire's first 10-year Wildlife Action Plan (WAP), which is a blueprint for managing and protecting wildlife that occurs in the state and the habitats that support them. The WAP was developed to assess the relative ecological condition of habitats through the use of statewide GIS data that represent species diversity, landscape context and human impacts. Habitats are then ranked to identify priority conservation targets across all habitat types. These maps, and the underlying data, are used for species recovery, land conservation and habitat restoration efforts. NHFG worked with many stakeholders, organizations, agencies, universities, municipalities, scientists, professionals and volunteers in every part of the state to develop the WAP, which was revised in 2015. The ARM Fund evaluation criteria are linked to information from the WAP and an application for funding may score higher if the project is located in Tier 1, highest ranked areas in the state where habitat exists in the best ecological condition based on biodiversity, arrangement of habitat types on the landscape, and lack of human impacts. The scoring also considers Tier 2 WAP areas, the highest ranked habitat in the biological region, as well as Tier 3 areas, which note location of supporting landscapes. Potential restoration sites or locations where improved management practices could be provided can also be teased out of the WAP data to make a grant application even more valuable.





ARM Fund Service Areas

- Androskoggin River
- Upper Connecticut River
- Middle Connecticut River
- Saco River

- A – Project:** Greenough Ponds
Location: Errol & Wentworth Location, Coos County
Award Amount: \$89,000
- B – Project:** Milan Community Forest
Location: Milan, Coos County
Award Amount: \$61,000

One of the truly remote locations in New Hampshire is in the Androskoggin Headwaters near Umbagog National Wildlife Refuge. In this area of remote forests, streams and ponds, the NHDES ARM fund enabled 31,300 acres to be conserved – one of the largest unprotected properties remaining in the state of New Hampshire. The Trust for Public Land (TPL), a national conservation organization, worked with the landowner, Plum Creek Timber Company, NHFG, the New Hampshire Forest Legacy Program and the Umbagog National Wildlife Refuge in a multiphase effort to bring the most critical wildlife habitat into public ownership while placing the balance of the property under a conservation easement.

TPL worked with Plum Creek from 2007 to 2014 in the Androskoggin region to complete the five-phase conservation transaction. Two phases, totaling 7,452 acres, were added to the Umbagog Refuge in fee. Two working forest conservation easement phases, totaling 22,957 acres, were conveyed to the New Hampshire Division of Forests and Lands. The capstone of the project was the protection of the Greenough Ponds, situated in Errol and Wentworth’s Location in Coos County, where ARM funds enabled the creation of a new 934-acre Wildlife Management Area (WMA) owned and managed by NHFG. The entire property is open to the public for fishing and hunting and is also popular for snowmobiling, with more than 20 miles of state-maintained snowmobile trails. Rich with assets that draw outdoors enthusiasts, the area also appeals to those seeking second homes, thus making the land highly vulnerable to development, particularly along the waterfront areas. The property is also important for the region’s timber economy and the conservation easement will ensure that sustainable practices will be followed on the lands that Plum Creek retained.

Greenough Ponds
Awardee: The Trust for Public Land
Award Amount: \$89,000
Total Project Cost: \$2.475 Million

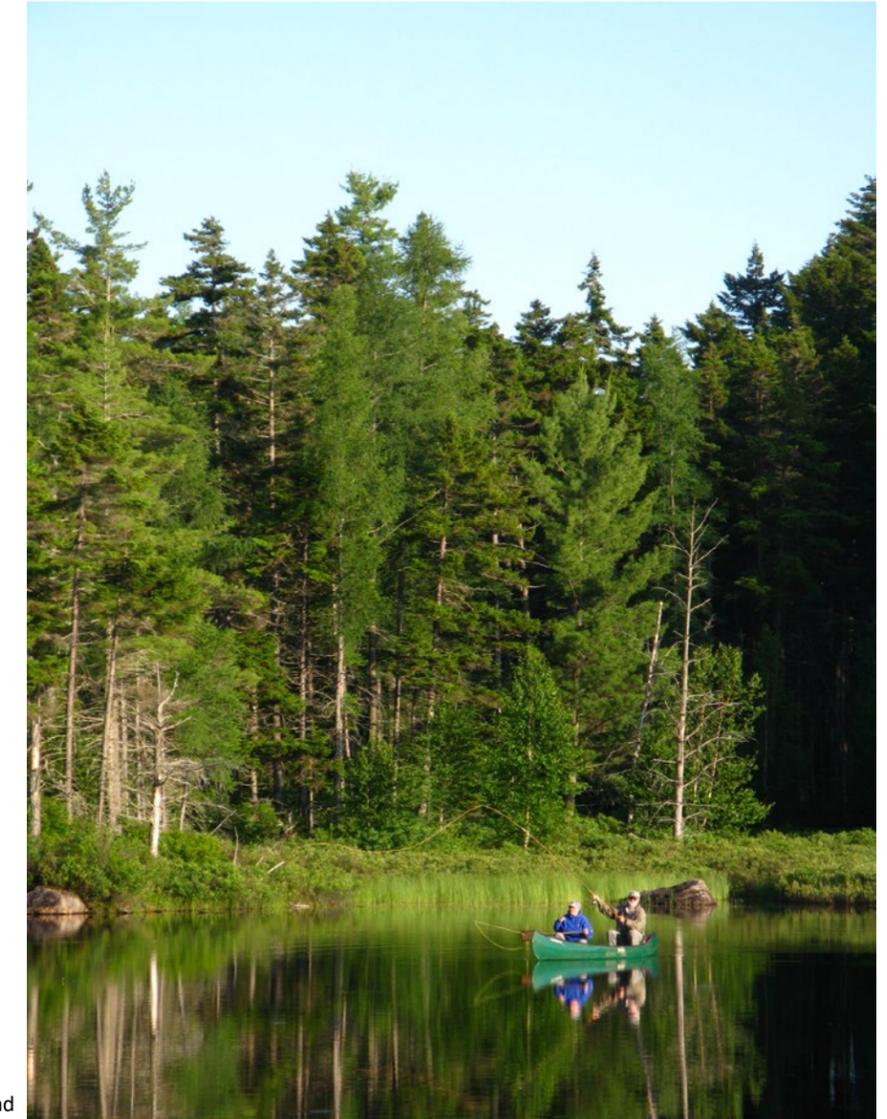


Photo courtesy of The Trust for Public Land

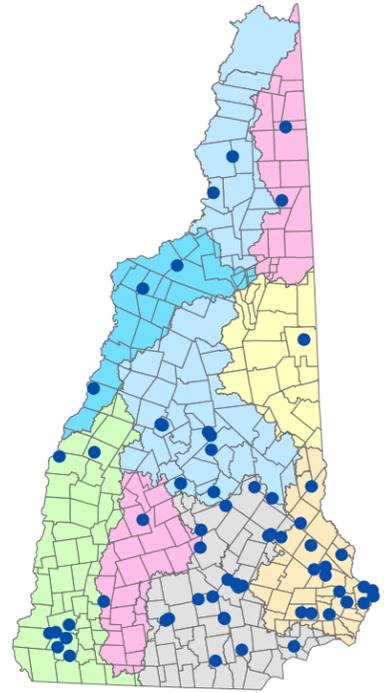
The property highlights are Greenough Pond and Little Greenough Pond, two of only three ponds in New Hampshire that sustain wild non-stocked brook trout populations, making them one of the state's premier cold water fisheries. The Eastern Brook Trout Joint Venture described the property as having "the best of the best" in eastern brook trout habitat. Additionally, the property contains over 56 acres of wetland communities that would be vulnerable to degradation through future cabin development on the 3.9 miles of shorefront if the parcel wasn't protected. NHB records note the presence of loons nesting on both of the ponds; American Marten sightings, which is a state endangered species; an NHB historic record of the Finescale Dace in Little Greenough Pond; and

an osprey nest within 0.5 miles of the property. The high habitat value of the parcel is attributed to it being a part of a large block of intact forest that is an anchor for wildlife connectivity planning. The Atlantic Coast Joint Venture for Bird Conservation identified the property as a "High Priority Habitat Block" for the Northern Forest Region.

"Protection of the Greenough Ponds is a high priority because it secures access for anglers, hunters, snowmobilers and paddlers in one of the most pristine locations in the state," said Glenn Normandeau, executive director of NHFG.

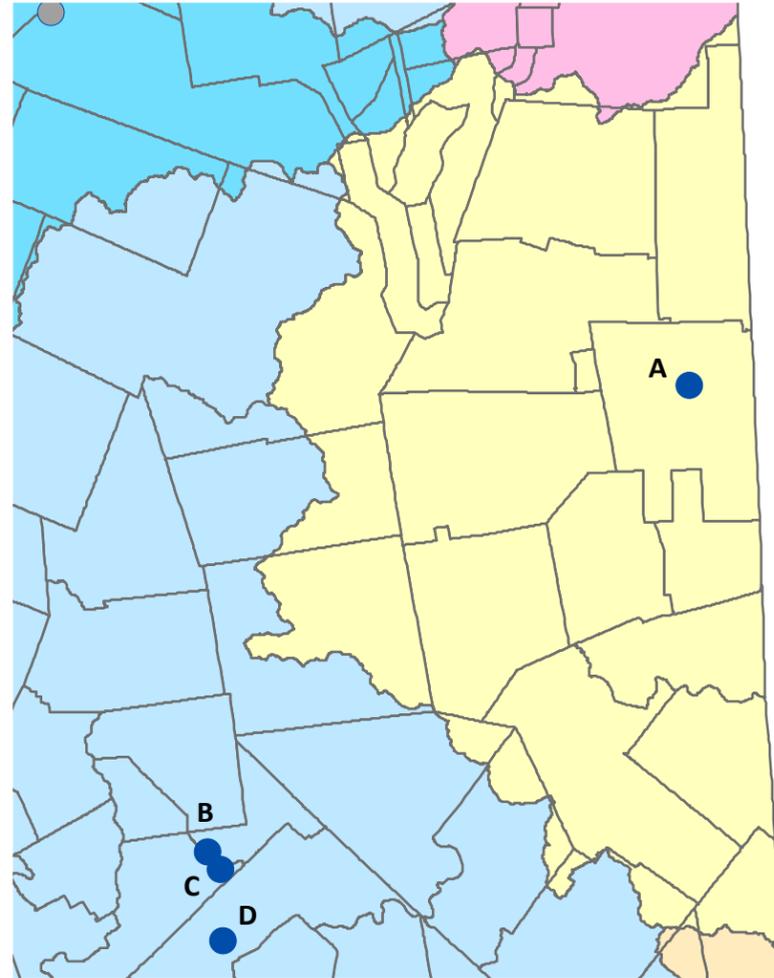


Above and facing photos by Jerry and Marcy Monkman/ Ecophotography courtesy of The Trust for Public Land



ARM Fund Service Areas

- Androscoggin River
- Saco River
- Middle Connecticut River
- Pemigewasset-Winnipesaukee Rivers



A – Project: Green Hills
Location: Conway, Carroll County
Award Amount: \$46,000

B – Project: Fogg Hill Bog
Location: Center Harbor, Belknap County
Award Amount: \$98,500

C – Project: Snake River
Location: New Hampton, Belknap County
Award Amount: \$95,097

D – Project: Lake Wicwas
Location: Meredith, Belknap County
Award Amount: \$64,236

Land conservation projects often take a strong vision and a lot of time to reach their goal. One particular project that spanned many years of hard work and planning is the Green Hill Conservation Project in Conway. In the 1990s, The Nature Conservancy (TNC) protected 2,822 acres thanks in large part to generous funding provided by resident Anna Stearns. In 1998, an additional 1,400 acres abutting the Green Hills Preserve were anonymously donated, and 24 more acres were added in 2010 through a land swap with the White Mountain National Forest. Finally, in 2014, the Green Hills Preserve grew with the addition of 1,300 acres located in Conway, which was the focus of the ARM Fund grant award.

The outcome of the Green Hills Conservation Project was to permanently protect the 1,014-acre Marshall property, including its approximately 56 acres of high-quality, headwater wetlands and on-site adjacent uplands. The project links the Green Hills Preserve and 2,760 acres of other connected conservation land to the north and west with an additional, currently unconnected 240 acres to the east, creating a 6,500-acre block of conserved

Green Hills Conservation Project

Awardee: The Nature Conservancy

Award Amount: \$46,000

Total Project Cost: \$1 million

land in this developed landscape. TNC ultimately owns the parcel and will manage the Marshall property, which spans the southern flanks of the Green Hills. The long-term management of the property will promote the conservation of any rare species, exemplary natural communities and other unique features found on the property. This will include ensuring that public use is compatible with the conservation of these features, providing active restoration and management if needed, and monitoring these features for their health and viability.

NHFG biologists noted that both the healthy, managed forests and a reclaimed gravel pit were in excellent condition and provided diverse, high-quality habitat. The property includes 6.5 miles of tributary streams, encompassing virtually the entire Mason Brook watershed. Mason Brook flows into an important aquifer recharge area along the Saco River just south of the property, helping to maintain water quality in many downstream private and commercial wells and in a river system that serves as a recreational destination for thousands every year. Mason Brook also hosts two fish species of greatest conservation concern, Eastern



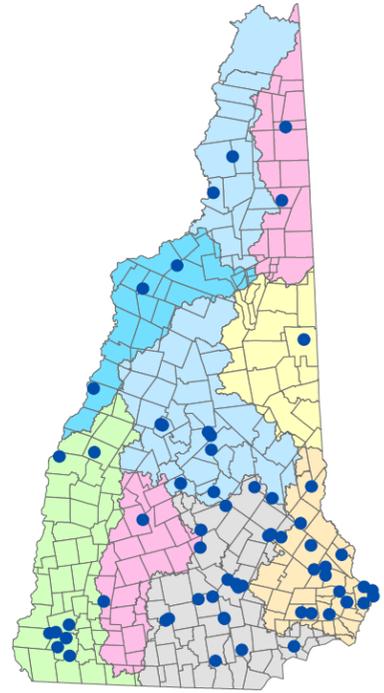
brook trout and slimy sculpin. As funds have become available, the Natural Resource Conservation Service (NRCS) has awarded funds for brook trout spawning habitat restoration work (e.g., “chop and drop”) along Mason Brook to further advance enhancement work in the future. This habitat improvement method has been funded by the ARM Fund in the past in the Nash Stream Forest with huge success.

The Green Hills property is part of a larger matrix of contiguous conservation lands including town land, the Conway State Forest, and the White Mountain National Forest. Some of the currently known natural resource features on the property include black gum - red maple basin swamps, a large deer wintering area, several sensitive headwater streams and their associated riparian zones, and brook trout spawning areas along Mason Brook. The management plan for the property will ensure permanent protection of water resources and species of conservation concern, wildlife habitat management and recreational/educational uses of the property.

Chop and Drop

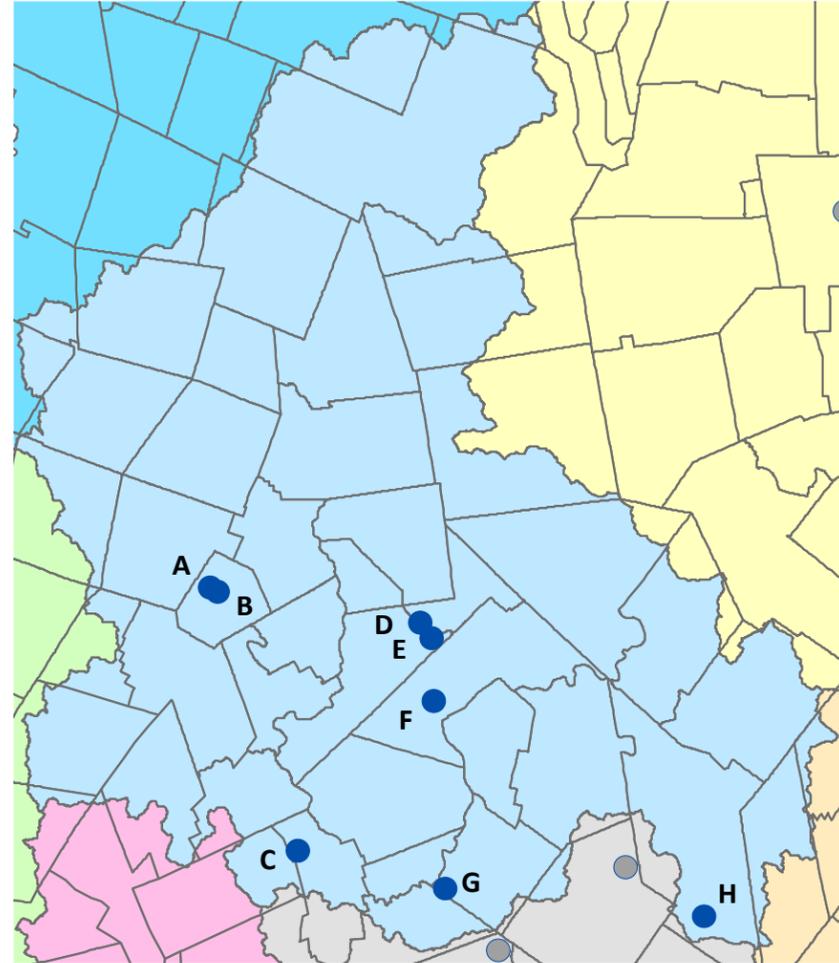
The term “chop and drop” is gaining popularity in the fisheries field as a method to improve stream habitat. The purpose of the work is to simulate natural dead-fall of wood to the stream with the goal of creating pools and habitat diversity, trapping sediment and adding organic matter to the system. Work is often done by hand-operated chainsaws, portable hoists and ratchet pullers to fell selected trees close to the stream so that the majority of the trunk or crown spans the channel. The trees are placed in a manner that maximizes stability and minimizes the potential for movement during high flows. There is no other disturbance in the work areas or need to stabilize the site. Multiple benefits are provided, such as creation and enhancement of brook trout habitat, moderating stream flashiness to create more stable flows, an increase in production of the aquatic insects upon which brook trout prey, and improvements in erosion control.





ARM Fund Service Areas

- Pemigewasset-Winnepesaukee Rivers
- Saco River
- Middle Connecticut River
- Lower Connecticut
- Contoocook River
- Merrimack River



- A – Project:** Frazian Property
Location: Hebron, Grafton County
Award Amount: \$175,000
- B – Project:** Hazelton Farm
Location: Hebron, Grafton County
Award Amount: \$100,000
- C – Project:** Strolling Woods
Location: Franklin, Merrimack County
Award Amount: \$131,500

G – Project: Tioga River WCA
Location: Belmont, Belknap County
Award Amount: \$28,738

H – Project: Coffin Brook
Location: Alton, Belknap County
Award Amount: \$23,000

- D – Project:** Fogg Hill Bog
Location: Center Harbor, Belknap County
Award Amount: \$98,500
- E – Project:** Snake River
Location: New Hampton, Belknap County
Award Amount: \$95,097
- F – Project:** Lake Wicwas
Location: Meredith, Belknap County
Award Amount: \$64,236

Coffin Brook Floodplain Connectivity Improvement Project

Awardee: Town of Alton
Award Amount: \$23,000
Total Project Cost: \$100,000

The Town of Alton received ARM funds in 2010 to implement the Coffin Brook Floodplain Connectivity Improvement Project, which improved public safety, while also improving wetland functions and values. Coffin Brook Road connects Route 140 to Route 28 in Alton and is the only town road that offers southern Alton an alternative road to connect to the downtown area and Route 140 when the Route 28 Merrymeeting Bridge is closed.

Coffin Brook Road, constructed over 140 years ago, is approximately 2.4 miles long and crosses a huge expanse of scrub-shrub and emergent wetlands. Based on a Prime Wetland Study and a wetland evaluation conducted according to the Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire (NH Method), this wetland complex is an ecologically diverse system that provides a wide range of wetland functions and values, including large flood storage capacity, nutrient attenuation, production export, wildlife habitat, sediment/toxicant retention, shoreland stabilization, visual aesthetics and noteworthiness. While noted as present, these functions and values were reduced by the fragmentation of the road.

The road also flooded on a regular basis because of the inadequacy of the area under the bridge to convey the floodwater, which should flow over the wetlands but was interrupted by the roadbed. After rain events of two inches or more, approximately 400 linear feet of Coffin Brook Road would flood, and the road would close. During larger events, the road would be flooded with two to three feet of water, a major safety concern. The long-term flooding also impacted water quality, as floodwater would crest the road and wash sediment and contaminants into the



stream and adjacent wetlands.

To address the frequent flooding of the road, the Town retained an engineer who determined that the existing 24-foot wide bridge on Coffin Brook was adequately sized but that the large adjacent wetland complex lacked adequate floodplain connectivity. In July 2011, seven 34 x 22-inch pre-cast elliptical concrete floodplain culverts were installed to prevent flooding and improve the functions and values of the wetland floodplain systems by promoting nutrient cycling and wildlife passage. Plantings were also installed to improve natural bank stabilization.

Since construction in 2011, the project objectives to improve public safety and improve wetland functions and values have been achieved. There were several large rain events, including Tropical Storm Irene in August 2011 when approximately 5.5 inches of rain fell in Alton, and Hurricane Sandy in October 2012, and flooding was not an issue. During monitoring events, sediment deposition was not observed on the road surface or in adjacent wetland areas. There was no evidence of undercutting or washouts around the floodplain culverts. These observations indicate restored hydrologic continuity per the design intent.

It is anticipated that the site will continue to prevent flooding and road damage within the parameters of the project design. Additionally, the restored hydrologic continuity within the Coffin Brook floodplain will have a positive effect on the overall wetland system's functions and values (as determined by the NH Method). By alleviating some of the fragmentation caused by the old road design, nutrient cycling and wildlife dispersal have been enhanced. Since floodwaters do not overtop the road, sediment and pollutants are less likely to be flushed into river system. Over time, these design features will also have a positive effect on the larger overall riverine floodplain system's ability to provide flood storage capacity, nutrient attenuation and production export.

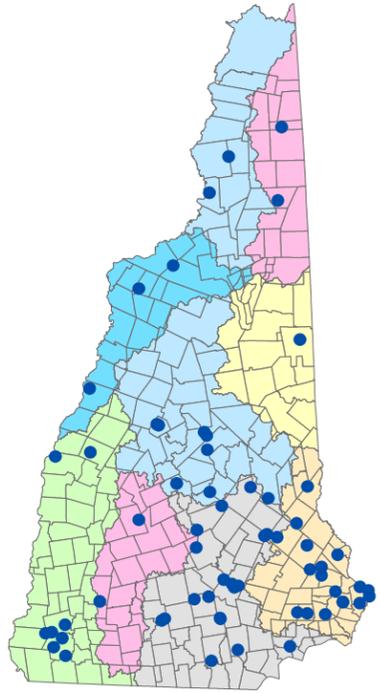


NH Method

The Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire (NH Method) provides communities, conservation groups and professionals a practical method for evaluating wetland functions. Originally published in 1991, the NH Method was first revised in 2011 and updated in 2012 and 2013. Wetland evaluation is the process of determining the values of a wetland based on an assessment of the functions it performs. A wetland inventory identifies and maps all wetlands in a study area using available map and aerial photo resources (such as the National Wetland Inventory maps, satellite imagery and LIDAR. NRCS Soil Maps, color, black & white or infrared aerial photos). Details on the NH Method and access to the Wetland Mapper can be found at <https://nhmethod.org>.

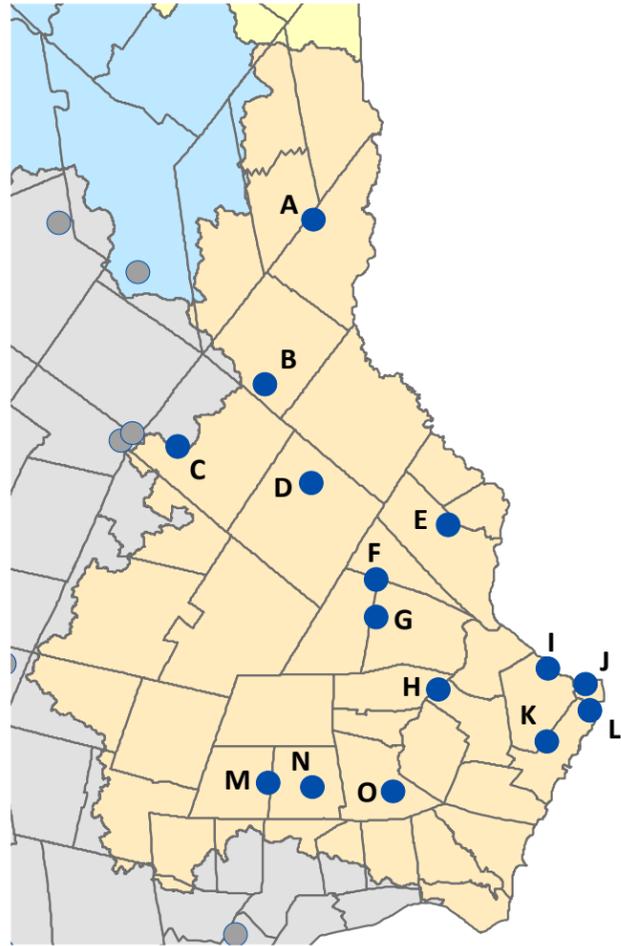


Fogg Hill Project, Center Harbor



ARM Fund Service Areas

- Pemigewasset-Winnepesaukee Rivers
- Saco River
- Salmon Falls – Piscataqua Rivers
- Merrimack River



A – Project: Siemon Family Trust
Location: Milton, Strafford County
Award Amount: \$29,300

B – Project: Huppe Farm
Location: Farmington, Strafford County
Award Amount: \$75,000

C – Project: Evans Mountain
Location: Strafford, Belknap County
Award Amount: \$367,750

D – Project: Calef Isinglass River
Location: Barrington, Strafford County
Award Amount: \$100,000

E – Project: Berry Brook Restoration
Location: Dover, Strafford County
Award Amount: \$440,000

F – Project: Powder Major’s Farm and Forest
Location: Durham, Strafford County
Award Amount: \$148,000

G – Project: Sprucewood/Oyster River Forest
Location: Durham, Strafford County
Award Amount: \$500,000

H – Project: TNC Oyster Restoration
Location: Greenland, Rockingham County
Award Amount: \$190,000

I – Project: Cutts Cove Restoration
Location: Portsmouth, Rockingham County
Award Amount: \$135,000

J – Project: River Road
Location: New Castle, Rockingham County
Award Amount: \$27,993

K – Project: Berry’s Brook
Location: Rye, Rockingham County
Award Amount: \$121,000

L – Project: Odiorne Point
Location: Rye, Rockingham County
Award Amount: \$43,000

M – Project: Spruce Swamp
Location: Fremont, Rockingham County
Award Amount: \$15,000

N – Project: Exeter River Project
Location: Brentwood, Rockingham County
Award Amount: \$78,468

O – Project: Exeter Great Dam Removal
Location: Exeter, Rockingham County
Award Amount: \$100,000

Berry Brook, 2010 **Awardee:** University of New Hampshire **Award Amount:** \$440,000

The Berry Brook Watershed Restoration project is an Urban Watershed Renewal effort in Dover that is being implemented through structural improvements of both storm-water management and stream restoration as well as the non-structural techniques of education and outreach. This ARM Fund project was the initial phase of on-going activities in the Berry Brook Watershed that have become a joint effort between the University of New Hampshire Storm-water Center (UNHSC) and the City of Dover, funded by a series of grants from NHDES. The Berry Brook Watershed represents a unique opportunity to work within a vibrant and supportive community at a neighborhood scale, partner with a local municipality, and measure watershed and ecosystem response in relation to restoration activities. The project also builds on partnerships with the Cocheco River Watershed Coalition (CRWC) and NHFG.



Berry Brook, a tributary to the Cocheco River, is a 0.9-mile-long stream in a 185-acre watershed in downtown Dover that is almost entirely built-out with 30% impervious cover. Generally speaking, impervious cover refers to surfaces such as parking lots, roadways and rooftops from which water runs off, instead of soaking into the soil. Berry Brook is listed as impaired for aquatic habitat and primary contact recreation due to benthic macroinvertebrate monitoring and high bacteria counts. These impacts are typical of high percentages of impervious cover, which contributes to large peak storm flows, low base-flows, and runoff contaminated by temperature, solids, metals, nutrients, and bacteria as it flows directly into the brook. Restoring the brook includes a combined approach of daylighting a large section of the brook and incorporating stormwater improvements to manage rainfall at

the source, increasing infiltration and treatment of stormwater.

The headwaters of Berry Brook originate in an area that was utilized by the City of Dover for its water supply dating back to 1888. Over time, the headwaters were piped underground when the site was developed for Dover’s municipal water supply. This area was the target of wetland and stream restoration activities. The restored area includes a previously existing 1-acre wetland, a newly created 3.2 acre wetland/floodplain complex and upland slopes serving as a natural buffer to the 1,000-foot-long riparian corridor. In addition, a stormwater treatment feature – a subsurface gravel wetland – funded separately by a NHDES Watershed Assistance Grant, is located in the northern part of this area. This treatment feature removes sediment and other

pollutants from stormwater generated from an upgradient shopping plaza and associated parking area, before it is discharged into the headwaters of Berry Brook.

In total, this area now consists of approximately five acres of “undeveloped” land, most of which was previously the storage yard for the city’s Public Works Department. The headwaters of Berry Brook were restored and reconnected through the reconstruction/daylighting of approximately 1,000 feet of stream channel. The enhanced wetland and stream channel are intended to improve water quality and habitat functions as well as create a green space in the heart of the watershed. The area is frequently used by neighborhood residents as a path from the Horne Street School area, to the shopping plaza.

Conservation of the 970-acre Evans Mountain property was a goal of the Town of Strafford for over three decades. Conservation of the area was recognized as a priority in the town’s Master Plan, Bear-Paw Regional Greenways Conservation Plan, WAP and the Conservation Plan for New Hampshire’s Coastal Watersheds. The Town of Strafford, in conjunction with the Blue Hills Foundation and Bear-Paw Regional Greenways, worked over many years to permanently protect the property and that goal was achieved in 2012.

The Evans Mountain property is now part of a 6,000-acre unfragmented forest that includes headwater streams of Bow Lake and the Nippo Brook/Isinglass Rivers. This block directly abuts another 16,000-acre block just to the north of New Hampshire Route 126, which is the largest unfragmented block remaining in this region of the state. Large, unfragmented forest ecosystems like this offer vital support to the region’s biodiversity and provide

resiliency against climate change. Wildlife such as moose, bobcat and bear depend on these large areas of habitat to survive and some bird species, including goshawk and veery, depend on the forest interior habitats provided by sites such as this to breed.

A true gem in this region, almost all of the property is ranked as either “highest ranked in the state” or “highest ranked in the biological region” in the WAP with approximately 67 acres of wetlands, multiple beaver ponds, vernal pools and waterfalls as well as cliff slopes and exemplary natural communities. The property is used for multiple recreational uses and includes the summit of the mountain with views overlooking Bow Lake to the south and of Mount Washington to the north.

The outstanding features of the project appealed to the goals of the ARM Fund as well as to local and creative funding sources. Other funding sources included the Strafford Conservation Commission/Fund, the Blue Hills Foundation, the New Hampshire Land and Cultural Heritage Investment Program (LCHIP), the Open Space Institute - Saving New England’s Wildlife program, the Samuel P. Hunt Foundation, and Piscataqua Region Estuaries Partnership. In addition, over \$40,000 was raised in private contributions for the project, including over \$7,000 from a “Flamingo Flock,” where residents could donate to have a flock of flamingos placed on other residents’ lawns! An additional \$25,000 was generated from a Harvest Breakfast.

The emphasis of the success of this project was on the land protection, but the project also included a wetland restoration and aquatic resource im-

Evans Mountain, 2010
Awardee: Bear-Paw Regional Greenways
Award Amount: \$367,750
Total Project Cost: \$920,000



Berry Brook before



Berry Brook after



Photo courtesy Harmony Anderson

provement component that restored 18 various sites that had been impacted by road building and other activities associated with heavy resource extraction by prior owners. These restoration activities would not only have a favorable impact on the wetlands immediately affected but would also enhance the ecological integrity of the entire protected property.

The ARM Fund provided \$367,750 in grant funds toward the total project cost of \$920,000. The area will be managed according to a professionally prepared Stewardship Plan required by the conservation easement. The plan will address the protection of species of conservation concern, wetland restoration and water quality protection, wildlife habitat and forest management, ecological reserve areas and recreational/educational uses.



Spruce Swamp/Donna Garrison Property

Awardee: Southeast Land Trust of New Hampshire

Award Amount: \$15,000

Total Project Cost: \$35,000



A regionally significant resource found in the central part of Fremont is the Spruce Swamp, an 824-acre fen nestled in a 1,700-acre unfragmented forest. A fen is defined as a low and marshy or frequently flooded area of land. Similar to a bog, a fen gets water not just from rain and snow, but also from groundwater and water running down slopes. Fens are usually characterized by their water chemistry, which is pH-neutral or alkaline, whereas bogs are acidic and low in minerals. Fens in New Hampshire have been lost in the past by land drainage activities.

Found adjacent to the Fremont Spruce Swamp is the Garrison property, which is in a Core Focus Area as designated by the Land Conservation Plan for New Hampshire's Coastal Watersheds. The Southeast Land Trust of New Hampshire (SELT) acquired the property and will own the land with NRCS holding an easement on the property. The Garrison property will add to the 120-acre adjoining Kelliher Memorial Forest, which is also owned by SELT. This forest and wetland combination is ranked as

Blanding's Turtles

Blanding Turtles are a species of Special Concern and are legally protected in New Hampshire. They utilize wetland habitats with permanent shallow water and emergent vegetation such as marshes, swamps, bogs, and ponds. They also use vernal pools extensively in spring and while traveling through the landscape and may use slow rivers and streams as mechanisms for dispersal between wetlands. Blanding's turtles use a variety of wetland and terrestrial habitats and may travel extensively among them. Therefore, a key conservation strategy for the long-term survival of Blanding's turtles is the conservation of large undeveloped areas in southern New Hampshire.

For more information on Blanding's turtles, or what to do if you find an injured turtle, visit www.wildnh.com/nongame.



the highest quality wildlife habitat in the state and is home to 13 species of plants and animals of greatest conservation concern in New Hampshire. NHFG has monitored Blanding’s turtles in the Spruce Swamp area and distinguishes this area as a part of the “top 10 sites” for Blanding’s turtles. This location is also important for spotted turtles, wood frogs and spotted salamanders.

Besides the unique eight acres of wetlands on the property, the upland forest is relatively mature and diverse with beaver-influenced shorelines consisting of high percentages of hemlock, beech, birch and red maple. The project request was limited, only \$15,000 to conserve 33.98 acres with an outstanding upland buffer that provides more than 300 feet of habitat to the wetlands they surround. The emergent and scrub shrub wetlands have been identified as a prime wetland by the Town, and a sweet pepperbush shrub wetland area is being considered a good candidate as an exemplary natural community. This is a hidden gem of a property with beautiful beaver ponds, a heron rookery, and possibly the largest wetland within a single town in the state of New Hampshire.

Sprucewood/Oyster River Forest

Awardee: The Trust for Public Land

Award Amount: \$500,000

Total Project Cost: \$4 million



There are some locations on the landscape that are obvious targets for conservation. The 172-acre Sprucewood Forest property now named the Oyster River Forest in Durham is one such place. Located in close proximity to the University of New Hampshire, the property was slated for a large student housing development that would have included a new bridge over the Oyster River and over 12,000 feet of new roads. Fortunately, the Durham Conservation Commission championed a conservation outcome instead and the town acquired it in 2010. TPL, a national conservation organization that helps communities protect lands as natural areas, open spaces and parks, coordinated the project, helping to raise more than \$4 million for the purchase.

Significant funding came from the NRCS Wetlands Reserve Program, which holds conservation easements on the property.

Conservation Fund Sources

USDA Natural Resources Conservation Service	\$2.46 million
NHDES Aquatic Resource Mitigation Fund	\$500,000
NH Land and Community Heritage Investment Program	\$76,700
NH Moose Plate Program	\$35,000
Lamprey River Advisory Committee	\$20,000
Durham Conservation Fund	\$375,000
Private donations (115 private individuals and foundations)	\$556,000





Image credit: NHFG Staff

Nearly all of the Oyster River Forest falls within what the NHFG WAP identified as “highest ranked habitat in the state.” This is a keystone property connecting over 2,200 acres of existing conservation land, including Durham’s 42-acre Spruce Hole Bog Conservation Area and University of New Hampshire’s 376-acre College Woods. The Oyster River Forest protects 4,640 feet of habitat and shoreline along the Oyster River, which flows into the Great Bay Estuary on Durham’s shores. More than 135 plants and over 100 animals are documented on this property, with its diverse mix of Appalachian oak-pine forest, fields and wetlands. The Oyster River watershed contains the only known population of state endangered American brook lamprey, including in locations near the Oyster River Forest.

Conserving the Oyster River Forest protected many values important to the Durham community and its conservation partners. The property helps protect the town and university water supplies, including the Oyster River and the Spruce Hole Aquifer. The large network of conserved lands and waters provides habitat and travel corridors for fish and wildlife, in a rapidly developing part of New Hampshire. Existing woods roads and trails and potential new trails offer visitors enhanced outdoor experiences including hiking, nature viewing, snowshoeing, cross-country skiing and fishing.

New England cottontail, a state endangered species, is a focus of habitat restoration on the Oyster River Forest. A 20-acre old field at the north end of the Oyster River Forest is the focus of significant habitat restoration to benefit the cottontail and other species that use early successional habitat. NRCS has provided most of the funding for management that has included invasive plant removal, native shrub planting, riparian restoration, upgrade to a trail/management stream crossing and woody debris added to a tributary stream. Volunteers from the community and conservation groups have helped with the projects. Future management includes a 10-acre clearing of forest adjacent to the old field to increase the patch of early successional habitat.

New England Cottontail

In the past 50 years, the range of this once-common rabbit has shrunk and its population has dwindled due to habitat destruction from development. New England cottontails are currently legally protected in New Hampshire and restoration efforts are underway to preserve and restore their habitat. The New England cottontail has a brown and gray coat that does not change color with the seasons. They can be distinguished from the more common Eastern cottontail by a black spot between the ears and a black line on the leading edge of the ears. Possession and taking of this animal is illegal.

Restoration efforts are currently focused in southern New Hampshire, where the species has continued to persist. The primary action includes preserving and creating more areas of brush, shrubs, thickets and densely growing young trees where cottontails can find food, rear young and escape predators. Thousands of acres that used to be young forest have also grown up into older woods, where rabbits don’t generally live. NHFG has a partnership with a regional captive breeding program, including Roger Williams Zoo in Rhode Island and Queen’s Zoo in New York, and have raised 150 New England Cottontails for release to the wild.

Learn more about efforts to restore New England cottontails throughout their former range including habitat improvement projects occurring in New Hampshire at <https://newenglandcottontail.org> and <http://www.wild-life.state.nh.us/nongame/project-ne-cottontail.html>.



Invasive Species Management

In the 10 years since the inception of the ARM Fund, the scope and scale of invasive species management and the science of treatment methodologies has continued to evolve, and the lessons learned from funded projects follows a similar trajectory. Projects completed during the initial grant rounds primarily included targeted, localized management of invasive species, and while some demonstrated short-term success, long-term management is necessary. In addition, as our understanding of invasive species management grows, the focus has turned toward incorporating it with other wetland or stream restoration opportunities. A recent document, *Picking Our Battles: A Guide to Planning Successful Invasive Plant Management Projects* (<http://www.wildlife.state.nh.us/invasives/>), details the need for a large-scale approach and prioritizing management strategies. This document will help guide our program in evaluating invasive species projects going forward.



Purple Loosestrife

One of the first ARM Fund grants was issued to the Town of Londonderry to improve impaired functions and values to wetlands associated with Nesenkeag Brook. The project proposed an assessment of habitat value and water quality issues with the anticipation of determining recommendations for control and removal of invasive species. The ARM grant included a survey of a property owned by the Town of Londonderry (head of the Nesenkeag Brook system) to determine the extent of the invasive species problem. The

2009 Nesenkeag Brook Awardee: Londonderry Conservation Commission Award Amount: \$20,000

consultant hired to perform the project provided recommendations on the management of the two major invasives on the property: purple loosestrife and phragmites. In 2012, a batch of Galerucella beetles was released on the property. In general, these leaf-feeding beetles cause a significant amount of damage to the foliage of purple loosestrife thus causing severe stunting and preventing or inhibiting flower/seed production. However, the beetles do not cause enough damage to completely destroy the plants since that would eliminate their sole food source. The stunted growth of the purple loosestrife can then allow native species to reestablish themselves and rebuild the ecosystem back to their natural state. Although purple loosestrife still lurks amongst the native plants, the plants are usually kept in check by the beetles so they do not have a subsequent population explosion. More information on the beetles can be found at <http://agriculture.nh.gov/divisions/plant-industry/faq-purple-loosestrife.htm>.

Herbicide spray management of the phragmites was conducted in 2013, and the town funded additional follow-up work in 2015 to continue to combat the patch that remains on the property. Although the ARM funding was limited, it provided the catalyst for the town to start discussing where invasive species are the biggest threat to high-quality habitats and to develop a plan to attack areas of biggest concern.



Phragmites

New Hampshire's 18-mile coast is home to a variety of unique natural communities and systems. The objective of this project was to restore ecological function of two exemplary communities: a maritime shrub thicket and coastal salt pond marsh, which were severely impaired by invasive plants. Located at Odiorne Point State Park, the coastal salt pond marsh is considered by NHB to be globally rare. The marsh is home to one endangered, and two state-listed threatened plant species. The coastal salt pond marsh is an isolated brackish marsh bordered by a 3-acre maritime shrub thicket between it and the ocean. The thicket stabilizes the natural berm that separates the marsh from the ocean. The berm is essential for maintaining unique patterns of variable salinity within the marsh associated with storm overwash, as well as providing habitat for wildlife. This project included control of invasive species and revegetation of the maritime shrub thicket. Approximately 1 acre of the 6-acre marsh had been documented as being gradually invaded by an increasing population of Phragmites.

2010 Odiorne Point Awardee: Rockingham County Conservation District, Rye Award Amount: \$43,000

Through the combination of ARM funds and other grant funding, The Rockingham County Conservation District (RCCD) developed recommendations for the invasive species control efforts in the coastal salt pond marsh and maritime shrub thicket, which resulted in approximately 98% control achieved. Yearly monitoring has revealed that the revegetation efforts have been hampered by harsh conditions in the shrub thicket and remaining stubble and litter in the Phragmites treatment areas in the marsh. Initial plantings of bare root plants at the maritime shrub thicket had very low survivorship, so in 2013 containerized plants were used. The plants survived well through the end of the growing season, though many appeared stressed.

ARM funding for this project provided a key piece of the puzzle in the restoration work at Odiorne Point State Park, which started at the end of 2009 and continues today. RCCD currently manages over 52 acres of restored habitats in the park. Project Manager Tracy Degnan noted, "The work marked a transition for us from using mostly contracted help to using a large amount of staff and volunteer labor. It also solidified our partnerships with the Department of Resource and Economic Development, the NHDES Coastal Program and the Seacoast Science Center."

The project continues to be monitored by the RCCD through established vegetation plots that have demonstrated an increasing species richness and colonization by native species, however foliage cover is still low due to the harsh conditions. Other sources of funding are continually being sought and acquired to continue the need to treat the Phragmites. After the grant ended, RCCD continued with minimal required maintenance of the marsh and thicket, which are gradually increasing in their proportions of native species. It has also been noted that two different species of saltmarsh cord grass found in the marsh are hybridizing and the hybrids form tussucks, which is where the rare plants are now found growing quite well.

2010 Tigoa River Wildlife Conservation Area

Awardee: Town of Belmont
Award Amount: \$28,738



Glossy buckthorn leaves and berries.

A common small tree or shrub routinely recommended many years ago for wildlife food and cover is glossy buckthorn. Glossy buckthorn, like many invasive shrubs, leafs out early in the spring and retains its leaves late into fall, increasing its energy production but shading out native plants. It is a particular pest on wet sites and poses a significant threat to wetland communities. Infestation of glossy buckthorn on this previously disturbed parcel threatened to convert wetlands associated with the Tigoa Wildlife Conservation Area to a monoculture and began to encroach on one of the highest-ranking wetlands in Belmont. The two-year ARM Fund grant project proposed removal of buckthorn in the first year with planting of native scrub-shrub wetland mix. Conservation commission members returned in the second year with a crew from the Student Conservation Association to remove remnant sprouts. The young adults battled heat, ticks and storms to pull everything from seedlings to saplings, removing as much of the root system of each plant as possible. Truly a hard job by these young conservationists!

The results after the two-year period indicated that the restoration activities of 2011 and 2012 successfully reduced the coverage of glossy buckthorn across the site, specifically an 18.61-acre area. Although the town was hop-

ing to treat a 26-acre parcel, it proved more beneficial from a management perspective to remove close to 100% of existing glossy buckthorn on a smaller area of the northeastern and eastern portion of the site, where this plant was well established but not existing as a complete monoculture.

Based on the monitoring plots, this provided clear positive gains as the plant communities in the plots responded immediately to the reduced light competition from the glossy buckthorn management activities. In addition, there was no re-growth of buckthorn within the plots one year after monitoring, which was unexpected. This project also demonstrated the use of hand tools as an effective treatment method to avoid the use of herbicides and increased community involvement and engaged middle school and high school students.

A final component of the funding involved the town completing conservation of the parcel to insure long-term protection and monitoring of the efforts to control the invasive glossy buckthorn. The Five Rivers Conservation Trust worked with the town and is the easement holder of the parcel. A site inspection conducted in September 2015 by members of the SSC revealed an abundant supply of buckthorn had grown up since 2012. The saturated soils made it possible to pull fairly large shrubs by hand. This monitoring information was useful for determining whether future requests for invasive species management is a valuable use of ARM funds.



Example of scrub-shrub cover, Ponemah Bog in Amherst, NH.



Conclusion

Minimizing the spread of invasive plants across the landscape is an important and common focus of wetland and stream restoration projects. While invasive species may not be the primary focus of some projects, they often become an integral part of the planning and construction. Several projects completed under the ARM Fund program, including Berry Brook in Dover, Beaver Brook in Keene and the McQuesten Brook projects in Manchester and Bedford, had numerous invasive species present on their sites that required careful and potentially expensive management during construction.

A list of prohibited invasive species is maintained by the New Hampshire Department of Agriculture. For these projects an invasive species management plan must be developed as part of the permitting process. These plans must

2010 River Road Saltmarsh

Awardee: Town of New Castle
Award Amount: \$27,993

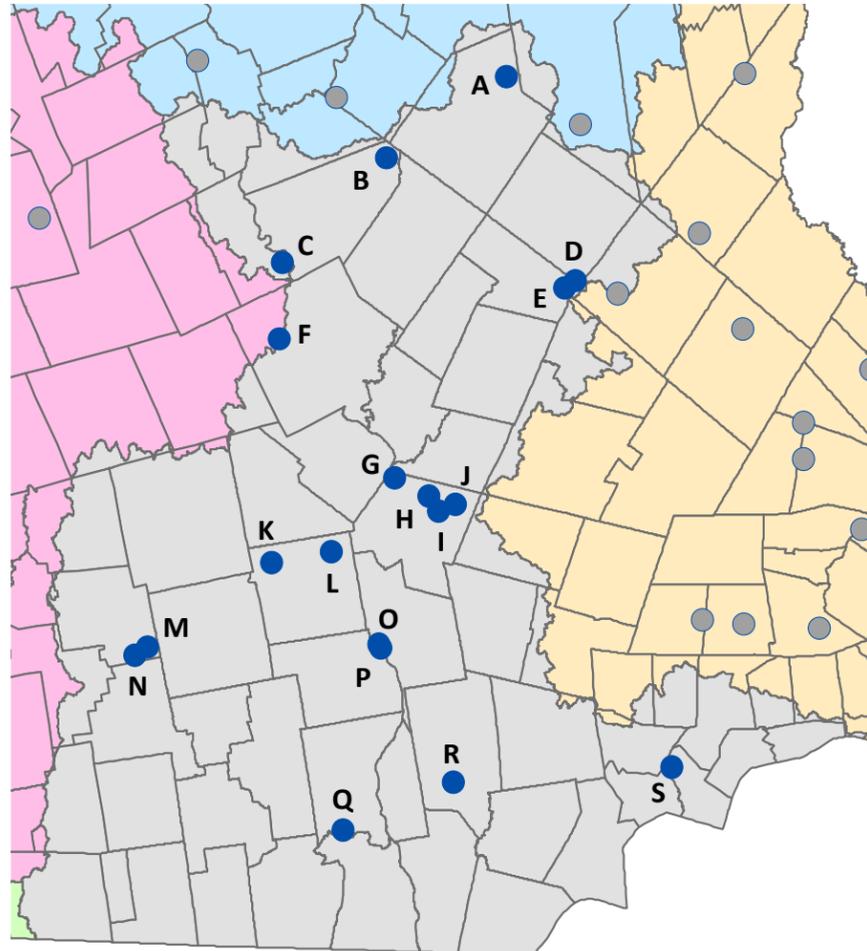
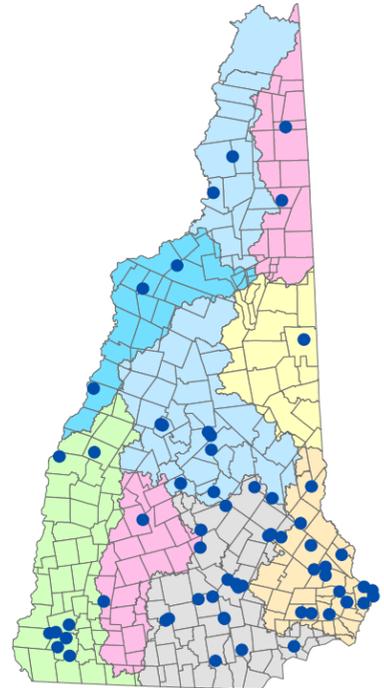
New Castle is a small island community that could potentially achieve eradication of the invasive species, phragmites. This effort has been spearheaded over several years by RCCD. The primary objectives of this restoration project were to reduce the invasive species found at the River Road saltmarsh and to restore hydrology and saltmarsh habitats. The restoration efforts focused on the removal of invasive species and the encouragement of native vegetation, as well as increasing appropriate hydrology at the site. Invasive species control used both mechanical and chemical methods. Methods used to foster native vegetation included reducing competition from invasive species, excavating and reshaping filled areas, seeding and planting native wetland species, and planting native upland shoreland buffer plants.

ARM funding for this project provided the key component to follow the recommended restoration plans to restore this degraded saltmarsh. Recommendations were formed after detailed evaluations were completed in 2009 with assistance from the Piscataqua Regional Estuaries Partnership. The New Hampshire Department of Agriculture, Markets & Food Integrated Pest Management Program funds were also utilized to assist in restoration efforts. In addition, volunteer assistance totaled over 70 hours at this site.

This restoration project became a significant catalyst for on-the-ground learning for elementary school children, abutters and neighbors. Trefethen Elementary School is within walking distance of this property, allowing for a living classroom curriculum. It also continues to serve as an excellent educational site for the hundreds of people that walk past it yearly. It is anticipated that the residents of New Castle will continue to support stronger wetland and buffer health in this special community.

depict the invasive plant species removal locations, final placement locations, and management practices according to the NHDOT Best Management Practices for Roadside Invasive Plants.

During construction, care must be taken to avoid spreading invasive plants to new sites. Prohibited invasive species shall only be disposed of in a manner that renders them nonliving and nonviable. This process can be time consuming, time-sensitive and costly and must be included in the project budget and construction sequence. Not planning for this component of the project can cause project delays and budget overruns. In addition, as demonstrated by some of the earlier ARM Fund projects, long-term management of the site must also be considered in the project plan.



ARM Fund Service Areas

- Pemigewasset-Winnepesaukee Rivers
- Merrimack River
- Salmon Falls – Piscataqua Rivers
- Contoocook River

J – Project: Hinman Pond I
Location: Hooksett, Merrimack County
Award Amount: \$503,739

K – Project: Shost
Location: Goffstown, Hillsborough County
Award Amount: \$150,000

L – Project: Black Brook Preserve
Location: Goffstown, Hillsborough County
Award Amount: \$70,000

M – Project: Avery Brook
Location: Frankestown, Hillsborough County
Award Amount: \$235,290

N – Project: Stewart Property
Location: Frankestown, Hillsborough County
Award Amount: \$48,000

O – Project: McQuesten Pond Dam Rem.
Location: Manchester, Hillsborough County
Award Amount: \$65,400

P – Project: McQuesten Brook Stream Rest.
Location: Bedford, Hillsborough County
Award Amount: \$354,000

Q – Project: Pennichuck Brook
Location: Merrimack, Hillsborough County
Award Amount: \$737,170

R – Project: Nesenkeag Brook
Location: Londonderry, Rockingham County
Award Amount: \$20,000

S – Project: Plaistow Town Forest
Location: Plaistow, Rockingham County
Award Amount: \$100,000

A – Project: Guinea Ridge Road
Location: Gilmanton, Belknap County
Award Amount: \$197,707

B – Project: Soucook River - Therrien Forest
Location: Canterbury, Merrimack County
Award Amount: \$68,830

C – Project: Oxbow Property
Location: Canterbury, Merrimack County
Award Amount: \$300,000

D – Project: Wild Goose Pond
Location: Pittsfield, Belknap County
Award Amount: \$217,200

E – Project: Crooked Run
Location: Barnstead, Belknap County
Award Amount: \$361,600

F – Project: Haller Farm Preservation
Location: Concord, Merrimack County
Award Amount: \$300,000

G – Project: Hinman Pond II
Location: Hooksett, Merrimack County
Award Amount: \$75,000

H – Project: Merrimack Riverfront
Location: Hooksett, Merrimack County
Award Amount: \$150,000

I – Project: Clay Pond
Location: Hooksett, Merrimack County
Award Amount: \$200,000

Clay Pond I and II, 2009 and 2012

Awardee: Bear-Paw Regional Greenways

Award Amount: \$200,000

Total Project Cost: \$1.3 million

Photo courtesy Bear-Paw Regional Greenways



A little-known area of Hooksett located south of Bear-Paw State Park and off the Chester Turnpike has become a significant location of land conservation efforts to date. The Town of Hooksett and Bear-Paw Regional Greenways worked in partnership to conserve approximately 710 acres of high-value wildlife habitat in the Clay Pond Headwaters area, including over 130 acres of wetlands. Three stream restoration sites were also funded to improve 105 linear feet of perennial and intermittent habitat that were negatively impacted during historic settlement of the area.

In addition to the wetland mitigation funds, the Hooksett Conservation Commission, LCHIP, the NHDES Water Source Protection programs, and the Open Space Institute's Saving New England's Wildlife program worked to fund this important project. The site contains large wetland complexes, vernal pools of high habitat value, and the town-designated prime wetland, Clay Pond. The protection of these properties will add three parcels that total 733 acres of

protected land adjacent to other large protected parcels.

The property has an undulating topography, with the lowest elevation at 480 feet and is located in the southeast corner of Hooksett, close to Candia. The highest elevation is about 700-710 feet found in two locations. The property is located within a large unfragmented block of forests and embedded wetlands. This unfragmented block is estimated to be about 22,000 acres; roughly 99% is comprised of forests. There are over 14,000 acres of protected or publicly owned lands either adjacent to or near the property. These include areas such as Bear Brook State Park (9,977 acres), the Hinman

Pond Preserves (767 acres), the Great Marsh Preserve (395 acres), and lands owned and managed by Manchester Water Works for protection of public drinking water (over 1,000 acres), as well as other protected parcels.

The project combined town ownership with a conservation easement(s) held by Bear-Paw and was a top priority in Hooksett's Master Plan, the WAP, Bear-Paw's Conservation Plan and others. The wildlife habitat management goals for the property include the following:

- Protection of water quality, wetlands and riparian areas.
- Maintenance or enhancement of wildlife habitat.
- Protection of unique or fragile natural areas.
- Conservation of native plant and animal species, and natural communities.

Clay Pond I was the first project Bear-Paw completed in Hooksett. Since then, Bear-Paw has continued working with surrounding towns and conserved over 2,000 acres in the area. The project led directly to Clay Pond II and indirectly to Hinman Pond I, Hinman Pond II (including the Buxton parcels), Hanscom-Lambert and Great Marsh. Bear-Paw has raised over \$2 million to complete these projects. The Town of Hooksett now owns over 700 acres in the area and recently developed a stewardship plan for their Clay Pond Conservation Area. In addition, Bear-Paw is working with NHFG to develop stewardship plans for the properties Bear-Paw owns in the area.



Vernal Pool

Vernal Pools

Vernal pools are unique wetlands that provide critical breeding habitat for several amphibian species of conservation concern in New Hampshire.

Some vernal pools flood in the spring with water from melting snow, rain or high groundwater and then typically dry by summer's end. Other pools follow a similar pattern, but fill with rain in autumn, hold water all winter and spring, and then dry out by late summer. The annual drying cycle of vernal pools makes them different from other wetlands and plays a key role in determining which wildlife species use which pools as habitat.

Visit <http://www.wildlife.state.nh.us/nongame/documents/habitat-vernal-pools.pdf> to learn more.



Salamander egg mass

Crooked Run and Wild Goose Pond (Barnstead, Pittsfield and Strafford)

Awardee: Bear-Paw Regional Greenways

Award Amount: \$361,600 (Crooked Run) and \$217,200

Total Project Cost: \$1.6 million

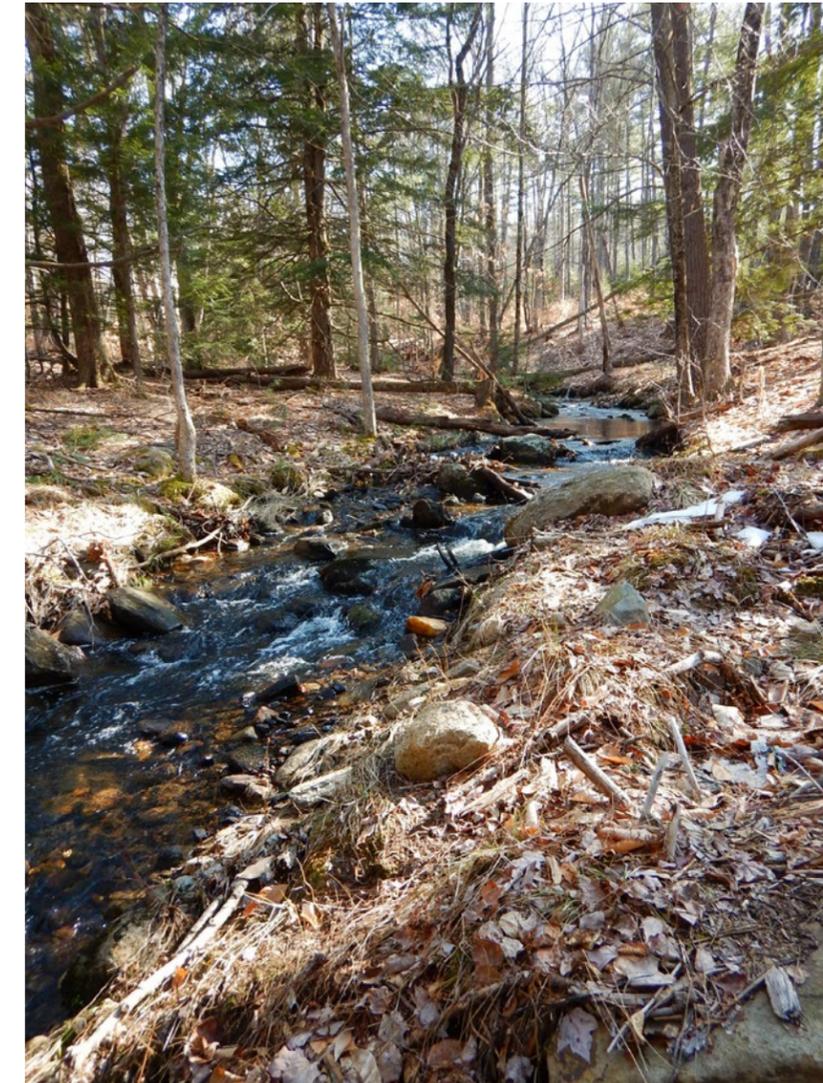
The collaborative effort of Bear-Paw and several local landowners in Barnstead, Pittsfield and Strafford resulted in the protection of over half of the relatively unfragmented 2,064-acre Wild Goose Pond watershed. The first of the projects funded by the ARM Fund program was the 450-acre "Crooked Run" acquisition and easement, which Bear-Paw secured by working with the Boston Minuteman Council. The Council property was founded in 1957 as a Scout Camp. It was opened in 1958 and continues to provide camping and scouting facilities for approximately 1,300 scouts to enjoy the outdoors and connect with nature. The camp buildings and recreational areas are excluded from the easement, but Bear-Paw also has a right-of-first-refusal on the remainder of the property if it is sold in the future. A portion of the ARM funds were also directed to assist in restoration of nine sites including removal of a bridge from a perennial stream, fill removal and slope stabilization adjacent to high-value peatlands.

One outstanding feature on the Crooked Run property is a NHB Giant Rhododendron community that is very rare in New Hampshire. The endangered ringed boghunter, Blanding's Turtle and small whorled pogonia also occur on the property. Blanding's turtles can live a long time and do not start breeding until age 14-20. They require large, unfragmented

habitat with a mix of wetlands to survive, as they are vulnerable to road mortality. The extensive wetlands associated with the Crooked Run watershed provide this endangered species excellent habitat.

The unfragmented forest that includes the 683-acre Crooked Run property serves as a connection between some of the largest forest blocks in southeastern New Hampshire – a 6,000-acre block that includes the Evans Mountain project funded through ARM Funds and a 16,000-acre block just to the north. These large, unfragmented blocks of habitat are important as they typically have greater capacity to support interior forest species (e.g., scarlet tanager, wood thrush), greater ability to sustain natural processes, including resilience to natural disturbances, and often encompasses a diversity of habitats in close proximity to each other.

The 118-acre Wild Goose Pond is one of the largest bodies of water in Pittsfield. The pond is fed from the west by Shinglemill Brook, a small stream that gathers water from the eastern slope of Catamount Mountain, winds its way north and east for nearly 2 miles and then flows into the northwest corner of the Pond. To the northeast, a tight ring of hills surround the 29-acre Adams Pond (on The T.L. Storer Scout Reservation), which drains a small area before entering at the northeast





corner of Wild Goose Pond. Water also flows into Wild Goose Pond from the low hills to the southwest.

The second-largest conservation area in this watershed was formed through the efforts of two landowners in Pittsfield, Carl Wallman and George and Diane Bachelder. Approximately 500 acres in the Wild Goose Pond watershed will now be protected by conservation easements. The properties exhibit many of the same features found in the Crooked Run easement area nearby with 12 vernal pools confirmed. More than 26 acres of valuable wetland resources and wildlife habitat and 1,000 feet of frontage on Wild Goose Pond will be conserved, including the headwaters and a portion of Shinglemill Brook, which is home to many songbirds: song sparrow, common yellowthroat, yellow warbler, tree swallow, Baltimore oriole and kingbird, among others.

The topography of the rolling Wallman property along Wild Goose Pond rises up to reach the Bachelder property on the side of Catamount Mountain – providing breathtaking views and remote natural habitats. Catamount Mountain is the highest point in the town of Pittsfield at 1,331 feet. The mountain’s wooded eastern slope forms the headwaters of the Wild Goose Pond watershed.

The Wild Goose Pond project adds directly to an already significant amount of conservation land in the area. The properties are part of a core conservation area that exceeds 8,000 acres of permanently protected land within 5 miles – properties protected by Bear-Paw, the Blue Hills Foundation, the towns of Barnstead, Pittsfield and Strafford, and others.

“To take care of and enjoy these lands and waters—whether a resident or a visitor. Your thoughtful stewardship is a gift to everyone, especially those who live downstream.”

– Carl Wallman

McQuesten Pond Dam Removal & McQuesten Brook Stream Restoration

Awardee: New Hampshire Rivers Council

Award Amount: \$65,400 (dam removals); \$354,000 (stream restoration)

Total Project Cost: \$855,000

McQuesten Brook represents a unique water resource located within a highly developed watershed in the City of Manchester and Town of Bedford. Despite the extensive development (more than a third of the 563-acre watershed is covered with impervious surfaces), the brook’s base flow conditions and favorable in-stream temperatures have sustained a robust population of eastern brook trout, as documented by NHFG. Thanks to two projects funded in 2013 and 2015, connectivity in the system will increase to 0.85 miles and provide new spawning areas and refuge for eastern brook trout and other aquatic and semi-aquatic species within the corridor.

McQuesten Brook originates in Bedford, flows into Manchester and collects outlet waters from McQuesten Pond before flowing under Second Street, through the Eastman Avenue and Wathen Road wetland complex in Bedford, and under the Everett Turnpike to meet the Merrimack River. The brook is listed in the 2012 surface water quality assessment for failure to support aquatic life due to insufficient dissolved oxygen concentration and saturation and for excessive chlorides. These impairments threaten the survival of the eastern brook trout that currently thrive in portions of McQuesten Brook. In addition to the pollutant-based impairments, McQuesten Brook has also been impacted by hydrologic and habitat modification resulting from the presence of under-sized stream crossings.

The project funded in 2013 included the removal of three earthen dams on a tributary to McQuesten Brook upstream of the culvert replacements. This project, with the assistance of the City of Manchester, was under way during the summer of 2016. When this is complete, connectivity in the system will increase to 0.85 miles and provide new spawning areas and refuge for eastern brook trout and other aquatic and semi-aquatic species within the corridor.



Wathen Road downstream, 2014 >>



Eastman Avenue inlet, 2012



Eastman Avenue inlet, 2016

The culvert removal project funded in 2015 was first conceived in a restoration plan authored by the New Hampshire Rivers Council (NHRC) in October 2013. Assessments of the culverts on these roads, completed as part of the restoration plan, indicated reduced or no ability for fish and other aquatic creatures to move up or downstream, and neither culvert was fully compatible with McQuesten Brook's stream geomorphology. As such, they were identified as priority replacements in the restoration plan.

When construction planning began for the project in 2014, the NHRC partnered with the Town of Bedford to apply for an ARM Fund grant. With assistance from the ARM Fund, the town was able to engage the services of John Field, fluvial geomorphologist, to ensure that in-stream habitat restoration was of the highest quality in the vicinity of both crossings, and that the integration of large wood, streambed features, wetland enhancement, riparian buffers, and floodplain habitat were incorporated into the project area. In addition, plantings in the restoration area were enhanced to ensure shade and habitat features were promoted and stormwater features along both roads were upgraded to provide water quality improvements before the water is discharged to the brook.

The grossly undersized 36-inch culvert beneath Eastman was replaced with a 16-foot span bridge. The Wathen Road culvert was completely removed thanks to a unique set of circumstances. The town approached the owner of the only house on the other side of McQuesten Brook that required the culvert to cross the stream, who agreed to sell the house and the associated land adjacent to the stream to the town. The cost to purchase and demolish the house was less than upgrading the stream crossing. In addition to the cost savings, this created an

opportunity to create a natural stream reach, remove impervious surfaces from the watershed (the house, driveway and roadway), and add additional floodplain storage and appropriate buffer along the brook.

Construction on Wathen and Eastman was completed in July 2016. The new stream crossing and culvert removal increased hydraulic and sediment transport capacity throughout the reach. Over time it will reduce or eliminate deposition of fine materials in pools and riffles where there is some of the highest value eastern brook trout habitat. Restoring full mobility for fish and other aquatic creatures at both Eastman Avenue and Wathen Road increased species' access to about 1,950 feet of McQuesten Brook between Interstate 293 and South Main Street and re-connected 2.57 acres of wetland habitat within this reach of McQuesten Brook.

The other expected outcome is reconnection of the floodplain and vital wetland habitat between I-293 and Second Street. This habitat connectivity is critical for eastern brook trout to find thermal refuge. While hourly water temperature monitoring within McQuesten Brook has shown the stream to offer suitable conditions for eastern brook trout (<68 F) during the summer; at times, increased water temperature (likely associated with stormwater runoff from rain events) has been observed to reach levels in excess of 68 F. Making additional areas accessible to the brook trout increase their chance for survival. In addition, removing the impounded water in the McQuesten tributary removes a warm water sink. Initial observations and limited monitoring this summer showed promising improvements in the stream. Continued monitoring will document the improvements these changes make in the stream over time.



Wathen Road inlet, 2012



Wathen Road inlet, 2016

Merrimack Riverfront Project
Awardee: Hooksett Conservation Commission
Award Amount: \$150,000
Total Project Cost: \$320,000

Hooksett has one of the last large remaining undeveloped areas of Merrimack River frontage in southern New Hampshire and in November 2012, the Hooksett Conservation Commission received an ARM grant to purchase and protect this parcel. The Hooksett Conservation Commission worked diligently to acquire this area. The ARM grant helped protect and preserve over 3,900 feet of Merrimack River frontage and adjacent riparian buffers through its acquisition of the 122 acres now protected by a conservation easement held by the Society for the Protection of New Hampshire Forests. The property is located over a

stratified drift aquifer and is within a source water protection area. The project protects 67 acres of wetland, including the protection of approximately 30 acres of a designated prime wetland.

The property is a mix of riverine wetlands and sandy uplands that is ideal terrain for the state endangered Blanding's turtle, and the site has suitable perches for bald eagles that have been sighted within one mile of the property. In addition, the property occupies the site of the former Head brickyard, a key part of Hooksett's and New Hampshire's cultural history with the site featured

on the town seal.

The Merrimack Riverfront is emblematic of the scenic view both for motorists on Interstate 93 and Routes 3 and 3A, and for paddlers on the Merrimack River. Now in 2016, construction of a 2-mile trail system is under way to provide an opportunity for residents and visitors to gain access to this special area. The protection of the parcel preserves the historical sense, place and "feel" that has defined New Hampshire's Merrimack River valley since Henry David Thoreau immortalized it in his "A Week on the Concord and Merrimack Rivers."

The property was featured in the Spring 2014 edition of Forest Notes and Governor Maggie Hassan chose to visit the site for Earth Day that same year.



Pennichuck Brook Conservation and Restoration
Awardee: Society for the Protection of New Hampshire Forests
Award Amount: \$737,170
Total Project Cost: \$1.083 million

The largest ARM Fund award to date, \$737,170, went to a project that permanently protected a total of 192 acres of forest, including an estimated 49 acres of wetlands and an additional 143 acres of upland buffer

in Nashua. The project was made possible through a combination of mitigation and restoration projects.

First, the City of Nashua needed to mitigate for the impact to approximately 11.6 acres of wetlands it created with an expansion at its airport. The expansion project resulted in the loss of wildlife habitat, groundwater recharge/discharge, sediment retention and flood storage functions. The City ultimately paid into the ARM Fund with the anticipation that the money would be used for conservation or restoration within the vicinity of the impacts.

Just such a mitigation project presented itself in an adjacent neighborhood, where SPNHF was working closely with the Southwood Corp., a wholly owned subsidiary of Pennichuck Corp., to conserve a piece of land they owned in Merrimack. This project was just 4,000 feet north of the runway and in the same watershed as the airport. Partnering with the city, SPNHF negotiated the purchase of a conservation easement on two parcels of land located north of Pennichuck Brook that was used as a buffer to protect the water quality of the brook but was not legally protected. Pennichuck Brook and its impoundment flows into the Pennichuck water supply intake that serves 85,000 residents of the City of Nashua, which is located less than two miles downstream of the conservation property.

The long-term goals of the Pennichuck Brook project are to carefully manage the parcel to produce timber, subject to the primary goal of protecting water quality of the Nashua and Merrimack water supplies. The project also included a restoration component that included removal of fill in

Riparian Buffers

Riparian buffers are strips of grass, shrubs and/or trees along the banks of rivers and streams that are a crucial piece of the ecosystem. Buffers are complex ecosystems that provide habitat and improve the stream communities they shelter. They perform a variety of functions, including water quality improvement, bank stabilization, flood reduction and provide a transition zone between water and human land use.

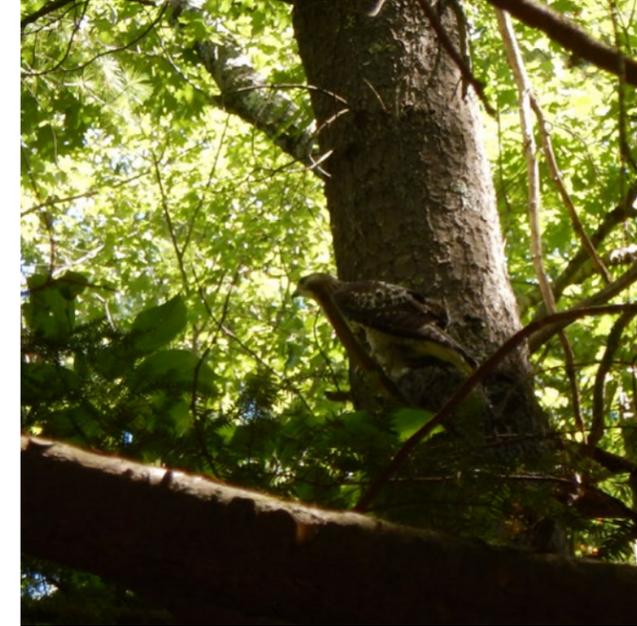
Riparian buffers are highly effective at filtering sediment and debris from surface water runoff. Depending upon the width and complexity of the buffer, 50–100% of sediments, and the nutrients attached to them, can settle out and be absorbed as buffer plants slow sediment-laden runoff waters. Wider, forested buffers are more effective than narrow, grassy buffers. They also regulate stream flows by slowing the velocity of runoff, allowing water to infiltrate into the soil and recharge the groundwater supply. This helps control flooding and maintains stream flow. Riparian vegetation also helps to stabilize stream banks and reduces erosion into the waterbody. Natural riparian buffers have been lost in many places over the years and restoring and preserving them is an important step in maintaining these functions.



a beaver pond and restoration of damage in wetlands from ATV activity. An additional restoration component involved blocking a man-made ditch in a red maple swamp to restore the original hydrology in the wetland area with the potential gain of improved functions in 3.35 acres of wetlands. A conservation easement provides permanent protection of the valuable resources on the site and ensures the proposed restoration measures will remain once completed.

A highlight of the Pennichuck parcel is that it includes over one mile of shoreline on Pennichuck Brook. Along this riparian buffer thrives a state endangered plant population, the smooth beggar-tick. The NHB estimates that 24% of the state's population is contained within this parcel. In addition, the majority of the property is rated as the best wildlife habitat in the state by NHFG, with 12 wetland areas, including a 14-nest heron rookery, a 26-acre beaver flowage, four vernal pools, a 4-acre white oak/red maple basin swamp, and protection for 5,000 feet of three perennial streams within the proposed easement area.

This parcel was recognized as being so important that two additional local infrastructure projects poised to pay into the ARM Fund contributed their payment to complete this land transaction. Both the Broad Street Parkway project and the Manchester Street bridge replacement were issued permits with the condition that the mitigation payment option be fulfilled through dedicating funds to the Pennichuck project. Collaboration on the part of SPNHF and good timing led to success in a conservation easement that promotes protection and restoration of wetland functions and values in perpetuity.



Plaistow Town Forest
Awardee: Southeast Land Trust of New Hampshire
Award Amount: \$100,000
Total Project Cost: \$136,500

Since the early 1970s, the town of Plaistow had a vision to conserve its northeast corner as a town forest, and with the help of an ARM grant in 2012, and assistance from SELT, that vision is a reality.

In the beginning, the town was divided into small woodlots that were owned by local farmers who used them to secure fuel wood and timber. The northeast section of the town was always poorly suited to pasture and agriculture because of its extensive wetlands and a predominance of rocky upland soils. Over time, as agriculture declined and woodlands reclaimed much of the region, these small inaccessible parcels lost value and were abandoned. The town began to acquire these parcels in the 1970s, after successive owners gave them up for

unpaid taxes. Led by the conservation commission and public officials, Plaistow then designated approximately 200 acres as town forest and continued to add acreage as parcels were acquired.

In 2012, the town and SELT secured an ARM Fund grant of \$100,000 to place conservation easements on the lands acquired through tax default, totaling 350 acres. The 17 tax default parcels have been managed over the years as town forests for the forest resources. At the 2014 Town Meeting, additional acreage was added to the town forest and now an entire 404.6 acres is designated as town forest. The conserved area lies within an unfragmented block of land that encompasses more than 490 acres in this highly developed part of the state. This town forest consists of mature woods dominated by Appalachian Oak-pine and more than 1.2 miles of riparian corridor along Kelly Brook. There are at least six beaver

Stewart Property & Avery Brook

Awardee: Francestown Land Trust

Award Amount: \$48,000 & \$170,000

Total Project Cost: \$235,290 & \$474,000



impoundments that encompass more than 60 acres along inlet streams, the main stem of Kelly Brook, numerous vernal pools and an active heron rookery.

The streams and wetlands on the town forest have excellent forested buffers providing cooling shade, course woody debris and nutrient/soil erosion control. The eastern portion of the town forest is included in several wellhead protection areas with another wellhead protection area in the northern corner of the property along Route 121A. The known list of endangered, threatened rare and species of concern on the property are redbfin pickerel, spotted turtle, Blanding's turtle, and a black gum red maple basin swamp.

A recent timber harvest was conducted in the town forest guided by a forest management plan, followed by the development of a trails network as part of an Eagle Scout project. Restoration work that was part of the ARM Fund grant focused on upgrades to heavily used sections of existing recreation trails and repairs from damage to the site by ATVs. A recent report submitted by local monitors noted use by hikers, runners and mountain bikers. Stone fords within shallow stream crossings and wooden bridges have been installed for the continued passive recreational use and protection to the important aquatic resources on site. Today the beauty of the forest can be enjoyed through the trail system accessed by a parking area off of Main Street.

The Stewart and Avery Brook Conservation parcels are a result of one person's ambition and effort to reach a goal: that person is St. Anselm professor Dr. Barry Wicklow and the goal has been to protect the water quality of Rand Brook and the Piscataquog River in Francestown. As a result of many years of research, negotiating with landowners and perseverance, Dr. Wicklow and the Francestown Land Trust have protected the 53-acre Stewart property and the 182-acre Miller property through the assistance of the ARM Fund. These two parcels together provide only a small snapshot of what extensive conservation work has been done by Dr. Wicklow and the Francestown Land Trust. In addition to Dr. Wicklow's commitment to conservation, he is equally committed to outreach and education and routinely uses these parcels to teach students the importance of biodiversity.

Stewart Property

The Stewart property includes over 1,300 feet of shoreline along Rand Brook and about 4,000 feet on the South Branch of the Piscataquog River. It connects to, and enhances, the ecological function of over 2,000 acres of biologically diverse open space, through various conservation instruments. In such an undisturbed setting, the Biomonitoring Unit at NHDES selected Rand Brook as a cool-water Reference Stream to establish assessment thresholds for aquatic life in wadeable streams. NHDES monitors Rand Brook upstream of the Stewart land because the water quality index is excellent



STEM students pointing out bear claw marks in a tree at the Avery Property.

and it supports a reproducing brook trout population and a high diversity of pollution-sensitive macroinvertebrates, including eight of the nine families of stoneflies that occur in the Northeast.

An important component of the ARM project included improving runoff from a 6-acre active cattle pasture that extends along the south side of Rand Brook and the South Branch of the Piscataquog River in the southeast portion of the parcel. The cattle pasture allowed free access to Rand Brook with obvious pollutants leaching into the river from the cattle and from the drainage of a small seepage pond that runs down slope across the pasture. Invasive multiflora rose (*Rosa multiflora*) is scattered throughout the pasture and concentrated in the east end of the pasture. By eliminating manure runoff, the quality of stream water will remain high as it flows into the Piscataquog River. The project partners also replaced the pasture grass and multiflora rose with native riparian vegetation to provide a buffer to pollutants and serve as habitat for various wildlife species.

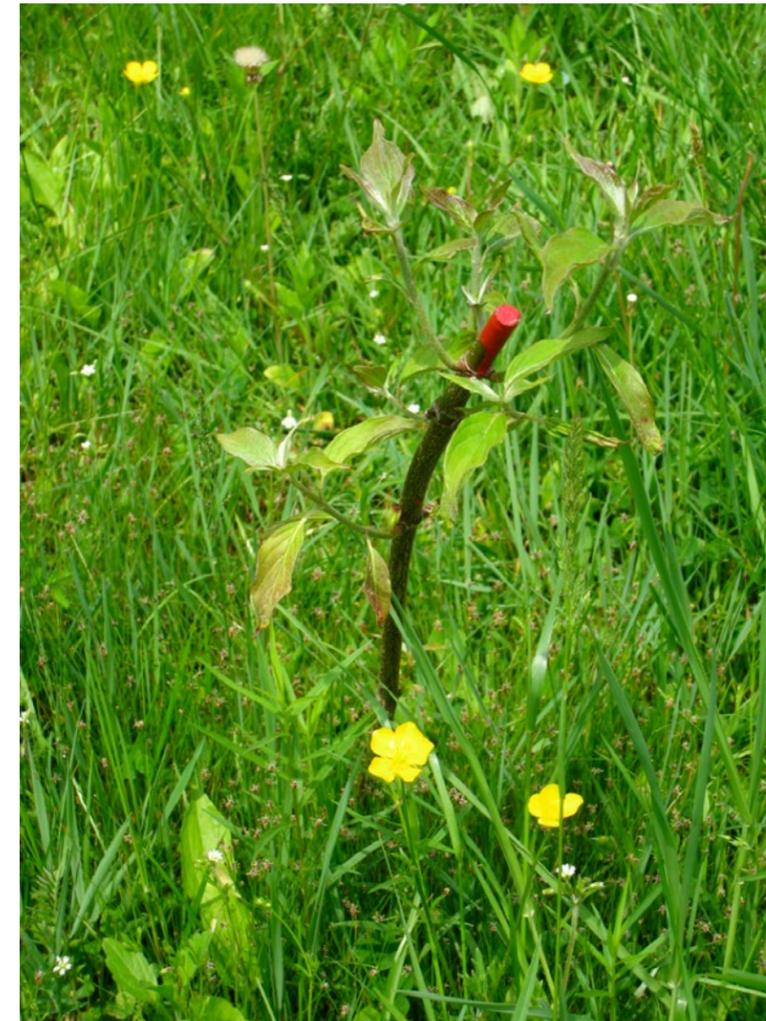
Miller/Avery Brook Parcel

The 180-acre Avery Brook parcel has just about everything: natural habitat, wildlife, forestry, wetland, water supply, and scientific, ecological, educational, recreational and agricultural significance. This historic riverside farm that has been in the family since the 1870s is now owned by Avery grandson Rick Miller and family. The property includes nearly the entire sub-watershed of Avery Brook including the entire length of Avery Brook West, 4,500-plus feet, nearly all of Avery Brook East, 2,800-plus feet, and 1,700 feet along the South Branch of the Piscataquog River. The Frankestown Land Trust worked to hold the conservation easement on the parcel that will help connect approximately 3,700 acres of protected land. The specific focus of the restoration on this prop-



erty was to restore the buffer that was impacted due to the logging to the edge of the Avery Brook wetland and the replacement of an undersized culvert. Bill Nichols, New Hampshire state botanist and senior ecologist, ranked the exemplary red maple-black ash swamp as “B-” and stated, however, that the rank would improve with a no-cut buffer around the wetland. Bill Nichols also concluded that “the buffer would eliminate sediment and nutrient runoff into the swamp and improve habitat for animal species using both the swamp and adjacent lands.” This management practice as well as extending the riparian vegetation to 200 feet of no-cut zone along South Branch of the Piscataquog River will effectively replace flood plain hayfield with native vegetation.

Both Avery Brook West and Avery Brook East are low-gradient, perennial headwater streams that are narrow, meandering and alluvial. They converge at the wetlands near Avery Brook. A 1- to 3-meter channel runs the length of the wetland eventually forming Avery Brook that then flows into the South Branch of the Piscataquog River. An undersized farm road culvert restricted aquatic passage and was replaced with a 48-inch embedded pipe for stream connectivity. The improved passage combined with the cold groundwater source and the shade from the dense forest canopy will help maintain the cool temperatures of the streams allowing brook trout and other coldwater species to thrive. The oversight of Dr. Wicklow and yearly monitoring of the buffer will attenuate nutrient flow into the river and create additional wildlife and fisheries habitat for years to come.



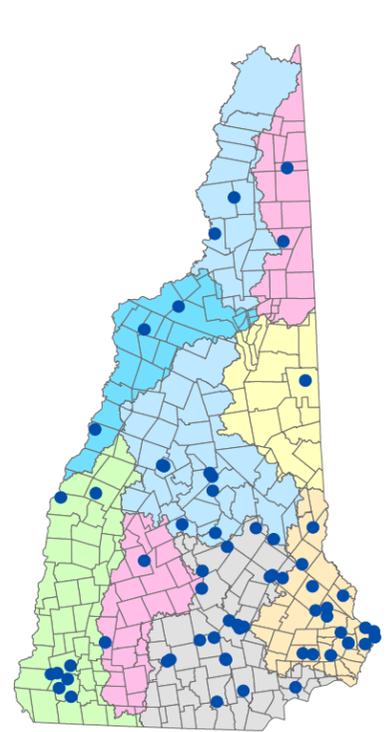
Above: Silky dogwood stake leafing out.
Facing page: Planting live stakes at the Stewart Property.

STEM-Biodiversity Program

In the STEM-Biodiversity project (science, technology, engineering, math) refugee, immigrant and underrepresented high school freshmen students were taught GPS, mapping and the importance of biodiversity. The program was developed by professors at Saint Anselm College with the aim of developing academic skills in STEM disciplines, promoting academic success and preparing students for college. Students earned high school credits in a college setting.

STEM at Avery Brook

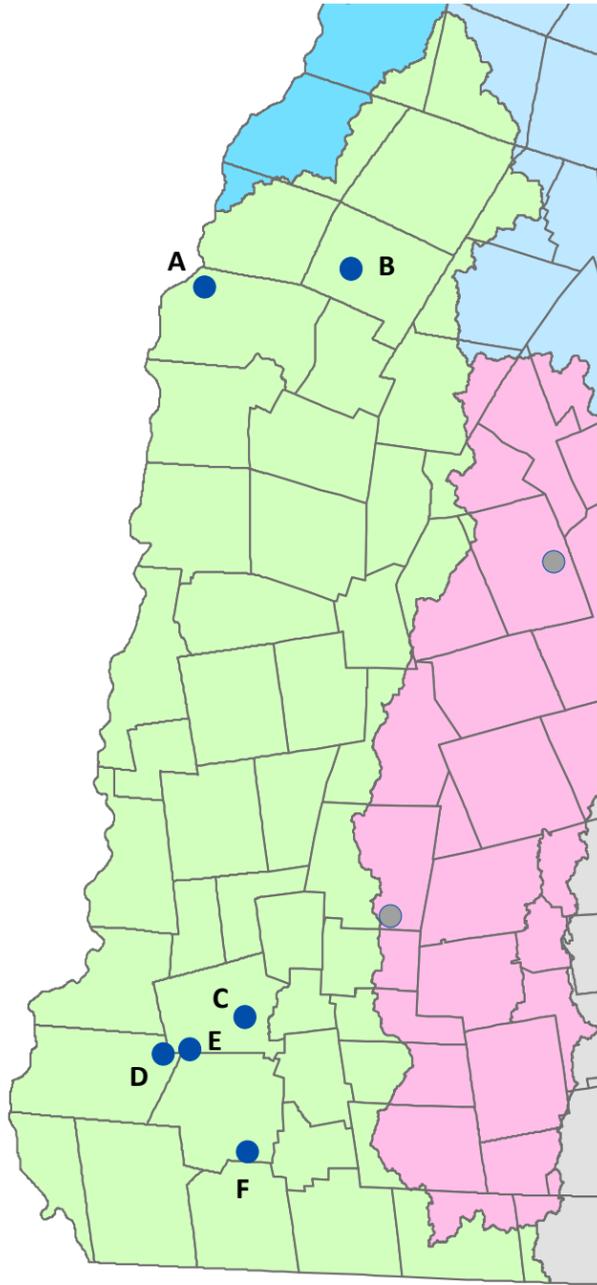
After learning GPS technology and mapping, students were bussed to the Avery Brook Watershed where they observed and marked GPS points of exemplary natural communities, moose tracks, stream salamanders, birds and other wildlife and plants as well as bear-marked trees. Upon their return to campus, students downloaded and merged data then created a Google map of the site. Thank you to the Miller Family for allowing us to explore Avery Brook.



A – Project: Hanchetts Brook Forest
Location: Plainfield, Sullivan County
Award Amount: \$110,560

B – Project: Smith Pond Property
Location: Enfield, Grafton County
Award Amount: \$362,385

C – Project: Beaver Brook Restoration
Location: Keene, Cheshire County
Award Amount: \$277,707



ARM Fund Service Areas

- Middle Connecticut River
- Pemigewasset-Winnipisaukee Rivers
- Lower Connecticut River
- Contoocook River

D – Project: Colony Project
Location: Chesterfield, Cheshire County
Award Amount: \$83,467

E – Project: West Hill
Location: Keene, Cheshire County
Award Amount: \$140,000

F – Project: Falls Brook Stream Restoration
Location: Swanzey, Cheshire County
Award Amount: \$115,000

Colony/California Brook & West Hill/California Brook Natural Areas

Awardee: Monadnock Conservancy
Award Amount: \$183,000 & \$140,000
Total Project Cost: \$311,387 & \$376,900

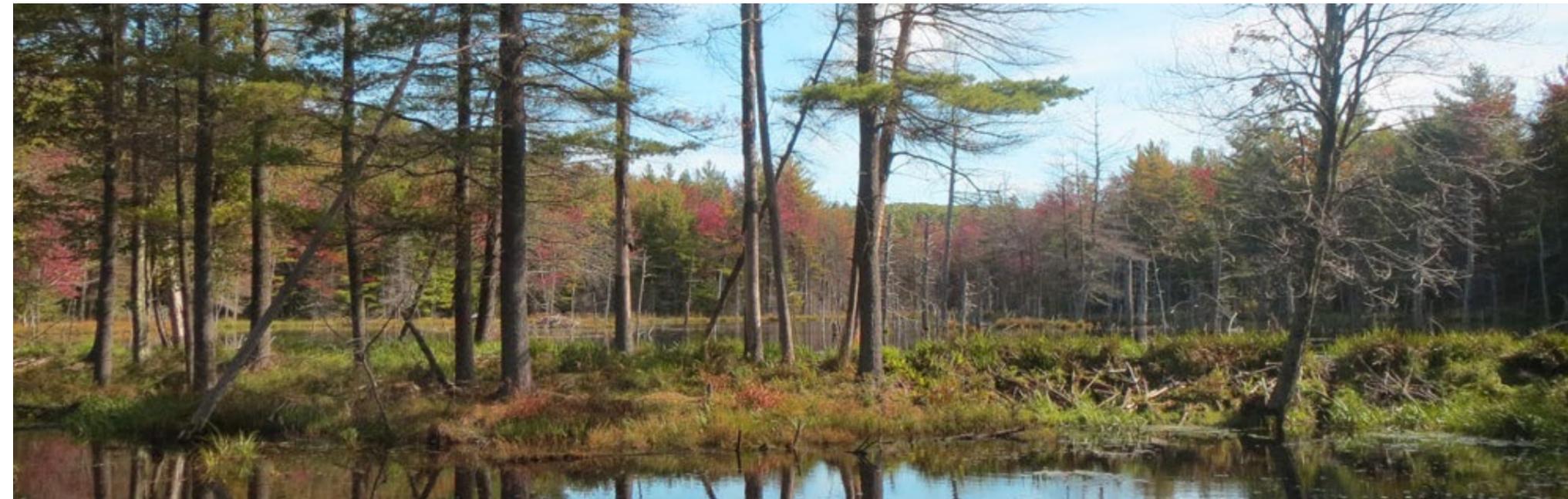
In 1998, Monadnock Conservancy was part of an informal coalition that sought to create a continuous corridor of protected land within the California Brook Natural Area (CBNA). Their goal was to connect Pisgah State Park (New Hampshire’s largest state park) to West Hill in Keene. The group included conservation commission members from Keene, Swanzey and Chesterfield; students and faculty from Antioch University New England; representatives from the Colony Memorial Trust (owners of the 500-acre Horatio Colony Preserve on West Hill); other nonprofit conservation groups; interested citizens; and landowners within the watershed. The CBNA is approximately five

miles long and consists of about 9,000 undeveloped acres. It comprises a rich diversity of upland and wetland natural communities and is within the largest block of unfragmented land (28,223 acres) in southern New Hampshire. All three communities, Keene, Chesterfield and Swanzey identified the CBNA as a priority for conservation.

The hard work and collaboration with surrounding communities has paid off. Since 1998, Monadnock Conservancy has acquired 14 conservation easements in the CBNA, protecting over 2,100 acres. Through the ARM Fund grants provided to Monadnock Conservancy in 2010, an easement

on the Colony property was acquired, involving 306.9 acres – with 32 acres of wetlands, seven of which are within a source water protection area – approximately 8,000 feet of streams, and eight vernal pools. The parcel contains 279 acres of Tier 1 habitat and 17 acres of Tier 2 habitat. The project protects habitat for wildlife species of concern: great blue heron, northern goshawk and red-shouldered hawk. There is also an active heron rookery with other species documented such as wood turtle, bobcat, and blue-spotted and Jefferson salamanders.

The two West Hill parcels provided an additional





553 acres to the CBNA effort. The West Hill property is located at the eastern end of the corridor and is a critical link between 1,500 acres of adjacent conserved land

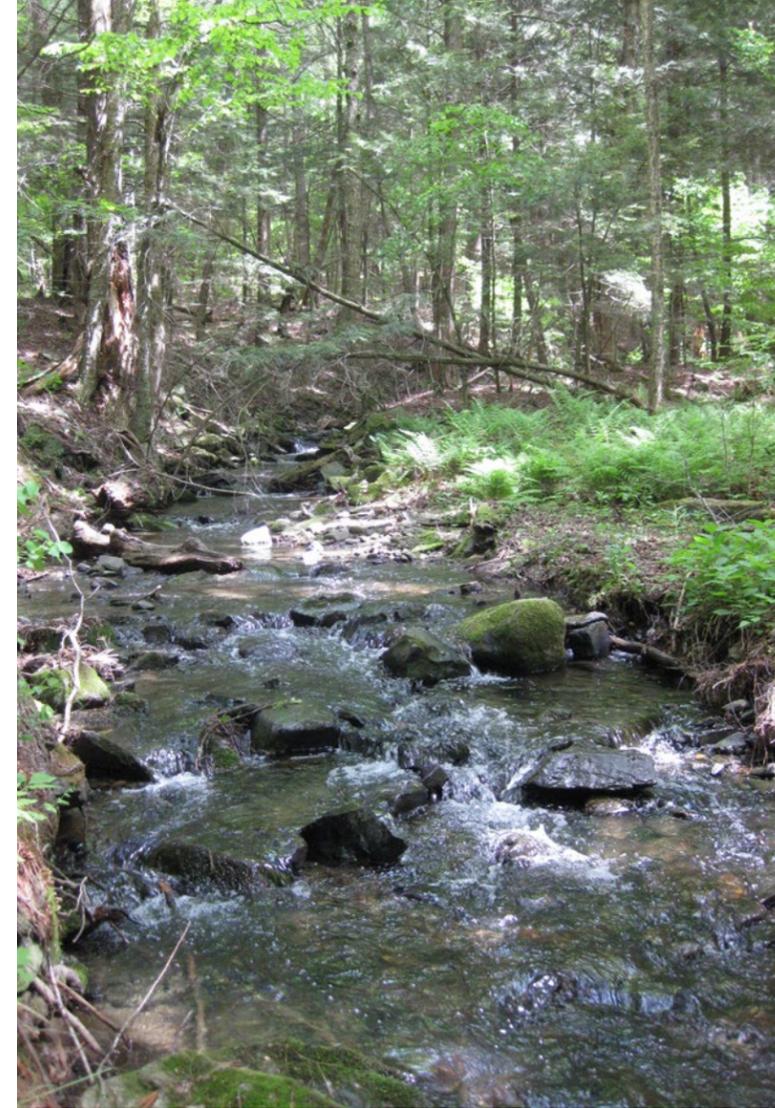
to the west and 670 acres of adjacent conserved land to the east. The West Hill property contains the ridgeline of West Hill, the most dominant natural landmark in Keene and part of a viewscape that, according to the Keene Master Plan, “defines the city.” This project was identified by Keene’s 2000 Open Space Master Plan, which states: “The city is defined by its hillsides, which should be protected to avoid erosion, sedimentation, increased valley flooding or the loss of natural beauty,” and calls for action to “obtain scenic easements for those hillsides that are the most visible from the valley floor.”

The West Hill project permanently protects two parcels comprising a rich diversity of upland and wetland natural communities. The area is noted to have Tier I wildlife habitat on 98% of the 553-acre property. The conservation easements on the property are held by Monadnock Conservancy. The larger tract allows for forest management with easement terms requiring a 100-foot riparian buffer in order to protect the aquatic resources. The conservation easement on the smaller tract will contain “forever wild” provisions and not allow for timber management.

Forever Wild Easement

“Forever Wild” is a designation for land to be protected in its natural condition so the wild character is preserved forever. Forever Wild land should be as free from human manipulation as possible, with management actions, if any, primarily limited to ecological restoration or to preservation of natural communities and rare species at risk. Natural occurrences such as floods, drought, wind and ice damage will continue to shape the land over time.

These parcels possess intact aquatic resources with high value upland habitat important to the health and ecological integrity of New Hampshire forests. The NHB noted the Jefferson salamander and wood turtle have been confirmed within 1 mile of the West Hill property and it is likely these species are found on the abutting Horatio Colony Preserve, where there are many documented vernal pools. Ecosystem management consultant Rick Van de Poll reported that there was possible evidence of the Jefferson’s-blue spotted complex observed in one pool and old jelly egg cases that appeared to belong to this species where a raccoon had pulled out and eaten a salamander egg mass.



the protections to the watershed and strengthen the original easement’s aquatic resource protections. All of Sky Ranch Pond and much of the pond’s watershed are now under the protection of UVLT held conservation easements funded by NHDES and LCHIP. The Plainfield Conservation Commission also contributed to the project through the award of a grant to help support the overall costs and future stewardship of the property.

Hanchetts Brook Project

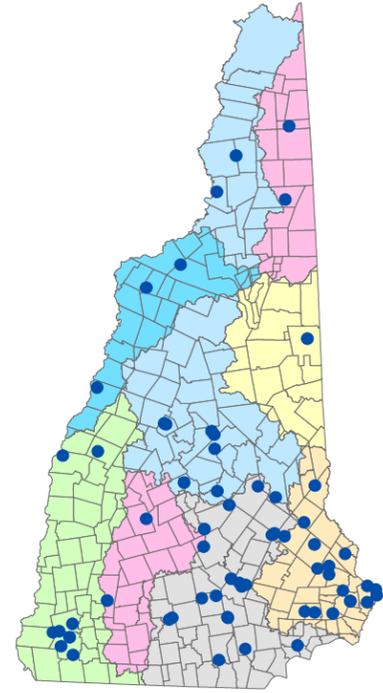
Awardee: Upper Valley Land Trust
Award Amount: \$110,560
Total Project Cost: \$119,560

Situated in the northern corner of Plainfield within a mile of the main stem of the Connecticut River, the Hanchetts Brook Forest parcel was the recipient of a 2012 grant award for the protection of 101 acres. This project helps to create a contiguous 548-acre protected upland forest in this watershed. The property provides connectivity between protected lands and aquatic resources within the watershed, two of the major criteria of the ARM Fund.

Permanent protections were accomplished through the conveyance of a conservation easement, on the Hanchetts Brook Forest, to the Upper Valley Land Trust (UVLT), a nationally accredited land trust. In addition, riparian restrictions were donated on an adjacent prior-conserved property (owned by Plainfield Cider Orchard) around a large water body known as Sky Ranch Pond. This effort effectively increased

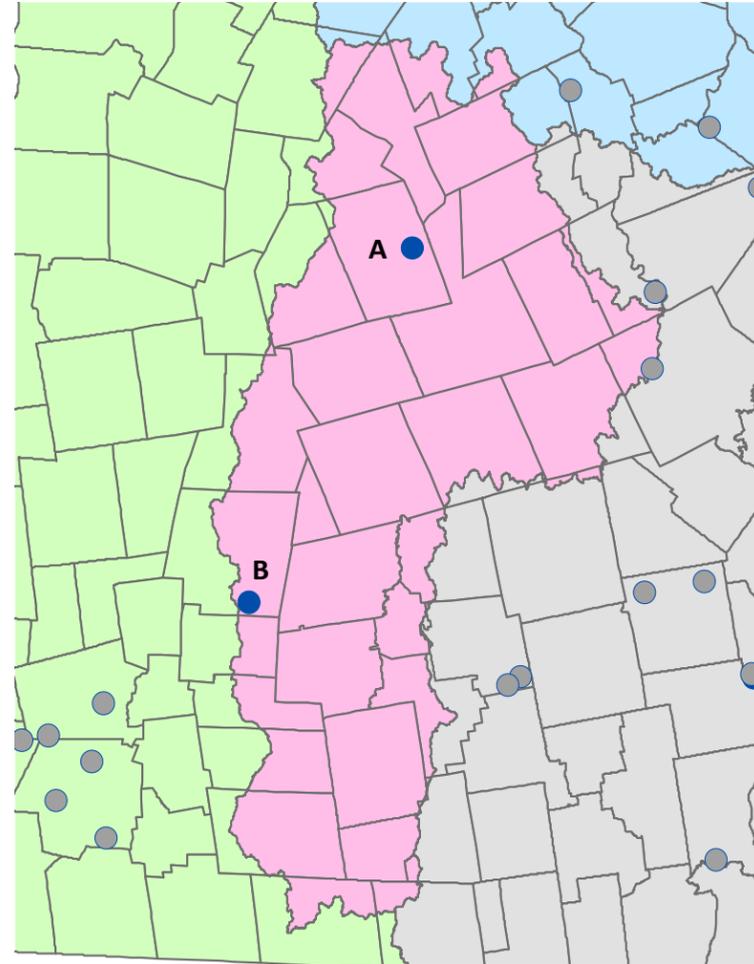
Hanchetts Brook Forest consists of approximately 101 acres, including stream frontage, meander wetlands and mature upland forest. The forest is adjacent to the 447-acre permanently protected “Plainfield Orchard” property. A significant stream resource, Hanchetts Brook flows through these conserved lands for about 1,750 feet, enters Sky Ranch Pond and continues flowing 5,870 from the pond to the Connecticut River. Near the height of land on Governor’s Hill, the property includes an outstanding example of a red oak-ironwood-Pennsylvania sedge woodland. This project protects this sensitive headwaters area and was identified on the Comprehensive Conservation Plan of the Silvio O. Conte National Fish and Wildlife Refuge as the “Connecticut River Rapids Macrosite.” This area has been noted by biologists as a region rich with concentrations of rare, threatened and endangered plant and animal species identified by NHB.

The conservation easement on Hanchetts Brook Forest includes public access provisions, allowing for continued access to the property for low-impact, pedestrian-type activities consistent with the conservation purposes of the easement. The Plainfield Cider Orchard property also contains provisions in its conservation easement that will ensure public access to the forests in a way that is consistent with the protection of the varied and significant natural resources present on these properties.



ARM Fund Service Areas

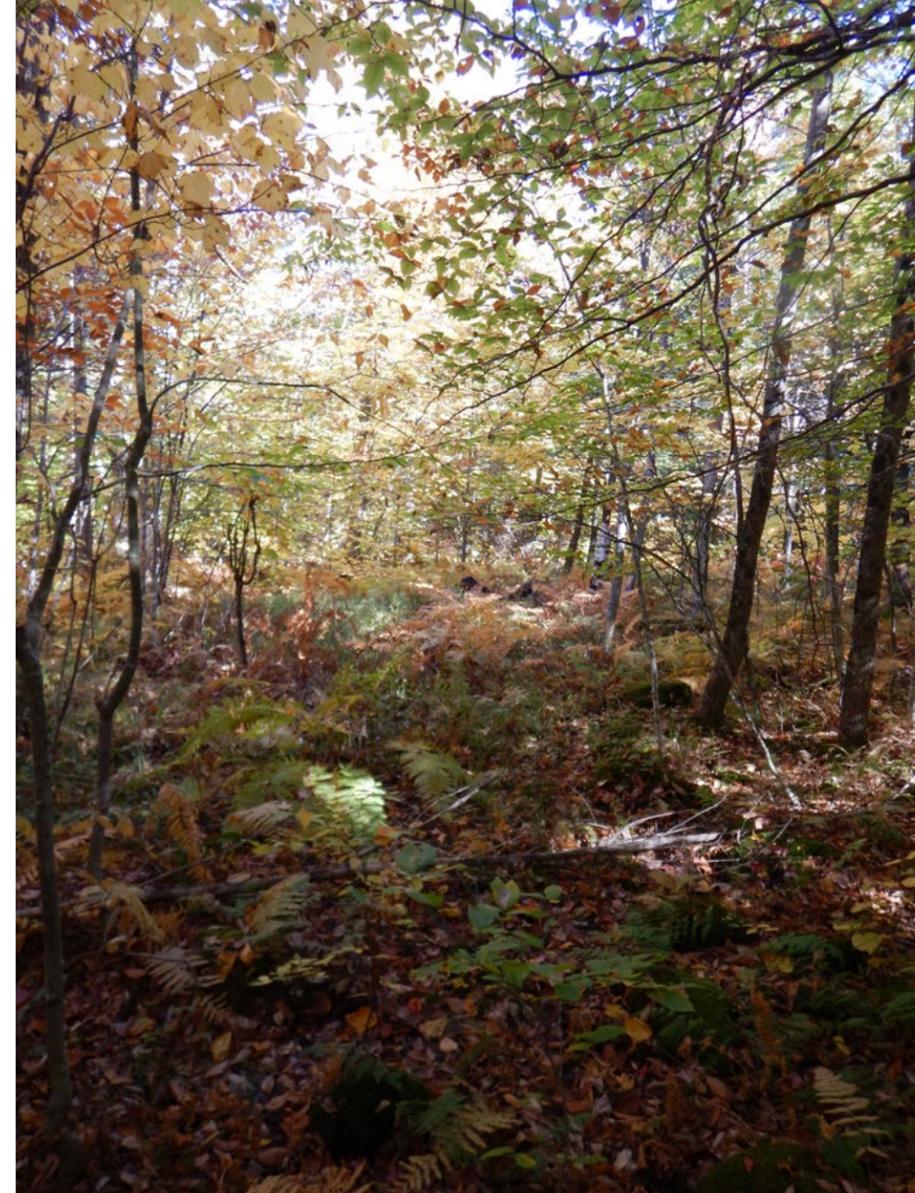
- Pemigewasset-Winnepesaukee Rivers
- Merrimack River
- Contoocook River
- Lower Connecticut River



- A – Project:** Brown Property
Location: Sutton, Merrimack County
Award Amount: \$150,000
- B – Project:** Green Crow
Location: Stoddard, Cheshire County
Award Amount: \$15,000

Green Crow Tract Conservation Easement

Awardee: Society for the Protection of New Hampshire Forests
Award Amount: \$15,000
Total Project Cost: \$461,300



The Harris Center for Conservation Education had the unique opportunity to purchase six contiguous parcels of land from the Green Crow Corp., a forest management and land development corporation, in Stoddard in 2013, with the help of an ARM Fund grant. The Harris Center bought the land with private donations, grants and a loan from the Spoonwood Fund, a revolving land protection loan fund of the Harris Center. As a donor-restricted loan fund, the money had to be repaid with interest. In order for this type of arrangement to be awarded ARM Fund money, the Harris Center acquired the property unrestricted and “sold” a conservation easement on the parcel. SPNHF agreed to hold the easement and to work on repaying the loan and cover all other transactional expenses.

The Green Crow property contains valuable wetlands and streams that drain into a tributary of the North Branch of the Contoocook River, a state designated river. Wetlands on the parcel vary widely because of regional and local differences in soils, topography, climate, hydrology and vegetation. The 360-acre parcel is recognized for its outstanding natural resources, scenic beauty, groundwater discharge and recharge function, and its overall value to wildlife. The wetlands found on the Green Crow

property occur along intermittent streams and in other low-lying areas that are dominated by herbaceous plants, a variety of ferns, fruit-bearing shrubs, and trees adapted to saturated conditions. A common deciduous tree found on the property is the red maple. An example of its adaptation to the seasonal hydrology is its development of buttressed roots at the base of the tree, which helps anchor them in the saturated soils. Forested swamps found on the Green Crow parcel serve a critical role in the watershed by reducing the risk and severity of flooding to downstream areas.

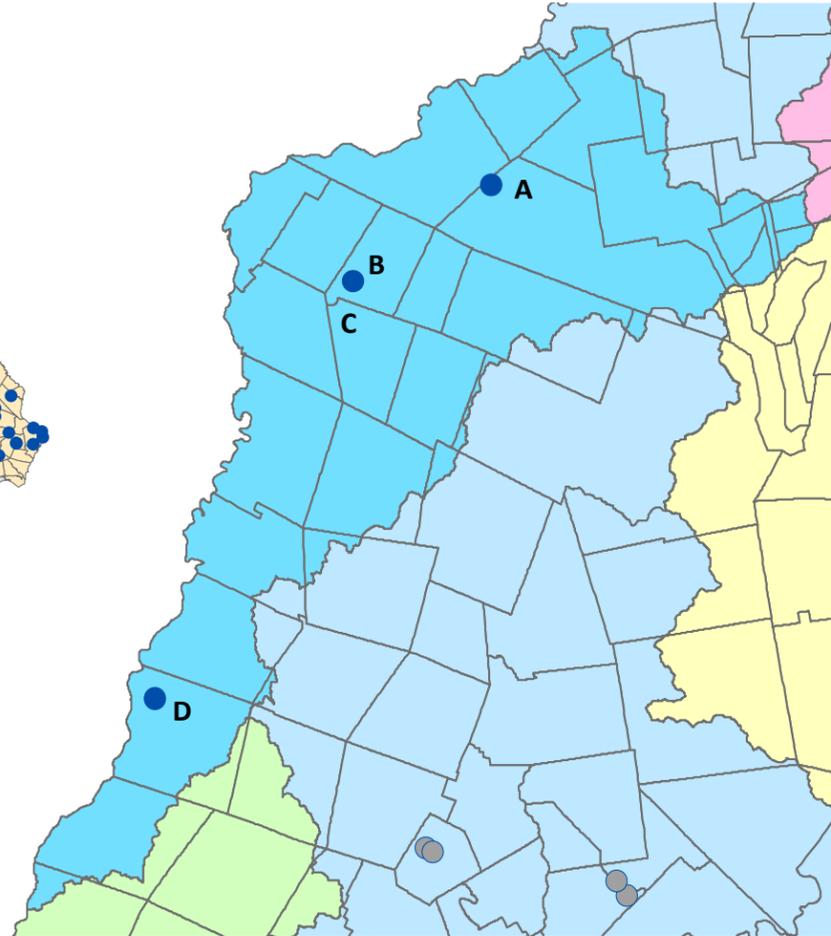
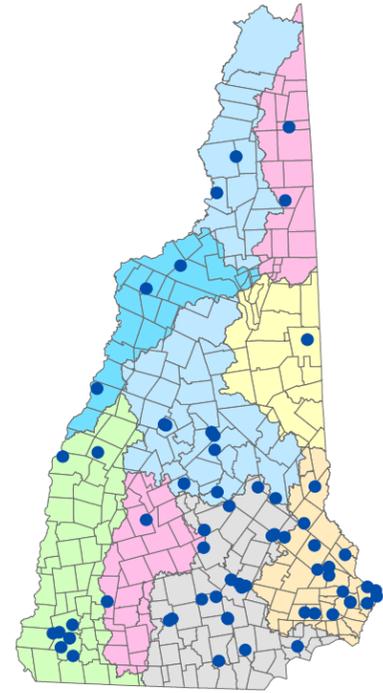


The parcel is currently referred to by the Harris Center as the “Wilson Tavern” based on an historic tavern site on the property. The former Monadnock Sunapee Greenway (since relocated approximately 1.5 miles to the west) is a dirt road, now unused and overgrown in places, that runs north south through the property, roughly bisecting the Green Crow land. The protection of this parcel enlarges existing protected lands and is located within a large contiguous block of open land identified as important by several regional and local conservation plans. This area has been the subject of a great deal of concerted conservation activity by the Harris Center, SPNHF and other groups. In all directions, the property abuts other conservation lands that provide substantial linkage to previously protected lands in Stoddard, Nelson and Hancock. Altogether, the estimated contiguous protected acreage in this area now comprises more than 30,000 acres. Because of these “greenway” connections that provide large areas of unfragmented forests, many wildlife species are found using the area including white-tailed deer, bobcat and moose.



As part of the negotiations and conditions of SPNHF assistance with this conservation transaction, a portion of the Green Crow tract had to be conveyed with a forever wild/natural area designation. Using the existing Monadnock Sunapee Greenway as a natural boundary within the parcel, the Forever Wild restrictions were placed on the eastern half of the property to include 181 acres. SPNHF will hold, monitor and enforce the conservation easement, ensuring the property’s long-term protection. Standard stewardship activities of SPNHF include monitoring all easement properties annually by flying over the property and taking a digital photograph (aerial monitoring). The photos are analyzed for land use changes that may be issues needing an on-ground visit. After each aerial monitoring session, staff contacts the owner if there are questions about what they see on the property. In addition to aerial monitoring, the property will be visited by an easement steward every two to three years.

The Harris Center is dedicated to promoting understanding and respect for our natural environment through education of all ages, direct protection and exemplary stewardship of the region’s natural resources, conservation research, and programs that encourage active participation in the great outdoors (<http://www.harriscenter.org/>). This property easily provides the outdoor pedestrian lots of recreation and education opportunities in all seasons of the year. Winter hikes have been held for the purpose of observing tracks of mammals passing through the area.



ARM Fund Service Areas

- Middle Connecticut River
- Pemigewasset-Winnepesaukee Rivers
- Saco River
- Lower Connecticut River

A – Project: Brebner Conservation Area
Location: Bethlehem, Grafton County
Award Amount: \$100,000

B – Project: Ammonoosuc Floodplain Restoration
Location: Lisbon, Grafton County
Award Amount: \$60,000

C – Project: Ammonoosuc Hanno Pond
Location: Lisbon, Grafton County
Award Amount: \$98,350

D – Project: Bailey-Clay Brook
Location: Lyme, Grafton County
Award Amount: \$60,000



Ammonoosuc Hanno Pond/Floodplain Restoration

Awardee: Ammonoosuc Conservation Trust

Award Amount: \$160,000

Total Project Cost: \$160,000

The Ammonoosuc Conservation Trust utilized ARM funds in 2012 to purchase and protect stream bank and valuable riparian buffer on a stretch of the Ammonoosuc River in Lisbon. The property includes portions of two parcels that contain a complex of wetland and agricultural land surrounding Hanno Pond, a 6-acre oxbow pond that was physically separated from the Ammonoosuc River in the 1850s. The WAP notes much of the site as having the highest ranked habitat in the biological region due to the juxtaposition of river and open water habitat. The property provides significant habitat for migratory waterfowl and neotropical songbirds. The land across the Ammonoosuc to the north contains an active bald eagle nest, the only known one on the Ammonoosuc River. Together the two parcels are now the Ammonoosuc River Wildlife Management Area.

In 2013, a second proposal was funded to begin habitat improvements along the river. This section of the river has seen severe flooding and bank erosion. Ice jams occur quite frequently; the most recent ice jams occurred in late 2010 and 2012, which contributed to a substantial loss of riverbank. The proposal to restore 4 acres of riparian forest buffer and vegetating 1,000 feet of eroding river bank will provide shoreline anchoring and assist in minimizing future erosion.

The site is approximately one-third of a mile

upstream of Lisbon Village and directly downstream of potential pollution sources, including substantial commercial development in the Ammonoosuc River floodplain in Littleton. The land across the river to the south is owned by the Town of Lisbon and contains the town's water supply consisting of gravel-packed wells. Protecting the lands around water supplies or potential water supplies is important to ensure a safe, clean water supply into the future. Every acre conserved helps to keep down the costs of water treatment.

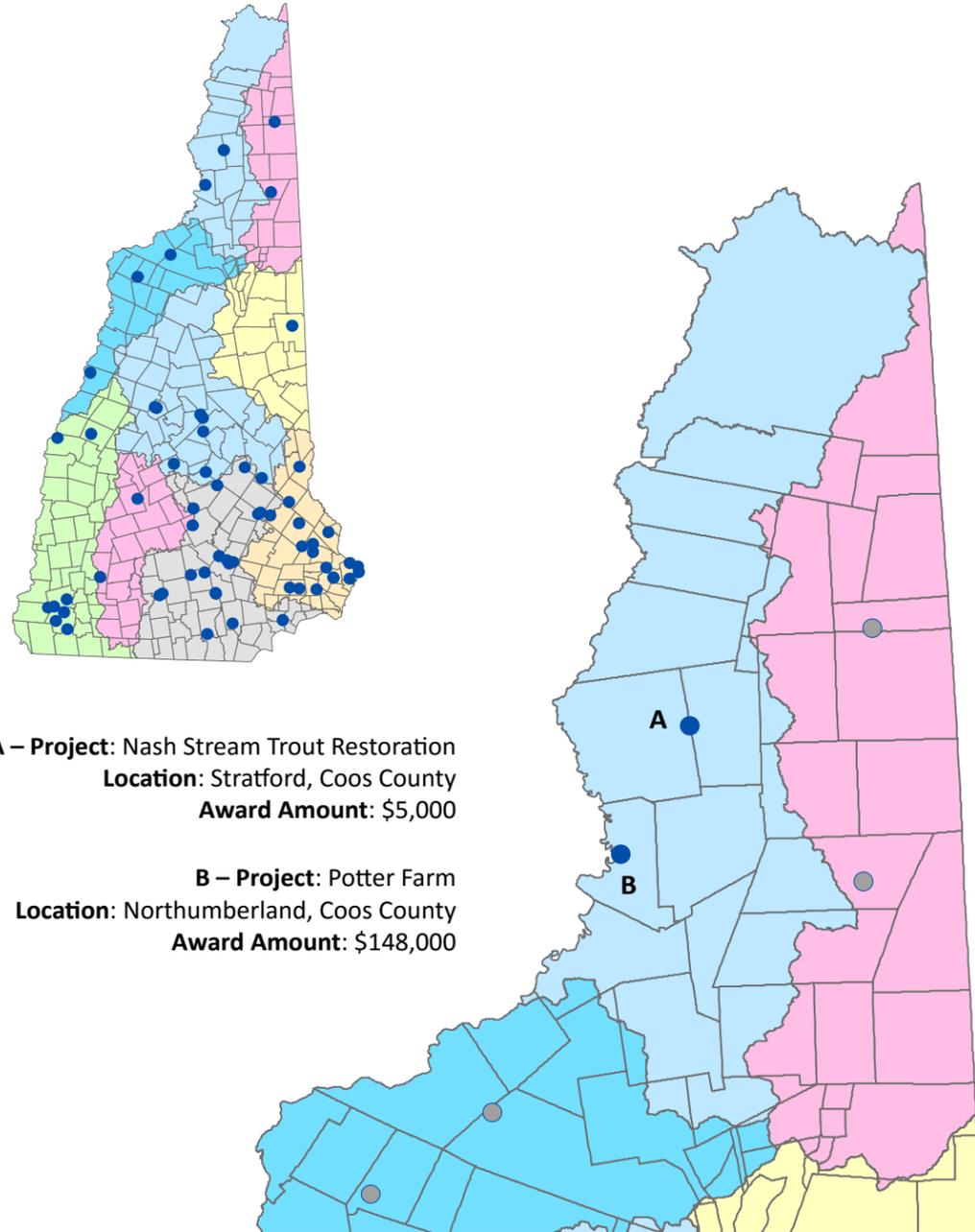
The long-term goals for this project are to restore and protect floodplain forest and restore/create riparian, wetland and upland functions and values. Additional goals are to buffer and enhance the Hanno Pond wetland complex and provide increased educational and recreational values. The site offers a wide variety of educational opportunities for Lisbon School students, both for field trips and for participation in conservation land management and enhancement. The school has already been involved in the dormant stake planting along the river bank. A total of 2,250 shrubs and trees were planted on the site including a 35-foot shrub buffer along the top of the bank along the Ammonoosuc River. Restoring a forested floodplain may take 40 to 50 years, but the initial steps undertaken on this property will result in a riparian forested buffer and a stabilized shoreline in a critical location for protection of water quality in perpetuity.

Potter Farm

Awardee: The Nature Conservancy
Award Amount: \$148,000
Total Project Cost: \$382,000

ARM Fund Service Areas

- Androscoggin River
- Upper Connecticut River
- Middle Connecticut River
- Saco River



A – Project: Nash Stream Trout Restoration
Location: Stratford, Coos County
Award Amount: \$5,000

B – Project: Potter Farm
Location: Northumberland, Coos County
Award Amount: \$148,000

On September 17, 2010, The Nature Conservancy purchased the Potter Farm in Northumberland along the Connecticut and Upper Ammonoosuc Rivers – a place that has emerged as one of the highest priority areas for floodplain forest restoration in the state. The 252-acre property has river shore and floodplain on both rivers in an area known as Maidstone Bends and includes riparian wetlands, hayfields and over 168 acres of upland field and forest that extend to the Cape Horn ridgeline.

The Potter Farm land stretches from the southeast near the height of land of Cape Horn to the confluence of the Connecticut River and the Upper Ammonoosuc River in the northwest. The upland portion is adjacent to the 2,175-acre Cape Horn State Forest and is located within an 119,600-acre forest block identified as a top priority for forest conservation by the Conservancy. The forest land also abuts the Town of Northumberland’s 65-acre conservation easement. With this acquisition, 2,500 acres of conservation land were connected, with approximately 640 feet of frontage on the Connecticut River and 5,400 feet on the Upper Ammonoosuc.

The floodplain and river habitat protected by this project lie on the southern end of this unique “Maidstone bends” section of the Upper Connecticut River. The federal and state endangered dwarf wedgemussel uses the sandy shifting river bottoms throughout this area of the river for habitat. The NHB documents satiny willow (*Salix pellita*), which thrives on the edges of the hayfields bordering the river. The U.S. Fish and Wildlife Service, Ducks Unlimited, NHFG and several other bird conservation organizations have identified Maidstone Bends as an important migratory corridor for ducks that overwinter in the Atlantic like American black duck, greater and lesser scaups, and ring-necked ducks. Other species of conservation concern such as bald eagles, northern harriers, American bitterns, and American woodcocks find food and breeding habitat in the oxbows and wetlands of Maidstone Bends. Numerous songbirds use the area as a stopover point. Osprey nest upstream and likely use floodplain



and shoreline trees at the Potter Farm for perching habitat. Additionally, several rare and unusual plant and natural communities have been identified in the uplands and along the ridgeline of the Potter Farm forest adjacent to Cape Horn State Forest including beaked panicle, green adder's mouth, slender cliffbrake and smooth woodsia.

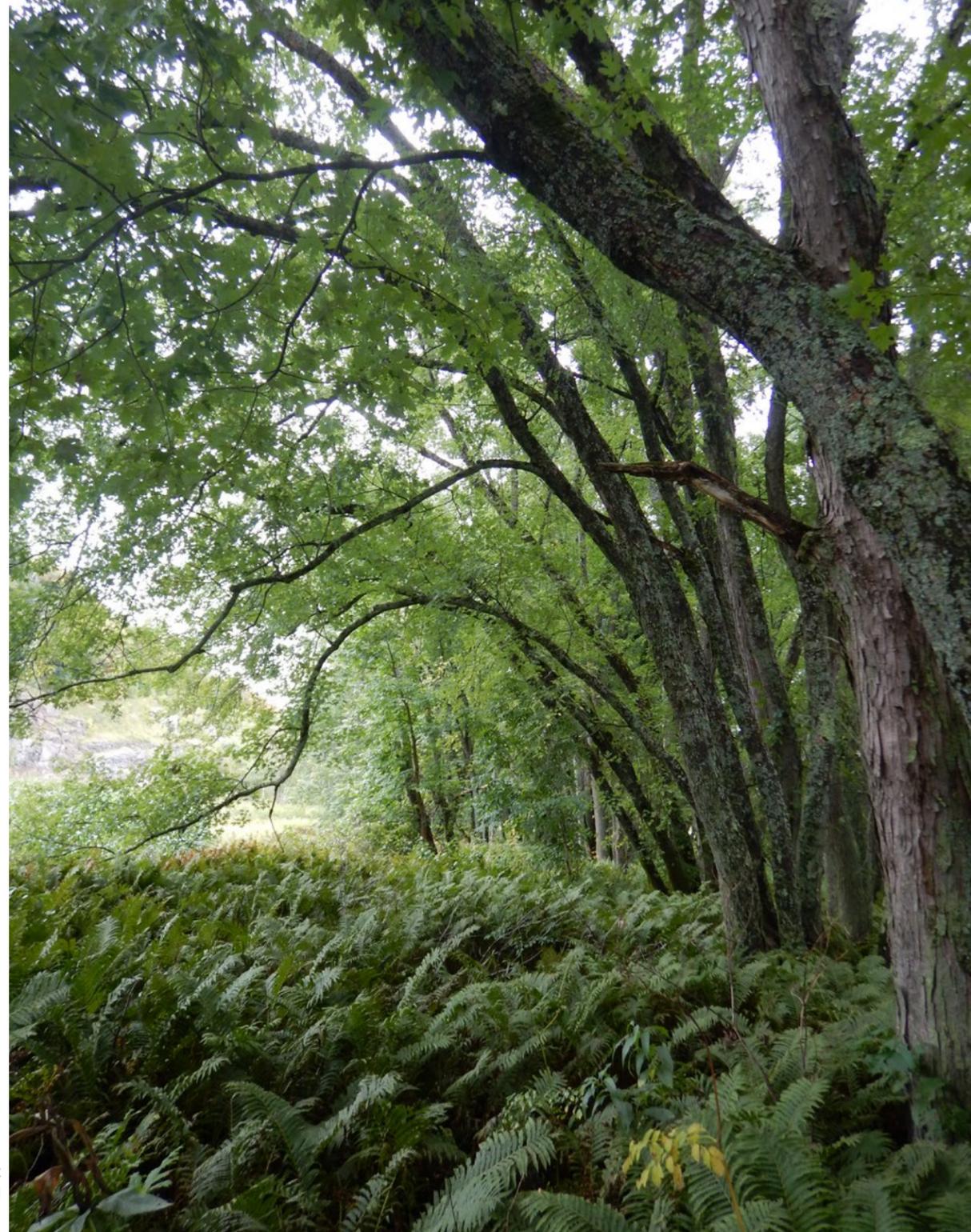
Within the Lower Terrace Fields, roughly 30 to 35 acres will be maintained as active hayfields, while the remaining 45 to 50 acres was targeted for floodplain forest restoration and enhancement. Floodplain forest restoration is focused on restoring two floodplain natural community types:

- Silver maple-false nettle-sensitive fern floodplain forest (S2).
- Silver maple-wood nettle-ostrich fern floodplain forest (S2).

This restoration and enhancement primarily included two approaches:

1. Restoring existing areas of floodplain forest that were degraded by various land uses (including harvesting of floodplain tree species for firewood).
2. Restoring floodplain forest vegetation to areas on the property that have the correct flood regime, hydrology and soil characteristics to support floodplain species.

Both approaches required planting of native floodplain species. The restoration of existing, degraded, floodplain forest areas included a focus on allowing current floodplain tree saplings to mature. As part of the planting,



Silver Maple floodplain forest
Androscoggin River watershed

The Nature Conservancy conducted experiments in some of the wetter portions of the floodplain to assess the planting success. These plantings have been monitored to observe how seedling versus sapling plantings survive. In preliminary monitoring efforts, it appears that planting silver maple saplings is the best approach. While saplings are more expensive, the saplings planted survived throughout the growing season, whereas

the seedlings were overtopped by vegetation and were negatively impacted by Japanese beetle herbivory. Visual observations during a 2016 site visit also indicated plantings in the lower lying, likely more "wet" areas demonstrated significantly greater growth. Both of these findings will be considered in future restoration projects.



Floodplain Forests

Floodplain forests usually occur in the low, flood-prone areas along rivers, typically less than 20 feet above the river channel. They are often associated with oxbows (pools that have become separated from the river channel), temporary wetlands that dry up in summer (vernal pools), open meadows of grasses and wildflowers, and dense shrub thickets. The periodic floods in these forests recycle sediment and nutrients, creating some of New Hampshire's richest soil deposits.

Along the Connecticut, Merrimack and other large rivers, floodplain forests consist of silver maple trees and a rich groundcover of wildflowers and ferns that thrive following large-scale floods that are common in these areas.

Floodplain forests are unique because of their periodic flooding. These regular disturbances, which deposit silt and sand along the banks of waterways, help create and maintain unique communities of plants that tolerate flooding and require nutrient-rich soils. Floodplain forests contribute many free ecological services to our society: they help filter pollutants to prevent them from entering streams, improve water quality, are critical in controlling erosion, and help buffer rivers against catastrophic flooding.

Floodplains are home to a diversity of wildlife. The damp soils create rich insect and amphibian breeding habitats, and these species in turn become prey for birds such as woodcock and barred owl, for mammals such as mink and raccoon, and for reptiles such as smooth green snake and wood turtle.

Afterward: Long-Term Stewardship

NHDES must ensure that all mitigation sites will be protected in perpetuity. Each applicant that receives an award for a land conservation project is responsible for ensuring long-term protection of the property. To ensure long-term success, the project must include a report describing how annual monitoring of the mitigation site(s) will be conducted and identify the name of the qualified professional responsible for monitoring. A component of the budget for a project should indicate the amount of funds to be transferred for the long-term management of the parcel. NHDES will enter into a long-term agreement with the steward that details stewardship requirements, including but not limited to such items as annual site visits, adaptive management strategies, control of invasive species and the maintenance of signs. According to staff at UVLT, funds are routinely set aside to assure the continuation of a Land Trust's ability to adequately protect the easements. UVLT

employs staff devoted to easement enforcement including a Vice President of Stewardship, a Stewardship Coordinator, a part-time Stewardship Intern, and almost 40 volunteer "Land Stewards," in addition to the rest of the UVLT staff team. A restricted stewardship fund supports UVLT's annual monitoring of conserved properties and the associated costs. Monies are added to the fund each time a conservation project is completed. Earned interest is used to help fund annual stewardship costs, while the principal is available in the event an enforcement action is ever necessary. Through yearly visits of the conservation sites, the terms of the easement can be reviewed and any problems encountered can be brought to the attention of the easement holder. More information on monitoring and becoming a volunteer steward can be found at <http://extension.unh.edu/Volunteer/Natural-Resources-Stewards>.



Sip Pond, Lower Connecticut River watershed



Black Brook Preserve, Merrimack River watershed



Connecticut River, Upper Connecticut River watershed >>

Moving Forward

The success stories highlighted in this book are a collaboration of 10 years of hard work and dedication by many project partners with a focus on preserving the integrity of our natural resources. The ARM Fund and many others in this state remain committed to continuing these efforts and addressing new challenges. One such challenge is the knowledge that New Hampshire’s climate is changing, and will continue to change in the future. Addressing the needs of ecosystems and wildlife in the context of human and climate change stressors requires preparation and coordination between partners.

Many predicted aspects of changing climate – higher temperatures, more intense rainfall events, more frequent and/or prolonged stream flow changes – will impact the state’s waterways and wetland areas. Land protection is widely recognized as one facet in adapting to this changing climate, but it is also recognized that other “structural” deficiencies must also be addressed. An effort recently undertaken by the ARM Fund is collaboration with the New Hampshire Geological Survey and the New Hampshire Department of Trans-

portation to establish an inventory of deficient stream crossings (i.e., culverts) on the state transportation system that fragment stream reaches. This collaboration combines the need for upgrading aging infrastructure with the opportunity to improve aquatic organism habitat and passage. The goal is to develop a robust inventory in order to prioritize the replacement of deficient crossings with the most potential to exacerbate the effects of climate change and improve aquatic habitat. Through the development of assessment scores relative to aquatic organism passage and geomorphic compatibility, the program will have the opportunity to fund high priority deficient culverts through ARM funds.

The “Stream Passage Improvement Program” is a new and promising model of collaboration to achieve measurable environmental gains and result in more recovery of aquatic systems throughout the state, which will build upon our existing program. We look forward to working with existing and future partners to create a sustainable future for the next generations.



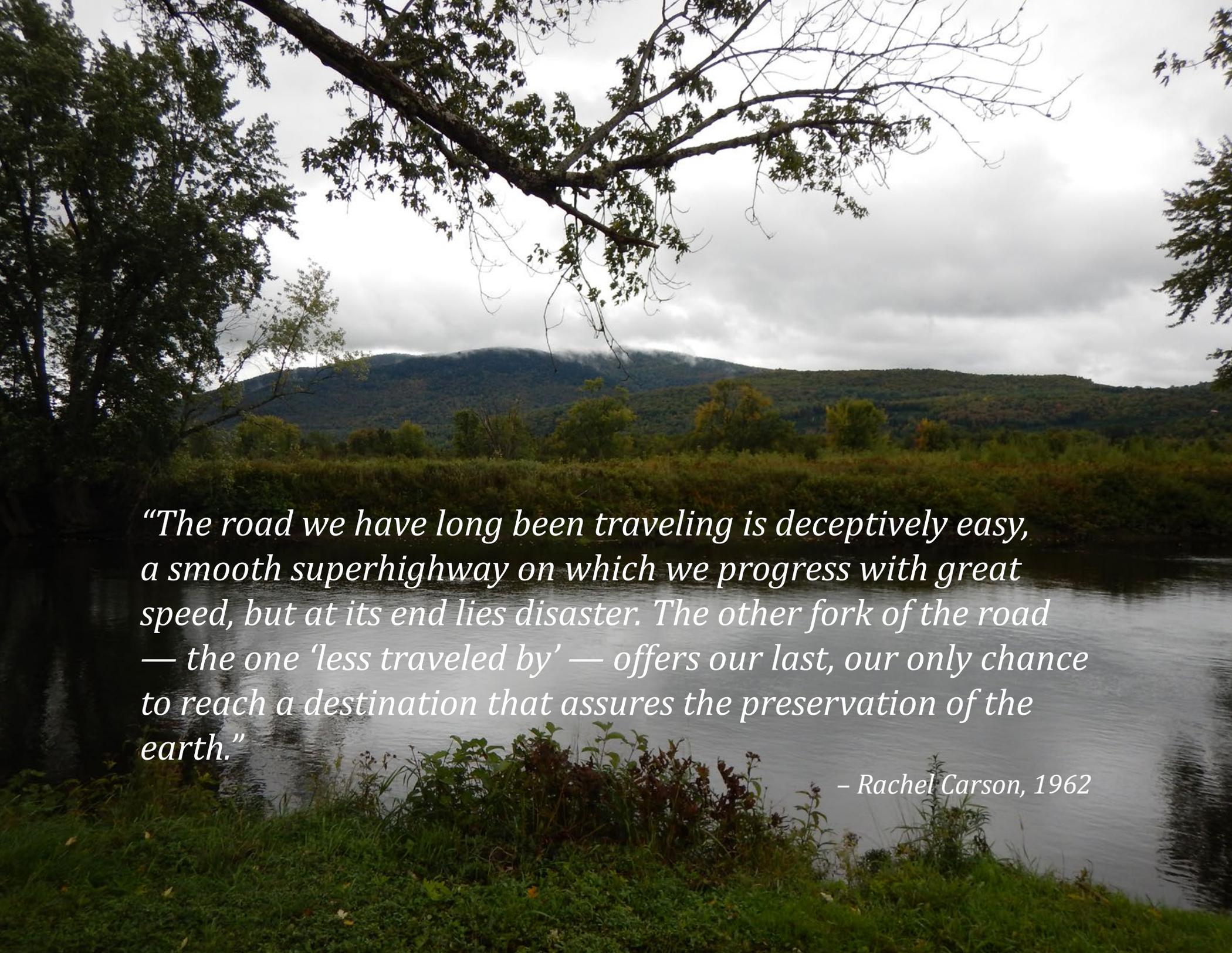
Falls Brook stream restoration volunteer day, Lower Connecticut River watershed



Ammonoosuc River, Middle Connecticut River watershed



Above: Beaver pond in Contoocook River watershed
Back cover: Connecticut River, Upper Connecticut River watershed



“The road we have long been traveling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster. The other fork of the road — the one ‘less traveled by’ — offers our last, our only chance to reach a destination that assures the preservation of the earth.”

– Rachel Carson, 1962