



2021 ALPINE Summer Institute
Standing on the Shoulders of Giants, Blazing New Trails



Participant Essays, September 2021

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Robin Austin and Olivia Lukacic

This set of essays was compiled by the staff of the 2021 ALPINE Summer Institute. ALPINE (Academics for Land Protection in New England) is a joint program of the Wildlands and Woodlands Initiative of the Highstead Foundation, based in Redding, Connecticut, and the Lincoln Institute of Land Policy, based in Cambridge, Massachusetts. The opinions expressed in the participant essays are those of the program participants.

Cover photo: Hiker on McAfee Knob along the Appalachian Trail. Photo courtesy of the Appalachian Trail Conservancy.

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INTRODUCTION

The year 2021 marks two milestones of note related to this report. The first milestone is being widely celebrated by the land conservation community, particularly in the United States. It was 100 years ago this October that the *Journal of the American Institute of Architects* published an essay authored by a young public servant, forester and rabble-rouser named Benton MacKaye (pronounced Mac-Eye). In his essay, MacKaye advanced an audacious, unprecedented proposal for what we might today characterize as a “large-landscape conservation corridor.” His idea was the to create an Appalachian Trail -- or more simply, the A.T. – which would encompass a continuous footpath stretching from Maine to Georgia. Today, of course, the A.T. is a global treasure, an icon among people who cherish outdoor adventure and the solace of wild places.

The second milestone is of more modest significance. The year 2021 marks the tenth year in which a summer institute focused on the subject of large landscape conservation has been organized by the Lincoln Institute of Land Policy and collaborating institutions – most significantly, the Quebec-Labrador Foundation in the early years, and more recently, the Highstead Foundation, home of the Wildlands and Woodlands Initiative and a key funder of ALPINE (Academics for Land Protection in New England).

What exactly is “large landscape conservation”? For the purposes of the Summer Institute, it continues to be defined as the protection and stewardship of land, water and natural resources across organizational, sectoral, jurisdictional, and even national boundaries. There are today myriad examples of large landscape initiatives across the globe, from Australia to the Arctic Circle. The 2021 ALPINE Summer Institute, as in previous summers, asked this year’s participants (university undergraduates, graduate students and early-stage professionals from New England and beyond) to consider a series of exemplary cases of large landscape conservation. It then challenged participants to analyze a large landscape initiative in which they might – today or in the future – play an instrumental role.

As they composed their essays on this topic, the Summer Institute staff asked the participants to be mindful of the question that MacKaye asked of his readers in 1921.

“Let us assume the existence of a giant standing high on the skyline along these [Appalachian] mountain ridges, his head just scraping the floating clouds. What would he see from this skyline as he strode along its length from north to south?”

The Summer Institute staff asked this year’s participants to undertake a similar exercise. We asked them to, figuratively, stand on the shoulders of giants in the field of large-landscape conservation – people like MacKaye, like Harriet Lawrence Hemenway (co-founder of the Massachusetts Audubon Society, the oldest Audubon society still operating in the world), like Charles Eliot (son of the President of Harvard and protégé of Frederick Law Olmsted, who spearheaded the creation of the first land trust in the world, The Trustees of Reservations), like Wangari Matthai (the Nobel prize-winning founder of the Kenya’s Greenbelt movement), and like Inuit communities in Canada, who recently agreed to the protection of more than 100 million acres of land and marine environment in Canada’s Far North. All of these conservation pioneers have brought us closer to the day that we can rightfully claim to have protected some 30 percent of the earth’s land and marine surfaces by the year 2030 – the so-called 30 x 30

(pronounced 30-by-30) goal now being considered for adaptation by the the fifteenth convening of the parties of the Convention on Biodiversity and Ecosystem Services (COP15 of the CBES). Representatives to COP15 from more than 190 nations will be physically and virtually convening in Kunming, China this fall, and in subsequent negotiations, to consider the adopting the 30 x 30 goal. The negotiations will have to consider a number of complex issues, including the recognition of indigenous people rights in land which might be conserved.

What this report includes are the essays written by 2021 ALPINE Summer Institute participants regarding project in which they are involved, or in which they hope to be involved sometime in the future, as conservation professionals, as volunteers or as engaged citizens. These essays demonstrate the imagination, determination, comprehension and skill of the 2021 ALPINE Summer Institute participants, giving us substantial hope for the future.

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Due to the restrictions and limitations imposed by the Coronavirus epidemic, the 2021 ALPINE Summer Institute was held virtually over a series of eight Zoom sessions, from June through August. We look forward to being able to convene in person once or twice during the summer in future years. The schedule of this year's sessions, listing the presenters at each session, follows on the next page of this report.

Participants in 2021 included fifteen students and young professionals who came from institutions and organizations across New England, as well as Oregon, Montana and Puerto Rico. In order to expand the opportunity to participate in this year's summer institute, we required of applicants a demonstrable and ongoing interest in large landscape conservation, rather than summer participation in a site-based job or internship. To our delight, this resulted in having the most experienced and diverse group we have hosted to date.

We had four TerraCorp members that were all working for land trusts, young professionals working at the New England Forestry Foundation, the Berkshire Natural Resource Council, the Doris Duke Charitable Foundation, the Network for Landscape Conservation, and the Conservation Trust of Puerto Rico/ Para la Naturaleza. Students came from Rhode Island Community College, Middlebury College, Oregon State University and University of Hawaii Manoa. Biographies are included with the papers submitted by the 11 participants who were able to complete final papers. Four additional participants in the course, listed in the "Additional participants" section of this paper," are either in the process of submitting their papers to professional journals or other published outlets, or withdrew from the final portion of the course due to family or personal exigencies.

Respectfully, the 2021 ALPINE Summer Institute Staff:

James N. Levitt, Director, International Land Conservation Network at the Lincoln Institute of Land Policy; Fellow, Harvard Forest, Harvard University; and Senior Fellow, Highstead Foundation

Marianne Jorgensen, ALPINE Program Manager at the Lincoln Institute of Land Policy

Robin Austin, Sustainable Land and Water Management Program Coordinator, Lincoln Institute

Olivia Lukacic, Instructor, University of Massachusetts Amherst

2021 ALPINE SUMMER INSTITUTE SCHEDULE

June 9:

Introductory session

Discussion of Benton McKay, the Appalachian Trail and the importance of large landscape conservation

Presenters: Jim Levitt and Tony Hiss, author

June 16

Land Protection Tools and Techniques

Presenter: Paul Catanzaro, Associate Professor in the Department of Environmental Conservation and State Extension Forester at the University of Massachusetts, Amherst

June 23

Case Study A: Harvard Forest and the North Quabbin Regional Conservation Partnership

Presenters: David R. Foster, Harvard Forest Director Emeritus, President of the Highstead Foundation and Leigh Youngblood, Former Executive Director of the Mount Grace Land Trust

June 30

Case Study B: Cold Hollow to Canada Initiative and Carbon Project

Presenters: Jim Shallow, Director of Strategic Conservation Initiatives, The Nature Conservancy Vermont and Charlie Hancock, Cold Hollow to Canada Initiative Cofounder and Board Chair

July 7 (no class session)—use time to research and select the focus for your own project

July 14

Case Study C: California's Cutting Green Tape Initiative

Presenters: Chandni Navalka, Associate Director of Sustainably Managed Land and Water Resources, Lincoln Institute of Land Policy; Sharon Farrell, Executive Vice President, Golden Gate National Parks Conservancy and Shawn Johnson, Managing Director of the Center for Natural Resources & Environmental Policy at the University of Montana

Case Study D: The Nature Conservancy Site Wind Right Initiative

Presenters: Brian Obermeyer, Director of Land Protection and Stewardship TNC Kansas; Nathan Cummins, GPRE Strategy Director; and Jessica Wilkinson, TNC Senior Policy Advisor, Energy & Infrastructure

July 21

Diversity, Equity and Inclusion in Conservation

Presenters: Karena Mahung, Consultant at Indufor Ltd.

Caroline Finney, author of *Black Faces, White Spaces: Reimagining the Relationship of African Americans to the Great Outdoors*

July 28 and August 3-4

Final participant presentations

PARTICIPANT PAPERS

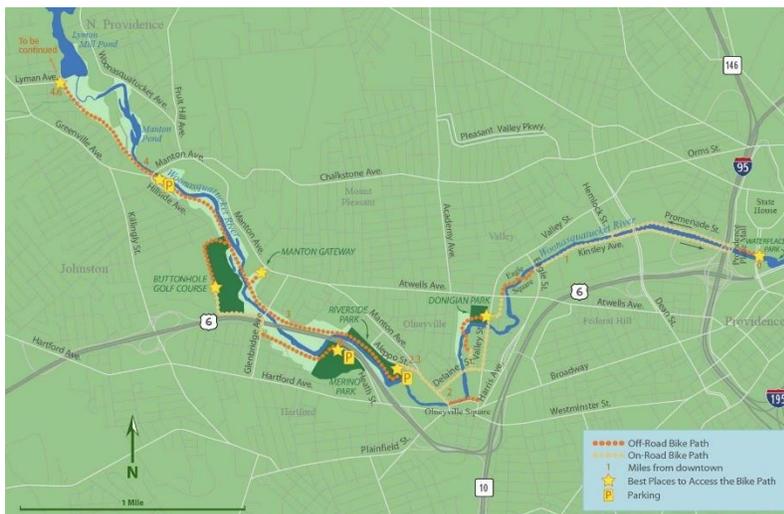
Clare Brown is a graduate of Loyola University in New Orleans with a degree in Economics. She is interested in the intersection of environmental and natural resource issues with economic principles and hopes to continue to learn and explore creative ways to sustain responsible natural resource access. She served in the Peace Corps in Madagascar as an Agriculture Food Security Advisor and is currently serving in the AmeriCorps as a Land Stewardship Coordinator for the Woonasquatucket River Watershed Council in Providence, RI.



Greenway Extension: Challenges and Impact for the Woonasquatucket River Watershed Council

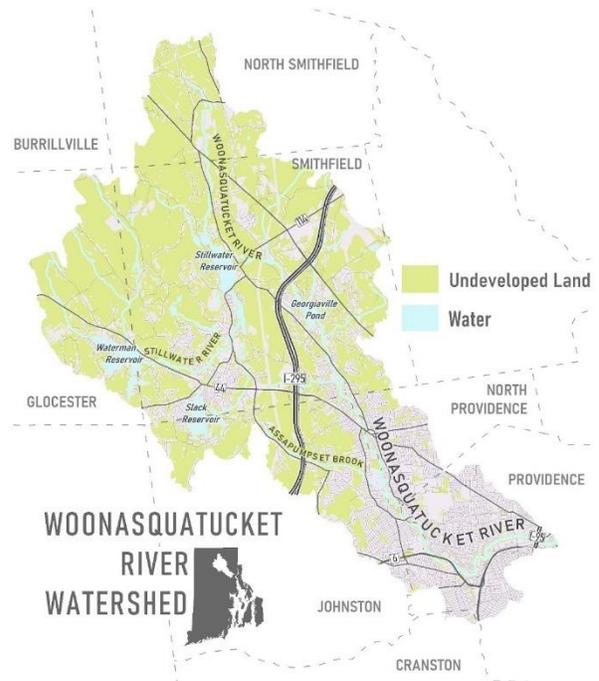
Background

The Woonasquatucket River Watershed Council (WRWC) started its work in the early 1990s, transforming the forgotten Woonasquatucket River to provide important resources to underserved communities in Providence. The council's Greenway has grounded the economic development and revitalization facilitated by the organization along the river. Though once maintained by the local Narragansett tribe, the Woonasquatucket River became a vital energy resource for Rhode Island during the Industrial Revolution. It was subsequently polluted and neglected, contributing to what also became neglected neighborhoods along the river. Through capital funding, the Greenway was established, and parks were restored from what had been polluted brownfields. These major efforts included trash removal, invasive plant removal, and wetland restoration—lead by local environmental visionaries and completed by community volunteers. To date, 75 acres of land along the river have been restored. All of this important work continues through the council's "River Ranger" team, who maintain the now 7-mile Greenway and five parks with the ongoing help of community volunteers and corporate sponsors.



The River Ranger team works on projects to sustain and improve the Greenway. This includes installations of critical Green Infrastructure. In Providence, this has included rain gardens, green roofs, bioswales, and parking lot retrofits. This is done to mitigate the effects of flooding and climate change on the watershed's vulnerable communities. Climate resilience is a major goal of the organization and is reflected in its educational and other programming.

The council has done an impressive job leveraging grant monies and sponsorships, community volunteer hours, and becoming a well-known organization throughout the state of Rhode Island. Though the council's success cannot be denied, their physical presence has not entirely escaped the Providence city lines. The Woonasquatucket River Watershed encompasses Cranston, Providence, North Providence, Johnston, Smithfield, Glocester, and North Smithfield. The existing Greenway runs 7-miles from downtown Providence to Lyman Avenue in Johnston—essentially at the Johnston town line. The path provides alternative transit to residents and connects to recreational resources, shopping centers, and apartment and office buildings. The path has sparked economic development in the communities it connects. Per the Northwest Bike Trail report published in 1999, the ultimate plan for the Greenway is 15 miles of continuous path along the river—a combination shared-use path and on-road bicycle facility, beginning at Providence Place in Providence and ending at Georgiaville Pond in Smithfield. This initiative is so important because the watershed encompasses the many other towns listed beyond Providence that are just as vulnerable to flooding and the effects of climate change and who would benefit from the path as a resource. Given a number of new developments, this proposal has been revisited with updates concerning its feasibility. This report identifies and examines the challenges associated with extending the bike path to that originally proposed terminus in Smithfield and discusses the strategies that may contribute to successful design and construction of the path and its long-term stewardship.



Updates

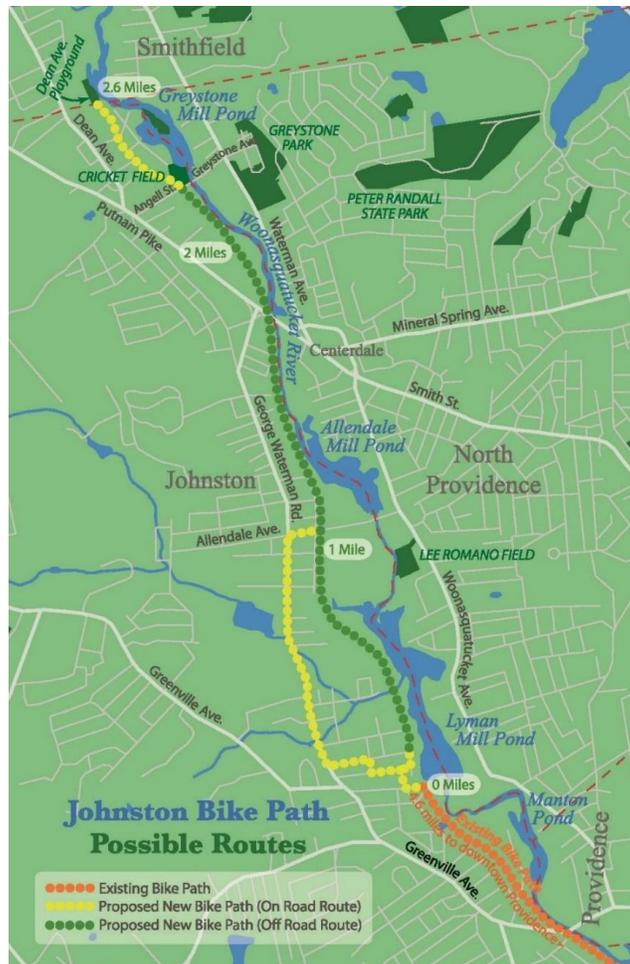
Since the 1999 report, a section of the proposed portion of bikeway in Johnston is undergoing a clean-up and restoration as part of an EPA Superfund Project. This area was polluted with dioxin and other toxins from chemical production from the 1940s to the 1970s. The site is capped, and the cleanup involves removing all contaminated soil, waste, and sediment over five years. The EPA will continue to produce substantial information that will be useful in the design process. This particular section of bikeway will likely be revisited once this cleanup has been completed.

The Town of Smithfield has decided not to support the implementation of the bikeway. Therefore, any plans to extend the path into Smithfield are on hold until this decision is reversed. This report will be concerned with the section of proposed bikeway from where the current path ends on Lyman Avenue in Johnston north until the Dean Avenue Playground, at the municipal boundary with the Town of Smithfield (save for the section undergoing Superfund cleanup).

Expansion Approach

Per the recommendation of Fay, Spofford & Thorndike, Inc., a civil engineering firm that completed a feasibility report on the proposed bikeway, the multi-use path would best be developed along or

adjacent to a former railroad right-of-way (ROW) north of Lyman Avenue in Johnston. By following this former ROW, the council can avoid constructing a bikeway that is majority on-road, and beautiful views of the Woonasquatucket River can be enjoyed given its proximity to the river. The former ROW is now under easement by the Narragansett Electric Company (NECo), a National Grid Company. National Grid supports the bikeway extension project. Therefore, following this ROW whenever possible will likely produce less challenges in terms of support and legality issues. The total estimated construction cost for the extension is approximately \$4,918,000, including construction, property acquisition (when necessary), design, and contingency costs. The challenges related to funding and property acquisition, among others, are discussed in the next section.



Expansion Challenges and Strategies

The challenges of expansion go beyond those related to the logistics of constructing the bikeway. The council will need to secure funding for construction and maintenance of the path, garner community support, foster long-term stewardship, and learn to navigate negotiations of land acquisition and the potential for legal issues associated with land use.

The challenges that the council will face in construction will likely be the parcels of privately owned land and whether those parcels will require acquisition or easements. There are also some potential contamination issues that have not been studied thoroughly and will need to be studied further during the design and construction phases of the path. The financial and remediation burdens of these

potential contaminations would fall on the council as the property owners. This, of course, is all contingent upon the agreeance of the current landowners. Along the existing Greenway in Providence, the Rhode Island Department of Transportation (RIDOT) handled all of the transactions with private property owners, so the council does not have much experience in that regard. It is recommended that they hire a professional outside of the organization or find someone pro bono to assist.

There are also some parcels where fencing or other structures may be necessary for safety and aesthetic purposes. There are some unsightly junkyards and other operations near this proposed path. Some parcels will require relocation of some factors of business operations, such as parking spaces. Where the path follows the ROW, there are issues of abutting residences that have encroached on the ROW in different fashions such as landscaping, fencing, and swimming pools. These are just a number of examples of potential issues regarding specific parcels of land along this proposed path. Given these potential issues, the council must invest in proper communication and relationship building with landowners and other residents. Building trust is vital to navigating these sorts of negotiations and garnering support for construction of the path.

The funding mechanism for the construction and maintenance of the path will also be a challenge for the council. The current Greenway is funded by a contract with RIDOT. This contract funded the design and construction and currently funds the team of River Rangers and all of the maintenance and projects along the Greenway. The relationship breakdown between different parties in Providence is as follows: RIDOT owns the Greenway and funds the maintenance; the River Rangers maintain the Greenway, and the Providence Parks Department maintains the parks along the Greenway. Unfortunately, the council is losing this funding from RIDOT this year. They will need to invest in negotiations with the town of Johnston and others to consider all possible avenues of ownership of the path and funding for ongoing maintenance.

In terms of the current community support for the path, residents of Johnston do seem to support its construction. The council held a public meeting in 2015, and a petition was created in support of the Greenway and signed by over 800 residents. This is not to say, however, that their approach in engagement was perfect. At that meeting, many residents were opposed to the path, citing increased activity as leading to an increase in crime. An important initial step in continuing this project is for the council to revisit their engagement with the Town of Johnston and the Town of Smithfield. The council needs to invest more in targeted and thoughtful outreach to educate the people who do not support the path and let them discuss and address their concerns in a more welcoming environment than the public meeting that was held. The council needs to highlight the path as a recreational and health equity asset to underserved communities. It is also important that they showcase the organization's other work in climate resilience and environmental education and literacy. This will require that they branch out more throughout the watershed and invest in the communities of Johnston and Smithfield in the same ways they have in Providence. If these challenges can be effectively navigated, the extension is feasible and will prove to be a very important asset for the towns of Johnston and Smithfield and their residents.

Erik Boyer is the Director of Stewardship at Wildlands Trust in Plymouth, MA. As Stewardship Manager he is responsible for the management of Wildlands Trust fee properties and conservation restrictions. He is motivated by his passion for both land management and improving public access opportunities for residents of Southeastern MA, enhancing the ecological value of conservation lands and public enjoyment. He previously worked with the Town of Dennis' Department of Natural Resources, as a Natural Resource Officer. Before that, he was a Program Supervisor and member with AmeriCorps Cape Cod. Erik is originally from the Philadelphia area and came to Massachusetts in 2004 to earn his bachelor's degree in biology at Gordon College. He grew up in a heavily developed suburb and always treasured hiking trips with his family to the New Jersey Pine Barrens and Acadia National Park. He spends most of his free time recreating outdoors in every way imaginable: trail running, rock climbing, mountain biking, and hiking the trails with his dog Tilly.



Plymouth Wishbone Trail Concept Paper

Introduction

The Plymouth Wishbone Trail (PWT) is an existing 14-mile trail that starts at the headquarters of Myles Standish State Forest (MSSF) and ends on the beaches of Ellisville Harbor State Park. The trail travels through conservation land owned and managed by the Massachusetts Department of Conservation and Recreation (DCR), the Town of Plymouth (TOP), and Wildlands Trust (WT). Since the creation of the PWT, there has been a vision to extend the trail with a northern leg that travels east to Duxbury Bay. At the time, much of the undeveloped land to the northeast of the trail was privately owned, but in the past five years, a number of land protection projects and easements have made this vision more feasible. This trail, when complete, will display a wide variety of protected land that is easily accessible to the prime tourist destination of downtown Plymouth and close to a major highway south of Boston, Route 3. Much of the land in the vicinity of the trail has been protected in the past five years.

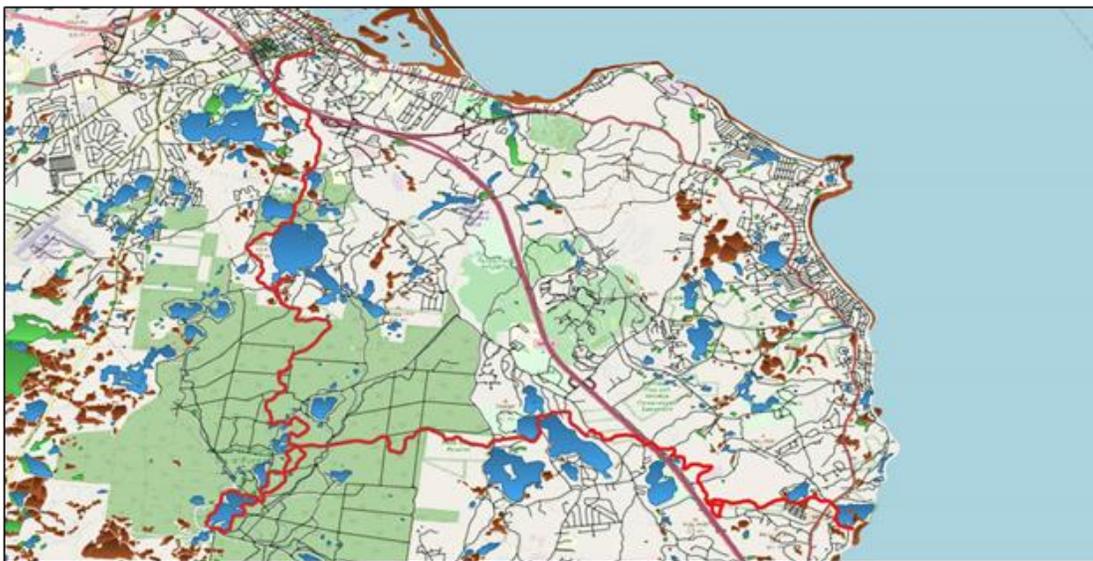


Photo 1 (Route of Concept Wishbone Trail provided by Malcolm MacGregor)

The Beginning

The original PWT was a project envisioned and implemented by rising Eagle Scout Alex Cavallo back in 2007. Alex worked with all three organizations to see this project to completion. Traveling west to east, the route starts at the headquarters of MSSF and continued east, traveling through the most popular trails in the park, the East-head Reservoir Trail, the Bentley Loop, and then onto a fire road that takes hikers out of the park. This first portion highlights some of the most pristine fire-managed pitch pine barren habitat on the east coast and the route travels through areas of the forest under different stages of fire management. The trail then continues through the WT's Halfway Pond and Emery Preserves to Old Sandwich Road and then to Ellisville Harbor State Park and the shores of Cape Cod Bay.



Photo 2 (Route of Original PWT provided by Malcolm MacGregor)

One issue with the original PWT is that hikers are walking on Old Sandwich Road for the final few miles of the trail, heading east to the ocean. Since the trail was established, the Town of Plymouth has now protected over 300 acres of land in the immediate area of Old Sandwich Road. If approved, moving the trail to traverse through this area would greatly minimize the portion of the trail on the road. However, one challenge to this plan is that off-road vehicles heavily use the conservation land in this area. There are also a number of privately owned parcels that, if protected, would keep the amount of road walking to under a mile and further improve the hiking experience. The trail is challenging to navigate on the ground, as many of the aluminum trail markers that were installed back in 2007 no longer exist. An easy-to-read trail map would make the trail more accessible for hikers.

The Other Half

Recently, members of the TOP Trails Committee (TC), MSSF, and local trail guru Malcolm MacGregor have been discussing the possibility of establishing the second leg of the trail, which would start on the waterfront in downtown Plymouth, at the Plymouth Rock. This potential 14-mile section would travel through a corridor of undeveloped land and finish at the headquarters of MSSF. A few things have

happened over the last few years that finally make this viable. In an effort to restore Town Brook, the TOP has made an effort to protect land adjacent to the brook. This is part of the town's dam removal efforts, aiming to improve the quality of the anadromous fish run located there. The headwaters of Town Brook originate from Billington Sea, and the TOP continues to protect land in this corridor to this day. The TOP has constructed a trail along the bank of the Town Brook heading south from Plymouth Rock.

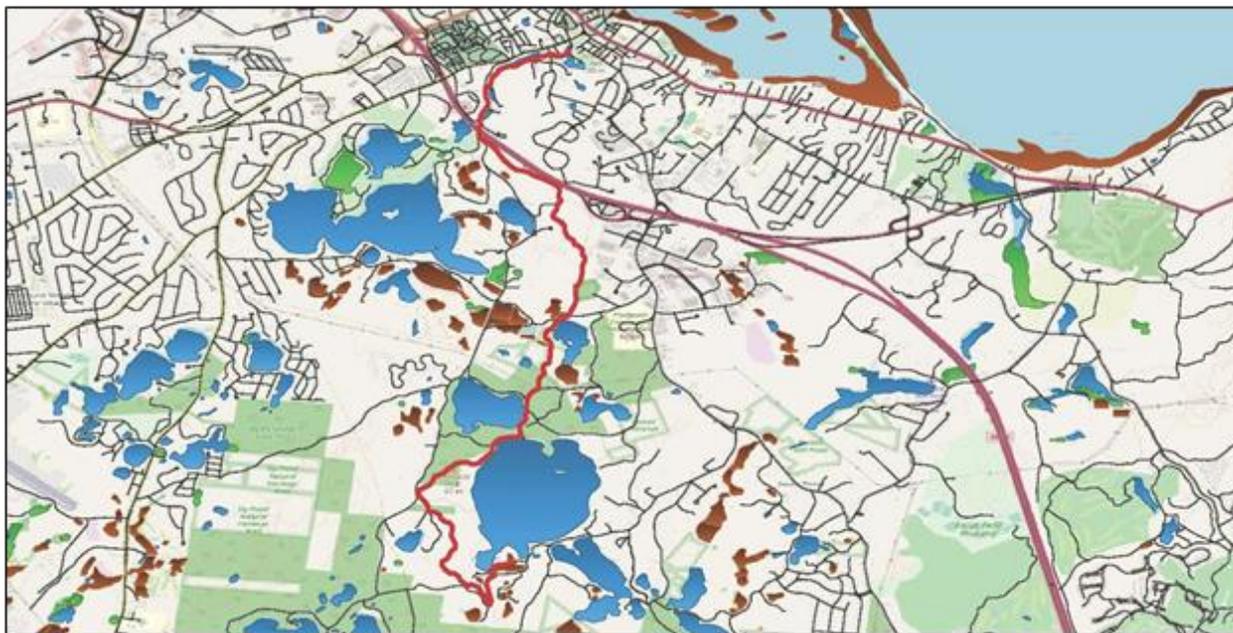


Photo 3 WT segment from Downtown Plymouth to WT's Cortelli Preserve (Map provided by Malcolm MacGregor).

The trail would follow Town Brook until veering away onto Braley road for a short time. From this location, there are a few challenges for trail development. Braley Road ends at a parcel of land owned and managed by the TOP Water Department. The land, though protected, is the site of a town well. The TC would have to obtain permission to cut a trail through this land and allow public access. This may prove difficult due to safety concerns related to the well. The trail could then go one of two directions as it heads south: it could pick up a cart path that travels through the land of five different private property owners, or it could take a route through a shopping center. There is believed to be a proscriptive easement on the cart path that would allow for public access. However, the path runs close to private homes, so outreach would be necessary to avoid potential issues. The route through the shopping center would prove less problematic in terms of dealing with property owners not used to the public using the path but would be both less safe and less scenic. Next, the path would join existing trails leading to the shores of Great South Pond, land that Mass Wildlife and the TOP protect.

In 2016, WT protected 275 acres of land encompassing much of the eastern shoreline of Great South Pond. Great South Pond is a coastal plain pond that is host to a variety of rare and endangered plants such as New England Boneset and Plymouth Rose Gentian. Once protected, the WT Stewardship Department developed a plan to construct a 3.1-mile trail that connected land owned by the TOP to the north to trails entering into Myles Standish State Forest to the south. The trail to the north summits Pinnacle Hill, which provides a panoramic view of the surrounding woods and ponds. This was done as one part of a vision to develop a 6-mile trail loop traveling around the protected open space in the Great South Pond region. WT worked with both the TOP and DCR to improve and create trails, to see this

come to fruition. At the time, WLT did not know or envision that protecting this land and creating this trail would create the potential to extend the PWT.

Some portions of this proposed trail require the construction of new trails and permissions from various property owners. These efforts are currently happening informally by the TOP TC and Friends of Myles Standish. Establishing a formalized Trail Coalition, including property owners and invested community members, could help these efforts move forward in an organized and intentional fashion. The first step is planning the trail layout, and the second is creating an easy-to-follow trail map with some navigational aid on the ground. Using the easiest path forward, the trail could be laid out by the end of the year. The more desirable routes will take more time to develop due to the private property involved. To help land owners understand the vision of WT, the coalition could offer guided hikes on sections of the trail.

This project is attractive because it only hinges on one approval from the TOP Water Department to exist in its most basic form. If approval is not received, the focus will turn to improving the southern portion of the route, where the trail currently exists. Luckily, other portions of the trail that require approval can use existing public ways if permission is not obtained.

Conclusion

At this time, the various trail systems part of the PWT are managed individually and not as part of a connecting system. The formation of a coalition would help with sharing volunteer and staff resources. The coalition could also be the entity that applies for funding opportunities to enhance the WT user experience. At this point, the only expected costs would be trail markers and the time to develop a map.

A 28-mile trail that starts in historic downtown Plymouth has a halfway point that allows for camping in MSSF and ends on the shores of Cape Cod Bay would be an incredible asset for outdoor recreation in Southeastern Massachusetts. This trail would traverse areas of both historical and ecological significance. Perhaps most importantly, it could also provide an impetus to drive further land protection in the area.

Ana Colón-García was born and raised in San Juan, Puerto Rico, and graduated from Haverford College with a major in anthropology and a minor in environmental studies. During her time there, she discovered a passion for environmental conservation and education through her work with an anti-mining organization in Intag, Ecuador. As a result, she decided to return to her Island to work with Para La Naturaleza, a nonprofit unit of the Conservation Trust of Puerto Rico. Ana currently writes and conducts research for the Communications Team. Before that, for the past three years, she worked as Volunteer Coordinator recruiting and training volunteers for the organization's Reforestation Unit.



Ana is passionate about community conservation and coastal restoration. She spends most of her time near the ocean, swimming, surfing, and taking pictures. Constantly amazed by Puerto Rico's ecosystems, she plans to continue working to ensure they are protected for generations to come.

A Coastal Conservation Trail for Puerto Rico

Let us assume the existence of a giant standing high on the skyline along these mountain ridges, his head just scraping the floating clouds. What would he see from this skyline as he strode along its length from north to south?

Benton MacKaye, 1921

My answer: a healthy, accessible coast that connects and protects habitats and communities across Puerto Rico.

In this paper, I explore the possibility of building a trail along the 799-mile Puerto Rican coastline.

Context

The Puerto Rican archipelago consists of the main island, five satellite islands, four islets, and 588 cays, totaling 2.2 million acres and 799 miles of coastline. With 25 ecosystem types, we can experience a rain forest and dry forest within a 20-minute car drive. According to Miller and Lugo (2009), some areas can receive up to 200 inches of rainfall per year, while others can receive as little as 10 inches.

Puerto Rico is part of the Caribbean Islands' biodiversity hotspot. A study by the Caribbean Natural Resources Institute (CANARI) states that "despite their small land area, the Caribbean Islands support one of the highest numbers of globally threatened species of any hotspot in the world" (2019). A study by Tufts Global Development and Environment Institute (GDAE) warns that the dozens of Caribbean nations and territories, and their 40 million inhabitants, are particularly vulnerable to the effects of land loss due to climate change even though they are among the list of those who have contributed the fewest greenhouse gas emissions (Bueno et al. 2008).



Figure 1. Map prepared by Kevian Perez (CoRePI)

As a small archipelago, Puerto Rico is particularly vulnerable to climate change, and the loss of prime coastal land will be significant as ocean levels rise, according to Barreto (2017). We have approximately 1,225 beaches in 44 coastal municipalities. From the 1970s to 2010, 60% of our beaches showed evidence of erosion (Barreto 2019). Around 62% of the population reside in coastal municipalities, as well as 25% of structures, including critical infrastructure: electricity plants (7), state roads (249kms), airports (7), hospitals (15), ports (12), and hotels (121) are in coastal zones (DRNA 2017).

According to Barreto, the population at the coastal zone is as follows: 2 million across all 44 coastal municipalities; 1.02 million in coastal areas from 0 to 10 meters of elevation; 554,939 in coastal areas between 0 and 3 meters of elevation; and 496,442 in the legally defined coastal zone (2017).

Based on future projections for sea-level rise, the Puerto Rico Climate Change Council recommends planning for a total sea-level rise of at least 0.8 meters and a maximum of 2 meters by 2100 (2013, 9). As temperatures rise and storms become more severe, tourism - the lifeblood of many Caribbean economies - will decline.



Figure 2. A beach in Manati shortly after Hurricane Maria. Photo from Para la Naturaleza archives.

This impact became even more significant after Hurricanes Irma and Maria in 2017. So much so that the mouth of the Río Grande de Manatí in Barceloneta lost 60 percent of its sediment. While during the same event, other beaches located in the metropolitan area were severely affected by storm surges and erosion caused by strong swells. Additionally, it is estimated that the archipelago lost around 31 million trees as a result of the 2017 hurricane season (Feng 2018).

Over 4,600 deaths, months without water, and up to a year without electricity are part of the metrics that start telling the hardships of over 3 million people. From 2017 to 2019, we estimate that Puerto Rico may have lost up to 470,335 residents or 14% of the population. In other words, Puerto Rico will lose the same population in a span of a couple of years after Hurricane Maria as the Island lost during a prior decade of economic stagnation.

Many communities have already begun to tackle coastal resilience through vulnerability assessments, dune restoration, and reforestation. Along the coast, there are various community-based initiatives to restore dunes and plant trees. Both project leaders and participants are volunteers. Though this is happening in a number of places, efforts are relatively scattered.

In order to adapt to climate change from a small archipelago in the Caribbean, we are going to have to reimagine our relationship with the coast and implement adaptation strategies at a national level. This will require cross-sector communication and collaboration as well as strong community-based partnerships.

A Coastal Conservation Trail for Puerto Rico

An approach that could allow for stronger holistic coastal resilience would be developing strategies for the coastline as a whole, connecting every beach in Puerto Rico through a coastal trail. This idea is inspired greatly by Benton McKay's vision for the Appalachian Trail. Jim Leavitt's essay *Benton MacKaye's Vision and its Emerging Realization: The First and Second Hundred Years* has been crucial in the conception of a coastal trail for Puerto Rico. Levitt cites McKay's following words:

"Let us assume the existence of a giant standing high on the skyline along these mountain ridges, his head just scraping the floating clouds. What would he see from this skyline as he strode along its length from north to south?"

My answer: a healthy, accessible coast that connects and protects habitats and communities across Puerto Rico.

The concept would be comparable to that of the AT: "an [island] -scale recreational trail that would link together a great many of pieces of land – some existing trails on land owned and managed by public agencies and nonprofit organizations, and some on lands held by private citizens" (2021).

This trail would pass through all 44 coastal municipalities. The trail-beach distance will depend on erosion and sea-level rise predictions. The idea is to protect, restore and maintain the areas adjacent to the trail, whether natural habitats, urban/developed areas, or rural communities. The priority would be habitat connectivity and restoration. Because it would be located in coastal zones, the focus would be reforestation and, when necessary, dune restoration. In some cases, the trail would take the form of a boardwalk in order to not disturb the sand dune regeneration process.

Similar to the AT, this trail would represent “not only a footpath but a realm stretching across a mosaic of ownerships, sectors, and jurisdictions” and “...in a very literal sense, a battle line against fire and flood, and even disease... – against the common enemies of man --...” (Levitt 2021). In this case, the trail would be a battle line against sea-level rise, coastal erosion, and other community health and safety impacts resulting from climate change.

Before delving into the details of the trail, let’s first consider who would be in charge of leading the design and implementation process, as it is a determining factor in the potential course and possibilities of success for such a project.

Para la Naturaleza (PLN)

A nonprofit unit of the Conservation Trust of Puerto Rico, Para la Naturaleza, would be an ideal entity to lead this project, as it would require collaboration from the government agencies, other NGOs, academia, volunteers, communities, landowners, schools, other citizens, and possibly even tourists.

Para la Naturaleza is a private, nonprofit organization committed to helping Puerto Rican society achieve the sustainability of the islands of Puerto Rico and its resilience against climate change by protecting 33% of its natural heritage, preserving its historical and cultural legacy, and rescuing an ecological culture that ensures the health of its natural and human ecosystems. The organization integrates society into a national movement that promotes conservation actions and sustainable development.



Figure 3. Dune restoration efforts in San Juan, PR. Photo from Para la Naturaleza

Para la Naturaleza inspires citizens through programs with a robust educational component focused on communities, schools, and supporting organizations allied to the mission. The organization promotes habitat recovery through large-scale reforestation efforts and the development of agro-ecological agriculture. It supports equitable and fair land use for its citizens and communities most disadvantaged by current governance systems. Para la Naturaleza currently manages 64 natural protected areas and six visitor centers.

Already working towards an ambitious conservation goal of conserving 33% of Puerto Rico’s lands by 2033, Para la Naturaleza’s work would benefit from and contribute immensely to this coastal trail. The conservation of the trail and surrounding areas could help advance PLN’s mission, and already-protected areas and PLN allies could be key to establish the first areas of the trail. Not to mention PLN’s network of around 20,000 volunteers who could participate in the construction of trail space inside protected natural areas.

A significant part of PLN’s current work is through partnerships with key entities such as Puerto Rico’s Department of Natural Resources, U.S Forest Service, U.S Fish and Wildlife Service, as well as community groups and landowners across the archipelago.

It is also worth noting that Para la Naturaleza is currently working with 33 communities to implement various resiliency projects, such as solar-powered community centers with rainwater collection systems. These relationships, some of which are decades long and others that have emerged post-Hurricane Maria, will be key in areas where the trail could go through. PLN is developing an organizational culture and methodology around community work centered around their needs and common goals. This will be incredibly useful in meeting with communities to propose the trail and receive input.

Key Project Elements and Goals

Habitat connectivity: this trail will be a great opportunity to create ecological corridors (when possible) between coastal natural areas and reserves. The idea is to protect either side of the trail by at least 2000 square feet on each side. Ideally, the trail would begin in priority areas identified by the Corps of Engineers (USACE) and the Department of Environmental and Natural Resources of Puerto Rico (DRNA), especially if they are already protected. We could begin by building trails within Para La Naturaleza's protected coastal areas with the help of volunteers while community consultation processes occur.

Sand dune restoration: this work would be done in collaboration with Vida Marina (Center for Coastal Conservation and Restoration of the University of Puerto Rico at Aguadilla), a group that has been pioneering this work on the northern coast of the island and other community environmental community-based groups. The idea is to support, highlight, and connect isolated community projects working towards coastal resilience through their efforts. Vida Marina specifically works with placing clustered wooden planks or pallets that mimic mature vegetation on the sand dune. The presence of these pallets causes the accumulation of wind-blown sand, and the suspended sand gradually begins to create the sand dune.



Figure 4. Vida Marina's dune restoration efforts. Boardwalks built with volunteers to grant access to the beach without interrupting the dune's regeneration process.

The pieces of wood used are light, less likely to be disturbed by people, easily readjusted as needed, and protect the newly planted vegetation from sudden sand movement and better withstand storms. They could continue to lead these efforts with volunteer and community support.

Reforestation: a reforestation effort will occur together with the dune restoration efforts and elsewhere according to each habitat and community's needs. Para La Naturaleza's Reforestation Unit could produce and provide native and endemic trees for this purpose. Tree planting communities could be led by Para La Naturaleza staff, volunteers, and/or community members.

Granting access to public spaces: even though beaches are legally considered public domain, beachside private development often obstruct pedestrian access to the coastal zone. . This trail will be the perfect

opportunity to assess points of entry to the beach and enable them when necessary and possibly give more people access to the beach.

Education: Cultivating in children a healthy relationship with nature and their habitat is important for the sustainability and long-term effect this trail could have on the conservation of our Island. Para la Naturaleza's partnership with the Montessori Public Schools network would be a good place to start. The project will engage schools close to the coast in the building and maintenance of the trail and in the projects of conservation protecting the dunes, the forest, and the coast. The trails would be an extension of school classrooms in a moment where outside activities are essential for children's mental and physical wellbeing. An essential part of this collaboration would be the creation of signs (by students and teachers) that tell the story of the trail and its ecological importance, as well as the community's local culture and history.

Recreation: The idea is to promote and enable healthy ecosystems that people can access for recreation, spirituality, health, etc. This will be key in developing a sense of belonging to these coastal areas and exposing citizens to their vulnerability and resilience. Communities, individuals, or local businesses could eventually adopt a section of the trail-boardwalk and the adjacent beach(es).

Ongoing Trail Maintenance: tree monitoring and replacement events will take place, as well as beach cleanups. Trail maintenance will be done in collaboration between PLN employees, volunteers, students, and local community members. These trail maintenance events also offer opportunities for community members to evaluate the effects of the trail on the community and collectively evaluate possibilities together for other potential uses.

Cross-sector collaboration: this project will only be successful if it is designed and implemented through close collaboration. Key partners would include the U.S Forest Service, the U.S Fish and Wildlife Service, the PR Department of Natural Resources, Vida Marina, Puerto Rico's Tourism Office (Discover Puerto Rico), and other local habitat restoration initiatives. Puerto Rico's universities and schools would also be crucial.

Community conservation: none of this work can be done holistically and sustainably without communities, without meeting them where they are. The people that live close to the coast are the most important actors of this quest. As they become aware of the dangers involved and the effects these would have in their lives, and in future generations, they become engaged and participate. They would essentially be the stewards of the evolving purpose of this trail.

Assessment + Design

According to Barreto, the Corps of Engineers (USACE) and the Department of Environmental and Natural Resources of Puerto Rico (DRNA) met with stakeholders to evaluate Course of Action (COAs) priorities after Hurricane María. They selected a series of priorities to mitigate coastal erosion. Their work and expertise would be essential in the design and community consultation process.

In summary, these are the priorities they point at: use coastal vulnerability approach as one of the metrics in the coastal planning and decision-making process; use scientific data as a baseline for coastal planning, management and policy; insert community participation in the local and regional decision-making and planning process; limit new constructions in selected high vulnerability areas; critically evaluate the need to reconstruct infrastructure damaged by the storms; strengthen natural barriers as beaches, dunes, coral reefs, beach rocks, mangroves; evaluate relocation with coastal communities and

stakeholders involved in the process; insert coastal erosion as a part of the assessment of the hazards that affect Puerto Rico (Barreto 2021).

In terms of next steps, they plan to take the following:

1. Complete coastal physical vulnerability assessments for the 44 municipalities in Puerto Rico
2. Validate and refine social vulnerability estimates by conducting site visits
3. Consult with federal agencies to forge a path that leads to implementation.

The trail would have to abide by the results of these vulnerability assessments and recommendations from Maritza Barreto and her colleagues at the University of Puerto Rico.

Timeline and investment

This project would require a one-year planning phase, around three to five for implementation (about 11 municipalities per year) and another five for follow-up and maintenance. The idea is that this trail is completed no later than 2033 (to accompany PLN's conservation goal).

The **investment** for the project could be funded by local agencies (natural resources, tourism) as well as federal grants already funding Vida Marina's dune restoration efforts.

Potential challenges include difficulty finding funding, already developed lands in these coastal areas and resistance from developers and hotel/complex owners. This could be potentially worsened by Puerto Rico's government's current public policy prioritizing economic "development" over the conservation of natural resources, particularly in coastal areas. Additionally, Puerto Rico is \$71B in debt, and there is a fiscal control board in place that could veto the project if deemed nonessential.

So what? "What might become the longer-term impacts, on a broader social level, of building such a trail?" (Levitt 2021)

The proposed trail itself speaks of the unity of purpose and common good. It could unite different communities and citizens that otherwise do not interact or collaborate. This trail is an invitation to the citizens to take care of their habitat; and, in some ways, a toolkit to do so. Through this community building experience, an island-wide conversation could lead to additional efforts to reverse the damage that climate change has already caused.

This community building experience gives people access to beautiful outside areas close to their homes and allows the scientific community to better understand how coastal preservation enriches our lives and the permanence of our homes in the short and long term.

This is also an opportunity for communities to determine social and ecological priorities based on their surrounding ecosystems while becoming more resilient. At the same time, the trail will foster a deeper sense of place and belonging. It could be an opportunity to enjoy an accessible open space to visit and become part of the solutions we need to bring forward.

Lastly, this initiative could become a key point promoting ecological tourism and cultural activities that continue to develop the ecological culture that we wish to see in Puerto Rico in the coming years. This could become a very concrete initiative to share with other Caribbean islands. We are all looking to promote coastal resilience and community conservation strategies to ensure the health of our planet and of generations to come.

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Born and raised on Cape Cod and the South Shore of Massachusetts, **Noah Henkenius** decided to venture out to Western Massachusetts for college. After graduating from Massachusetts College of Liberal Arts in December of 2020, Noah was hired to be Berkshire Environmental Action Team's (BEAT) Stewardship Manager in January of 2021. Noah became a dedicated bird watcher in college and continues to do so recreationally in his free time as well as occasionally leading bird walks for BEAT. In addition to leading bird walks, as Stewardship Manager for BEAT, Noah is responsible for performing water quality sampling, doing stream continuity assessments using NAACC protocols, coordinating invasive species removal efforts, and certifying vernal pools for the state's database, among various other activities.



Coldwater Stream Conservation Plan for Berkshire County, MA

Abstract: Coldwater streams are an important natural resource, especially for coldwater fish species such as Brook trout (*Salvelinus fontinalis*), which are native to New England. Climate change could threaten up to 50% of thermal habitats in the lower 48 states of the United States for fish species requiring water temperatures under 20°C. To mitigate the potential impacts of climate change on coldwater streams in Berkshire County, Massachusetts, I propose the initial stages of a project to preserve thermal temperatures in vulnerable streams. The primary strategies I propose include removing non-essential dams and replacing inadequate culverts with ones that allow for better aquatic connectivity, restoring riparian areas, and carefully managing groundwater resources.

Introduction

Coldwater streams are an important natural resource that provides essential ecological conditions for certain species of fish that are unable to survive in warmer water temperatures. In addition to water temperatures that do not exceed 68 F (20 C), favorable coldwater streams will provide habitat characteristics such as pools, riffles, intact riparian areas, maintain low levels of pollutants, and contain highly oxygenated water (Rosenfield 2003, Williams et al. 2015, MA Fish & Wildlife 2018). Fish such as native brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*) are all coldwater fish species that people like to capture for consumption or catch and release (MassGOV 2021). In Berkshire County, Massachusetts, many streams have been recognized by the state as coldwater fisheries resources (Figure 1) and could be susceptible to warming from climate change (MassGOV 2021, Manomet Inc., and the National Wildlife Federation 2013). Strategies to preserve this valuable ecological resource include removing inadequate infrastructure such as culverts built without consideration for aquatic connectivity, removing non-essential dams, restoring and preserving riparian buffers, and working with municipalities to conserve groundwater.

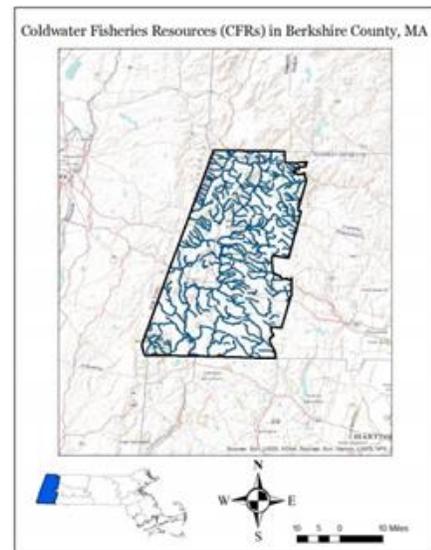


Figure 1: Streams and rivers marked as coldwater fisheries resources (CFRs) by the Commonwealth of Massachusetts Division of Fisheries and Wildlife. Data from: http://maps.massgis.state.ma.us/map_ol/oliver.php accessed 26 July 2021

Timeline

I have assembled a proposed timeline for this project (Figure 2). This timeline serves as a guideline for the project and highlights milestones on when steps should ideally be initiated or completed. Unanticipated setbacks and obstacles could cause this project to be delayed further than I have predicted.



Figure 2: Proposed project timeline highlighting ideal milestones; this is not necessarily an accurate reflection of exactly when phases will be able to be initiated or completed.

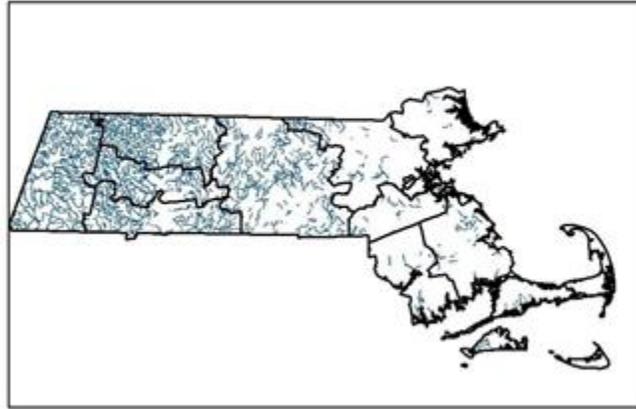
Costs

Costs for this project will be highly variable. In the preliminary stages, the most significant expense is the cost of water temperature monitors to collect initial data. On average, water temperature monitors cost ~\$150-\$200. Multiple loggers may be necessary for specific streams if there are obstacles such as culverts and dams that could disturb water temperatures in some but not all parts of the stream. It is not possible to assess costs of implementation in the preliminary stages because it will depend upon the design and process that is determined appropriate/necessary for each individual culvert replacement and dam removal.

Significance

Climate change threatens to negatively alter the conditions necessary to maintain coldwater streams (Manomet Inc. and the National Wildlife Federation 2013). Berkshire County is unique because it contains a large portion of the state's coldwater fisheries resources (CFRs) (Figure 3). Further, this region is also an area of interest for the Staying Connected Initiative (SCI) which aims to maintain connectivity for native terrestrial wildlife such as otter, porcupine, foxes, bear, bobcat, moose, deer, etc. from the Hudson Highlands in New York to the Green Mountains in Vermont (SCI 2021). In addition to conserving natural resources for wildlife, this project also helps benefit people living within the municipalities of

Berkshire County. Many culverts and dams within the county are old, in need of repair, and at risk of failure. Updating this infrastructure in a way that preserves CFRs and allows for wildlife connectivity not only benefits aquatic and terrestrial wildlife but also means residents get infrastructure that is better equipped to withstand increasingly severe weather, which climate change is predicted to bring to the region (EPA 2016). Throughout the United States, there could be up to, or more than a 50% reduction in thermal habitat



for coldwater fish species as climate change persists (Eaton et Scheller 1996). However, it is difficult to predict the exact reduction in thermal habitat because models often ignore localized landscape conditions that can act as a refugia for coldwater fish; this often leads to overly pessimistic predictions (Trumbo et al., 2010). If nothing is done to mitigate the impacts of climate change on coldwater streams, fish species such as brook trout. Which rely on these habitats, can expect to see additional physiological stress, which can contribute to reduced growth in summer months (Lund et al. 2003, Robinson et al. 2010, Chambers et al. 2017).

Conclusion

Coldwater streams are an essential resource to protect biodiversity within the commonwealth of Massachusetts. Through mitigative efforts, some of their habitats may be able to be preserved for future generations. Many actions to achieve this goal, such as upgrading culverts to allow better aquatic connectivity, are positive for more than just coldwater fish species and benefit a wide variety of stakeholders.

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Samantha Myers is currently a graduate student working towards a MS in Environmental Conservation at the University of Massachusetts, Amherst. Originally from Maryland, she grew up biking along the Potomac River and exploring marshes around the Chesapeake Bay. After earning a B.A. in Environmental Biology from Washington University in St. Louis, Sam headed back home to work for The Nature Conservancy's Maryland/D.C. chapter, where she helped with prescribed burns and rare plant monitoring as part of the Land Management team and studied the historical impacts of fire on forest health in western Maryland. Now in Western Mass, Sam's current research focuses on developing forest management strategies that landowners can implement to increase forest carbon storage and resilience to climate change. Her interest in conservation work stems not only from a love of the natural world but also from recognizing the need for effective long-term stewardship of conserved lands, which ecological research can help to inform. In her free time, Sam enjoys cooking and finding new spots to hike or bike in New England.



Appalachian Old-Growth Mosaic Forest Management Network

Project summary

Old-growth and late-successional forests provide a myriad of benefits. However, these forests are in decline due to land development and climate change which brings intensified pest and pathogen outbreaks. With a unified conservation and stewardship strategy implemented locally but coordinated and financed by a broader network, we can work to preserve and enhance these forests through active stewardship to maintain the beneficial ecosystem that these forests provide.

This project seeks to identify regions with old-growth and late-successional forest characteristics around the Appalachian corridor from Virginia to New Hampshire which have not yet been permanently protected. The paper recommends conservation and stewardship action on this network of lands, including adjacent existing protected lands. Using USFS Forest Inventory and Analysis data and GIS analysis data, I have outlined the regions where this plan should be implemented and recommended potential partners to protect and steward these lands across the Appalachian landscape.

This initiative will leverage existing conservation networks across the Central and Northern Appalachians to shape priority areas, utilize cross-sector partnerships for a unified conservation and stewardship vision, and tap into carbon markets to assist in financing. Conservation prioritization will occur in conjunction with existing regional landscape networks to promote connectivity. These parcels should be continuously monitored and stewarded to promote a diverse species composition, forest structure and maintain old-growth characteristics amidst global change.

Background and problem statement

Old-growth and late-successional forests provide numerous ecological benefits, including storing high amounts of carbon and providing habitat for a diversity of plants and wildlife. These forests, which are already rare across the Northeast, are threatened due to climate change (invasive pests, pathogens, and extreme weather events), land conversion, and fragmentation. Before European colonization, these forests were abundant across the landscape, but now in southern New England, for example, less than

0.1% of the forested landscape is old-growth (D'amato et al. 2006). Across the Eastern U.S., less than 1% of old-growth forests remain on average (Old-Growth Forest Network).

This calls for a unified movement to protect and thoughtfully manage these forests to sustain the benefits they provide into the future. Many conservation organizations' missions include protecting old-growth forests (i.e., Mass Audubon) or restoring old-growth forests characteristics (i.e., TNC's central Appalachian forest restoration project in Maryland). However, there lacks a unified vision across the Eastern U.S. to preserve and restore old-growth forest characteristics through active management.

The diversity of species and structures in these forests are especially crucial in fostering rich benefits. This calls for conservation strategies that protect a connected mosaic of forests with different ages and species composition, resulting in a diversity of species and structural characteristics (i.e., ages and sizes of trees, legacy structures, dead and downed trees) across the landscape. Ongoing stewardship should focus on promoting these characteristics across the landscape as well.

Though old-growth forests store high amounts of carbon, younger forests with faster growth rates sequester carbon at a higher rate. Therefore, when protecting and stewarding old-growth forests, protecting additional intact younger forests surrounding these parcels and stewarding them to enhance their carbon sequestration rate could maximize the carbon benefits across the landscape (i.e., as a forest "mosaic").

Old-growth forest analysis and results

To determine conservation priority areas for the old-growth management network, I implemented an analysis of USFS Forest Inventory and Analysis (FIA) data in R software and a Geographic Information System (GIS). In R, I ran the most recent FIA plot inventory data for 11 states that comprise the Central and Northern Appalachians through an old-growth forest classification based on Lorimer and Halpin (2014). This classification system focuses on forest structure to identify old-growth characteristics by setting threshold ratios of basal area between each size class of trees. I then excluded plots with lower species richness (less than or equal to six different tree species). With the resulting plot locations classified as "old-growth" with high species richness, I used ArcGIS to narrow down to plots within 25 miles of the Appalachian Trail and further excluded plots that were located within existing protected lands (federally protected land, easements, and fee lands; USGS Protected Areas Database).

This analysis resulted in 173 FIA plots representing areas prioritized for protection across three regions (Lower Alleghany, Upper Alleghany, and New England) along the Appalachian corridor. Private landowners own a majority of the prioritized forest plots, but some are owned by state/local landowners or the U.S. Forest Service.

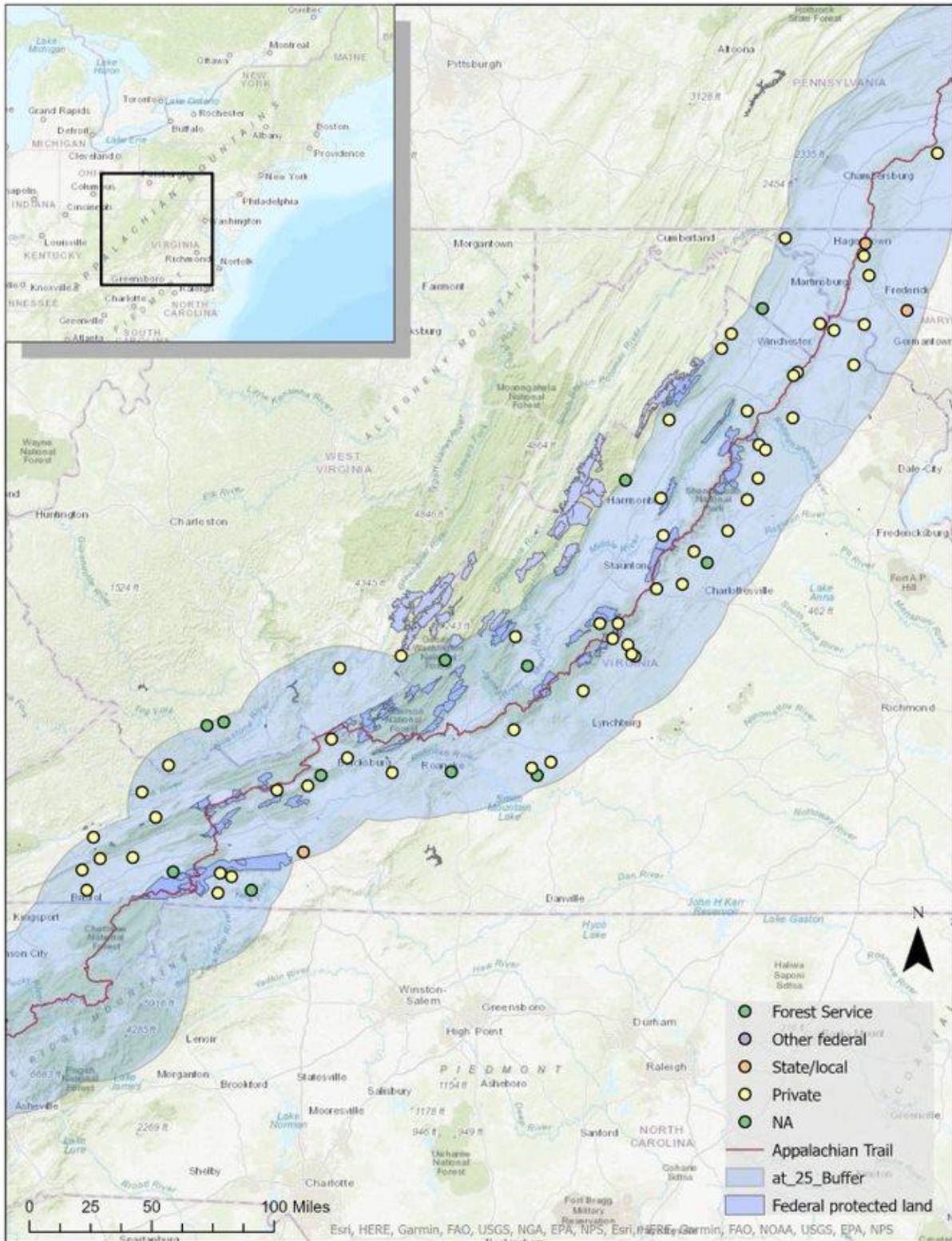
These plots are a snapshot in time of 1/5 acre of land, so they do not necessarily represent the characteristics of the surrounding landscape but do hint at where conservation projects could be warranted. It should also be noted that the exact location of FIA plots are slightly altered for data privacy, so plot locations should be taken as a more general indication of conservation priority locations, as in multi-parcel areas that could be locally prioritized. It should also be noted that while this "old-growth" classification was used, it is still imperfect and must be ground-truthed. Ideally, field verification would be done by landowners, conservation organizations, or using citizen science to confirm old-growth characteristics on the ground and move forward in the prioritization process.

Figure 1A-D. Forest plots with old-growth characteristics based on the most recent USFS Forest Inventory and Analysis data. Plots were first classified as old-growth based on Lorimar and Halpin (2014). Plots were then narrowed down based on tree species richness, current protection status, and distance from the Appalachian Trail network (within 25 miles). Maps include the entire Appalachian corridor (A); and zoomed-in regions of the Lower Allegheny (B), Upper Allegheny (C), and New England (D). Dots represent FIA plots of different ownership types (locations are skewed slightly for privacy) within the 25-mile buffer of the trail. Federally protected lands are depicted in purple.

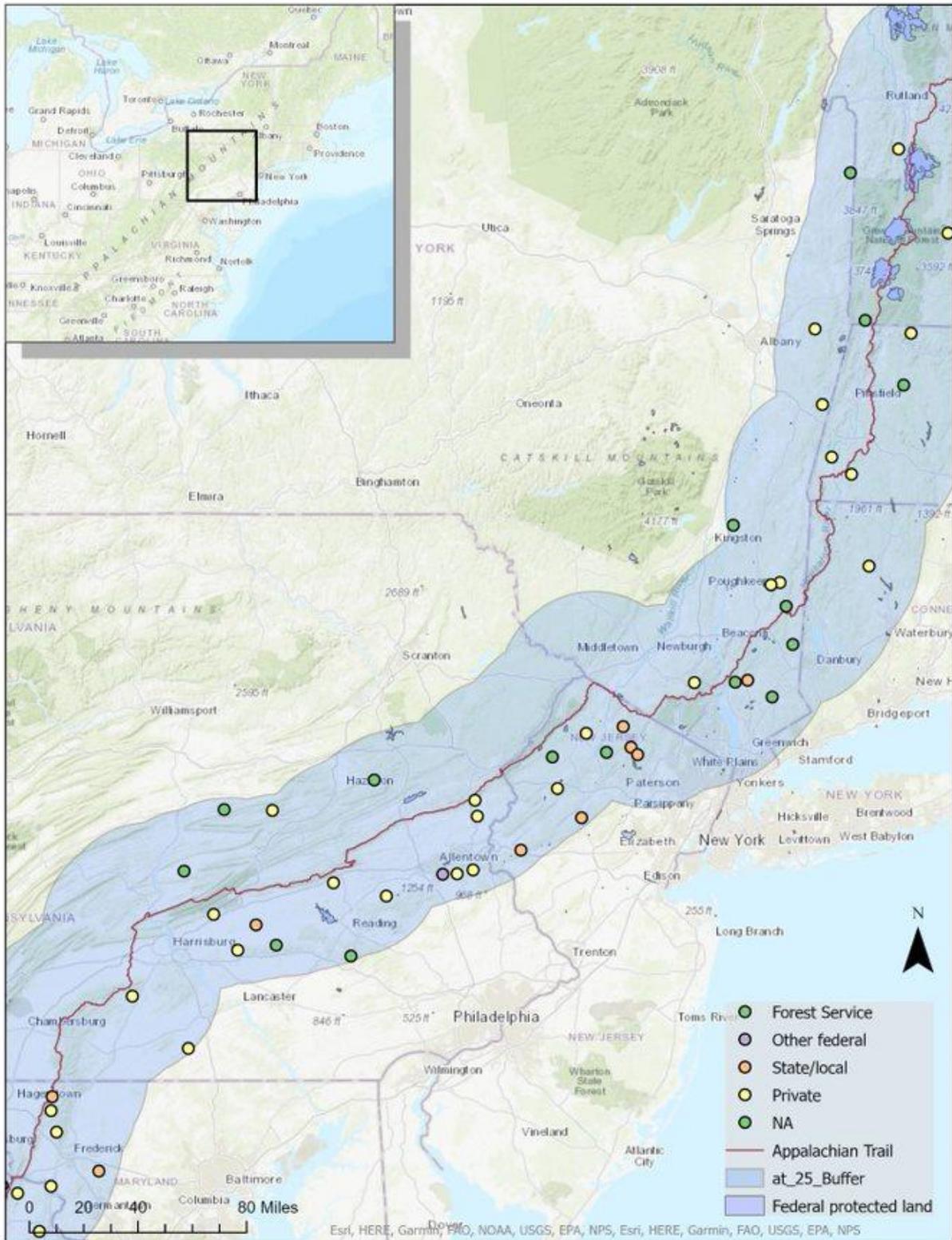
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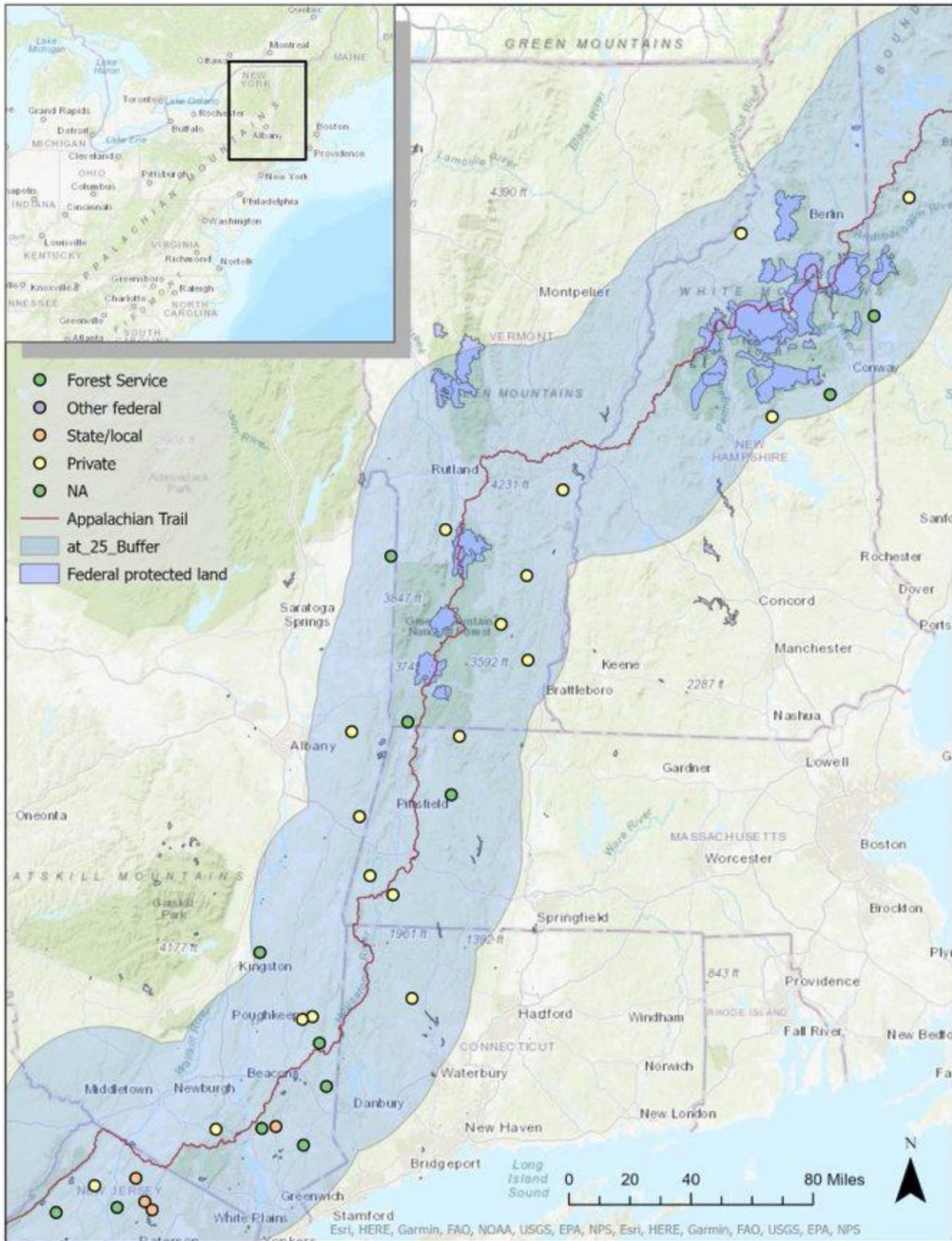
B



C



D



Recommended conservation and stewardship strategy

The old-growth network should be broken up into three regions, with each regional partnership developing a protection and stewardship plan based on lands they collectively want to protect and lands they currently steward within the old-growth network. The three regions and potential partnerships within each region could include:

- Lower Alleghany (Virginia, West Virginia, Maryland; 86 plots)
 - Key partners: Shenandoah National Park and Washington and Jefferson National Forests, state natural resources agencies, friends of Shenandoah Mountain and other local land trusts, local Nature Conservancy (TNC) chapters
- Upper Alleghany (Pennsylvania, New Jersey, New York; 58 plots)
 - Key partners: state natural resources agencies, local TNC chapters
- New England (Connecticut, Massachusetts, Vermont, New Hampshire; 25 plots)
 - Key partners: Green and White Mountains national forests, state natural resource agencies, Mass Audubon, Berkshire Natural Resources Council, other local land trusts, local TNC chapters

Parcels closest to existing protected land should be prioritized and directly integrated into forest management strategy to provide connectivity and a diverse mosaic of forest types. Still, the primary goal should be to preserve old-growth characteristics where they exist and address broader threats to forest health through adaptive management across the landscape. Stewardship efforts should include working with state foresters to implement forest management strategies that reduce the risk of pests and pathogens and enhance old-growth characteristics on private, state, and federal lands.

Organizations that could serve as coordinators of the project as a whole include the Open Space Institute, Appalachian Trail Conservancy, The Nature Conservancy, the American Forest Foundation, and the Old-Growth Forest Network. These organizations will work together to assist in coordinating regional partners, aggregate and distribute funds, create outreach materials, assist local organizations in proper messaging for outreach materials, and provide other capacity-building needs of local/regional partners.

These organizations have a high capacity to support this kind of project, work at a broad scale, and have related interests that may fit this proposed project. Specifically, the Open Space Institute has an Appalachian Landscapes Protection Fund with overlapping priority areas. The Appalachian Trail Conservancy's work spans the length of the AT and includes existing partners who may be important stakeholders that can donate valuable time and expertise to this project. The Nature Conservancy has worked with forest carbon offset markets and could be key to determining if project funding is feasible from a forest carbon credit aggregation standpoint. American Forests Foundation has teamed up with TNC on the Family Forest Carbon Program and would generally be an asset when focusing on private family forest landowners. Lastly, the Old-Growth Forest Network is a small organization that works to protect old-growth forests across the U.S. and would be a key player to help prioritize and protect these forests.

Once much of the identified old-growth or late-successional forests are protected, then the goal of this initiative would shift to protect forested parcels surrounding these old-growth forests and focus on long-term stewardship of this connected forest mosaic. Stewardship would include active forest management practices to enhance old-growth characteristics while creating patches that enhance carbon sequestration (i.e., through variable retention thinnings). This would provide both forest

connectivity and habitat diversity and may help to finance the project through the selling of carbon offsets after aggregating them across the entire network.

Since a majority of the plots identified are privately owned, the network partners should focus on local education and outreach to private landowners. These should include distributing educational materials about the benefits of these forests and tools for conserving them aimed towards private, state, and local landowners. In addition, recommendations for stewardship including forest vulnerability assessments and forest management strategies to enhance old-growth characteristics in these areas (Catanzaro et al. 2016, D'Amato and Catanzaro 2007).

Estimated timeline and cost

Implementation will likely take 10-15 years and will first involve regional partnership building within the network, more in-depth forest parcel prioritization, and outreach to private landowners within prioritized regions. The next step is to carry out conservation deals with prioritized forest parcels and outline comprehensive stewardship plans across newly acquired forest parcels in conjunction with existing adjacent protected lands. The project will be ongoing and require continuous involvement of partners and capacity-building to accomplish stewardship plans (including both active and passive forest management practices across old-growth and non-old-growth forest parcels) to enhance carbon storage, sequestration, and forest resilience in the long term.

Financing and stewardship of the old-growth management network will be led and coordinated by a few overhead organizations mentioned earlier. These organizations will help ensure the financial capacity of local and regional partners through a revolving fund distributed to local partners to help protect and steward the land. Carbon markets will be used as a financing tool that will provide revenue back to the revolving fund, given that the project as a whole (protection of old-growth parcels as well as active stewardship of adjacent parcels for carbon sequestration) meets additionality requirements. Ideally, forested parcels will be permanently protected with a conservation easement or donated to a local land trust in fee for continued stewardship. Local partners who lead the landowner outreach and ongoing stewardship are key in this project to build upon existing trust in the local community to accomplish community-supported land deals. Existing state and federal programs such as the USFS Forest Legacy Program or state Forest Stewardship programs can also be used to assist landowners in cost-sharing of conservation and stewardship action.

Lasting impact

If implemented in part or in full, this project would help conserve vital old-growth and late-successional forest habitat on a landscape scale along the Appalachian corridor. It would also provide incentives to conserve intact forested parcels surrounding these old-growth forests to promote habitat diversity, connectivity, and forest resilience amidst climate change and invasive pests. This mosaic network of connected forest would be stewarded in such a way as to promote old-growth forest characteristics in old-growth parcels and enhance carbon sequestration in surrounding parcels in order to maximize the forest carbon benefits. Local conservation and stewardship needs will be met by involving key local stakeholders, while regional coordination will maintain the financial and technical capacity of stakeholders and partners across the entire network. If this project is able to produce verifiable carbon offsets, it could serve as an example of a novel large-scale aggregated carbon project that could spur other large-scale projects involving payment for ecosystem services.

Anticipated challenges

This project requires buy-in from local land trusts, agency partners, and landowners. It also requires an organizing body with enough financial and organizational capacity and common conservation goals to help this initiative get off the ground and be successful in the long run. Without this base of key people and organizations, this initiative could not work. If buy-in at the larger scale is lacking, this project could be divided into smaller regional projects with a similar goal. The individual regions would need to have enough capacity to see the project through in the long-term, including long-term stewardship, and aggregated funding from carbon offset markets could be more of a challenge.

Another element to keep in mind is the need to avoid over-crediting of forest offsets. Due diligence is needed for carbon credit verification in order to ensure that a real ecosystem service is occurring on the ground due to stewardship. This verification is necessary to ensure that this project is still working towards a broader goal of climate mitigation in addition to its forest habitat conservation goal.

With these key challenges in mind, the organizations willing to initiate this project or one similar to it should be ready with the tools to approach these challenges head-on and should first build a network of partners with complementary skills and goals to carry out this project successfully.

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Hailing from the Sonoran Desert of Arizona, **Sara Pearce** is settling into her new home in the Northern Rocky Mountains. She is currently an AmeriCorps member serving at the Center for Large Landscape Conservation, a nonprofit organization in Bozeman, Montana. In December of 2019, Sara graduated from the University of Hawaii at Manoa with a B.S. in Natural Resource and Environmental Management. During her time in the Hawaiian islands, Sara was able to put her love of wildlife to work as a student assistant with the Hawaii Department of Land and Natural Resources in their endangered invertebrate lab while also volunteering on a translocation project for Black-footed Albatross at the James Campbell National Wildlife Refuge. Looking forward, Sara is excited to have a hand in building connectivity and environmental resilience in a changing world and hopes to one day become a wildlife biologist.



Conservation in the Greater Yellowstone Ecosystem

What?/Where?

The Greater Yellowstone Ecosystem (GYE) spans across 20 million acres, three states, two national parks and is one of the world’s largest “nearly intact” natural landscapes. It is home to the most iconic wildlife of the West; in fact, according to the National Parks Service (NPS, 2020) - the area is known to see over 4 million visitors a year who primarily travel to witness the landscape and the wildlife that inhabits it. This ecosystem is home to the greatest concentration of wildlife in the lower 48 states, featuring grizzly bears and bison as well as a plethora of aquatic and ungulate species. These ungulates or hooved mammals include bison, elk, mule and whitetail deer, bighorn sheep, moose, and many others.

Each year ungulates follow the richest food sources across the landscape during their seasonal migrations, but for many years no one quite knew where they went. Luckily, the Wyoming Migration Initiative has been researching and capturing these seasonal migrations over the years and is now working to share this scientific information with the public along with conservation networks and agencies to protect and preserve essential habitats and migratory routes.



Greater Yellowstone ecosystem map courtesy of USGS.

(Figure 1: Map of GYE boundaries)

A past project of the Wyoming Migration Initiative found that the GYE was the backdrop for the longest ever recorded mule deer migration. Researchers were able to track mule deer 120 miles across the state

of Wyoming, making this particular ungulate migration the longest in the lower 48 states (Sawyer et al., 2014). In order to complete this trek, these deer crossed two national forests, a national park, several highways, rivers, and fences, all while dodging hunters and predators alike. Pictured below is the mapped route the mule deer traveled. However, the migration comes to an abrupt stop at the southern end of the route. This endpoint is right at Interstate 80, where if the deer had chosen to cross, they would have faced the many lanes of heavy, high-speed traffic.



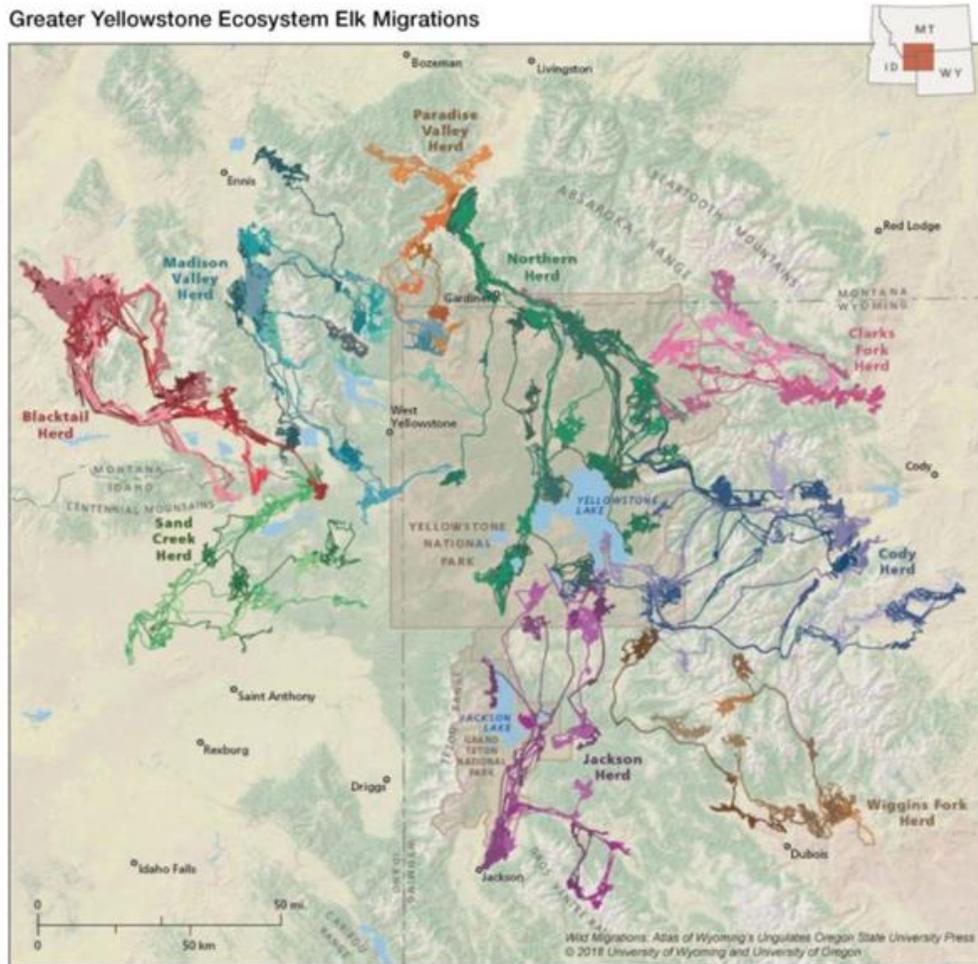
(Figure 2: Longest Mule Deer Migration, map credit to 2014 Atlas of Wildlife Migration: Wyoming's Updates)

Currently, ungulates in the GYE face many obstacles which make it increasingly difficult to complete successful migrations. These challenges include habitat fragmentation and manmade barriers like fencing and roads. Conservationists working to aid the issues face challenges that span across multiple jurisdictions while facing high costs for management and mitigation measures. In researching how to combat these issues, I found that there was already a suite of ideas and projects similar to those I might suggest. So, I will discuss a menu of options that may be implemented to help safeguard ungulate migrations into the future.

Why?

All across the globe, we see fewer large-animal migrations. This is primarily due to habitat fragmentation. Luckily, due to the relatively open space in the GYE, many of the ungulates who reside here have been able to maintain their natural migrations. Ungulates that migrate in general do so to escape harsh winter weather while following food availability. For example, several herds of elk that call the Greater Yellowstone Ecosystem home spend their summers at higher elevations within Yellowstone National Park, where temperatures are cooler, and typically food sources are high in availability. These areas are known as their summer ranges. However, in the fall and early winter, when temperatures begin to drop and snow starts to fall - the elk herds begin to move out of the mountains where conditions are harsh for months at a time and begin to move to lower elevations where the snow is not

as deep, and it is easier to find enough food to sustain them through the winter months. These are known as winter ranges. In the spring, they are on the move again - transporting energy and nutrients across the region along the way.



(Figure 3: Map of Elk Migrations in the GYE)

Unfortunately for wildlife, the Greater Yellowstone Ecosystem is seeing more people moving into the area each year. The Northern reaches of the ecosystem, Bozeman, MT, is currently facing massive increases in human populations - predicted to double in size in the next 17 years if growth remains at current rates. This growth leads to new development of roads and housing subdivisions, which can be problematic for migrating wildlife and easily lead to habitat degradation and fragmentation. Due to the extensive roadways within the United States, 1-2 million vehicle wildlife collisions occur each year. This can cost Americans roughly \$8 billion, not to mention the needless loss of wildlife resulting from these same accidents (Clevenger et al., 2008).

In the case of the Cody, WY elk herd, those animals have been cut off from their winter ranges by human development completely and now require supplemental winter feeding and face the dangers of rapid disease spread within the designated feeding areas. Studies have shown that the winter range of as many as 80% of the GYE elk is on private lands, primarily ranches and other large areas at low

elevations (Tilt, 2020). Unfortunately, as these areas are growing, many ranches are getting bought out, leaving the land to be parceled and sold, consequently ridding the elk of food and shelter.

Humans also inundate the area with large amounts of fencing. It has been found that there are nearly 4,000 miles worth of fencing crisscrossing the ecosystem like obstacle courses for migrating ungulates. The same study also found that, on average, pronghorns encountered fences 248 times per year, and 40% of the time, the fences forced the animals to change behavior or course entirely (Xu et al. 2021). Fascinatingly, not all ungulate species react the same when they encounter obstacles like fences. For example, whitetail and mule deer prefer to jump over fences if they can - while pronghorns prefer to squeeze below the wires of fencing. Either of these behaviors can be prohibited if fences are too high or too low to the ground, which often results in animals' separation from the herd or getting stuck in the fence.

Seasonal migration in ungulates is a combination of learned behavior and genetically inherited traits (Jesmer et al., 2018). This means that not all animals within each species or even geographic area follow the same migration patterns. If these species lose their migrations, their health and populations may suffer as they are unable to consume adequate nutrients.

How? Who?

In a larger context, the initiative works across multiple jurisdictions, boundaries, and landowners. Unfortunately, there is no singular strategy that will work throughout the ecosystem. Due to its large nature, in order to be successful, this initiative needs to take a multiscale, collaborative approach - meaning work needs to be done at the local, state, and federal levels. Partners facing this challenge include state and national government agencies, Wyoming universities, researchers, nonprofit organizations, and landowners. The duties of these different organizations will range from research and data collection to program development and implementation. Additionally, as more land is being developed due to increasing human populations in the area, it is important to note that the most cost-effective way to manage issues like this is to address them in the planning process before they are implemented in the first place.

At the local level, there are citizens, private landowners, and sometimes nonprofit organizations. One of the powers that can be utilized here is citizen science. There are mobile phone applications, like the ROaDS (Roadkill Observation and Data System) app - developed by the Western Transportation Institute at Montana State University to allow anyone to collect data on where wildlife crosses roads in addition to documenting roadkill. Decision-makers can then utilize this type of data to influence the implementation of wildlife crossings and even local policy. At this scale, we also have private landowners. At this point, we can simply encourage them to be good stewards of the land or even educate and help them construct wildlife-friendly fencing. Fencing can be quite costly, so at times landowners are able to work in partnership with local nonprofit organizations to help with the costs. Nonprofit organizations and local land trusts can also get involved with private landowners interested in conservation easements and protecting their land and wildlife in that way.

Within the state level are Universities, which can offer research and data collection for projects and influence policy. It would also involve state agencies from Idaho, Wyoming, and Montana - including their departments of fish and game, and transportation. These agencies would manage their respective areas and ideally work together to help address these issues.

Migrations take place largely on federal lands, so work at the federal scale is important. Along with state agencies, sometimes federal agencies have to intervene as well. For example, the Cody, WY elk herd has long been cut off from their winter ranges, which led to the creation of the National Elk Refuge - where US Fish and Wildlife officials now must supplement the entire herd with hay in the harsh winter months. Another option at the federal level to raise funds for conservation in the GYE is conservation fees. These small fees could be tacked on to other visitor fees at Yellowstone and Grand Teton NP's, if even as small as one dollar were tacked on to each entry fee, parks could easily generate millions of dollars to preserve this essential ecosystem. Additionally, there is national policy that may soon be implemented where congress is working to solve some of these challenges. The Surface Transportation Reauthorization Act of 2021 includes over \$300 million for highway, road, and bridge upgrades throughout the U.S. to address safety, climate change, and even the potential for wildlife crossings.

Conclusion

With large-scale, collaborative initiatives like the Wyoming Migration Initiative, we can produce conservation efforts that last. These efforts may include reduced wildlife-vehicle collisions and increased protected areas in the face of urban sprawl. Overall, ensuring successful ungulate migrations into the future. This fight will be ongoing and face many costs and challenges, but by collaborating with stakeholders and educating the public on these issues, there is the potential to let the wild stay the wild.

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Rachel Sharon is 30 years old and, for the past six years, has worked seasonally with the state parks department in Massachusetts. This summer, Rachel is doing a Terra Corps service term and working at the Mass Audubon Sanctuary Broadmoor. Rachel is currently attending Framingham State, working towards a BS in Wildlife Biology and a Minor in Art. She is a Registered Yoga Teacher and an Aspiring wildlife rehabilitator, ideally specializing in Opossums.



Callahan State Park Trail Assessment

Introduction

Callahan State Park is a 388-hectare park located in Framingham, Massachusetts, owned and operated by the Massachusetts Department of Conservation and Recreation (DCR). The Park has a winding network of trails totaling over 7 miles. Some of the trails are maintained while others are not. In a park, trails should be looked at as an asset. They are pathways to nature and, therefore, pathways to education and add a lot of value to a landscape. Similar to other assets, these pathways must be periodically maintained and structurally assessed to see if improvements are needed.



Callahan currently has one summer seasonal worker, and most of the trail work at the park is done by volunteers, mainly through the New England Mountain Bike Association (NEMBA). NEMBA maintains only the northern side of the park, leaving the southern side to the DCR and volunteers. I have walked five of the main trails on the southern side of the park, and using an app called Gaia, made notes about areas I think need maintenance. In this report, I will assess how these trails should be managed and some new partnerships I think would be beneficial to keep the costs down.

The majority of the proposed work is simple trail maintenance or closure due to habitat fragmentation. I additionally note some areas where I think boardwalks would be helpful and some areas of potential rock work using a small construction vehicle. This work would significantly enhance the Callahan experience for visitors. Boardwalks allow users to cross wet areas of trail that would be difficult to reroute due to their location. This generally occurs when there is no higher ground, and the path must go through a wet area. The use of boardwalks will aid patrons in truly experiencing the park because they won't need to keep their eyes on their footing to make it through that stretch of trail. The rock work I propose will also greatly enhance the user's experience by creating a more natural passage over some areas of trail that streams flow over. I suggest rock work exclusively in some areas because the rocks are already there, and the areas that need crossing are relatively small with little to no current in the stream.

Partnerships

DCR will need to create more partnerships with neighboring schools and organizations to save money in accomplishing this work. Currently, DCR does not have the (wo)manpower to complete this project. If they did, they likely would already be doing it. I recommend that DCR partner with two local schools, The Sudbury Valley School and Joseph P. Keefe Technical High School to carry out most of the work.

The Sudbury Valley School is located down the street, and the educational structure of the school allows students to choose what they want to work on. I believe with the proper guidance and inspiration, these students will be great stewards of the land. They could work on trail maintenance tasks such as trimming vegetation and ensuring the signage is accurate and in good repair. They could also work on invasive removal projects and GIS plant mapping projects.

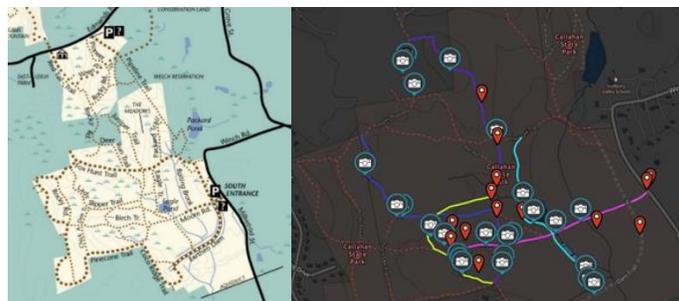
Keefe Tech is a technical school with programs that include carpentry, horticulture and landscape design, and graphic arts. They could work together to plan and create the proposed boardwalks and bridges and do a lot of the more serious trail work, such as using tools to do bench cutting or moving gravel to fill holes.

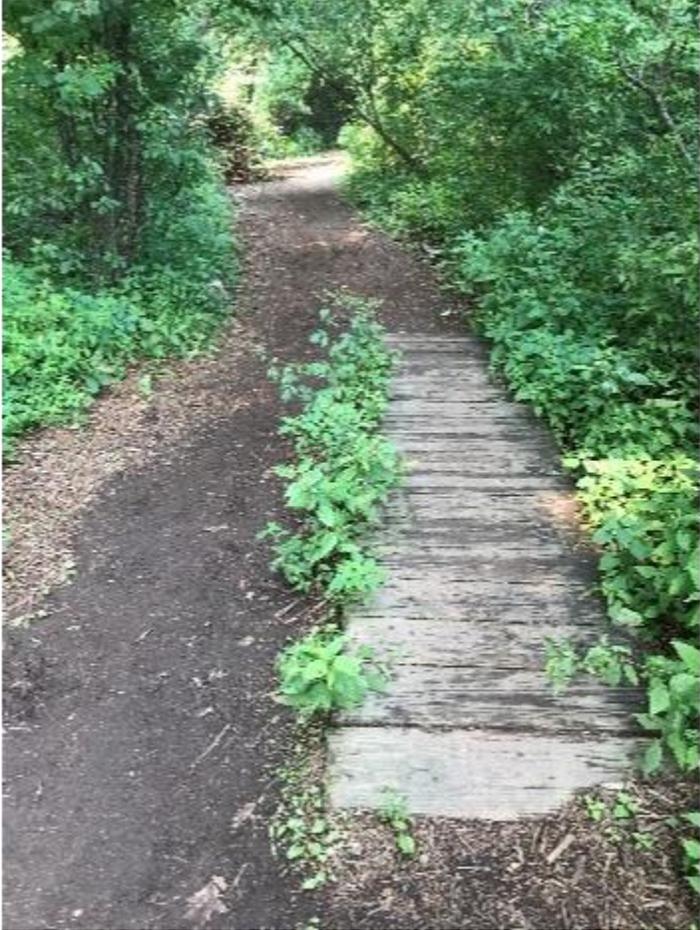
Another critical partnership I think the DCR should make is with the neighboring Native American tribes, mainly the Natick Praying Indians and members of the Nipmuc Nation. DCR could recruit within the indigenous community to work with the student volunteers and assist them with their stewardship projects. They have sacred connections to this property, and I think it would be respectful for DCR to offer them an opportunity to have the authority to manage the land with their own hands.

Assessment

In this report, I will provide my notes on the issues at Callahan State Park. I have assessed Moore Road (pink), Eagle Trail (light blue), Juniper Trail (purple), Birch Trail (yellow), and Lady Slipper Trail (dark blue). I provided GPS coordinates to the problem areas. Most trail assessments use natural landmarks as well as GPS. The assessment addresses the following:

- Adding stonework: there are a few places where stone work would be an appropriate solution to creating a pathway across wet areas of trail.
- Monitoring or adding boardwalks: structures like bridges and boardwalks need to be evaluated frequently and repaired or replaced, as necessary.
- Drainage and erosion problems: there are many places where minor maintenance actions or drainage improvements are recommended.
- Abandon redundant trails: this would save time and expense on maintenance.
- Reduce habitat fragmentation: some trails are currently running through the middle of fields.



| | | |
|----------------------|-------------------|---|
| Trail Segment | Moore Road | |
| Length: | .5 miles | |
| Location | Condition | Comments/Work Needed |
| 42.31682, -71.46013 | Good | Annual gravel assessment, use Kubota to drive in and dump gravel into holes and problem areas as needed |
| 42.31951, -71.46611 | Okay | Area needs gravel fill in some low spots |
| 42.31866, -71.46968 | Needs Work | <p>Bridge does not cover area of trail</p>  |
| 42.31868, -71.47098 | Needs Work | Trail must be relocated 10 feet to the right to reach the higher ground, grade reversals will be installed in the trail by implementing bends in the trail to provide high and low points for the water to more easily flow off the trail |
| 42.31818, -71.47269 | Good | Moore road ends and meets the center of Birch |

| Trail Segment | Eagle Trail | |
|------------------------|-------------|--|
| Length: | .51 miles | |
| Location | Condition | Comments/Work Needed |
| 42.31681, -71.46563 | Poor | Trail begins, trail cuts straight down a grassy hill fragmenting habitat, trail is over grown and eroded due to the trail having no grade reversals and going straight down the hill |
| 42.31701, -71.46589 | Poor | Old bridge goes over small stream, this bridge needs repair however I am proposing it be dismantled as it is a continuation of the habitat fragmentation |
| 42.31748, -71.46607 | Poor |  <p>Very high grass, trail is about half a foot wide, it continuing to fragment habitat</p> |
| 42.31904, -71.46766 | Good | Trail joins up with Moore road and habitat fragmentation ends |
| 42.32015, -71.46922 | Needs work | Stream crossing trail, some rocks available to create stepping stones |
| 42.32254, -71.46921 | Good | Trail intersects Fox Hunt Trail |

| | | |
|------------------------|----------------------|---|
| Trail Segment | Juniper Trail | |
| Length: | .77 miles | |
| Location | Condition | Comments/Work Needed |
| 42.31731, -71.47052 | Okay | Trail begins, some erosion |
| 42.31765, -71.47018 | Poor | Stream crosses trail, excellent opportunity for rock work |
| 42.31803, -71.46999 | Poor | Lots of erosion, add grade reversals to trail |
| 42.32276, -71.47044 | Good | Junction of Juniper and Fox Hunt Trail unmarked |
| 42.32606, -71.47475 | Good | Trail intersects Rocky Ridge Trail |

| | | |
|------------------------|--------------------|---|
| Trail Segment | Birch Trail | |
| Length: | .43 miles | |
| Location | Condition | Comments/Work Needed |
| 42.32036, -71.47062 | Good | Trail begins |
| 42.31894, -71.47369 | Good | Trail is too wide, needs to be moved over to higher ground and brush should be moved over closed portion |
| 42.31861, -71.47300 | Good | Trail is too wide, needs to be moved over to higher ground and brush should be moved over closed portion |
| 42.31787, -71.47222 | Needs Work |  <p>Good opportunity for rock work, very mushy area, rocks could be moved and relocated to create stepping stones through the muddy area, lots of large stones with flat faces in an area that would be suitable for this kind of work.</p> |
| 42.31726, -71.47060 | good | Trail connects to Juniper Trail |

| Trail Segment | Lady Slipper Trail | |
|---------------------|--------------------|--|
| Length: | .50 miles | |
| Location | Condition | Comments/Work Needed |
| 42.31995, -71.47056 | Okay | Trail in good condition but fairly close to Eagle trail, eagle crosses this trail further down, consider joining Juniper to Eagle there and closing down this portion |
| 42.31973, -71.47336 | Good | Junction of Eagle and Lady Slipper |
| 42.31980, -71.47506 | Needs work | Trail has been so eroded for so long that people walking the high ground has created new trail, the old area needs to be brushed out and new trail needs to get more defined with more deliberate grade reversals consider the landscape and what is already naturally occurring. |
| 42.31972, -71.47535 | Good | Signage labeling junction of Lady Slipper and Chickadee is reversed |
| 42.32130, -71.47685 | Needs work |  <p>Trail has been so eroded for so long that people walking the high ground has created new trail, the old area needs to be brushed out and new trail needs to get more defined with more deliberate grade reversals consider the landscape and what is already naturally occurring.</p> |
| 42.32259, -71.47712 | Good | Trail intersects with Rocky Road |

Colleen Smith graduated with a BS in forestry with an emphasis in soils and a minor in geospatial analysis from Humboldt State University in 2019. Colleen is a California native but moved out to Massachusetts a year ago now with her partner and dog. She's recently ended an AmeriCorps term working with a land trust in Falmouth, MA and has started a research assistant position at the Woodwell Climate Research Center in Falmouth, where she's focused on soil carbon monitoring. Some of Colleen's hobbies include plant ID and foraging, hiking, reading, and napping.



Falmouth's Wildlife Corridors: The Moraine Trail

Background

The zoning bylaws for the town of Falmouth place great importance on protecting and conserving open space and forested corridors. In a joint effort with the help of The 300 Committee Land Trust (T3C) and other non-profit organizations, the town has worked to purchase and protect land with forest connectivity, corridors, greenbelts, wildlife and water resources in mind using a suite of data to determine parcel priority. Some of the elements that increase the rank of a parcel are the potential for connectivity with open space, distance from schools, vulnerable resources, etc. The town's Park and Open Space plan of 1986 identified the goal of establishing a moraine greenway and wildlife corridor. With this specific target for land acquisition, T3C and the town established the largest greenbelt in Falmouth, and the "Moraine Trail" totaling nine miles in length was born.

The Moraine Trail was established by a small group of volunteers led by John Gould, John Dmochowski, and Dick Payne. These volunteers routed and cut the entire trail, working with neighboring landowners, the town, and T3C to create the longest continuous trail in Falmouth.



Alexandra Zollo, Stewardship Coordinator for The 300 Committee posing with John Gould, a pioneering volunteer who first blazed the Moraine Trail.

Issue: WHAT

The Moraine Trail relies entirely on the organization of volunteers for maintenance. As both the town and T3C have taken on other properties and projects, the maintenance of the Moraine Trail has fallen to the wayside over the past 15 years, aside from T3C's volunteer trail crew clearing more heavily used sections of the path annually. The white blazes that once marked the trail are now few and far between as trees have died, bark has sloughed off, and weather has deteriorated the paint. Now only those who have known the Moraine trail feel confident embarking on the 9-mile journey. This leaves a vast majority of the community left out, and many do not even know that such a trail exists. The number of frequent users is much lower than other open space trails, and the trail itself does not have significant

name recognition within the community. The goal of this project is to revitalize and promote the Moraine Trail in order to make it more accessible and to increase public use.

Importance: WHY

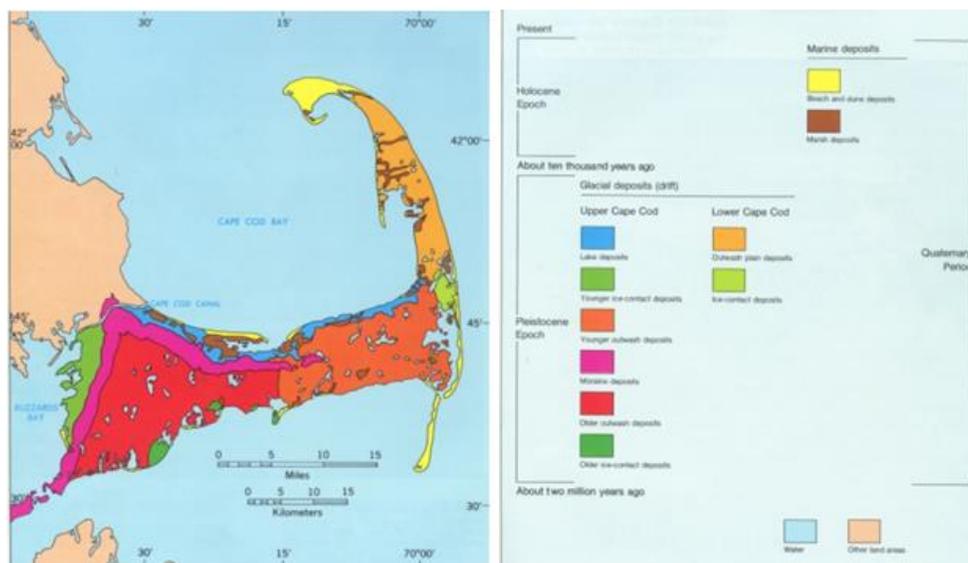
The map of the Moraine Trail that is currently available to the public is both out of date in terms of trail sections that have been rerouted and difficult to access as it can only be purchased for \$2 as a printed map pamphlet from T3C's offices. To date, the Moraine Trail is not located in any online format, despite the recent influx of mobile mapping applications like AllTrails and Gaia. In my opinion, the public deserves not only access to open space but ease of mind when accessing open space. There are many members of the community who, for one reason or another, feel uncomfortable recreating in open space areas without clear signage and access to trail maps. One of the easiest ways to increase trail users' comfort is to improve and maintain signage and waymarkers. The hope and the goal of this project is to make the Moraine Trail more accessible to the public through increased signage and the creation of a new web-based interactive map as well as printable PDF versions of the map that hikers can print off at home and bring with them to the trail.

Project Partnerships: WHO

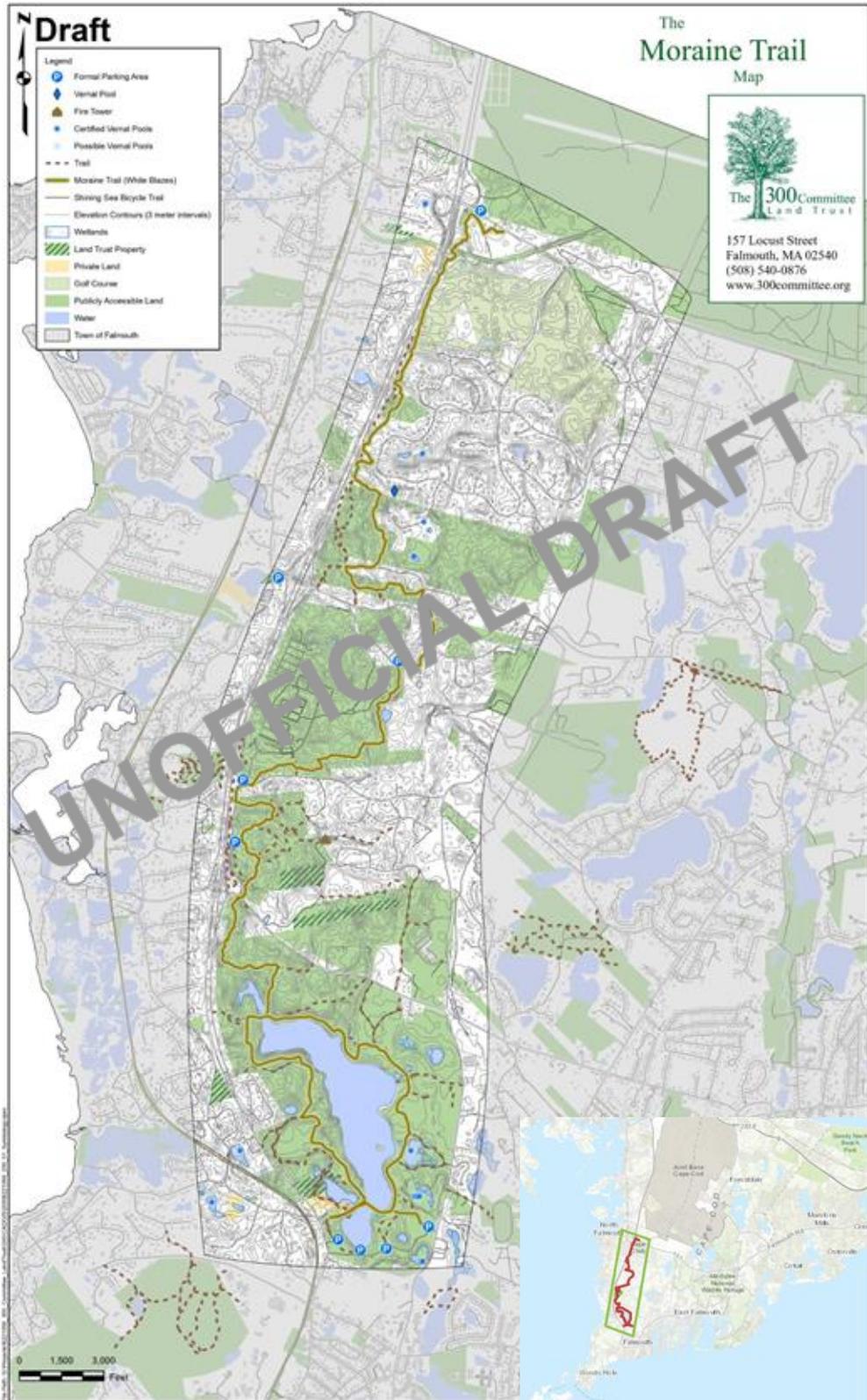
There are several key partners in this project. The 300 Committee Land Trust will be coordinating efforts to accomplish the goals of this project. T3C will work closely with Gradient, an environmental and risk sciences consulting firm, to create the updated web-based and pdf versions of the Moraine Trail map. As a TerraCorps service member at T3C, aiding Gradient in providing map data was one of my main tasks. Portions of trail that branch off the Moraine have been blazed throughout Spring 2021 by volunteers coordinated by T3C. Service members of AmeriCorps Cape Cod are currently re-blazing the Moraine Trail. While T3C is leading the charge on this project, the town of Falmouth as a primary landowner along the trail is acting as the overseeing body of this work.

Project Area: WHERE

The Moraine Trail is located in Falmouth, MA, and runs North-South from Nathan Ellis Hwy (151) to Jones Rd, hugging along Route 28. The trail covers a diverse topography that includes high ridges and steep valleys as the trail follows the glacial path and deposition of glacial drift.



USGS Geologic map of Cape Cod (generalized from detailed mapping by K. F. Mather, R. P. Goldthwait, L. R. Theismeyer, J. H. Hartshorn, Carl Koteff, and R. N. Oldale).



Unofficial locator map showing the location of the Moraine Trail in reference to the rest of Falmouth

Timeline: WHEN

Re-blazing of the trail is set to be completed before Fall 2021. The web-based and pdf versions of maps from Gradient are slated to debut by the end of August 2021. Further signage for the trail will be evaluated for necessity and installed throughout the next year

Strategy: HOW

Gradient Corp. will work with T3C to create a new map of the Moraine Trail with the updated route, parking, and access information. The map will be presented in both a web-based story map as well as three 8.6x11 printable pdfs of the trail (North, Central, and Southern sections). The interactive story map will highlight different user groups of the trail and communicate the significance of this 9+ mile trail in Falmouth. The interactive story map will tell the story of 8-9 different trail users and show the Moraine Trail's commonality. The perspectives highlighted through media in the story map are: geologist, indigenous Wampanoag representative, local artists, hikers, T3C volunteers, mountain bikers, and a representative from AmeriCorps Cape Cod. The maps will be hosted on T3C's website and advertised through mailings and social media. Gradient will also create a small advertising campaign around the completion of this pro bono project.

The media will be recorded and compiled by T3C Stewardship Coordinator Alexandra Zollo, then will be passed off to Gradient to complete the story map. AmeriCorps Cape Cod will complete the re-blazing of the trail, and volunteers will do any remainder of the work. T3C's volunteer trail crew will take responsibility for trail maintenance, and since the corridor is too large to assign a single steward to, T3C will rely on trail users to notify them of any necessary trail maintenance.



AmeriCorps Cape Cod Member painting a blaze along the Moraine Trail

Project Budget: HOW MUCH

Gradient is providing the mapping work pro bono as a donation to T3C. This donation is an incredible opportunity to create a lasting and usable resource for the community. The main costs associated with this project are T3C staff time, blazing supplies, and the potential larger installation of signage at major points of interest along the trail. While T3C has a large pool of volunteers to pull from, the proper installation of permanent signage can be pricey. T3C is a relatively small non-profit with only three full-time employees, making coordinating large projects and groups of volunteers more difficult.

Future Goals: SO WHAT

This project has the potential to impact the community near and far. Once users feel comfortable navigating the trail, there are endless opportunities to make memories. The interactive web-based story map will act as a historical marker and a way to honor those who have dedicated their time to create and share this beautiful trail.

The future goals of this project are to create and install permanent interpretive signage where necessary and maintain the trail. A social media campaign advertising the trail to the public will be run after completing the maps. T3C volunteers will host hikes along the trail to engage with the community.

Potential Roadblocks: WHAT IF

The roadblocks that may be expected are delays in the launch of the web-based story map. With only three full-time employees, T3C does not have the capacity to focus all of its effort on this single project, and there is potential for the media compilation for the map to take longer than expected. Since this project is highly collaborative, there are many individuals schedules to work around. As with any project, there is potential to step on toes, and this should be avoided as much as possible. As the project coordinator, T3C is responsible for keeping all interested parties in the loop and on board with the material being produced.

Project Summary

This project focuses on the revitalization and promotion of the Moraine Trail to make it more accessible and used by the public. This project has many components, including re-blazing the trail, gathering media for the online map, gathering and compiling map data, planning community outreach, consulting with those who originally established the trail, working with the town, etc. This project has many different stakeholders and is almost equally about managing people as it manages the land. To have such a long continuous trail through our town is a blessing, and it is one that I think everyone has the right to feel comfortable enjoying. This project is a huge undertaking, with what I consider great potential for recreation.

After growing up with a firm hatred of camping and the outdoors, **Kate Sutcliffe** wisely changed her mind after impulsively spending a summer working on a trail crew in Utah. After several professional detours through the worlds of public health and management consulting, she has meandered her way back to conservation. Kate is currently spending a year serving with TerraCorps at Mount Grace Land Trust in Athol, MA, where she collaborates with Open Space Committees and other municipal volunteers across the state.



A New England transplant, she holds a deep fondness for prairies and cornfields but must admit the forests are clamping down on her heart. She is particularly interested in the intersection between workforce development and conservation, as well as how people perceive and represent their wilderness experiences.

Establishing a Municipal Revolving Loan Fund to Acquire Chapter 61 Right of First Refusal Parcels

Abstract

Massachusetts Chapter 61 regulations allow landowners to reduce their annual property tax burden in exchange for committing to keep their land in forestry, agriculture, or open space/recreational purposes.¹ However, Chapter 61 is not a permanent protection option: landowners may subsequently choose to convert or sell a property for non-Chapter 61 use. When this happens, the town or city has a 120-day Right of First Refusal (ROFR) option to purchase the land. A municipality may have strong confidence in its ultimate ability to receive a grant, fundraise, or approve CPA funding but be unable to secure it within a 120-day window. A state-wide revolving loan fund earmarked for properties being converted to non-chapter uses would provide the necessary bridge funding for towns and cities that would like to exert a ROFR purchase option but need a longer period of time to raise funds.

Introduction

Massachusetts' Chapter 61 tax program allows landowners to receive a significant reduction in property taxes in exchange for maintaining their property as forest, for agricultural production, or general open space and recreation purposes. By reducing the property tax burden, Chapter 61 programs aim to allow landowners to continue ownership of their land in a way that provides public benefit, rather than being forced to sell some or all to development to reduce the costs of management.

Depending on the specific usage their land is enrolled in, landowners must keep their property in an approved use for a set amount of time (10 years for forest, five years for agriculture, and one year for open space and recreation). If they choose to sell or convert the land to a non-chapter use during that timeframe, they must pay back taxes on the property; in addition, the town or city in which the parcel is located receives a Right of First Refusal (ROFR) purchase option on the property. During a 120-day notice period, "the city or town has the right of first refusal to meet a bona fide offer to purchase the land or, in the case of conversion by the landowner, an option to purchase the land at full and fair

¹ "Chapter 61 Programs: Understanding the Massachusetts Ch. 61 Current Use Tax Programs." Van Fleet, T; Catanzaro, P; and Kittredge, D. University of Massachusetts Extension. Accessed at <https://masswoods.org/sites/masswoods.net/files/Ch61-v2.pdf>

market value to be determined by an impartial appraisal” (Conservation and Land-use Planning under Massachusetts’ Chapter 61 Laws, 2007). If the town or city chooses to exert their ROFR, the landowner must sell to the municipality rather than any individual or developer who made the initial offer.

The ROFR is an important caveat in the Chapter 61 laws: it helps prevent landowners from using Chapter 61 merely as a tax haven until they can receive an offer from a developer that is financially beneficial enough to make it worth paying back taxes. However, the 120-day window is an extremely short time period for a town to act to purchase a piece of land. Within this approximate 4-month period, the town must identify if the parcel in question is of significant value to the town, give notice of and hold a public hearing, and – if deciding to exercise the option – find funding to pay for the parcel. Even if a community is strongly interested in the property, their usual sources of conservation funding (such as state grants, CPA funds, or allocating funds from the annual town budget) may not align with the timeframe of the ROFR. As such, it is likely that many parcels that may be of either high conservation value or have other uses for the public good may not be purchased by the municipality.

Current utilization of Right of First Refusal

To determine whether additional funding options would assist communities in exerting their ROFR requires examining how many times they waive their right due to lack of financing. However, there is no centralized database of how often municipalities are presented with a ROFR or how often they choose to exercise versus waive that ROFR. Without this information, it is difficult to assess the success of Chapter 61 as a conservation program. Does it truly prevent the land from being developed by allowing towns to purchase parcels that would otherwise be developed? Or do towns typically waive their ROFR, resulting in a situation where a landowner simply avoids property taxes and reduces the town’s income stream for many years before ultimately selling the land for further development and parcelization?

While this question can only be answered by a full assessment of all tax and land records of every municipality within the Commonwealth², an interim assessment was conducted by searching local newspapers throughout Massachusetts for any articles referencing Chapter 61 and the Right of First Refusal, under the assumption that notice of public hearing or debates about Chapter 61 are frequently local news items of note. In addition, Massachusetts’ land trusts webpages were reviewed to see if any of their conservation properties had been acquired through Chapter 61.³

This search identified **33** instances of ROFR options between 1998 and 2020. Of those 33 instances, the town released their ROFR in **10** cases (30%), assigned it to a land trust in eight cases (24%), and purchased the parcel in seven cases (21%). The outcome was unknown in seven cases (21%); in one case (3%), the landowners canceled the conversion.

Even in this extremely limited sample size, the most common outcome was a town declining to exert its ROFR. This is likely to be a drastic underestimate of the frequency of releasing a RORF option. Most ROFR parcels likely do not even make it to the public hearing stage – whether because the town does not act within the time frame, a planning board is uninterested, or the developer is urging a quick ruling (language frequently observed in the notice of intent to convert letters sent to town select boards). The Chapter 61 cases that make it to a newspaper are the most public and most contentious and yet still are

² Not within the scope of an 8-week summer program.

³ Towns and cities may assign their ROFR to a land trust in lieu of exerting it themselves

often passed on. In some cases where the town did end up exercising their ROFR option, such as the case of Southampton in 2019, action only took place after vigorous community activism.⁴

As of 2007, 97,000 acres of land in Massachusetts were enrolled under Chapter 61 forestry programs, and 209,000 acres were enrolled under agricultural programs.⁵ These numbers are likely far higher today, but it appears doubtful towns are able to act on any meaningful proportion of those acres that come up under ROFR. This is a severe limitation in Chapter 61's ability to act as a true conservation program rather than a tax avoidance program.

Right of First Refusal Revolving Loan Fund

This problem can be addressed by establishing a Right of First Refusal Revolving Loan Fund, earmarked for use by towns or cities in Massachusetts who wish to utilize their ROFR option for a parcel of land being withdrawn from Chapter 61. This fund would provide short-term loans (no more than three years in duration) to a town or city for any costs associated with purchasing the land or a CR on the land (including appraisal cost) at a low-interest rate. With easily available, low-cost financing, towns will be able to act within Chapter 61's 120-day ROFR window to purchase the parcel in question and then secure permanent funding later. By having a fund earmarked for this specific use, towns will no longer need to pass on ROFR simply because of short-term financial circumstances, such as being at the wrong point in a grant cycle.

Source funding and loan administration

Real estate transactions can be expensive in Massachusetts, particularly for coastal regions: a parcel that came up under RORF in 2020 in Peabody, MA, would have cost the town \$13 million to purchase.⁶ As such, any revolving fund will need to begin with a significant source of capital, particularly if the fund is to make loans for ROFR to multiple municipalities simultaneously. While a smaller dollar amount would still be able to provide loans, it is also likely that those same smaller amounts are more easily overcome even in the absence of a revolving loan fund.

Considering that a ROFR needs a high capital amount and infrastructure to rapidly process loans within the 120-day window, the best funding seed source for a ROFR is an existing organization that already operates revolving loan funds for other conservation purposes. Two likely candidates for this are:

- **The Conservation Fund:** Already established as an organization that provides bridge financing, in 2020, The Conservation Fund worked on over 150 projects with a total of over \$323 million⁷, demonstrating its ability to meet the dollar amounts and scope that a ROFR project would require. They have a wide range of conservation priorities - including food,

⁴ "Right of First Refusal in Southampton, MA." Madsen, K. Talk given at the 2021 Open Space Conference – From Planning to Implementation, March 2021. Recording accessed at https://www.youtube.com/watch?v=_nboMv-_wyc

⁵ "Conservation and Land Use Planning under Massachusetts' chapter 61 Laws: A Primer for Cities, Towns & Conservation Organizations." Mount Grace Land Conservation Trust. 2nd Edition. November 2007. Accessed at https://www.mountgrace.org/fileadmin/files/Publications/MGLCT_Chapter_61_Handbook.pdf

⁶ "Salem Country Club contemplating land sale." Leighton, P. The Salem News. Accessed June 2021 at https://www.salemnews.com/news/local_news/salem-country-club-contemplating-land-sale/article_7ff71e38-2e0d-584c-b046-fc7ebe2b3668.html

⁷ "Our Impact." The Conservation Fund. Accessed July 2021 at <https://www.conservationfund.org/impact>

forests, community development, and climate – that would accommodate the variety of reasons a town or city may wish to purchase a parcel.

- **The Open Space Institute Conservation Capital Fund:** Provides short-term bridge loans for land transactions in the eastern United States.⁸

Since these existing funds are already familiar with and administer bridge financing, they are well-positioned to expand their current operations to protect properties coming up under ROFR. This may not even require developing further fundraising; instead, they simply need to expand the scope of accepted applications to municipalities seeking bridge financing for a ROFR parcel. This purpose may see increased legitimacy if the organization earmarks a specific line of credit for this type of project. While things like interest rates may need to be adjusted based on the unique needs of loaning to a municipality, the hosting organization can use the loan operating processes they already have in place for this work.

One key consideration is that towns must, ultimately, still have a way to pay for the parcel – whether through receiving a state grant, approving CPA funds, fundraising, re-selling the land, or finding a land trust to purchase the parcel. This bridge financing is only intended to last, at most, a few years; it is a stopgap, not a source of funding in and of itself. If a town does not have strong support for purchasing a ROFR option on a property, it should not seek a bridge loan from a revolving loan fund in hopes that funding support can be drummed up at a later date. This type of funding is best suited for projects with an identified funding source that will not be available in time to complete the purchase.

Use Cases: Creating New Opportunities for Municipalities

The narrow window to exert ROFR can limit a municipality's creativity when it comes to protecting land. There are numerous longer-term strategies a community could use to purchase a ROFR parcel for a range of purposes, but unless the town has previous experience doing so, they would be less likely to attempt such deals in 120 days or tackle experimental conservation tools. By contrast, providing bridge funding would give the town or city the space to try conservation methods for a greater diversity of purposes.

Some of the potential use cases that would be made possible by a revolving loan fund could include:

Buy and re-sell a portion of the parcel: A common tool in land conservation is carving out a few development lots for re-sale while keeping the rest of the property intact; this maintains the integrity of the majority of the parcel while the development lots pay for the transaction and land cost. However, this type of transaction takes a significant amount of time, and the lots cannot be re-sold until the parcel has already been purchased by the town. Using the revolving loan fund, a town or city could purchase a ROFR parcel, carve out development lots, re-sell those lots to pay back the loan and keep the rest of the property intact for conservation purposes. While this does not conserve 100% of the land, it would enable the conservation of far more than if the entire property had been sold for development.

⁸ "Funding Conservation Capital." Open Space Institute. Accessed June 2021 at <https://www.openspaceinstitute.org/what/funding/conservation-capital>

- *Precedent:* A 24-acre property in Boxborough, MA, was purchased after it came up through ROFR by carving out and selling four housing lots.⁹

Provide a down payment: Some towns may wish to pay for a property over numerous years by borrowing against revenue sources like future CPA funds; however, this would still require a down payment. The revolving loan fund would provide the initial capital for the down payment. The town then makes regular payments later to purchase the property fully.

- *Precedent:* Hopkinton, MA purchased a parcel through ten annual installments of \$30,000 each, paid out of future CPA revenue.¹⁰

Buying and holding land for a farmer: Land enrolled under Chapter 61A for agricultural purposes is frequently of little use to a town or city – in March 2019, the town of Palmer passed up a ROFR option on a farm, saying there was “no reason to buy it.”¹¹ While this is an understandable position, as towns and cities are unlikely to manage agricultural practices, protecting high-quality farmland is frequently a stated goal in the same municipality’s open space planning process. Bridge financing could allow a town to purchase farmland, hold it until a farmer can be found, and then re-sell to that farmer. This would not only retain local farmland but help increase new farmer access to land.

- *Precedent:* Hatfield, MA assigned their ROFR option on a 26-acre Chapter 61 parcel to Kestrel Land Trust, who purchased the land and then re-sold it to the adjacent Black Birch Vineyard.¹²

Buying and holding land for other purposes: Towns and cities may have a long list of desired uses for lands that come up through ROFR, such as building affordable housing. Bridge financing for this purpose would cover the funding gap between land acquisition and carrying out the project.

- *Precedent:* Easton, MA purchased a 1-acre parcel removed from Chapter 61A to build affordable housing; once purchased, they issued an RFP for low-income housing developers to complete the project.

Estimated Impact

Currently, there is no centralized record of how many acres are withdrawn from Chapter 61 each year, how frequently towns are presented with a ROFR option, or how often towns either release their options or purchase the parcel. Without these numbers, it is difficult to estimate the full impact a revolving loan fund could offer towns because there is no way to gauge how many lands are lost to development from withdrawal from Chapter 61 each year.

⁹ “Inches Woods.” Boxborough Conservation Trust webpage. Accessed June 2021 at <https://bctrust.org/inches-woods/>

¹⁰ CPA Projects – Detailed Report. Community Preservation Coalition Project Database. Accessed June 2021 at https://www.communitypreservation.org/cpc-report?report_src=bcstvw3d3%7Ca%3DAPI_GetRecordAsHTML&key=864

¹¹ “Solar project for North Street in Three Rivers approved by Palmer Planning Board.” Stabile, L. (2019). MassLive. Accessed at https://www.masslive.com/news/2012/08/solar_prpject_for_north_street.html

¹² “Farmland Protected for Local Vineyard in Hatfield.” Kestrel Land Trust, 2019. Accessed at <https://www.kestreltrust.org/2019-hatfield-farmland-protected-for-local-vineyard/>

However, with funding a constant challenge for conservation projects, any access to bridge funding is likely to make the process easier for towns, particularly when operating on a tight timeline. A “snowball” effect may emerge once towns and cities see their peers successfully using the fund, encouraging others to apply as well. Since the fund should be hosted by an already-existing conservation organization that gives loans for other purposes as well, there is no risk that available conservation capital will go unused even if the first few years of the program yield only a few ROFR-specific loan applications.

Utilization of this type of fund will also increase the normalcy of *all* types of revolving loan funds for municipalities – particularly crucial as towns and cities begin to seek funding for things like long-term climate change resilience projects and infrastructure updates.

Outreach and Education Considerations

Any type of revolving loan fund will not be utilized unless towns and cities understand they now have access to an earmarked ROFR income stream, as well as guidance on how to use it. Additionally, having access to these funds is irrelevant if the community does not already understand which currently-enrolled Chapter 61 parcels are ones they may wish to conserve if offered the option under ROFR. As such, any establishment of a ROFR revolving loan fund should come with significant community outreach, training, and education. As part of this outreach and education, towns and cities should be encouraged to:

- Pre-inventory properties within municipal boundaries that are enrolled in Chapter 61
- Identify which Chapter 61 enrolled properties align with the town’s strategic conservation priorities (outlined in other documents such as the Open Space and Recreation Plan)
- Establish a standard operating protocol for the town’s response when a property comes up through ROFR, including under what guidelines the revolving loan fund will be accessed

Conclusion

Without a mechanism for towns and cities to exert their Right of First Refusal option, many properties with high conservation value to communities will be lost to development and subsequent parcelization. While available data is limited, it does suggest that towns frequently use ROFR. To help towns and cities better take advantage of the ROFR option, a reliable line of bridge financing can help them execute short-term deals to buy time to identify longer-term funding sources. Combined with outreach and education on using these programs more frequently, this financing would strengthen the success of Chapter 61 as a long-term conservation program.

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“Solar project for North Street in Three Rivers approved by Palmer Planning Board.” Stabile, L. (2019). MassLive. Accessed at https://www.masslive.com/news/2012/08/solar_prpject_for_north_street.html

Sophie Traficonte graduated from Connecticut College in 2015 with a major in Environmental Science and a minor in photography. After graduating, Sophie worked for the Massachusetts Department of Conservation and Recreation, first as a Director's Fellow and then as a Project Manager in the Boston office. This position included working on different programs in the parks, and it allowed her to get a start in the world of conservation. She joined New England Forestry Foundation (NEFF) in 2017, and she is currently the Conservation Project Manager at NEFF. Sophie focuses on land protection projects in New England and also manages the implementation of the Pooled Timber Income Fund, which uses planned giving principles to draw new lands into protection. Her goals are to expand her knowledge in the technicalities of land protection so that she can reach her maximum potential in the field of conservation.



Lake Champlain Basin, Monkton Landowner Conservation

What

As Benton MacKaye pointed out in his years of being a forester and a conservationist, a crisis is approaching, and our realm may disappear or become severely disfigured.¹³ MacKaye's observation has proven accurate as our society spreads and builds into the natural landscape around us. In order to protect important landscapes from this development, we must pursue large landscape conservation. Approximately 56% of all U.S. forest land is in private hands, and family forest owners, in turn, control 62% of that land.¹⁴ Getting individual landowners involved in conservation efforts is essential to expanding conserved areas and preventing the loss of critical habitats. This type of conservation also comes with many complexities, like identifying funding and organizing multiple landowners to commit to conservation of their properties. This means that family forest owners' collective decisions will have an immense impact on the future landscape. Recently, a group of five landowners with approximately 460 acres in Monkton, Vermont, have come forward hoping to conserve their land. An additional three landowners may be convinced of joining this effort, which would bring the total acreage to 750. This project will focus on identifying potential challenges to a land deal with multiple landowners and finding solutions for these challenges so that this large-scale conservation can occur successfully.

Where and Why

Monkton, Vermont lies in the Lake Champlain Basin, which is the entire drainage area for Lake Champlain. Any precipitation that falls on the watershed will eventually reach Lake Champlain and flow north to the Richelieu River and on to the St. Lawrence River and the Atlantic Ocean. Ninety percent of the water that enters Lake Champlain flows through the lake's drainage basin before it reaches the Lake. Approximately 200,000 people depend on Lake Champlain for drinking water or about 35% of the Basin's population. This makes the area an incredibly important focus for conservation efforts.¹⁵

¹³ Hiss, Tony. *Rescuing the Planet Protecting Half the Land to Heal the Earth*. Alfred A. Knopf, 2021.

¹⁴ "Land Conservation." *New England Forestry Foundation*, 24 Jan. 2020, newenglandforestry.org/learn/land-conservation/.

¹⁵ *Watersheds*. Lake Champlain Basin Atlas. (2019, February 11). <https://atlas.lcbp.org/nature-environment/watersheds-and-tributaries>.

Within this watershed, and in the town of Monkton, is another significant water resource, Pond Brook Watershed. Pond Brook Watershed is a 19,000-acre area of northern white cedar swamps, oak-covered ridgetops, and prime agricultural soils. Over 95% of the Pond Brook Watershed is in private ownership, and the town has prioritized the conservation of this area because it is an essential part of protecting the ecologically significant habitats of Monkton.¹⁶

The landowners identified in this project sit within these watersheds, which are important for water resources. They also lie near Raven Ridge, which includes important clayplain habitat. Raven Ridge was identified as biologically state-significant by ecologists in 1991. The area has been found to have an impressive 142 bird species, and it remains a place where many animal species call home. About 15,000 years ago, this ridge was a part of the melting continental ice sheet that deepened the glacial Lake Vermont. This occurrence turned the 800-foot-high Raven Ridge into “a refugia—an island of dry land encircled by icy waters.” Today, the Nature Conservancy owns and protects a part of Raven Ridge, which remains a sanctuary within the Champlain Valley.¹⁷ Land abutting the conserved area is important because it creates contiguous habitats and allows for wildlife corridors that provide species with protected roaming areas.

In addition to this diverse region along Raven Ridge, the target area of Monkton also boasts Valley Clayplain Forest, which is a natural community in Vermont that occurs on clay soils in the Champlain Valley. The Champlain Valley Clayplain Forest is classified in Vermont as a rare natural community. This forest community experienced a drastic decrease in area during European colonization due to heavy clearing and farming in the late 1700s. Unlike other areas of Vermont that have reforested over the past two centuries, only 10% of the original area covered by clayplain forest is now forested, and most of the remaining forestland is in an early successional stage. This creates a need for areas that include clayplain forest to be protected so that the forest can regrow and expand.¹⁸

With such essential habitats, there are also important species to protect. According to the Monkton Town Plan of 2020, the town is home to the eastern rat snake, the federally endangered Indiana Bat, the Wood Turtle, Upland Sandpiper, and other endangered and threatened grassland birds. Healthy ecosystems are highly connected and depend on these species as their foundations. When a species becomes endangered, it can cause the loss of other species within its ecosystem and further damage the environment.

Monkton’s ecological importance is clear, and the threat of development is very relevant. Presently, the town is in an economic development chapter where dominant land use is changing from farmland and woodlands to high-density single-family homes. There has been pressure from town development for roads and community building and also increased non-resident commuter traffic. The town must prioritize the protection of these single-family properties to preserve the area as a natural landscape.¹⁹

¹⁶ Brennan, Lyra D., "Master's Project: An Ecological Inventory and Assessment of the Pond Brook Region in Monkton, Vermont" (2017). Rubenstein School Masters Project Publications. 16.

<https://scholarworks.uvm.edu/rsmpp/16>

¹⁷ “Raven Ridge Natural Area.” *The Nature Conservancy*. <https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/raven-ridge/>

¹⁸ “History of Rare Champlain Valley Forests in Vermont.” *ECONews VT*. <http://www.econewsvt.org/news/history-of-rare-champlain-valley-clayplain-forests-in>

¹⁹ “Monkton Town Plan 2020-2028”. January 13, 2020. http://monktonvt.com/documents/2019/10/proposed-monkton-town-plan_2019.pdf

Who and When

The strategy going into this project is to bring in a diverse group of partners, including private, public, and educational institutions. Multiple partners will allow us to use collaborative efforts and maximize the collective resources available to the project to close in a timely manner.²⁰

Nonprofit partners will include New England Forestry Foundation (NEFF), Vermont Housing and Conservation Board (VHCB), and Vermont Land Trust (VLT). New England Forestry Foundation has the capacity to hold the Conservation Easements (CEs) on the potential properties. With the help of the VHCB and VLT, all three organizations can share resources that may help with landowner communication and bring additional landowners into the project. Other shared resources may include knowledge about the area, which helps with landowner accepted CE templates, local funding, and learning community goals based on past conservation projects. Partners like this can bring additional donors and funding opportunities that are often new sources of funding that otherwise would not have been identified. In addition to this, funding sources sometimes prioritize projects with multiple partners because it is easier to award funding to a larger project with a group of organizations instead of picking between organizations and funding just one of many applicant groups.

Local and state partners may include Monkton's Agricultural and Natural Areas Committee, Monkton Conservation Commission, and the Vermont Department of Forests, Parks and Recreation. Monkton's Agricultural and Natural Areas Committee has already assisted in identifying potential landowners interested in protecting their land. It is advantageous to have local support in this area due to their knowledge of the local landowners and their backgrounds. These types of projects also frequently require extra assistance from the state for funding recommendations and support for the project. Support for conservation projects from the Vermont Department of Forests, Parks and Recreation shows solidarity around the project and underscores the importance of the issue to landowners and other stakeholders.

The last partner group involved, and the key to this project, are the individual landowners who are interested in conserving their land. Their participation is vital to the project's success because each landowner must be eager and willing to conserve their land. In order to keep landowners interested in the project, they must be happy and agreeable with the conservation easement terms and the costs that come with the easement. As of now, five landowners would like to donate a conservation easement on their land, with an opportunity to expand it to other neighbors. The timeline for this is to start with two abutting landowners with 313 acres and are on a time crunch to close this year. After these easements close, we will do a phase two for the remaining landowners interested in placing a CE on their land. This timeline may also be beneficial because it will allow the other landowners to view successful easements and be encouraged to follow the same route. Organizing many landowner project deals at once can often get complicated, so doing the projects in phases will hopefully simplify the conservation easement process.

²⁰ "Collaborative Opportunities for Land Trusts." We Conserve PA. <https://conservationtools.org/guides/101-collaborative-opportunities-for-land-trusts>

How and How Much

To close the conservation easements projects in two different phases, the next step is to determine funding sources for the project. Though some landowners are willing to fully donate a CE to NEFF, not all landowners can afford to do this, so it will be essential to find grants and funding sources to assist in project costs. Conservation Easements can often be more expensive than landowners expect. Due diligence expenses can include a survey of the property, stewardship endowment, legal fees, and an appraisal. The survey is important because it determines the true boundary lines of the property and therefore allows the holder of the CE, in this case NEFF, to monitor and steward the accurate area of the property. The stewardship endowment helps to fund future stewardship for the land, and this endowment amount is calculated based on how large the property is, what kind of access and terrain there is, how far it is from other easements that NEFF has, and other features that could influence the stewardship of the land. An appraisal must be ordered for the landowner if they would like to claim a federal tax deduction for the gift of the easement, which can typically allow them to deduct the fair market value of the gift in the year of the donation, with the limit of 50% of annual income and a carry forward of 15 years.²¹ There are also costs for New England Forestry Foundation to carry the project forward and hold the easement. These costs include staff time, legal fees, title reviews, and frequently an environmental hazard report to ensure there are no liabilities relating to contamination on the property.

With all of these fees associated with the conservation easement, it is imperative to identify funding sources. This can come from private donations, town money sources, and other federal and state grants. For this project in Monkton, Monkton's Agricultural and Natural Areas Committee has some funding set aside for conservation efforts. This may help to cover landowner costs like the stewardship endowment or even help pay for the conservation easement in the structure of a bargain sale if the landowner cannot afford to donate the easement outright. A bargain sale, or straight donation of the CE, will also allow the landowner to claim a federal tax deduction on the donated CE value. The federal tax deduction available can assist in financially supporting the CE projects because landowners can receive money back that can cover the costs of certain due diligence steps.

In addition to this, there are grants available through the Vermont Watershed Grants Program, which is provided by the state and supports the protection of watersheds. This program is co-administered by the Department of Environmental Conservation and the Department of Fish and Wildlife. It takes half of the proceeds derived from the sale of the Vermont Conservation License Plate and distributes it for local and regional water-related projects within Vermont. Because the Monkton landowners are technically within the Champlain Valley Watershed, this project may qualify for this grant under the protection of wildlife and enhancement of recreation.

There is also potential funding from VHCB to improve water quality in Vermont. VHCB will sometimes fund Conservation Easements for conserved lands focused on compliance with state water quality rules, soil health, and environmental stewardship. In the past, VHCB's Farm & Forest Viability Program has awarded \$647,573 in Water Quality Grants to 22 landowners, leveraging an additional \$2.9 million for infrastructure projects on farms that improve or protect water quality.²²

²¹ "Income Tax Incentives for Land Conservation". Land Trust Alliance.

<https://www.landtrustalliance.org/topics/taxes/income-tax-incentives-land-conservation#:~:text=If%20a%20conservation%20easement%20is,donor's%20federal%20income%20tax%20return>

²² "Our Programs." Vermont Housing and Conservation Board. <https://www.vhcb.org/our-programs>

These grants and funding sources do require applications and include competition from other projects, so nothing is ever guaranteed, but identifying several possible areas of funding will help to provide options.

What If

There is always a potential for the project to go wrong, especially when organizing many landowners in different financial situations with distinct goals for their property. Some landowners may back out because they are not able to afford the costs of the CE, especially if funding is unavailable. If the project fails to bring in the identified landowners, outreach efforts will continue to neighboring properties in hopes that others come forward. As mentioned before, the local organizations can often help with landowner conversations and outreach. If this does not work, NEFF will need to move forward with the landowners who are interested and financially able, with the hope that in the future, something changes and we can bring the remaining land into conservation.

So What

Finding willing landowners who abut each other and would like to conserve their land is not very common, so moving these types of projects forward is important. Conserving the 460 acres in Monkton that are being threatened by the change in land use will help the town maintain its ecologically important habitats and even preserve its identity as a place of beautiful natural landscapes. Hopefully, the project's success will serve as an example for other landowners regarding the potential of conservation and encourage neighbors to place CEs on their land.

Overall, the conservation of such a large area owned by many different landowners may allow for further conservation in this ecologically important area. Recently, NEFF has received interest from landowners in Morristown, VT, who are also reaching out about conserving their land. The expansion of conservation throughout Vermont is dependent on these individual landowners, and hopefully, the effort will continue to spread throughout the Champlain Basin and lead to more permanent conservation of these individually owned parcels.

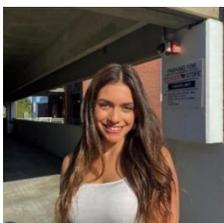
ADDITIONAL PARTICIPANTS

Christopher Densmore is a writer, naturalist, and conservationist living on ancestral Mohican lands presently known as Berkshire County in Western Massachusetts. He works on communications, outreach, education, and volunteer management for the Berkshire Natural Resources Council. After earning a BA from Carleton College in Minnesota, he lived in Oregon and New Mexico for several years working as a sommelier and outdoor educator. He recently returned to his original home in New England and is currently a student in Eastern Oregon University's low-residency MFA in Creative and Environmental Writing.



Colin Howe grew up in upstate New York and has found the Adirondack Park a particularly inspiring example of successful conservation. His experiences in the Adirondacks initially interested him in the natural world and inspired him to major in biology at Middlebury College, where he graduated in 2021. While pursuing his degree at Middlebury, he focused on ecology and came to appreciate the importance of large tracts of functional habitat to ecosystem health. Colin is starting a post-baccalaureate fellowship at the National Institute of Allergy and Infectious Diseases, studying HIV antibody development.

Delia Kostner is a psychologist and psychoanalyst in private practice in Amherst, New Hampshire. She is on the faculty of the Boston Psychoanalytic Society and Institute. Her recent research has focused on ways our environment shapes human personality and, more specifically, the psychological underpinnings of our mistreatment of the earth. Delia is an avid outdoors person and an amateur naturalist. Most weekends, Delia can be found with her husband hiking and exploring the New England mountains in all four seasons. They have been known to wander further afield across the US, as well as the mountains of Bhutan, Nepal, India, and Japan. Delia lives on seven mostly wooded acres in Southern NH with her husband, a pediatrician, and a very opinionated cat, Sid.



Alyssa Seibt is from Portland, Oregon. She is about to finish her freshman year at Oregon State University, where she is majoring in environmental economics and policy and minoring in comparative international agriculture. Alyssa plans on attending law school after attending OSU to become an environmental lawyer. Alyssa has lived in Oregon her entire life, and in her free time, she loves to explore what the state has to offer through hiking or camping.

Sean Thackurdeen is a biocultural conservationist working as a grantmaker to uplift nature, people, and well-being. He spent seven years working as an ally and environmental anthropologist with indigenous communities in the South Pacific. He currently serves as Program Associate for the Environment at the Doris Duke Charitable Foundation.





Deana Thomas is currently a student at the Community College of Rhode Island. She lives in the rural town of North Scituate, where she has started a small farm. She is cultivating mushrooms outdoors, growing flowers, vegetables, and helping to ensure the success of native plants in the woods. Deana enjoys spending time in nature, photography, hiking, and primitive tent camping. She has been observing and documenting fungi and other organisms she finds as a hobby. She feels a great calling to contribute to the protection of the land, its history, and the life it supports.

ALPINE SUMMER INSTITUTE 2021 STAFF

Jim Levitt is: the director of the International Land Conservation Network at the Lincoln Institute of Land Policy; a fellow at the Harvard Forest, Harvard University; and a Senior Fellow at Highstead, a Redding, Connecticut based non-profit advancing land conservation in New England. He is the editor of four books and numerous articles, and has lectured extensively on the topic of innovation in the field of land conservation. A graduate of Yale College and the Yale School of Management (Yale SOM), he was named by Yale SOM as a member of the first class of Donaldson Fellows, an honor that recognizes career achievements that “exemplify the mission of the school.”



Marianne Jorgensen serves as program manager at the Lincoln Institute of Land Policy for ALPINE (Academics for Land Protection in New England). ALPINE is a network of New England academic institutions interested in promoting and expanding their role in conserving the natural heritage of the region. Prior to her work with ALPINE, she worked for 16 years in the field of international education sending undergraduate students from US colleges and universities on study abroad programs. Marianne has an MBA from Boston University and a BA in botany from Connecticut College.



Robin Austin is the program coordinator for the Sustainable Land and Water Management team at the Lincoln Institute in Cambridge, Massachusetts. She is a graduate of Smith College and served as an Americorps Volunteer for two years, with a focus in the field of land conservation. In addition, Robin is taking courses at Salem State College in Massachusetts in Geographic Information System. She completed the ALPINE Summer Institute program in the summer of 2019.



Olivia Lukacic, who helped edit the participant essays in this report, is an instructor at the University of Massachusetts Amherst, and is teaching a survey course on land conservation there in the Fall Semester of 2021. Lukacic is working at UMass with the mentorship of UMass Assistant Professor Paul Catanzaro, who is on sabbatical in the last half of 2021 in Finland. A graduate of the University of Vermont with dual Bachelor of



Science degrees in Forestry and Environmental Science, Lukacic holds a Master's Degree in Environmental Conservation from UMass Amherst. She completed the ALPINE Summer Institute in 2020.