



# Vermont's return on investment in land conservation

THE  
TRUST  
FOR  
PUBLIC  
LAND





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The Trust for Public Land  
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Conducted by The Trust for Public Land, in collaboration with fellow members of the Vermont Forest Partnership:



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and protects land for people,  
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# About Us

## The Trust for Public Land's Conservation Economics Team

The Trust for Public Land's Conservation Economics team has extensive experience measuring the economic benefits and fiscal impacts of land conservation. Partnering with its award-winning GIS team, it has published over 40 economic analyses across the country, including return-on-investment reports in Alabama, Colorado, Georgia, Illinois, Kentucky, Maine, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Virginia, and Wyoming. The Trust for Public Land has advanced this research working with leading academic partners and research institutions including Colorado State University, Dartmouth College, Georgia Institute of Technology, Michigan State University, University of California-Davis, University of Georgia, Texas A&M, University of Minnesota, University of New Hampshire, University of Wyoming, and the U.S. Forest Service.

## The Vermont Forest Partnership

The Vermont Forest Partnership is a coalition of five organizations including Audubon Vermont, The Nature Conservancy, The Trust for Public Land, Vermont Land Trust, and Vermont Natural Resources Council, established in 2015 to ensure a future in which Vermont's forests continue to contribute to the health and well-being of our state. As a coalition, we work to address mounting concerns about the impacts of forestland conversion. Although from above the Vermont landscape has an appearance of densely forested lands, a closer look at the surface reveals that our forests are being compromised and fragmented by scattered, unplanned development. Our goal is to prevent forest fragmentation through public awareness about the risks, sound policy, and the conservation of important forestland.

# Executive summary

**THE TRUST FOR PUBLIC LAND CONDUCTED AN ECONOMIC ANALYSIS OF THE RETURN ON THE STATE OF VERMONT'S INVESTMENT IN LAND CONSERVATION** and found that every state dollar invested in land conservation returned \$9 in natural goods and services. This study was conducted in collaboration with the Vermont Forest Partnership, a coalition that includes Audubon Vermont, The Nature Conservancy, The Trust for Public Land, Vermont Land Trust, and Vermont Natural Resources Council. State investment in land conservation also supports critical industries in Vermont that depend on the availability of high-quality protected land and water such as forestry, farming, outdoor recreation, and tourism. Conservation investments not only support jobs in these diverse industries, they also provide additional value by creating resilience from flooding and other major weather events, as well as reinforcing Vermonters' strong sense of place and preference for the state's rural character. A summary of the key findings are presented below.

**PROVIDING NATURAL GOODS AND SERVICES:** Lands conserved in Vermont provide valuable natural goods and services such as water quality protection, food production, flood control, wildlife habitat, and carbon sequestration and storage. The Trust for Public Land used the benefits transfer methodology—a well-established approach in environmental economics—to analyze the benefits of lands conserved using state funding and found that every dollar invested in land conservation returns \$9 in economic value in natural goods and services.

**SUSTAINING WORKING FORESTS:** Land conservation supports forestry in Vermont by helping to maintain the intact working landscape on which this industry depends. The forest products industry supports 10,600 employees and generates \$1.48 billion in economic output.

**BOLSTERING THE FARMING INDUSTRY:** Vermont's farms annually produce \$786 million in agricultural commodities, including \$468 million in dairy products and \$59.7 million in maple syrup. Vermont also leads the country in farm stands, direct-to-consumer sales, farmers' markets per capita, and maple syrup production. Although robust, Vermont's farming sector faces challenges due to aging farmer populations and lack of affordable farmland for new farmers. Conserving land and ensuring that working lands remain open and accessible are key components of Vermont's farming future.

**STIMULATING TOURISM, AGRITOURISM, AND OUTDOOR RECREATION:** Conservation lands are critical to the state's tourism and outdoor recreation industries. Each year, tourists spend \$2.61 billion in Vermont. The state's scenery, world-renowned fall foliage, local foods such as cheese, meats, and beer, and opportunities for outdoor recreation play an important role in attracting visitors, owners of second homes, and future residents. A recent survey found that 33.7 percent of

visitors hiked or backpacked, 27.0 percent viewed wildlife, and 16.3 percent canoed or kayaked. In addition to tourists, 72 percent of Vermont residents participate in outdoor recreation each year. In fact, Vermont residents are more likely to snowshoe or day hike than the average American. Together, tourists and residents generate \$5.5 billion in annual consumer spending related to outdoor recreation, which generates \$505 million in tax revenues. This spending also supports 51,000 jobs with an associated \$1.5 billion in wages and salaries.

**PROPELLING ECONOMIC DEVELOPMENT:** Land conservation contributes to Vermont's economy by fueling a working and natural landscape, as well as enhancing the scenic beauty that is essential to Vermont's identity and sense of place, improving quality of life for residents, and enabling the state to retain and attract high-quality workers. In 2014, *USA Today* ranked Vermont the third-best state for quality of life. These spaces also enable a wide range of recreation opportunities for residents throughout the state, which generate economic activity, support recreation related businesses, and provide jobs.

**SUPPORTING FISCAL HEALTH:** Land conservation also saves Vermonters money through avoided costs on expensive infrastructure and other municipal services required by residential property owners, such as schools, police, and fire protection. A nationwide study found that the median cost to provide public services for each dollar of tax revenue raised is \$1.16 for residential lands and \$0.37 for working and open land. Similar work in Vermont found that, on average, property tax bills are lower—not higher—in the towns with the most conserved lands.

**ENHANCING HUMAN HEALTH:** Access to conserved lands, parks, and trails can help a community meet health goals and reduce medical costs. Increased access to public outdoor spaces encourages people to exercise more and reduces health care costs related to obesity and associated chronic diseases such as diabetes, which cost the state over \$200 million per year for adults alone. Increased exposure to the outdoors can lead to long-term mental health improvements, and new research is finding that conservation can decrease the risk of tick-borne illnesses such as Lyme disease.

**LEVERAGING FEDERAL, PRIVATE, AND NONPROFIT FUNDS:** Vermont's land conservation programs leverage funding from federal, local, private, and nonprofit sources, which maximizes the impact of state investments. For example, every conservation acquisition in Vermont that received state funding in the last 10 years was matched at least dollar for dollar by non-state funding, far exceeding the match requirements of the state's funding programs.



Every state **\$1** invested in land conservation returned **\$9** in natural goods and services.



Spending on outdoor recreation in Vermont supports **51,000 jobs**

with an associated **\$1.5 billion** in wages and salaries.



Each year, tourists spend **\$2.61 billion** in Vermont. Tourists and residents generate **\$5.5 billion** in annual consumer spending related to outdoor recreation, resulting in **\$505 million** in tax revenues.



In 2016, Vermont produced **1.99 million gallons** of the country's 4.21 million gallons of maple syrup, worth **\$59.7 million**.



**THE TRUST FOR PUBLIC LAND:** The Trust for Public Land has extensive experience in determining the return on state investment in land conservation. Its Conservation Economics team has published return-on-investment analyses in states across the country, including Alabama, Colorado, Georgia, Illinois, Kentucky, Maine, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Virginia, and Wyoming. The Trust for Public Land has worked with leading academic partners to advance this research, including Colorado State University, Dartmouth College, Georgia Institute of Technology, Plymouth State University, University of Georgia, University of Minnesota, and University of Wyoming—Ruckelshaus Institute of Environment and Natural Resources.

# Introduction

**VERMONT'S LANDSCAPE OFFERS DIVERSITY, PRODUCTIVITY, AND BEAUTY.** Covered by forests, mountains, farms, lakes, and rivers, the state possesses a rich rural character. Residents and visitors benefit from the varied geography and natural resources that extend from the Northeast Kingdom through the Green Mountains to the Champlain Lowlands.

Land conservation has been one of the most important mechanisms for keeping Vermont's lands open, working, and productive. From family farms to nationally recognized outdoor spaces, municipal, state, and federal agencies have been critical to protecting Vermont's conserved lands.<sup>1</sup> These lands offer substantial economic benefits to local communities and the people of Vermont. These benefits are provided in the form of support for working forests and farms, natural goods and services, opportunities for tourism and outdoor recreation, increased quality of life that attracts business and employees, avoided costs on expensive infrastructure, and improved health outcomes. Increasingly, these lands are also providing much-needed climate mitigation and resiliency services. The state of Vermont has long recognized the importance of investing in conservation to support these critical benefits and has a well-established history of investment in land conservation.

The goal of the economic analysis conducted for this report was to better understand the return on Vermont's direct investment in land conservation. The economic analysis thus focused on a subset of conserved lands in Vermont—those lands that have been conserved through fee simple purchase and purchase of conservation easements from willing sellers, using state dollars.

Vermont has several programs that administer state conservation funding programs and steward or manage state conservation land. The analysis conducted for this report included data from the following programs:

- Vermont Housing and Conservation Board
- Vermont River Corridor Easement Program
- Vermont Duck Stamp Fund
- Vermont Long Trail funds

For the historical acres and spending on land conservation by the following state agencies and programs, see the “Investment in land conservation” section of the report beginning on page 11.



## Vermont Housing and Conservation Board

The Vermont Housing and Conservation Board (VHCB) was created in response to development patterns in the 1980s that threatened the rural character of Vermont and pressured the state's farming and natural lands as well as housing affordability. The Vermont Housing and Conservation Trust Fund Act, enacted in June 1987, established the dual goals of creating affordable housing and protecting farms, forests, historic properties, natural areas, and recreation lands of primary importance to the state's economic vitality and quality of life.

Since 1988, Vermont has funded VHCB through a real estate transfer tax, along with bonds and general fund appropriations. The state's transfer tax rate is 0.5 percent of the first \$100,000 of value for a principal residence and 1.25 percent of valuation for real estate transfers above this \$100,000 threshold. By statute, one-half of the proceeds from this tax are required to be dedicated to VHCB, although the actual appropriations have typically been well below this level. Funds appropriated to VHCB are then divided between housing and conservation projects. This report focuses exclusively on the land conservation investments by VHCB; investments in housing are beyond the scope of this analysis.



### Vermont River Corridor Easement Program

Within the Agency of Natural Resources (ANR), the mission of the Department of Environmental Conservation (DEC) is to preserve, enhance, restore, and conserve Vermont's natural resources and protect human health for the benefit of current and future generations. The River Corridor Easement Program is responsible for protecting and restoring natural river and floodplain processes to enhance water quality, ecological health, and flood resilience. The program promotes the protection of river corridors by providing a financial incentive to landowners to allow for passive restoration of river channels. Incentives are available via ecosystem restoration grants.

### Vermont Duck Stamp Fund

In 1985, the Vermont legislature created the Vermont Duck Stamp Program. Hunters are required to purchase a special state migratory waterfowl stamp, the sale of which is deposited into the Duck Stamp Fund. Interest earned from the fund is dedicated to wetland acquisition and enhancement projects. Monies generated have helped to acquire wetland and adjacent uplands, and important habitat through conservation easements. The fund is administered by the Fish and Wildlife Department within ANR.

### Vermont Long Trail Funds

Starting in 1990, protection of the Long Trail corridor has been enabled through State of Vermont Capital Appropriations, provided through ANR for the Long Trail Protection Campaign. Funds are utilized by the Green Mountain Club and the state of Vermont for the fee acquisition of lands along the Green Mountains containing the treadway of the Long Trail.

# Investment in land conservation

**THE TRUST FOR PUBLIC LAND'S CONSERVATION ALMANAC RESEARCH TEAM COLLECTED DATA ON VERMONT'S INVESTMENTS IN LAND CONSERVATION THROUGHOUT THE STATE.** The funding programs and sources that were included in this study represent the breadth of state land conservation activity for which sufficient data were available at the time of analysis.

Data adhere to the following guidelines:

- Spending and acreage information is from land conservation activity that occurred between 1988 and 2016;
- Spending is state expenditures to permanently protect land via fee acquisition or conservation easement;
- Spending is state expenditures only. Other contributions are considered matching funds and are discussed in the section of the report entitled “Leveraged federal, local, and private funding” on page 43;
- Acres are land acquisitions using state funding either in-part or in-full; and
- Spending and acres are assigned to the year in which the project was completed.

CHARLES HELFER



**TABLE 1. HISTORICAL ACRES AND STATE FUNDING ON LAND CONSERVATION<sup>4</sup>**

Year	Acres	Spending
1988	1,910	\$1,420,000
1989	5,250	\$2,600,000
1990	5,280	\$3,470,000
1991	6,260	\$3,590,000
1992	4,160	\$2,180,000
1993	9,630	\$2,970,000
1994	10,500	\$5,310,000
1995	17,600	\$5,670,000
1996	9,170	\$2,880,000
1997	7,010	\$2,810,000
1998	9,740	\$2,880,000
1999	145,000	\$8,190,000
2000	3,350	\$1,760,000
2001	7,960	\$3,220,000
2002	8,150	\$3,480,000
2003	7,950	\$3,150,000
2004	3,720	\$2,020,000
2005	4,120	\$2,720,000
2006	4,860	\$3,970,000
2007	3,240	\$2,770,000
2008	5,970	\$5,490,000
2009	2,740	\$1,530,000
2010	5,570	\$4,120,000
2011	4,030	\$2,670,000
2012	7,170	\$4,620,000
2013	3,760	\$2,750,000
2014	4,200	\$2,500,000
2015	3,790	\$2,510,000
2016	2,720	\$2,100,000
<b>Total</b>	<b>315,000</b>	<b>\$95,400,000</b>
<b>Median</b>	<b>5,280</b>	<b>\$2,880,000</b>

All numbers reported in the text and tables are rounded to three significant digits unless otherwise noted. Because of rounding, some report figures and tables may appear not to sum.

Based on the above criteria, The Trust for Public Land was able to analyze 315,000 acres of the 397,000 total acres protected through state investment between 1988 and 2016. This acreage includes both land protected through conservation easements (i.e., voluntary conservation agreements with willing landowners) and fee simple acquisitions (i.e., lands purchased outright from willing sellers). This represents \$95.4 million of the \$117 million total state investment during the same period. The analyzed acreage comprises the majority of land conservation activity, or 81.5 percent of direct spending and 79.5 percent of acres protected through direct spending, and is representative of total acreage and spending, during this time frame. For more information on the acreage and spending analyzed in this report, please see the methodology on page 19. Historical acres and spending for land conservation were determined using The Trust for Public Land’s Conservation Almanac.<sup>2</sup>

Between 1988 and 2016, approximately 5,280 acres were protected annually through state spending, using \$2.88 million each year.<sup>3</sup> The average state expenditure per acre conserved during this period was \$303. **Table 1** breaks out the historical acres conserved and dollars spent from the following state funding sources only: Vermont Housing and Conservation Board, Vermont River Corridor Easement Program, Vermont Duck Stamp Fund, and Vermont Long Trail funds.

# Natural goods and services

**VERMONTERS DERIVE SIGNIFICANT ECONOMIC BENEFITS FROM LAND CONSERVATION THROUGHOUT THE STATE.**<sup>5</sup> Some of the key economic benefits of land conservation come in the form of natural goods and services.<sup>6</sup> These include but are not limited to flood control, water quality enhancement and protection, air pollution removal, carbon sequestration and storage, habitat for fish and wildlife (both game and nongame), food production, stormwater management, and other necessary functions.<sup>7</sup> While current economic modeling techniques are unable to quantify all of these benefits, it is nonetheless important to understand the diverse suite of natural goods and services provided by conserved lands. The following section qualitatively describes in more detail some of the essential natural goods and services provided by Vermont's principal ecosystems. For a list of the specific natural goods and services included in the return on investment calculation, please see the Appendix.

## Forests improve water and air quality, as well as absorb and store carbon.

Forests purify water by sustaining healthy porous soils and filtering contaminants. They also regulate the quantity of available water and seasonal flow by capturing, storing, and slowing the release of surface and groundwater.<sup>8</sup> In fact, forests process nearly two-thirds of the freshwater supply, providing water to about 40 percent of all municipalities or approximately 180 million people across the United States.<sup>9</sup>

Forests also defray costs of erosion-related damage (e.g., repairing damaged infrastructure and treating contaminated water). The Vermont DEC has identified several impaired watersheds as sensitive and erosive waterways that would benefit from forested corridors to support the restoration of the natural river processes of the river.<sup>10</sup> Forests and forested corridors along waterways provide soil stability while reducing erosion, suspended sediment, and stormwater runoff.<sup>11</sup>

By releasing oxygen and filtering particulates, forests improve air quality throughout Vermont. They also play a critical role in absorbing and storing carbon, which mitigates the impacts of climate change.<sup>12</sup> Vermont's forests remove more than 8 million metric tons of carbon dioxide along with 1,610 metric tons of other pollutants annually.<sup>13</sup> Finally, forests also provide habitat to a wide array of species, including important breeding habit for many species of mammals and birds.<sup>14</sup>

## **Wetlands reduce flooding, enhance water quality, and support biologically diverse habitats.**

Wetlands are a fundamental part of local and global water cycles and provide other natural services such as water purification, erosion control, flood protection, and resilience to storms. In addition, these lands provide a range of services that depend on water, including agricultural production and tourism. Managing and restoring wetlands can lead to cost savings when compared to man-made infrastructure solutions.<sup>15</sup>

One-acre of wetland can typically store about 1 million gallons of water. Trees and other wetland vegetation help slow runoff from storms and snowmelt and reduce floodwaters. Water storage by wetland vegetation can lower flood heights and reduce the destructive power of floodwaters.<sup>16</sup> For example, research in Middlebury, Vermont, found that wetlands upstream from the town provided at least \$126,000 per year in flood protection services. Looking specifically at Tropical Storm Irene, this same research found wetlands reduced flooding-related damages by 95 percent.<sup>17</sup>

Wetlands act as a natural filtration system to improve water quality by absorbing excess nutrients from fertilizers, manure, and sewage. In their role as natural purifiers, wetlands reduce water treatment and infrastructure costs.<sup>18</sup>

They are also very productive habitats, providing spawning and nursery grounds for freshwater fish species, such as northern pike, yellow perch, and bluegills.<sup>19</sup>

## **Grasslands, pasturelands, and shrublands protect water quality, provide habitat, and boost agricultural production.**

Grasslands and shrublands capture water and filter pollutants, minimizing the ability of contaminants to reach water supplies.<sup>20</sup>

Grasslands, pasturelands, and shrublands provide habitat for native pollinators that are essential to agricultural production and for various bird species.<sup>21</sup>



### **Conserved farmland provides wildlife habitat while sustaining water and soil quality.**

While conserved farmland supports economic activity and food production, such lands also provide natural goods and services. High-quality agricultural land is often located in floodplains and many farms have forested land as well. Conservation easements on farmland are designed to protect and enhance these assets as well as important resources such as rivers, wetlands, and rare habitats, or require management plans for working forests.

Recognizing the importance of water quality issues related to farming in Vermont, the Vermont Housing and Conservation Board (VHCB) now requires that management plans address soil health and water quality prior to closing on an agricultural easement. Conservation practices such as crop residue management, land retirement, and conservation tillage can decrease soil erosion and improve soil quality by reducing the runoff of soil, nitrate, phosphorus, and herbicides.<sup>22</sup> There is also special easement language to protect surface waters. Thus, conserved farmland is more likely than unprotected farmland to result in improved water quality.<sup>23</sup>

### **Water bodies provide clean drinking water, flood control, and recreational opportunities.**

Water bodies, such as rivers and lakes, provide flood control and clean drinking water by storing runoff from stormwater, retaining sediment, and recharging groundwater. They support agricultural livelihoods through irrigation for crops and drinking water for livestock and provide opportunities for recreation and tourism.<sup>24</sup>

# Highlighting the economic value of natural goods and services

**WHILE OTHER SECTIONS IN THIS REPORT DETAIL A MORE COMPREHENSIVE LIST OF NATURAL GOODS AND SERVICES**, the following section demonstrates how conserved lands provide essential economic benefits to local communities through two illustrative examples that are of importance to all Vermonters: drinking water protection and flood control and prevention.

## Drinking water protection

Vermont’s conservation lands help maintain and improve the state’s water quality. By providing vegetation and pervious soils, these areas can capture runoff, enhance infiltration, and remove sediments and pollutants. A growing body of research suggests that high-quality source water and well-controlled flow can lead to treatment cost savings.<sup>25</sup>

This issue of drinking water quality is significant in Vermont. Nearly 30 percent of Vermont’s public water systems were not in compliance with drinking water standards in 2016 (Table 2 [🔗](#)); in fact, the Vermont Department of Environmental Conservation Drinking Water and Groundwater Protection Division issued 797 violations to 412 water systems that year. Community water systems supply water to 72 percent of the population in Vermont, and over a third of those systems were not in compliance in 2016.<sup>26</sup>

Water system type	Total number of water systems	Water systems not in compliance	
		Number	Percent
Community Water System*	418	140	33.5%
Non-Transient Non-Community Water System**	250	56	22.4%
Transient Non-Community Water System***	721	216	30.0%
Total	1,390	412	29.7%

\* A community water system is a public water system that supplies water to the same population year-round.

\*\* A non-transient non-community water system is a public water system that regularly supplies water to at least 25 of the same people at least six months per year but not year-round. Some examples are schools, factories, office buildings, and hospitals that have their own water systems.

\*\*\* A transient non-community water system is a public water system that supplies water to places where people do not remain for long periods, such as campgrounds, restaurants, and hotels with their own water sources.

Where Vermont faces significant water quality challenges and costs, conserved lands offer an important means of addressing these challenges. The quality of drinking water supplies is affected by land use in surrounding watersheds. For instance, stormwater can cause runoff of pollutants related to human activity. Conversely, natural lands filter contaminants, reducing the levels of harmful pollutants reaching public water supplies during rain events.

State-funded land conservation in Vermont has included considerable wetland, headwater, forest, and river corridor protection that safeguards drinking water quality in communities across the state. For example, Lake Champlain supplies drinking water to about 145,000 people, including the city of Burlington.<sup>27</sup> In 2016, the U.S. Environmental Protection Agency established limits for phosphorous pollution in the lake that the state was required to incorporate into the state's Water Quality Management Plan. Land conservation, in conjunction with other strategies, is part of the solution to address water quality issues.

Various efforts by researchers across the state are investigating the link between land use, land conservation, and water quality. For example, at the University of Vermont, research is under way to understand the impact protected lands and forested areas can have on reducing nutrient runoff to receiving waters as well as flood mitigation.<sup>28</sup> In addition, The Nature Conservancy's Water Quality Blueprint and the Department of Environmental Conservation's Clean Water Roadmap are helping to show how natural green infrastructure, best management practices, and land conservation can play a role in improving water quality.<sup>29</sup> Additional work has assessed the economic value of clean water in Lake Champlain and found that tourism, quality of life, and property values were all strongly impacted by water quality on the lake.<sup>30</sup>

Vermont's conserved lands also support water quality and management issues through river corridor restoration. Easements along impaired watersheds such as the Missisquoi River provide a set of conservation restrictions within the meander belt corridor of land adjacent to the river. The corridor easement limits channel management by preventing riprap, dredging, and other river manipulation, which allows the river to move over time and establish its natural patterns; it also creates a permanent 50-foot naturally vegetated riverside buffer. The importance of such efforts is highlighted by the additional support such projects receive from other compatible water quality programs such as Natural Resources Conservation Service's Conservation Reserve Enhancement Program (CREP) and Environmental Quality Incentives Program (EQIP). These programs encourage buffer plantings, exclusionary animal fencing, sustainable water crossings, and alternate animal watering systems, creating direct impacts on the health of Vermont's rivers and watersheds.



## Flood control and prevention

Conserved lands can provide flood protection services. Flooding can lead to major road washouts, extensive debris on and damage to state and local road infrastructure and facilities, and damage to private residences. In recent years, severe storms and flooding have resulted in major disaster declarations in Vermont: three between June 2014 and August 2017.<sup>31</sup> From 2002 to 2016, all of Vermont's 14 counties have been impacted by floods. These floods have caused \$1.49 billion in property damage and \$25.6 million in crop damage in Vermont, much of the damage caused by Hurricane Irene in 2011.<sup>32</sup> Conserving land in floodplains can help avoid related expenses by preventing development in flood-prone areas. Wetlands and natural areas near rivers and streams also prevent costly property damage by absorbing and storing potentially devastating floodwaters.<sup>33</sup>

# Return on investment methodology and findings

**THE TRUST FOR PUBLIC LAND CONDUCTED AN ANALYSIS OF THE RETURN ON VERMONT'S INVESTMENT IN LAND CONSERVATION** by comparing the state's investment with the economic value of the natural goods and services provided by conservation lands. Every dollar invested by Vermont in land conservation through state-funded programs returns \$9 in economic value of natural goods and services.

## Methodology

To determine the natural goods and services provided by conserved lands, The Trust for Public Land analyzed the ecosystem types found within conserved lands using a geographic information system (GIS) analysis. To complete this analysis, data from The Trust for Public Land's Conservation Almanac database were utilized. This database contains GIS data (i.e., mapped boundaries) of conservation lands that were protected with state funding.<sup>34</sup> The Trust for Public Land collected the best available information on the land conservation investments made using state funding sources. Programs and funding sources analyzed included Vermont Housing and Conservation Board, Vermont River Corridor Easement Program, Vermont Duck Stamp Fund, and Vermont Long Trail funds.

The Trust for Public Land analyzed a total of 315,000 acres protected through state investments between 1988 and 2016. These acres were protected using \$95.4 million in state funding (nominal spending, i.e., not adjusted to present value). The projects included in the analysis represent the majority of the state's land conservation activity through these four programs during that period (i.e., 81.5 percent of direct spending and 79.5 percent of acres protected through direct spending).<sup>35</sup> Owing to the complexities of aligning spending records to spatial records, the remaining parcels could not be aligned spatially and were excluded from the analysis.

The Trust for Public Land then determined the underlying ecosystem types using the 2011 National Land Cover Database (NLCD 2011), which uses satellite imagery to identify different types of land cover at a spatial resolution of thirty meters.<sup>36</sup> With this analysis, The Trust for Public Land calculated the number of acres of each of the ecosystem types found within conserved lands included in the study. The most commonly acquired land cover type is deciduous forest, representing 36.1 percent of all conserved land. [Table 3](#) breaks out the full results of the land cover analysis.

The monetary values of the natural goods and services provided by the distinct ecosystem types found within Vermont's conserved lands were determined using the benefits transfer methodology. That is, The Trust for Public Land conducted a thorough review of the literature

focused on the types of natural goods and services provided by the 15 ecosystem types identified in conserved lands using recent, relevant, and scientifically sound sources. The Trust for Public Land then used the economic values of the different ecosystem types identified in that literature to estimate a per-acre economic value of the natural goods and services provided. A conservative 5 percent discount rate was applied to determine the value of past and future cash flows. Benefits transfer methodology is a common and accepted approach in environmental economics because it is a practical alternative to time-intensive and data-intensive original research for a given locality. Please see the Appendix for a complete methodology.

## Results

Based on the per-acre economic values, 315,000 acres of conserved land provide \$2.23 billion (present value or the value of past investments in today's dollars) in total economic value in the

**TABLE 3. LANDS CONSERVED BY LAND COVER TYPE**

Land cover type	Acres	Percent land cover
Deciduous Forest	114,000	36.1%
Mixed Forest	55,900	17.7%
Pasture/Hay	48,100	15.3%
Evergreen Forest	30,400	9.64%
Cultivated Crops	27,500	8.73%
Woody Wetland	21,000	6.67%
Shrub/Scrub	7,270	2.31%
Emergent Herbaceous Wetland	3,130	0.99%
Developed Open Space*	2,740	0.87%
Open Water	2,060	0.65%
Developed (Low, Medium, High)**	2,430	0.77%
Grassland/Herbaceous	866	0.28%
Barren Land	73	0.02%
<b>Total</b>	<b>315,000</b>	<b>100.0%</b>

\* Developed open space/parks are areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total land cover.

\*\* The developed category combines low-, medium-, and high-intensity development land cover types. This includes areas with a mixture of constructed materials and vegetation with impervious surface accounting for between 20 percent and 100 percent of the total land cover.



form of natural goods and services. This value was determined by analyzing the annual benefits provided by every acre of conserved land from its original date of purchase until the date this study began (2017), and extending 10 years into the future, from 2018 to 2027. This value included such goods and services as flood control by wetlands, air pollution removal by forests, pollination services for cropland, and many others discussed in the Appendix.

The Trust for Public Land used this value to estimate the return on investment in land conservation by the State of Vermont from 1988 to 2016. During this time, Vermont invested \$227 million (present value) in 315,000 acres of land conservation. The Trust for Public Land compared this investment to the total economic value of natural goods and services generated by these lands, discussed above. The result of that comparison is that every dollar invested in conservation by the State of Vermont returns \$9 in economic value from the natural goods and services provided by land conservation. These goods and services will continue to be provided well beyond 2027, increasing the total return on investment beyond that calculated in this analysis.

# Land conservation supports the economy

**IN ADDITION TO THE QUANTIFIED NATURAL GOODS AND SERVICES CAPTURED IN THE 9:1 RETURN ON INVESTMENT IN NATURAL GOODS AND SERVICES**, state-funded conservation lands are critical components of a broader landscape of conservation in Vermont. Through the leveraging of other funding streams and the strategic choices of conservation acquisitions, Vermont's state programs buttress a mosaic of conservation lands that support numerous industries, including those that rely on intact natural landscapes, providing economic benefits beyond the provision of natural goods and services. For example, land conservation provides critical support for the forestry, farming, recreation, and tourism industries, which create and sustain thousands of jobs for Vermonters and underpin the local and statewide economies. Vermont residents and nonresidents also enjoy high-quality opportunities for outdoor recreation, hunting, fishing, and wildlife watching. Land conservation also boosts economic development, improves quality of life, and helps local governments balance the costs of community services.<sup>37</sup> The marginal impact of conservation land on each of these economic benefits is not directly quantifiable, however; this section details the magnitude of these industries and describes the importance of land conservation to the economy.



KURT BUDIGER

## Forestry and farming

Land conservation supports forestry and farming in Vermont by helping to maintain the intact working landscapes on which these industries depend.

### FOREST PRODUCTS INDUSTRY

The forest-based economy is critical to Vermont. In 2011, 914,000 cords of wood were harvested and 860,000 cords were processed in the state. The forest products industry directly supported nearly 6,640 jobs and generated \$861 million in output annually. This includes forestry, logging, trucking, wood products manufacturing, furniture manufacturing, paper manufacturing, wood energy, Christmas trees, and maple syrup—all of the activities that go into the harvest of raw materials and the production of related products for consumption. The impact of these industries flows through the economy, as business and employees purchase additional goods and services. This ripple effect creates more jobs and a larger economic impact. In total, the forest products industry supports 10,600 employees and generates \$1.48 billion in economic output. Forest-based recreation creates further economic benefits, producing \$1.94 billion in economic output and 10,000 jobs. Thus, forests—through forest products and recreation—generate \$3.42 billion in economic output and support 20,600 jobs.<sup>38</sup> Even forests without easements benefit from nearby land conservation because they provide economic stability by ensuring the permanence of forestry and supporting industries in an area.

### COMMUNITY AND TOWN FORESTS

Vermont's municipalities have a history of forest ownership. In fact, 168 municipalities in Vermont own more than 68,800 acres of forestland.<sup>39</sup> Town and community forests provide unique opportunities for economic development by expanding community assets, creating revenue and jobs, and protecting ecological services. While many town forests are conserved, community forests are, by design, permanently protected through conservation easements and run with sustainable forest management practices.<sup>40</sup>

Town and community forests often generate economic benefits for their communities. For example, the Town of Barre owns a 370-acre town forest that provides timber production, water protection, hiking trails, and wildlife habitat. The Town conducted its first logging operation in the winters of 2016 and 2017, generating \$13,000 in revenue.<sup>41</sup> The Barre Town Forest is also a critical component of the 70-mile Millstone Hill Trail Network, and over 20 miles of this trail system are located on the Town Forest. The Barre Town Forest is also part of the statewide Vermont Association of Snow Travelers trail network. A 2013 study by the Gund Institute at the University of Vermont estimated that 10,500 visitors come to the Barre Town area each year, spending \$640,000 annually and supporting 20 jobs.<sup>42</sup> In addition, a portion of the forest

is managed for source water protection because it contains the water supply for the Village of Websterville and the Town of Barre.<sup>43</sup>

In addition to revenue-generating benefits, some town and community forests support their local communities by providing fuelwood to needy families or using the revenues to subsidize fuel costs for low-income families. These forests also offer recreation and educational opportunities, by providing trail networks or classrooms for outdoor learning.

### **SPECIALTY FOREST PRODUCTS**

Maple syrup and Christmas trees are two specialty forest products produced in Vermont that benefit from the protection of working lands. Maple products are the state's third-largest agricultural commodity.<sup>44</sup> In 2012, over 1,550 farms in Vermont produced over 999,000 gallons of maple syrup.<sup>45</sup> This industry continues to grow. In 2016, Vermont was the top producer of maple syrup in the nation, with 4.85 million taps producing 1.99 million of the country's 4.21 million gallons of maple syrup. At an average price of \$30 per gallon, the state's output was worth \$59.7 million.<sup>46</sup> Land conservation efforts to protect maple stands help ensure that this industry will remain viable into the future.

Christmas tree production is also supported by the protection of forestland. There are 288 farms and over 3,600 acres in Christmas tree production in Vermont. Over 135,000 trees are harvested annually from 232 farms.<sup>47</sup> Conservation easements placed on Christmas tree farms in Vermont have helped these business enterprises remain viable and the lands remain undeveloped into the future.

### **FARMING**

Farmland protection has played a major role in preserving the land base that is vital to Vermont agriculture. Farmland conservation supports the state's agricultural economy by keeping these lands in active production.<sup>48</sup> Farmland conservation also helps provide qualified farmers with access to high-quality agricultural land, assists with the start-up or expansion of commercial agricultural businesses, promotes the conservation of existing farms, and aids the transition of conserved or non-conserved farms to the next generation of farmers.<sup>49</sup>

From small family farms to large commercial operations, the economic impacts of farming are critical components of local economies across the state. Approximately 7,340 farms in Vermont encompass 1.25 million acres.<sup>50</sup> Vermont's farms produce \$786 million in agricultural commodities.<sup>51</sup> Dairy products are the top agricultural commodity in Vermont with \$468 million in sales in 2016, representing 59.6 percent of total state farm receipts. Over 850 dairy



farms and 134,000 cows are owned and operated by Vermont families. As a whole, the dairy industry contributes \$2.2 billion each year in economic activity to the Vermont economy.<sup>52</sup> Organic dairy farms are a growing subsection of this industry. For example, between 2008 and 2010, Vermont's 180 organic dairy farms annually contributed \$76.3 million in output, 808 jobs, and \$26.3 labor income to Vermont's economy.<sup>53</sup> Miscellaneous crops were the second agricultural commodity, with \$110 million in sales, accounting for 14.0 percent of state receipts. Maple products, ranking third, generated over \$59.7 million in sales, which accounted for 7.6 percent of the state's agricultural sales but 40.6 percent of the country's receipts.<sup>54</sup>

Vermont is also a leader in the local food movement that has been gaining momentum across the country. Vermont leads the country in farm stands, direct-to-consumer sales, and farmers' markets per capita.<sup>55</sup> The local food economies in several Vermont communities have grown as new food and agriculture businesses are established and existing farm product businesses expand. However, access to affordable farmland can be a key constraint to this growth. This is especially true for businesses that depend on being near economic growth centers, where land is more expensive. Conservation easements, representative of the development value of farmland, have been one way to help farm businesses deal with such constraints. Accessing this development value without having to convert farmland to development, farmers can reinvest into, and expand, farm operations.<sup>56</sup> Meanwhile, as the farming population ages, more farms are going on the market, increasing the threat to the future of Vermont's economy. Placing conservation easements on farms has been a particularly effective tool for ensuring the future

## Mighty Food Farm: How VHCB is empowering Vermont's next generation of farmers

BY VERMONT LAND TRUST

Lisa MacDougall started Mighty Food Farm in 2006 on five leased acres in Pownal with a 1953 Ford Golden Jubilee and an old Troy-Built rototiller, eventually growing her business to 10 acres and a 200-member community supported agriculture share program. MacDougall spent six years searching for good-quality, affordable farmland—not an easy feat in many parts of Vermont. “Land is expensive,” she explained.

Created in 2004, the Vermont Land Trust’s Farmland Access Program helps farmers like MacDougall find farms of their own by matching farmers with land they can afford, often through conservation of the land. In 2016, a 154-acre horse, beef, and maple farm in Shaftsbury, previously owned by Owen and Kathy Beanchesne, was being offered for sale through the program. MacDougall put in a proposal for the farm.

The Beanchesnes wanted their farm to stay in agriculture so they had agreed to give VLT time to find the right farmer and adequate funding for the conservation easement. A grant from VHCB, matched by funding from the USDA Natural Resources Conservation Service, plus contributions from community members and loyal customers of Mighty Food Farm, made it possible for VLT to purchase a conservation easement on the property, which permanently restricts the land to agricultural use and reduced its sale price. This funding allowed MacDougall to purchase the land.

“VHCB [was] pleased to help an enterprising farmer like Lisa purchase a permanent home for her farm business. Through our partnership with the Vermont Land Trust, VHCB provides funding for the conservation easement, and for VLT’s Farmland Access Program,” said Gus Seelig, executive director of the Vermont Housing & Conservation Board. “Additionally, our Farm & Forest Viability Program provided Lisa with two years of in-depth business planning as she sought to expand her business.”



MacDougall is transitioning the property into a certified organic vegetable farm and is now growing 22 acres of vegetables that supply her year-round 200-member CSA, three farmers’ markets, and five wholesale accounts in and out of state. Her business now supports eight full-time employees.

“Conservation takes down the barriers by preserving farmland and making it a fiscal reality for farmers,” explained MacDougall. “Owning land means we will be able to invest in our farm and take care of our soil for future generations.” By contributing to the purchase of conservation easements on farmland, VHCB plays a key role in ensuring that farmers throughout Vermont can keep their land in production for many years to come.

of Vermont's farms. Easements allow retiring farmers to extract a portion of the development value of their land, while at the same time making their protected farmland more accessible for new farmers.

In addition to supporting the next generation of farmers, conservation is reducing some of the negative costs associated with traditional agricultural practices. Most notably, farms with lands held under agricultural easement are increasingly incorporating nutrient runoff and erosion protection practices into their farming operations, often as part of the process for receiving VHCBC or other public funding.<sup>57</sup> Easement holders also manage stewardship programs that can provide opportunities for farmer education and technical assistance related to the adoption and implementation of best practices.<sup>58</sup> Costs associated with nutrient runoff from farms can be significant. For example, some estimates put the cost to clean up the algae blooms in Lake Champlain associated with phosphorus runoff at over \$1 billion.<sup>59</sup> Land conservation and programs like EQIP that promote farming conservation practices are helping mitigate these costs and reduce further damages.

In places like the Mettowee Valley, the Champlain Valley, and parts of far-northern Vermont, easements have conserved landscape-scale contiguous blocks of farmland, some as large as 7,000 acres.<sup>60</sup> Protecting large blocks of farmland helps ensure that there is enough contiguous land to support the vital farm business infrastructure and diminishes potential conflict from nonfarm uses. Farm supply stores know they will have enough customers each season to remain open. Meanwhile, nearby farmers without easements can continue to invest in their properties because they know the industry will remain intact. In this way, easement benefits spill over across the entire agricultural sector. As Vermont's farmers look to the next generation, easements will continue to play a crucial role in ensuring that this trademark of Vermont's economy and culture continues to thrive.

#### **AGRITOURISM**

Land conservation helps support a growing agritourism industry in Vermont, which includes a wide array of opportunities, from farm tours to hay and sleigh rides, overnight farm stays, pick-your-own-produce, corn mazes, and farmers' markets.<sup>61</sup> These agritourism strategies provide not only supplemental income to help farmers remain viable, but also important chances for tourists seeking authentic Vermont experiences. The number of farms that incorporate tourism in their farming practices is growing: over a five-year period from 2007 to 2012, the number of farms with agritourism and recreational services grew from 109 to 155. Revenues from these activities grew from \$1.49 million to \$1.74 million, which represents an average value of \$11,200 per farm.<sup>62</sup> In a recent tourism survey, 34.8 percent of respondents



were planning to visit farms or farmers' markets while in Vermont.<sup>63</sup> There are over 70 summer farmers' markets, 23 winter markets, and 19 agricultural fairs and field days in Vermont, which further demonstrates the importance of agritourism to the economy.<sup>64</sup>

### Tourism and the outdoor recreation industry

From the agricultural land of the Lake Champlain and Connecticut River Valleys' lowlands to the peaks of the Green Mountains that run the length of the state and the expansive forestlands of the Northern Highlands, land conservation preserves the beautiful areas that attract out-of-state visitors as well as residents to Vermont. The tourism and outdoor recreation industries benefit greatly from Vermont's conserved and wild places. Unfortunately, the information necessary to isolate the direct contribution of conservation lands to the two industries is not currently available in Vermont. In addition, both tourists and residents engage in outdoor recreation, resulting in significant overlap between these sectors. For these reasons, The Trust for Public Land uses a qualitative approach to describe the value of conservation lands to each industry.

In 2015, over 13 million people visited Vermont and spent more than \$2.61 billion in the state. Tourism is responsible for 8 percent of the state's gross domestic product. The spending by visitors to the state provides \$473 million in tax revenue to the state and municipalities.<sup>65</sup> Vermont's scenery and outdoor recreation play an important role in this industry and in its growth. A 2014 survey by the Vermont Tourism Research Center found that 72.8 percent of respondents were going to participate in sightseeing, 33.7 percent in hiking or backpacking, 27.0 percent in viewing wildlife, and 16.3 percent in canoeing or kayaking.<sup>66</sup> Meanwhile, in 2015, Vermont's 52 state parks were visited by more than 1 million people.<sup>67</sup> As people spend time and money visiting conservation lands in Vermont, they create substantial economic benefits.

#### **JOBS AND LOCAL ECONOMIES**

Spending by tourists supports the employment of 31,000 Vermonters who have wages and business income of nearly \$1 billion. These wages and income add \$750 million in economic activity in the state. The tourism and recreation sectors represent 8 percent of the Vermont workforce and more than 5 percent of wage and business owner income.<sup>68</sup> A large portion of visitor spending in Vermont is for lodging, restaurants, and bars. These expenditures support local businesses and contribute to Vermont's bottom line. The State imposes a 9 percent tax on the sale of meals and rooms, as well as a 10 percent tax on the sale of alcoholic beverages served in restaurants. Municipalities can also impose local option taxes, such as the taxes imposed in 18 cities and towns, including Burlington, Middlebury, Montpelier, and Rutland.<sup>69</sup> In Fiscal Year 2017, the State of Vermont collected \$1.08 billion in meal taxes, \$530 million in lodging taxes, and \$214 million in alcohol taxes.<sup>70</sup>

Seasonal homeownership is an essential component of the tourism and real estate economies in Vermont and a key contributor to local tax bases around the state. According to the 2010 U.S. Census, 15.6 percent of the state's housing stock was used for seasonal, recreational, or occasional purposes.<sup>71</sup> A study of the economic impact of tourism in Vermont found that second home expenses account for \$670 million of the total \$2.49 billion that visitors to Vermont spent in 2013.<sup>72</sup> Seasonal homeownership, like other types of tourism in Vermont, is driven by the state's rural character and abundance of recreational opportunities.<sup>73</sup>

In addition to tourists, 72 percent of Vermont residents participate in outdoor recreation each year. In fact, Vermont residents are more likely to snowshoe or day hike than the average American. Outdoor recreation generates \$5.5 billion in consumer spending and \$505 million in state and local revenues each year. This spending directly supports 51,000 Vermont jobs associated with \$1.5 billion in wages in salaries.<sup>74</sup> The importance of the outdoor recreation industry in Vermont is consistent with nationwide trends. Vermont is one of several states that

has recently created a special task force or state office dedicated to the promotion of the outdoor industry. The Vermont Outdoor Recreation Economic Collaborative focuses on driving economic development in outdoor recreation and throughout the economy.

Protected lands and trail networks are key to providing recreational opportunities. A recent study found that the 410,000 annual users of the Long Trail, Catamount Trail, Kingdom Trails, and Vermont All-Terrain Vehicle Sportsman's Association trails together generate \$30.8 million in annual economic activity and support 365 jobs with \$8.8 million in earnings.<sup>75</sup>



THE NATURE CONSERVANCY



### SKIING

Downhill, backcountry, and cross-country skiing are popular winter sports in Vermont. There are many privately owned ski resorts in Vermont, including 20 alpine and 30 Nordic skiing centers.<sup>76</sup> The state leases public land to seven ski companies, including Jay Peak, Killington Mountain, and Smugglers' Notch,<sup>77</sup> and cross-country skiing is popular in state parks and forests. The University of Vermont conducted a study that found that ski areas in Vermont employed 13,200 individuals, or an average of 115 full-time staff and 621 part-time or seasonal staff per area. Visitors who came to Vermont to ski spent an average of \$876, which led to a total economic impact of \$722 million.<sup>78</sup> Backcountry skiing is also a popular and growing sport nationwide and one for which public lands provide key access.<sup>79</sup> A 2017 analysis of backcountry ski use indicated that on a single powder day, Brandon Gap Backcountry receives approximately 171 visits, and users generate approximately \$200,000 in sales, which supports three jobs and creates \$29,900 in federal, state, and local taxes.<sup>80</sup>

### MOUNTAIN BIKING

Vermont has some of the best mountain biking trails in the Northeast. There are a number of trail networks for mountain biking developed on conserved land. There are also trails that have critical portions protected by public access easements. These trail systems provide outdoor recreation and local economic development. For instance, the Kingdom Trails network in East

## Ascutney Mountain: Shutdown ski town leverages VHCB funding to shape its own future

BY THE TRUST FOR PUBLIC LAND

The residents of West Windsor were used to the financial ebb and flow that comes with being a small ski town. It thus was troubling when Ascutney Mountain Resort filed for bankruptcy in 2010. But it wasn't until the new owner started dismantling and selling off the ski equipment that residents and business owners of West Windsor really started to worry. "Once we saw the lift towers coming off the mountain, it really got our attention," says Glenn Seward, Selectboard chair when the resort closed in 2010. Like many towns across Vermont, Ascutney Mountain was the community's economic lifeblood. Home values near the mountain dropped by as much as 60 percent within just three years. "We saw the likelihood of commercial skiing at Ascutney vanish," notes Seward.

It became clear that these trying times called for creative measures. The traditional resort model was no longer working, but there was still Ascutney Mountain and its miles of trails and other recreation amenities at stake. Town and business leaders felt these amenities could be turned into an economic driver through activities such as mountain biking, backcountry skiing, and hiking. West Windsor residents began to ask, "What would it take to own and operate these lands ourselves?"

That is when The Trust for Public Land was brought in. "The town had a vision for Ascutney as a four-season recreation destination," says Kate Wanner, a project manager in Vermont. "They wanted public ownership of the mountain so that the whole region could benefit from the recreation opportunities and economic benefit that more visitors would bring. They knew that was the key to reviving the community."

The Trust for Public Land facilitated meetings with hundreds of residents and stakeholders to create a plan. This culminated in an overwhelming majority vote by town residents in October 2014 to purchase the resort land and add it to an existing town forest and trail network.

The last piece of the puzzle was funding the project. A grant of \$303,000 from VHCB helped leverage the funding needed to turn this Vermont community's vision into a reality. VHCB funding was matched by additional funds from the Town of West Windsor and more than half a million dollars in foundation and private donations. In 2015, the town took ownership over its most important asset for the first time.



JERRY AND MARCY MONKMAN

Since then, the town has been busy. Part of Ascutney Mountain is now home to Ascutney Trails, a 30-mile network of nonmotorized, recreational trails that scale the peak and hug the western base of the mountain, built and managed by Sport Trails of the Ascutney Basin. Meanwhile, Ascutney Outdoors, a nonprofit formed to manage the mountain on the town's behalf, has created a community ski area on the property, providing free skiing opportunities for families. The result? Business is picking up. The network has become a destination for mountain bikers, backcountry skiers, and hikers from across New England. Home prices are rebounding. And, in a notoriously volatile industry, VHCB funding is helping this Vermont town build a stable future.

Burke and Lyndon provides a popular multiuse, four-season trail for more than 7,000 annual users. A 2014 study of mountain bikers using Kingdom Trails estimated the yearly economic impact to the region was \$6.5 million. Additional research on Blueberry Lake Trail, a portion of the Mad River Valley's trail system in Washington County, also found significant economic impacts related to the use of the trail system, including \$1.2 million in annual direct spending related to trail use.<sup>81</sup>

### **MOTORIZED RECREATION**

Land conservation provides opportunities for motorized recreation that generates economic activity in Vermont. Snowmobiling is a popular activity in the state, with over 17,100 registered snowmobiles.<sup>82</sup> More than 125 snowmobile clubs are operating statewide, and the Vermont Association of Snow Travelers maintains over 4,700 miles of snowmobile trails each winter. Approximately 25 percent of those trails are located on publicly owned lands across the state. A study by Johnson State College found that snowmobiling had an economic impact of \$350 million annually.<sup>83</sup> Public investments in land conservation are essential to this component of the economy in Vermont.

## **Providing opportunities for hunting, fishing, wildlife watching, and other activities**

The conservation of Vermont's lands and waters supports hunting, fishing, and wildlife watching. These activities are important to Vermont residents and to the economy. The most recent national survey of hunters, anglers, and wildlife watchers, conducted by the U.S. Department of the Interior, found that in 2011, 512,000 residents and nonresidents fished, hunted, or wildlife-watched in Vermont and spent over \$744 million on wildlife recreation in the state.<sup>84</sup>

### **HUNTING**

Hunting is a popular sport in Vermont. In 2011, 90,000 hunters spent 1.58 million days hunting in the state. Hunting by Vermont residents and nonresidents generates a substantial economic impact. For example, resident and nonresident hunters in Vermont spent \$292 million in 2011.<sup>85</sup> All hunting activities in Vermont support 4,390 jobs, produce \$141 million in wages, and generate \$33.9 million in state and local taxes.<sup>86</sup> Conservation lands play an important role in supporting this industry by providing areas for hunting to take place.

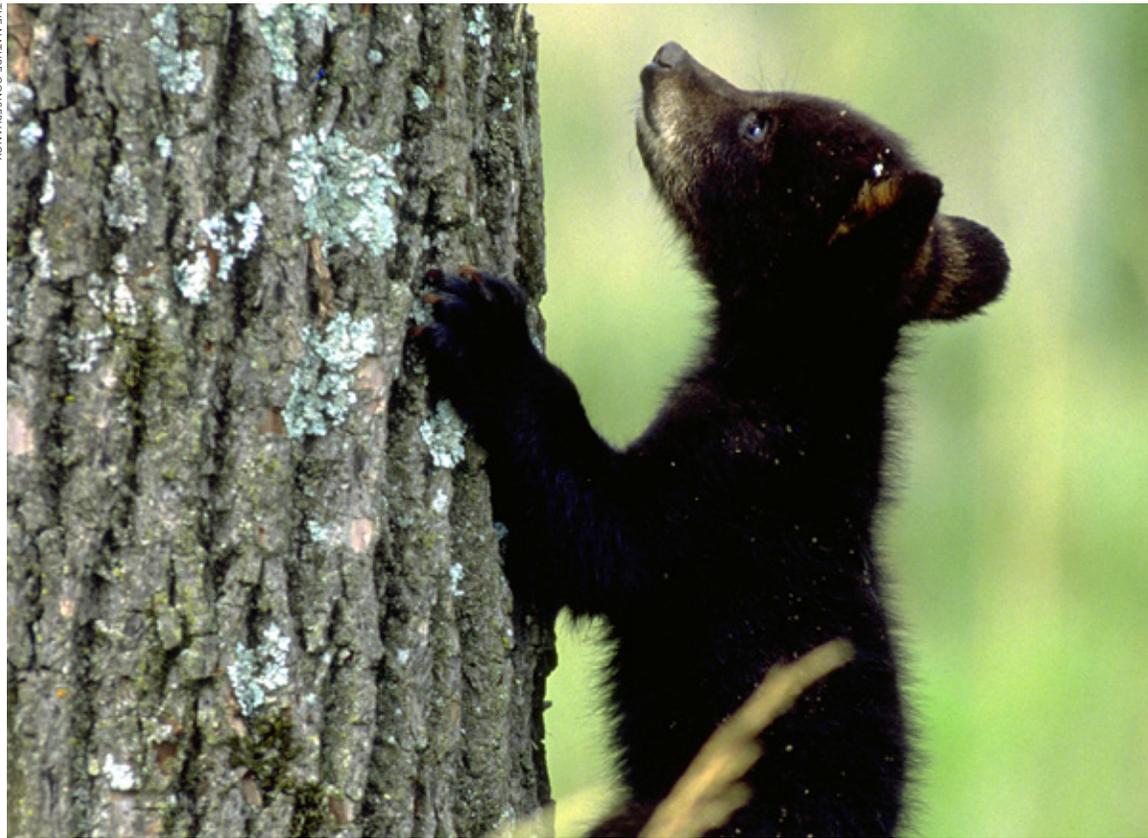
### **FISHING**

Conserved lands and natural areas help improve and protect water sources, which are important to Vermont's robust recreational fishing industry. With more than 23,000 miles of

rivers and streams and 800 lakes and ponds,<sup>87</sup> Vermont has excellent fishing habitat and hosts a diversity of freshwater species and fish—there are 93 species of fish in the Lake Champlain Basin alone.<sup>88</sup> Recreational fishing attracts residents and nonresidents alike. In 2011, 207,000 anglers—54 percent of whom were nonresidents—spent \$131 million while fishing Vermont’s waters.<sup>89</sup>

#### WILDLIFE WATCHING

Vermont’s diverse and varied conservation lands enhance biodiversity and provide abundant opportunities for wildlife watching. This diversity leads to economic benefits. In 2011, 370,000 residents and nonresidents participated in wildlife-watching activities and spent \$289 million on trip and equipment-related expenditures in Vermont to do so. Interestingly, 270,000 residents observed wildlife close to home.<sup>90</sup> This suggests that not only are the “marquee” lands, rivers, and streams being visited but that lands close to home also provide value.



THE NATURE CONSERVANCY

## Pomainville Wildlife Management Area: Vermont Duck Stamp funds create a birders' paradise

BY AUDUBON VERMONT

The story of the Pomainville Wildlife Management Area (WMA) is a story of transformation. What was once marginal farmland is now a critically important wildlife corridor that controls flooding, attracts over 160 species of birds, and is a regional draw for birdwatchers, hunters, and hikers. State support made this transformation a reality, culminating in a 585-acre network of marshes, hardwood swamps, grasslands, and upland forest located along 8,000 feet of Otter Creek in Pittsford, Vermont.

These diverse benefits generated by Pomainville WMA are a recent occurrence. For three generations, the Pomainville family farmed this challenging property. Growing crops under normal conditions is hard enough—the Pomainville family also battled annual flooding from Otter Creek. Things began to change in 2003, however. Realizing the great recreation potential and riparian significance of the property, Babe Pomainville signed a Wetland Reserve Agreement with the U.S. Department of Agriculture's Natural Resources Conservation Service, leading to the creation of Pomainville WMA.

The newly protected area quickly developed a reputation as a premier birding location, attracting birdwatchers from around the state and the region. Half of Vermont's Bird Species of Greatest Conservation Need, including bald eagles, eastern meadowlarks, American woodcock, and bobolinks, use the area as habitat for breeding or migration stopover. The Rutland County Audubon Society regularly leads field trips to the site and identifies Pomainville WMA as a birding hotspot. Over 323 checklists of bird sightings at Pomainville WMA have been submitted to eBird, an online citizen science project where users cite birds seen and heard during an outing, including sightings of rare LeConte's and Nelson's sparrows. "Who knew we would have gotten the response we have with the wetland and riparian forest restoration?" said Marv Elliott, past president of the Rutland County Audubon Society. "Watching the site return to a more natural state has attracted all kinds of birds and now people are showing up to enjoy the results."

**"Watching the site return to a more natural state has attracted all kinds of birds and now people are showing up to enjoy the results."**

MARV ELLIOTT  
PAST PRESIDENT  
RUTLAND COUNTY AUDUBON SOCIETY

The restored wetlands of the Pomainville WMA also provide natural flood control to the area. During Tropical Storm Irene in 2011, for example, the wetlands of the WMA proved their worth by helping minimize flooding in the area and by protecting the downstream communities of Middlebury and Vergennes, Vermont.

Pomainville WMA continues to grow with state support. The 350 acres of farmland originally placed under conservation easement were eventually acquired by Vermont Fish and Wildlife Department in 2005. Funding for the acquisition came from Ducks Unlimited and the Vermont Duck Stamp Fund. The WMA has since been expanded to include 66 acres of floodplain forest on the west side of Otter Creek and an additional 154 acres of upland forest.

## Black Mountain: A gem in southeast Vermont

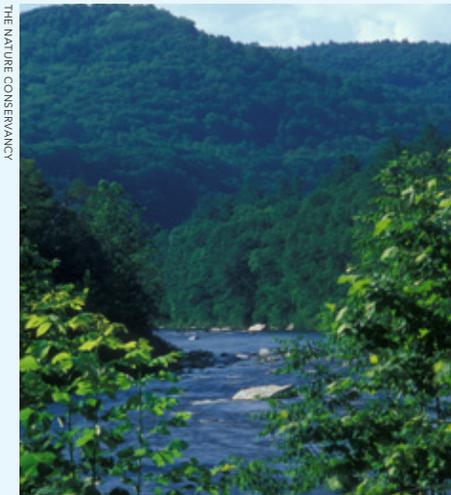
BY THE NATURE CONSERVANCY

Black Mountain, located in Dummerston in southeast Vermont, rises 1,260 feet from the valley floor along the West River. The mountain is a geologically unique piece of land. It is made of granite that formed between 345 and 395 million years ago as molten rock cooled slowly beneath Earth's crust, and was exposed after millennia of erosion. This once molten mountain is a present-day hotspot for beautiful views, unique biodiversity, and recreation opportunities that draw visitors from across the region.

Black Mountain Natural Area is not only a draw for residents and visitors; it is an economic driver for Dummerston and neighboring communities. A prime example is the West River Trail that connects Black Mountain to nearby Brattleboro. "Having Black Mountain at the end of the West River Trail from Brattleboro helps make our trail a recreational resource of regional significance," says Lester Humphreys, vice president of the Friends of the West River. According to Humphreys, Black Mountain attracts visitors "who dine, shop, and stay in our communities ... creating a boon to our economy in southeast Vermont."

The same is true in Dummerston. "People come here from all over the region, the country, and the world to enjoy and refresh themselves experiencing the remarkable 'fairy land' and incredible views created by the unique flora, fauna, geology, and hydrology of this pristine environment," notes Mary Ellen Coperland, chair of the Dummerston Conservation Commission. "While they are here they join with local people ... taking advantage of the many farms that surround the mountain ... popular bed and breakfasts ... and many home-based businesses." One notable example is the Scott Farm, where filming for *The Cider House Rules* took place. With its tremendous skyline accented by Black Mountain, it has become a popular wedding site.

The singular geology and ecology, as well as the recreation potential of Black Mountain, made it an early priority for protection. A grant of \$190,000 from the VHCB in 1988 enabled The Nature Conservancy to acquire 98 acres of Black Mountain. Since then, The Nature Conservancy has protected 10 more parcels at Black Mountain, stitching together a total area of 1,010 acres, and creating a regionally significant nature preserve open to the public. VHCB funding has leveraged support from the Vermont Fish and Wildlife Department, the Open Space Institute's Resilient Landscapes Fund, and additional private donations to make this Black Mountain Natural Area a reality.



THE NATURE CONSERVANCY

Public access is an important feature of Black Mountain Natural Area that keeps visitors coming to the region. In that spirit, The Nature Conservancy is working with the Friends of the West River Trail to improve a multimodal trail at the base of the mountain. The trail will allow residents and visitors to hike or bike from Brattleboro to Black Mountain, further increasing the natural area's accessibility and usability for the community. More than just a place to hike and bike, Black Mountain's unusual geology and plant communities will continue to draw visitors and explorers for years to come. State funding through VHCB and other programs is ensuring that this asset remains a Vermont gem.

# Economic development

**INVESTMENTS IN LAND CONSERVATION SUPPORT ECONOMIC DEVELOPMENT IN THE STATE IN SEVERAL WAYS.** First, these programs support the creation and maintenance of conservation lands, parks, trails, rivers, and farms. From school field trips to study wildlife to evening walks to stay fit, access to these lands provides diverse recreational, educational, and health opportunities for residents and visitors and enhances quality of life for all Vermonters. The high quality of life, in turn, attracts talent, employers, and investment to the state. Second, residents take advantage of the state's plentiful outdoor recreation opportunities. By purchasing equipment and gear to use while participating in those activities, residents boost local businesses and contribute to Vermont's recreation economy. Finally, businesses that sell an outdoor recreation experience depend on protected waterways and lands to lead hunting, fishing, rafting, and adventure trips. These businesses offer jobs, attract visitors, and contribute significantly to the state's economy.

IAN MACCELLAN



## Quality of life

Vermont is attractive to families, individuals, and businesses. Quality of life plays a significant role in the state's economic development because sought-after employees in today's economy consider more than salary when choosing places of employment. Focus groups conducted by Carnegie Mellon University have found that young creative workers consider lifestyle factors, such as environmental and recreational quality, more heavily than the job itself when choosing where to live.<sup>91</sup> In 2014, *USA Today* ranked Vermont the third-best state for quality of life.<sup>92</sup> More recently, in 2018, *U.S. News* rated Vermont the ninth-best state overall, considering health care, education, economy, opportunity, infrastructure, crime, fiscal stability, and quality of life.<sup>93</sup> Communities are continually recognizing the importance of the state's rural character and quality of life in their economic development strategies. In fact, the Vermont 2020 Comprehensive Economic Development Strategy is focused on enhancing the Vermont brand and preserving the working landscape as part of the state's overall strategy.<sup>94</sup>

## Recreation economy

The Trust for Public Land's work in communities across the country shows that residents and visitors use conserved lands and trails for many types of activities. These activities generate economic activity and support businesses, including those that sell recreation-related equipment. Local retail businesses and guides in Vermont benefit from public spaces that provide recreational opportunities. For example, the Vermont Outdoor Guide Association (VOGA) promotes recreational services, such as guides, outfitters, educators, lodging providers, tour operators, and retail and rental businesses across the state. VOGA directs individuals to Green Mountain National Forest and state forests, parks, and wildlife management areas, as well as to the diverse collection of recreational trails when they are looking for places to hunt, fish, or recreate.<sup>95</sup> Win Smith, majority owner and president of Sugarbush Resort in Warren, Vermont, underlines the connection between conserved open spaces and recreation businesses. "At Sugarbush, our brand in the marketplace is intimately connected with the beauty of our natural environment," notes Mr. Smith, "and VHCB has played a major role over the years by funding important conservation projects."<sup>96</sup>

# Fiscal health

**LAND CONSERVATION ALSO SAVES VERMONT COMMUNITIES MONEY THROUGH AVOIDED COSTS ON EXPENSIVE INFRASTRUCTURE AND OTHER MUNICIPAL SERVICES** required by residential property owners, such as schools, police, and fire protection. Research conducted in 151 communities across the United States shows that the median cost to provide public services for each dollar of revenue raised is \$1.16 for residential lands and \$0.37 for working and open land. These studies over the last 30 years demonstrate that working and open lands generate more public revenue than they require back in public services. Further, on average, residential lands do not cover their costs, which must be subsidized by other land uses.<sup>97</sup> These findings are also supported by research in Vermont. A 2009 report found that more development in Vermont tends to lead to higher taxes, and on average, property tax bills are lower—not higher—in the towns with the most conserved lands.<sup>98</sup>

BRIAN MOHRMEIER PHOTOGRAPHY



## Bolton Valley Nordic and Backcountry: Recreation for all

BY VERMONT LAND TRUST

Forty years ago, the late Gardiner Lane became a guide, trail cutter, and volunteer at the Bolton Valley Ski Area. Lane worked with other volunteers to clear what is now the Bolton Valley Nordic and Backcountry (BVNB) trail system, an extensive 90-kilometer network of groomed and backcountry trails for skiing and snowshoeing. Lane's leadership instilled a spirit of commitment to the land, sparked a long history of volunteerism, and inspired an effort that permanently secured the land for public use in 2012.

The effort began in 2011 when Ann Gotham, a nurse practitioner and ski patroller, reported to work and learned that Bolton was being sold and would be closed to the public. Gotham quickly formed what became Friends of Bolton Valley Nordic and Backcountry (FOBVNBC) to protect the trails network and the public's access to it. A letter from Gotham to the prospective buyer convinced the buyer to withdraw, with the hope that the land would be conserved.

Following a 15-month, \$1.85 million fundraising campaign, Vermont Land Trust purchased the 1,144-acre property and conveyed it to the Vermont Department of Forests, Parks and Recreation. A three-year, \$800,000 grant from VHCB was critical to the project's success. The grant provided momentum and reduced the amount of fundraising required to just over \$1 million. "When VHCB made their commitment, this was the point at which we had a good sense that [protection] was going to be possible," said VLT's Elise Annes.

The extraordinary BVNB property provides critical wildlife habitat and offers significant outdoor recreational opportunities. The property sits at the highest base elevation of any Nordic center in Vermont and is traversed by the Catamount Trail, Vermont's state-spanning ski trail. The land is highly accessible, located less than 40 minutes from Burlington and Montpelier, and is the launching point for several classic ski tours, including "Bolton to Trapps."

More than 20,000 people access the BVNB land annually to recreate and participate in community events, outdoor education, and ski racing and training. The variety of terrain and trails allows users of all ability levels and ages. The property is used as a practice area by the Northwest Vermont Nordic Ski Club, the University of Vermont's top-ranked Nordic team, local high school teams, and others.

The Green Mountain Club (GMC), manager of Vermont's Long Trail, built two spur trails across the BVNB property and restored the historic Bolton Lodge and Bryant Camp, both located on the property. The lodge and camp offer rustic accommodations and are part of GMC's effort to revive hiking in the Bolton area. Nearly 1,000 visitors use the cabins each year, about 20 percent of whom are from out of state.

Since June 2012 the BVNB property has been owned by the public as part of Vermont's Mt. Mansfield State Forest. A conservation easement, held jointly by VLT and the Vermont Housing and Conservation Board, protects the property in perpetuity.



# Human health benefits

**ACCESS TO CONSERVED LANDS, PARKS, AND TRAILS CAN HELP A COMMUNITY MEET HEALTH GOALS AND REDUCE MEDICAL COSTS.** The physical benefits of public open spaces are well documented. There are many potential ways by which nature has been empirically tied to specific physical and mental health outcomes.<sup>99</sup> Increased access to public outdoor spaces encourages people to exercise more, reducing overall health care expenditures.<sup>100</sup> Public health can be improved by making communities more friendly to bikers and walkers.<sup>101</sup> Physical exercise can reduce the likelihood of illnesses such as obesity, cardiovascular disease, diabetes, or arthritis, and can reduce associated medical costs.<sup>102</sup> Similarly, studies have found that physical inactivity and poor diet are the second leading cause of death in the United States.<sup>103</sup> Investment in publicly accessible conservation land encourages behavioral changes that not only reduce chronic diseases and health care costs but also improve quality of life.<sup>104</sup>

In addition to physical benefits, research indicates that people who have increased exposure to the outdoors show long-term mental health improvements. Several studies have demonstrated that access to public outdoor spaces can decrease stress, aid in mental fatigue recovery, and reduce levels of depression and anxiety.<sup>105</sup> Meanwhile, leisurely walks in natural environments lead to decreases in the body's production of stress hormones and are linked to reduced levels of depression.<sup>106</sup>



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The physical and mental benefits of land conservation are seen in Vermont. The United Health Foundation ranked Vermont the third-healthiest state in 2017 based on behavior, community, environment, policy, clinical care, and health outcomes. On average, Vermont residents are more physically active than other states. That is, only 19.5 percent of Vermont residents are physically inactive, compared to 23.1 percent of adults nationwide. However, despite this high ranking, Vermont also has the 12th-highest percentage of obese residents; 27.1 percent of the state's residents have a body mass index of 30.0 or higher.<sup>107</sup> The implications of physical inactivity become starker when the percentage of the population that is overweight is considered as well. In 2016, 52.7 percent of adult females and 70.5 percent of adult males in Vermont were overweight or obese.<sup>108</sup>

The costs of obesity are substantial and include direct medical expenses and the reduced productivity of obese workers. Studies have shown that the very obese lose one month of productive work per year without considering the extra sick days taken. This costs employers an average of \$3,790 per very obese male worker and \$3,040 per very obese female worker each year.<sup>109</sup> Higher rates of obesity also mean higher medical costs. Those suffering from obesity have medical costs \$1,430 higher than those of normal weight on average.<sup>110</sup> Vermont spends over \$200 million each year on the treatment of adults with chronic diseases that are linked to obesity, such as diabetes, heart disease, and cancer in adults alone.<sup>111</sup> To sum, although Vermonters are more active than adults nationwide, obesity is a prevalent and costly issue across the state. This fact further underlines the importance of conserved lands—especially when activated through community programming and initiatives that get families outdoors—in supporting the physical as well as mental well-being of area residents.

New research is finding even more diverse ways that health outcomes are supported by conservation, including decreasing the risk of tick-borne illnesses such as Lyme disease. Lyme disease is the most commonly reported tick-borne disease in Vermont, and in 2016, Vermont had the second-highest rate of reported Lyme disease cases in the United States.<sup>112</sup> Land conservation prevents habitat fragmentation and supports biodiversity. Researchers have found that white-footed mice, which are among of the top carriers of Lyme carrying ticks, are able to thrive in areas with less biodiversity.<sup>113</sup> This work is finding that preserving biodiversity and preventing fragmentation thus have the potential to reduce the prevalence of infectious disease transmission, including Lyme disease.<sup>114</sup> From controlling specific diseases to providing diverse physical and mental health benefits, the human health benefits derived from Vermont's conserved lands are robust.

# Leveraged federal, local, and private funding

**VERMONT'S LAND CONSERVATION PROGRAMS LEVERAGE FUNDING FROM FEDERAL, LOCAL, PRIVATE, AND NONPROFIT SOURCES**, which maximizes the impact of state investments. For example, Vermont state programs have leveraged federal investments through the U.S. Fish and Wildlife Service, U.S. Forest Service, National Park Service, and Natural Resources Conservation Service to protect lands. As the catalyst for many additional investments, state land conservation programs in Vermont have been able to leverage funds, facilitate partnerships, and create an overall environmental and economic impact greater than each program's bottom-line spending. By attracting support from these other sources—including new funding originating outside the state—Vermont does not have to bear the entire cost burden of conservation projects.

Leveraging additional support translates into more local projects completed and the creation of additional economic benefits. Every dollar spent by the State of Vermont in the last ten years (2007–2016) was matched by at least one dollar of federal, local, private, or nonprofit funding. This far exceeds the match requirements of the state funding programs studied in this report. In the case of local conservation projects, VHCB requires project applicants to raise at least 33 percent of the total project costs from other sources.<sup>115</sup>

In the last ten years, the Vermont Duck Stamp Fund leveraged at least \$1.16 million in federal, private, and nonprofit funding. That is, every dollar of spending on land conservation by the Duck Stamp was matched by at least \$1.56 in contributions from other non-state sources. This analysis was conducted by The Trust for Public Land using data from the Conservation Almanac.<sup>116</sup>

Several projects across the state exemplify the leveraging nature of these state investments. For example, the West Windsor Town Forest was protected in 2015 and involved \$303,000 in state funding through VHCB. This contribution leveraged a \$667,000 contribution from the Town of West Windsor as well as a \$557,000 investment from private sources, including the Open Space Institute, and numerous foundations and private donors. Thus, each state dollar was matched by over \$4 in contributions from other non-state sources.



# Conclusion

**VERMONT'S INVESTMENTS IN LAND CONSERVATION ARE CRITICAL TO PROTECTING AND ENHANCING THE PLACES THAT MAKE THE STATE A GREAT PLACE TO LIVE, WORK, AND PLAY.** From the shores of Lake Champlain to the ridgelines of the Green Mountains, land and water conservation contributes to a high quality of life and the state's unique sense of place. It does so while simultaneously sustaining economic activity within critical industries across the state.

Using a well-established analytical approach, this study found that every dollar invested in land conservation by the State of Vermont returns \$9 in economic value of natural goods and services.

Vermont's conservation lands also contribute to the economic well-being of the state in a number of other ways. Land conservation supports forestry and farming in Vermont by helping to maintain the intact working landscapes on which these industries depend. Beautiful landscapes, including the state's mosaic of fall foliage, historic working farms, and rolling mountains, also bolster the state's outdoor recreation economy and attract visitors who spend money in local communities. These industries generate billions of dollars in output and support thousands of jobs.

Whether new arrivals or families with generations of history on the land, Vermonters take great pride in the state's rural character and tremendous outdoor opportunities. Land conservation supports these values and promotes economic development by making Vermont an attractive place to live, work, and play. Conservation lands also help communities maintain their fiscal health through such means as attracting development and boosting property values while requiring a minimum of upkeep and services. Further, be it a rigorous hike or leisurely stroll in a town forest, by providing a place for physical activity, these lands lead to savings in community health care costs.

One of the greatest benefits of Vermont's investments in land conservation is its ability to bring further returns by leveraging additional funds from diverse federal, local, private, and nonprofit sources. This ensures that every dollar invested maximizes the economic benefits it generates for the people, communities, and businesses of Vermont.

# Appendix: Methodology

The natural goods and services provided by the distinct ecosystem types found within Vermont’s conserved lands, and their monetary values, were determined using the benefits transfer methodology. That is, The Trust for Public Land conducted a thorough literature review of the types of goods and services provided by the 15 ecosystem types identified in conserved lands using recent, relevant, and scientifically-sound sources. The Trust for Public Land then used the economic values of the different ecosystem types identified in that literature to estimate a per-acre economic value of the natural goods and services provided.

Benefits transfer methodology has become a common approach in environmental economics because it is a practical alternative to time-intensive and data-intensive original research.<sup>117</sup> This methodology is not without its limitations, though, which can include the levels of uncertainty that may come from utilizing data collected in one region to describe another. In addition, there may be other, more specific land types that are not available in existing data sets for Vermont.<sup>118</sup> One way this analysis addresses uncertainty is by applying the most conservative values supported in the ecosystem valuation literature. Until more time- and resource-intensive, wide-scale primary data collection can take place, benefits transfer provides a conservative estimate of the value of natural goods and services.

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Other researchers have employed the benefits transfer methodology to measure the return on public investments in land conservation. For example, Kovacs et al. looked at Minnesota's return on investment in land conservation.<sup>119</sup> In their approach, they also considered various scenarios of land use change and estimated the marginal return of land conservation efforts. The Trust for Public Land's approach captures the entire value. This is appropriate because threat of development, in instances such as the Green River Reservoir lands purchased in 1999 and the Bolton Valley Nordic and Backcountry project in 2012, has been and continues to be an important factor for conservation projects receiving state funding throughout Vermont. The Trust for Public Land followed the steps below in conducting the benefits transfer:<sup>120</sup>

- STEP 1.** Define the policy context. This definition should include various characteristics of the program site, what information is needed, and in what units.
- STEP 2.** Locate and gather original research outcomes. Conduct a thorough literature review and obtain copies of potentially relevant studies.
- STEP 3.** Screen the original research studies for relevance. How well does the original research context correspond to the policy context? What is the quality of the original research?
- STEP 4.** Select a point estimate or average of a range of point estimates. Convert each to dollars per acre.
- STEP 5.** Transfer the point estimate or average value estimate. Aggregate the point estimate or average value estimate by multiplying it by the total number of acres, providing a total value for the good or service at the program site.

The Trust for Public Land considered a broad set of natural goods and services based on the availability of high-quality sources but did not examine every natural good and service. An analysis of additional natural goods and services would reveal further benefits. The benefits examined in this study are therefore likely to underestimate the "true" economic value and return on investment of Vermont's conserved lands. For example, as shown in Table A1, this study quantifies forest services that include air quality improvements, carbon sequestration and storage, and erosion control and water quality benefits. Vermont's forests also provide other natural goods and services, such as wildlife habitat-related benefits; however, the per-acre value of this benefit has not yet been measured in the literature and is therefore not included in this analysis. Similar limitations are found with other land cover types. Further, conserved lands throughout Vermont provide many additional economic benefits beyond natural goods and services. As discussed throughout the report, conserved lands are also key resources that foster tourism, drive recreation, and support forestry and farming.

Such additional benefits are not captured in these per-acre values of natural goods and services. The value of each land cover type thus underestimates the true, full value of these goods and services.

Based on existing research, The Trust for Public Land determined the natural goods and services provided and estimated their values for each land cover type, as shown in [Table A1](#).

TABLE A1. ESTIMATED ANNUAL PER-ACRE VALUE OF NATURAL GOODS AND SERVICES BY LAND COVER TYPE		
Land cover type*	Natural goods and services	Annual value per acre (2018\$)
Deciduous Forest	Air pollution removal, carbon sequestration, carbon storage, erosion control/water quality	\$180.00
Mixed Forest	Air pollution removal, carbon sequestration, carbon storage, erosion control/water quality	\$174.00
Pasture/Hay	Carbon sequestration, habitat/biodiversity, livestock/livestock products, and pollination services	\$58.80
Evergreen Forest	Air pollution removal, carbon sequestration, carbon storage, erosion control/water quality	\$168.00
Cultivated Crops	Food production, pollination services	\$63.10
Woody Wetland	Flood protection, habitat	\$590.00
Shrub/Scrub	Habitat/biodiversity, carbon sequestration	\$19.40
Emergent Herbaceous Wetland	Flood protection, habitat	\$590.00
Developed Open Space/Parks	Air pollution removal, carbon sequestration	\$91.60
Open Water	Freshwater regulation and supply, wildlife habitat	\$108.00
Developed lands**	No natural goods and services provided	N/A
Grassland/Herbaceous	Carbon sequestration, habitat/biodiversity, and pollination services	\$33.90
Barren Land	No natural goods and services provided	N/A

\* In order from the most commonly conserved to the least commonly conserved.

\*\* The developed category combines low-, medium-, and high-intensity development types. This includes areas with a mixture of constructed materials and vegetation with impervious surface accounting for between 20 percent and 100 percent of the total land cover.

## Natural goods and services included in annual value per-acre calculation

### FORESTS (DECIDUOUS, EVERGREEN, AND MIXED)

The Trust for Public Land analyzed four natural services provided by Vermont forests: air pollution removal, carbon sequestration, carbon storage, and erosion control/water quality. The annual per-acre value of these services is \$180 for deciduous forest, \$174 for mixed forest, and \$168 for evergreen forest.

Forests provide clean air by removing harmful air pollutants. The Trust for Public Land considered the removal value of four major air pollutants: ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>10</sub>), and sulfur dioxide (SO<sub>2</sub>). The volume of pollutants removed from the air on an annual per-acre basis was derived from a U.S. Forest Service analysis of community forests in Vermont.<sup>121</sup> Pollution-removal dollar values on a per-volume basis were obtained for each of the air pollutants from a 2014 study of the impacts that trees and forests have on air quality and human health.<sup>122</sup> The values of these changes for each pollutant are based primarily on savings in health care costs, derived from the Environmental Protection Agency's environmental Benefits Mapping and Analysis Program (BenMap) as well as other externality values used in energy decision making developed by a well-cited study.<sup>123</sup>

Forests remove carbon from the atmosphere, a natural service referred to as carbon sequestration. Carbon sequestration rates for deciduous and evergreen forests in the state were obtained from published research on how to calculate carbon in forests.<sup>124</sup> The Trust for Public Land utilized regional estimates of average carbon stocks for the three most predominant forest types<sup>125</sup> in the Northeast Region at time of clear-cut and at the maximum length of tree life. The Maple-Beech-Birch forest type was used to estimate the carbon value of deciduous forests, while the White-Red-Jack Pine forest type was used for evergreen forest. An average of the two was used for mixed forests. The amount of carbon sequestered per acre per year was calculated by subtracting the average carbon density at the time of clear-cut from the average carbon density at the maximum length of tree life for each forest type and dividing by the maximum length of tree life. The social cost of carbon was used as the dollar value of carbon to calculate an annual per-acre value for carbon sequestration by forests in the state.<sup>126</sup>

The Trust for Public Land also utilized this report to estimate the value of carbon storage by forests, including carbon stored in live trees, standing dead trees, the understory, downed

dead wood, and the forest floor. Forested lands also store significant amounts of carbon in forest soils, by some estimates as much as 40 percent of total carbon.<sup>127</sup> However, measuring the carbon storage through forested soil is less certain and therefore excluded in this analysis in order to be conservative.<sup>128</sup> The value of carbon storage per acre was based on the regional estimates of forestlands immediately after clear-cut harvest for the same forest types as used for the carbon sequestration benefit.<sup>129</sup>

The per-acre value of water quality protection and erosion control by forests was estimated using the Conservation Reserve Enhancement Program (CREP) in Vermont. CREP is a voluntary program designed to reduce sediment runoff and improve water quality by removing land from agricultural production and establishing vegetative buffers.<sup>130</sup> CREP payments represent a proxy value for soil erosion protection services that forested lands provide naturally. The Trust for Public Land considered Vermont's per-acre rental payments available through CREP. To be conservative, upfront state and federal payments were excluded from this value. Further, this analysis applied Vermont's minimum annual payments.<sup>131</sup>

## WETLANDS

The Trust for Public Land estimates the annual value of woody and emergent herbaceous wetlands in Vermont to be \$590 per acre for flood protection and wildlife habitat. Wetlands mitigate storm-related damages by acting as a form of green infrastructure, reducing peak flows downstream during storm events. The Trust for Public Land calculated this value based on recent research by Watson et al. carried out in Middlebury, Vermont. Watson et al. determined the annual mitigation services provided by wetlands upstream from the town of Middlebury using different hydrological modeling scenarios in conjunction with historical flood rate and damage data.<sup>132</sup> The minimum annual flood protection value from this study was used to determine the per-acre value of flood protection services for wetlands. Wetlands also provide critical wildlife habitat.<sup>133</sup> In Vermont, wetlands are the only habitat for numerous waterfowl and other species, ranging from beavers to bullfrogs. They are also a critical habitat for large mammals such as black bear and moose.<sup>134</sup> The habitat value is based on a published meta-analysis that calculated wetland service values per acre across the country.<sup>135</sup>

## PASTURE

The Trust for Public Land estimates the annual value of carbon sequestration, wildlife habitat, pollination services, and the production of livestock goods to be \$58.80 per acre of pasture. The value of carbon sequestration was calculated using the social cost of carbon and the minimum grassland carbon sequestration volume per acre from a national study of carbon sequestration.<sup>136</sup>

The Natural Resources Conservation Service's former Grassland Reserve Program (GRP) provides a proxy measure of the value of pastureland for wildlife habitat. The program provided landowners financial incentives to conserve their land for wildlife habitat. This report used the statewide average of GRP rates to calculate an annual per-acre value.<sup>137</sup>

To estimate the value of livestock production, this analysis used the average rental rate paid for pastureland in Vermont, which is an implicit value for the production of food and goods from livestock. Rent represents the most accurate value of land compared with values associated with production and income, which reflect a variety of other forces and inputs. Annual data on pastureland rent (per acre) were obtained from United States Department of Agriculture's National Agricultural Statistics Service (NASS).<sup>138</sup>

The per-acre value of pollination services was calculated based on Vermont's top agriculture commodities that also were included in a recent study on crop dependence on native pollinators, including hay and apples.<sup>139</sup> The Trust for Public Land used this information to determine each crop's dependence on native bees and then calculate the average annual crop production that is dependent on native bees.

## SHRUB/SCRUB

The annual value of shrub/scrub land is estimated to be \$19.40 per acre for the provision of habitat and carbon sequestration.

The Natural Resources Conservation Service's former GRP provides a proxy measure of the value of shrub/scrub land for wildlife habitat. The program provides landowners financial incentives to conserve their land for wildlife habitat. The Trust for Public Land used the statewide average of GRP rates to calculate an annual per-acre value, as discussed previously in the description of the pasture value.<sup>140</sup>

Values for carbon sequestration were averaged from the mixed forest and grassland land cover types because of the characteristics of shrub/scrub ecosystems in Vermont.

#### **CULTIVATED CROPS**

Vermont receives \$63.10 per acre in annual value for each acre of cropland for food production. The average rent paid by Vermont farm operators for nonirrigated cropland was used as the value of cropland for food production. Rent represents the most accurate value of land compared with values associated with production and income, which reflect a variety of other forces and inputs. Annual per-acre rent data were obtained from NASS.<sup>141</sup>

#### **DEVELOPED OPEN SPACE (I.E., PARKS)**

Open space near developed areas is typically parkland or characteristically similar to parks. The Trust for Public Land analyzed the value of air pollution removal and carbon sequestration provided by parks in Vermont. The annual per-acre value of these services is \$91.60.

The Trust for Public Land considered the removal value of the same major air pollutants for developed open spaces as for forested lands, with the volume of pollutants removed from the air on an annual per-acre basis derived from a U.S. Forest Service analysis of urban forests in Vermont.<sup>142</sup> Similarly, the per-acre value of carbon sequestration for mixed forest trees immediately after clear-cut is transferred to the per-acre value of carbon sequestration for parks.

#### **GRASSLAND**

Grassland provides an annual economic value of \$33.90 per acre in carbon sequestration, pollination services, and wildlife habitat. Values for carbon sequestration, pollination services, and wildlife habitat were transferred from the pasture calculation because of the similar levels of services provided by both land cover types; however, the value of livestock products was not included.

#### **OPEN WATER**

The annual value of open (surface) water of \$108 per acre for freshwater regulation and supply and wildlife habitat was obtained from a published study that calculated an ecoregion-specific ecosystem service value for a variety of ecosystem types found on U.S. National Wildlife Refuges.<sup>143</sup>

# Endnotes

- 1 State of Vermont, Vermont Open Geodata Portal: Vermont Protected Lands Database, accessed April 3, 2018, <http://geodata.vermont.gov/datasets/vt-protected-lands-database>.
- 2 The Trust for Public Land's Conservation Almanac is a powerful online resource for discovering, analyzing, and mapping the results of federal, state, and local funding for land conservation across the United States. Available at [www.conservationalmanac.org](http://www.conservationalmanac.org).
- 3 This is based on median annual acreage and spending from 1988 to 2016, and dollar values have not been adjusted to current year dollars.
- 4 The 1999 figures include the 133,000-acre Champion Lands project acquired with \$4.5 million of VHCB funds.
- 5 Joe Roman and Jon Erickson, *Economics of Conservation in Vermont*, Burlington: Gund Institute for Environment, 2017, accessed March 23, 2018, [https://www.researchgate.net/publication/317580365\\_Economics\\_of\\_Conservation\\_in\\_Vermont](https://www.researchgate.net/publication/317580365_Economics_of_Conservation_in_Vermont).
- 6 Natural goods and services are sometimes referred to as ecosystem services, natural capital, nature's benefits, or environmental goods and services.
- 7 Protected lands provide additional values, such as option value, bequest value, existence value, spiritual value, and aesthetic value. These values have not been included in this analysis owing to the complexity involved in their measurement. Ecosystem services such as recreation and tourism have not been included in the per-acre values of natural goods and services but are discussed separately in the "Land conservation supports the economy" section on page 22. The return on investment in land conservation would presumably be higher if these additional values had been included in the analysis: their omission results in a more conservative estimate (i.e., underestimate the "true" value).
- 8 Vermont Agency of Natural Resources, Department of Forests, Parks and Recreation, Vermont Urban and Community Forestry Program, *Forests, Trees and Water*, accessed March 7, 2018, [http://fpr.vermont.gov/sites/fpr/files/Forest\\_and\\_Forestry/Community\\_Forests\\_and\\_Trees/Library/Forests%2C%20Trees%20and%20Water.pdf](http://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Community_Forests_and_Trees/Library/Forests%2C%20Trees%20and%20Water.pdf).
- 9 National Research Council, *Hydrologic Effects of a Changing Forest Landscape* (Washington, DC: The National Academies Press, 2008).
- 10 Vermont Agency of Natural Resources, Department of Environmental Conservation, "River Corridor and Floodplain Protection," accessed April 25, 2018, <http://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection>.
- 11 Beverley Wemple et al., "Hydrology and Water Quality in Two Mountain Basins of the Northeastern US: Assessing Baseline Conditions and Effects of Ski Area Development," *Hydrological Processes* 21 (2007): 1639-1650.
- 12 Jared S. Nunery and William S. Keeton, "Forest Carbon Storage in the Northeastern United States: Net Effects of Harvesting Frequency, Post-Harvest Retention, and Wood Products," *Forest and Ecology Management* 259, no. 8 (2010): 1363-1375; Charles D. Kerchner and William S. Keeton, "California's Regulatory Forest Carbon Market: Viability for Northeast Landowners," *Forest Policy and Economics* 50 (2015): 70-81; David G. Ray et al., "Mitigating Climate Change with Managed Forests: Balancing Expectations, Opportunity, and Risk," *UVM Journal of Forestry* January/February 2009.
- 13 Vermont Agency of Natural Resources, Department of Forests, Parks and Recreation, *2015 Vermont Forest Fragmentation Report*, 2015, accessed April 26, 2018, <https://legislature.vermont.gov/assets/Documents/2016/Work-Groups/House%20Ways%20and%20Means/Bills/H.489/Witness%20Testimony/H.489~Mike%20Snyder~2015%20Forest%20Fragmentation%20Report~5-11-2015.pdf>.
- 14 Vermont Center for Ecostudies, *The Status of Vermont Forest Birds: A Quarter Century of Monitoring*, 2017, accessed April 25, 2018. <http://vtcostudies.org/wp-content/uploads/2017/04/Status-of-VT-Forest-Birds.pdf>; Vermont Fish and Wildlife Department, *Vermont Habitat Blocks and Habitat Connectivity: An Analysis using Geographic Information Systems*, 2014, accessed April 25, 2018, [http://fpr.vermont.gov/sites/fpr/files/Forest\\_and\\_Forestry/Vermont\\_Forests/Library/VFWD%20Habitat%20Block%20Report-April%202014.pdf](http://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Vermont_Forests/Library/VFWD%20Habitat%20Block%20Report-April%202014.pdf).
- 15 D. Russi et al., *The Economics of Ecosystems and Biodiversity for Water and Wetlands*, London: IEEP, 2013, accessed March 26, 2018, <http://www.teebweb.org/publication/the-economics-of-ecosystems-and-biodiversity-teeb-for-water-and-wetlands/>.
- 16 Keri B. Watson et al., "Quantifying Flood Mitigation Services: The Economic Value of Otter Creek Wetlands and Floodplains to Middlebury, VT," *Ecological Economics* 130 (2016): 16-24; U.S. Environmental Protection Agency, *Wetlands: Protecting Life and Property from Flooding*, EPA843-F-06-001, 2006, accessed March 26, 2018, <https://www.epa.gov/sites/production/files/2016-02/documents/flooding.pdf>.

- 17 Keri B. Watson et al., "Quantifying Flood Mitigation Services: The Economic Value of Otter Creek Wetlands and Floodplains to Middlebury, VT," *Ecological Economics* 130 (2016): 16-24.
- 18 U.S. Environmental Protection Agency, *Economic Benefits of Wetlands*, EPA843-F-06-004, 2006, accessed April 2, 2018, <https://www.epa.gov/sites/production/files/2016-02/documents/economicbenefits.pdf>.
- 19 Vermont Agency of Natural Resources, Department of Environmental Conservation, "Wetland Function and Values: Fish Habitat," accessed March 7, 2018, <http://dec.vermont.gov/watershed/wetlands/functions/fish>.
- 20 Ducks Unlimited, "Wetlands and Grassland Habitat: The Benefits of Two Key Waterfowl Habitat Types," accessed March 7, 2018, <http://www.ducks.org/conservation/habitat/benefits-of-wetlands-and-grasslands>.
- 21 U.S. Department of Agriculture, Forest Service, "Ecosystem Services from National Grasslands," accessed March 7, 2018, [www.fs.fed.us/grasslands/ecoservices/](http://www.fs.fed.us/grasslands/ecoservices/); Insu Koh et al., "Modeling the Status, Trends, and Impacts of Wild Bee Abundance in the United States," *Proceedings of the National Academy of Sciences* 113, no. 1 (2016): 140-145; Vermont Center for Ecostudies, "Grassland Birds," accessed April 25, 2018, <https://vtcostudies.org/wildlife/birds/grassland-birds/>.
- 22 American Farmland Trust, *The Environmental Benefits of Well-Managed Farmland*, DeKalb, IL: Center for Agriculture in the Environment, 2005, accessed March 23, 2018, [http://www.farmlandinfo.org/sites/default/files/Env\\_Benefits\\_of\\_Farmland\\_1.pdf](http://www.farmlandinfo.org/sites/default/files/Env_Benefits_of_Farmland_1.pdf).
- 23 Vermont Housing and Conservation Board, *House Committee on Agriculture and Forestry*, 2018, accessed March 30, 2018, <https://legislature.vermont.gov/assets/Documents/2018/WorkGroups/House%20Agriculture/Housing%20and%20Conservation/W~Nancy%20Everhart~VHCB~1-19-2018.pdf>.
- 24 D. Russi et al., *The Economics of Ecosystems and Biodiversity for Water and Wetlands*, London: IEEP, 2013, accessed March 26, 2018. <http://www.teebweb.org/publication/the-economics-of-ecosystems-and-biodiversity-teeb-for-water-and-wetlands/>.
- 25 Todd Gartner et al., "Protecting Forested Watersheds Is Smart Economics for Water Utilities," *Journal of American Water Works Association* 106, no. 9 (2014): 54-64.
- 26 Vermont Agency of Natural Resources, Department of Environmental Conservation, Drinking Water and Groundwater Protection Division, *Annual Report on Public Water System Violations: Calendar Year 2016, 2017*, accessed November 16, 2017, <http://dec.vermont.gov/sites/dec/files/dwgp/DW/2016annualreport.pdf>
- 27 Lake Champlain Basin Program, "Drinking Water," accessed November 16, 2017, <http://www.lcbp.org/water-environment/human-health/drinking-water/>; Burlington Department of Public Works, Water Division, *Annual Water Quality Report: Water Testing Performed in 2016, 2017*, accessed November 16, 2017, <https://www.burlingtonvt.gov/sites/default/files/u123/2016%20Water%20Quality%20Report.pdf>.
- 28 Beverley Coghill-Wemple, associate professor, University of Vermont, email message to author, March 14, 2018.
- 29 Vermont Agency for Natural Resources, Department of Environmental Conservation, *Clean Water Roadmap for Vermont*, accessed March 30, 2018, <https://anrweb.vt.gov/DEC/CWR/Home>; The Nature Conservancy, "Nature-Based Solutions for Clean Water: We Are Investing in Nature to Clean Up Lake Champlain," accessed March 30, 2018, <https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/vermont/freshwater/nature-based-solutions-for-clean-water.xml>.
- 30 Brian Voigt, Julia Lees, and Jon Erickson, *An Assessment of the Economic Value of Clean Water in Lake Champlain*, Technical Report Number 81. 2015.
- 31 U.S. Department of Homeland Security, Federal Emergency Management Agency, *Disaster Declarations for Vermont*, 2017, accessed November 17, 2017. <https://www.fema.gov/states/vermont>.
- 32 Hazards & Vulnerability Research Institute, *The Spatial Hazard Events and Losses Database for the United States, Version 15.2 [Online Database]*, Columbia, SC: University of South Carolina, 2018.
- 33 Roy Schiff et al., *Evaluating the Costs and Benefits of Floodplain Protection Activities in Waterbury, Vermont and Willisboro, New York, Lake Champlain Basin, U.S.A.*, 2015, accessed March 23, 2015, [https://www.floods.org/ace-files/documentlibrary/committees/78\\_CostsBenefits-Floodplains.pdf](https://www.floods.org/ace-files/documentlibrary/committees/78_CostsBenefits-Floodplains.pdf).
- 34 The Trust for Public Land, *Conservation Almanac*, 2018, accessed May 25, 2018, [www.conservationmanac.org](http://www.conservationmanac.org).
- 35 The Trust for Public Land's methodology only includes areas directly acquired using public funding and does not include methods of incorporating land into a system such as land exchanges, donations, or matching tracts.

- 36 C. G. Homer et al., "Completion of the 2011 National Land Cover Database for the Conterminous United States—Representing a Decade of Land Cover Change Information," *Photogrammetric Engineering and Remote Sensing* 81, no. 5 (2015): 345-354.
- 37 For more information, see the "Fiscal Health" section on page 39.
- 38 North East State Foresters Association and Northern Forest Center, *The Economic Importance of the Forest-Based Economies of Maine, New Hampshire, New York, and Vermont*, 2013, accessed March 26, 2018, [http://www.nefainfo.org/uploads/2/7/4/5/27453461/nefa13\\_econ\\_importance\\_summary\\_aw\\_feb05.pdf](http://www.nefainfo.org/uploads/2/7/4/5/27453461/nefa13_econ_importance_summary_aw_feb05.pdf); North East State Foresters Association and Northern Forest Center, *The Economic Importance of Vermont's Forest-Based Economy 2013, 2014*, accessed March 26, 2018, [https://www.inrslc.com/download/Nefa\\_Publications/NEFA13\\_Econ\\_Importance\\_VT\\_final\\_web\\_Jan29.pdf](https://www.inrslc.com/download/Nefa_Publications/NEFA13_Econ_Importance_VT_final_web_Jan29.pdf).
- 39 Data reported by Vermont Urban and Community Forestry and updated to reflect transactions between January and April 2018 by The Trust for Public Land. Vermont Urban and Community Forestry, "Town Forests," accessed April 26, 2018, <https://vtcommunityforestry.org/places/town-forests>; Kate Wanner, project manager, The Trust for Public Land, email message to the author, April 26, 2018; Martha West Lyman, Cecilia Danks, and Maureen McDonough, "New England's Community Forests: Comparing a Regional Model to ICCAs," *Conservation and Society* 11, no. 1 (2013): 46-59.
- 40 Community Forest Collaborative, *Community Forests: A Community Investment Strategy*, 2007, accessed March 7, 2018, [https://northernforest.org/images/resources/community-forests/Community\\_Forests\\_Report\\_1.7MB.pdf](https://northernforest.org/images/resources/community-forests/Community_Forests_Report_1.7MB.pdf).
- 41 Town of Barre, *Report of the Town Officers for Fiscal Year, 2017*, accessed April 26, 2018, <http://www.barretown.org/BarreTown%20Town%20Report%202017.pdf>.
- 42 Steve Posner and Marta Ceroni, *Potential Economic Impact of Outdoor Recreation in the Barre Town Forest, Vermont*, Gund Institute for Ecological Economics, University of Vermont. Burlington, Vermont, 2012.
- 43 The Barre Town Forest Management Plan Committee, *Community Forest Plan for the Barre Town Forest*, 2013, accessed March 7, 2018, [http://www.barretown.org/Budget\\_And\\_Plans/Town\\_Forest\\_Plan/Final\\_BarreTown-Forest\\_ManagementPlan\\_Full.pdf](http://www.barretown.org/Budget_And_Plans/Town_Forest_Plan/Final_BarreTown-Forest_ManagementPlan_Full.pdf).
- 44 U.S. Department of Agriculture, Economic Research Service, *State Fact Sheet: Vermont*, 2018, accessed March 7, 2018, <https://data.ers.usda.gov/reports.aspx?StateFIPS=50&StateName=Vermont&ID=17854>.
- 45 U.S. Department of Agriculture, National Agricultural Statistics Service, *2012 Census of Agriculture, Vermont, State and County Data*, 2014, Table 42. Woodland Crops: 2012 and 2007, accessed March 7, 2018, [https://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Volume\\_1,\\_Chapter\\_1\\_State\\_Level/Vermont/vt1.pdf](https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/vt1.pdf).
- 46 U.S. Department of Agriculture, National Agricultural Statistics Service, *United States Maple Syrup Production*, 2017, accessed March 7, 2018, [https://www.nass.usda.gov/Statistics\\_by\\_State/New\\_York/Publications/Latest\\_Releases/2017/2017\\_Maple\\_Syrup.pdf](https://www.nass.usda.gov/Statistics_by_State/New_York/Publications/Latest_Releases/2017/2017_Maple_Syrup.pdf).
- 47 U.S. Department of Agriculture, National Agricultural Statistics Service, *2012 Census of Agriculture, Vermont, State and County Data*, 2014, Table 42. Woodland Crops: 2012 and 2007, accessed March 7, 2018, [https://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Volume\\_1,\\_Chapter\\_1\\_State\\_Level/Vermont/vt1.pdf](https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/vt1.pdf).
- 48 Mamie Marcuss, Federal Reserve Bank of Boston, *Made in Vermont: Protecting the Rural Working Landscape*, 2005, accessed March 15, 2018, <https://www.bostonfed.org/-/media/Documents/cb/PDF/Vermont.pdf>.
- 49 Vermont Land Trust, *An Example of a Sale of a Farm Restricted by an Option to Purchase at Agricultural Value*, 2008.
- 50 U.S. Department of Agriculture, Economic Research Service, *State Fact Sheet: Vermont*, 2018, accessed March 7, 2018, <https://data.ers.usda.gov/reports.aspx?StateFIPS=50&StateName=Vermont&ID=17854>.
- 51 U.S. Department of Agriculture, Economic Research Service, *State Fact Sheet: Vermont*, 2018, accessed March 7, 2018, <https://data.ers.usda.gov/reports.aspx?StateFIPS=50&StateName=Vermont&ID=17854>.
- 52 Vermont Dairy Promotion Council, Vermont Agency of Commerce and Community Development and the Vermont Agency of Agriculture, Food, and Markets, *Milk Matters: The Role of Dairy in Vermont*, 2015, August 9, 2018, <https://legislature.vermont.gov/assets/Documents/2016/WorkGroups/House%20Agriculture/Dairy/W~Diane%20Bothfeld~Milk%20Matters-4-14-2015.pdf>.
- 53 J. K. O'Hara, R. L. Parsons, "The Economic Value of Organic Dairy Farms in Vermont and Minnesota," *Journal of Dairy Science* 96, no. 9 (2013): 6117-6126.

- 54 U.S. Department of Agriculture, Economic Research Service, *State Fact Sheet: Vermont*, 2018, accessed March 7, 2018, <https://data.ers.usda.gov/reports.aspx?StateFIPS=50&StateName=Vermont&ID=17854>.
- 55 Scott Sawyer, *An Analysis of Vermont's Food System: Understanding Consumer Demand*, Vermont Sustainable Jobs Fund, 2013, accessed April 26, 2018, [http://www.vtfarmtoplate.com/assets/plan\\_sections/files/3.1\\_Understanding%20Consumer%20Demand\\_MAY%202013.pdf](http://www.vtfarmtoplate.com/assets/plan_sections/files/3.1_Understanding%20Consumer%20Demand_MAY%202013.pdf).
- 56 American Farmland Trust, "Statement on Farm Bill Funding for Farmland Protection," accessed April 26, 2018, <https://www.farmland.org/press-releases/american-farmland-trust-statement-on-farm-bill-funding-for-farmland-protection>.
- 57 For example, NRCS Easements. U.S. Department of Agriculture, Natural Resources Conservation Service, "Easements," accessed May 24, 2018, <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/>.
- 58 Elise Annes, vice president of Community Relations, Vermont Land Trust, email message to the author, May 28, 2018.
- 59 Wilson Ring, "Lake Champlain Cleanup Could Exceed \$1 Billion," *Burlington Free Press*, January 17, 2017, accessed May 24, 2018, <https://www.burlingtonfreepress.com/story/news/2017/01/17/lawmakers-ponder-lake-champlain-cleanup-costs/96686544/>.
- 60 Nadine Berrini, communications director, Vermont Land Trust, email message to the author, April 26, 2018.
- 61 Lisa Chase et al., *Agricultural and Culinary Tourism Literature Review: Summary of Findings and Annotated Bibliography*, 2012, accessed March 26, 2018, [http://www.uvm.edu/~snrvtdc/agtour/publications/agritourism\\_lit\\_review.pdf](http://www.uvm.edu/~snrvtdc/agtour/publications/agritourism_lit_review.pdf).
- 62 U.S. Department of Agriculture, *2012 Census of Agriculture, Vermont, State and County Data*, 2014, Table 7. Income from Farm-Related Sources: 2012 and 2007, accessed March 7, 2018, [https://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Volume\\_1,\\_Chapter\\_1\\_State\\_Level/Vermont/vtv1.pdf](https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Vermont/vtv1.pdf).
- 63 Vermont Tourism Research Center, University of Vermont, *Vermont Tourism and Recreation Survey*, 2014, accessed February 27, 2018, [http://www.uvm.edu/tourismresearch/publications/Vermont\\_Visitor\\_Survey\\_Final\\_Report\\_7-24-14.pdf](http://www.uvm.edu/tourismresearch/publications/Vermont_Visitor_Survey_Final_Report_7-24-14.pdf).
- 64 Vermont Agency of Agriculture, Food, and Markets, "Vermont Fairs and Field Days," accessed March 7, 2018, [http://agriculture.vermont.gov/producer\\_partner\\_resources/fairsfielddays](http://agriculture.vermont.gov/producer_partner_resources/fairsfielddays); Vermont Agency of Agriculture, Food, and Markets, "Farmers' Markets," accessed March 7, 2018, [http://agriculture.vermont.gov/producer\\_partner\\_resources/market\\_access\\_development/farmersmarket](http://agriculture.vermont.gov/producer_partner_resources/market_access_development/farmersmarket).
- 65 Vermont Department of Tourism and Marketing, *2015 Benchmark Report: Tourism in Vermont*, 2017, accessed February 27, 2018, <http://accd.vermont.gov/sites/accdnew/files/documents/VDTM-Research-2015BenchmarkStudyFullReport.pdf>.
- 66 Vermont Tourism Research Center, University of Vermont, *Vermont Tourism and Recreation Survey*, accessed February 27, 2018, [http://www.uvm.edu/tourismresearch/publications/Vermont\\_Visitor\\_Survey\\_Final\\_Report\\_7-24-14.pdf](http://www.uvm.edu/tourismresearch/publications/Vermont_Visitor_Survey_Final_Report_7-24-14.pdf).
- 67 Associated Press, "Vermont State Parks Annual Visitation Passes 1 Million," *Bennington Banner*, October 28, 2015, accessed February 27, 2018, <http://www.benningtonbanner.com/stories/vermont-state-parks-annual-visitation-passes-1-million,296289>.
- 68 Vermont Department of Tourism and Marketing, *2015 Benchmark Report: Tourism in Vermont*, 2017, accessed February 27, 2018, <http://accd.vermont.gov/sites/accdnew/files/documents/VDTM-Research-2015BenchmarkStudyFullReport.pdf>.
- 69 Vermont Agency of Administration, Department of Taxes, "Participating Municipalities," accessed February 27, 2018, <http://tax.vermont.gov/business-and-corp/sales-and-use-tax/local-option-tax/municipalities>.
- 70 Vermont Agency of Administration, Department of Taxes, "2017 Meals and Rooms Statistical Reports," accessed February 27, 2018, <http://tax.vermont.gov/research-and-reports/statistical-data/meals-and-rooms/2017-meals-and-rooms-tax-statistical-reports>.
- 71 U.S. Census, *Housing Characteristics 2010, 2011*, accessed March 30, 2018, <https://www.census.gov/prod/cen2010/briefs/c2010br-07.pdf>.
- 72 Vermont Department of Tourism and Marketing, *Benchmark Study of the Impact of Visitor Spending on the Vermont Economy: 2013, 2015*, accessed March 30, 2018, <https://www.uvm.edu/~snrvtdc/publications/vermont-tourism-benchmark-study-2013.pdf>.

- 73 Vermont Tourism Research Center, University of Vermont, *Vermont Tourism and Recreation Survey*, 2014, accessed February 27, 2018, [http://www.uvm.edu/tourismresearch/publications/Vermont\\_Visitor\\_Survey\\_Final\\_Report\\_7-24-14.pdf](http://www.uvm.edu/tourismresearch/publications/Vermont_Visitor_Survey_Final_Report_7-24-14.pdf).
- 74 This includes the spending of residents. Outdoor Industry Association, *Vermont Outdoor Recreation Economy Report*, 2017, accessed March 1, 2018, <https://outdoorindustry.org/resource/vermont-outdoor-recreation-economy-report/>.
- 75 Camoin Associates, *Economic and Fiscal Impact Analysis of the Vermont Trails and Greenway Council Member Organizations*, 2016, accessed March 9, 2018, [https://www.uvm.edu/~snrvtdc/trails/Final\\_Report%20Impact%20Analysis%20VT\\_Trails\\_and\\_Greenways.pdf](https://www.uvm.edu/~snrvtdc/trails/Final_Report%20Impact%20Analysis%20VT_Trails_and_Greenways.pdf).
- 76 Ski Vermont, "About Ski Vermont," accessed March 6, 2018, <https://skivermont.com/about/>.
- 77 Vermont State Auditor, *Report to the Vermont Legislature and the Agency of Natural Resources: State Land Leases Boost Ski Industry, but Are Dated and Inconsistent*, 2015, accessed March 27, 2018, <http://auditor.vermont.gov/sites/auditor/files/documents/Final%20SAO%20Report%20on%20Ski%20Resort%20Leases.pdf>.
- 78 University of Vermont, *The Vermont Ski Industry*, 1999, accessed March 29, 2018, <https://www.uvm.edu/~snrvtdc/publications/vt%20ski%20industry.pdf>.
- 79 Snowsports Industries America, *SIA Snow Sports Industry Insights Study*, 2017, accessed April 6, 2018, <https://441s9e2c9d4j48sl6j3f9vn4-wpengine.netdna-ssl.com/wp-content/uploads/2017-market-intelligence-report-v4-1.pdf>.
- 80 SE Group, Memorandum: Catamount Trail 2017 Backcountry Ski Use Economic Impact Analysis, provided to TPL by Angus McCusker, member of the Catamount Trail Board of Directors on April 5, 2018.
- 81 Mad River Valley Active, *Mad River Valley Active Transportation Plan*, 2016, accessed April 25, 2018, [https://mrvmoves.files.wordpress.com/2016/12/mrv-active-transportation-plan-doc\\_final\\_opt.pdf](https://mrvmoves.files.wordpress.com/2016/12/mrv-active-transportation-plan-doc_final_opt.pdf).
- 82 Leslie Smith, motor vehicle unit supervisor, Vermont Department of Motor Vehicles, email message to author, March 12, 2018.
- 83 Vermont Association of Snow Travelers, *Testimony for the Subcommittee on Public Lands and Environmental Regulation*, 2013, accessed March 9, 2018, <http://docs.house.gov/meetings/II/II10/20130627/101061/HHRG-113-II10-Bio-NelsonA-20130627.pdf>.
- 84 A portion of these 512,000 residents and nonresidents 16 years old and older participated in more than one wildlife-related activity.
- U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Vermont*, accessed March 2, 2018, <https://www.census.gov/prod/2013pubs/fhw11-vt.pdf>.
- 85 U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Vermont*, accessed March 2, 2018, <https://www.census.gov/prod/2013pubs/fhw11-vt.pdf>.
- 86 Tom Allen, Rob Southwick, and Doug Howlett, *Hunting in America: An Economic Force for Conservation*, Fernandina Beach, FL: Southwick Associates, 2013, accessed March 27, 2018, [http://www.nssf.org/PDF/research/HuntingInAmerica\\_EconomicForceForConservation.pdf](http://www.nssf.org/PDF/research/HuntingInAmerica_EconomicForceForConservation.pdf).
- 87 Vermont Agency of Natural Resources, Department of Environmental Conservation, "Welcome to the Watershed Management Division," accessed March 2, 2018, <http://dec.vermont.gov/watershed>.
- 88 Lake Champlain Basin Program, "Fish and Wildlife," accessed March 2, 2018, <http://www.lcbp.org/water-environment/ecosystem-health/fish-and-wildlife/>.
- 89 U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Vermont*, accessed March 2, 2018, <https://www.census.gov/prod/2013pubs/fhw11-vt.pdf>.
- 90 U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Vermont*, accessed March 2, 2018, <https://www.census.gov/prod/2013pubs/fhw11-vt.pdf>.
- 91 Richard Florida, *Cities and the Creative Class* (New York: Routledge, 2005).
- 92 Alexander E. M. Hess and Thomas C. Frohlich, "The 10 States with the Best Quality of Life," *USA Today*, October 11, 2014, accessed March 9, 2018, <https://www.usatoday.com/story/money/business/2014/10/11/24-7-wall-st-states-quality-of-life/16960973/>.

- 93 U.S. News, "Best States," accessed March 9, 2018, <https://www.usnews.com/news/best-states/vermont>.
- 94 Vermont Department of Economic Development, *Vermont 2020 Comprehensive Economic Development Strategy*, 2015, accessed March 9, 2018, <http://accd.vermont.gov/sites/accdnew/files/documents/DED/CEDS/CEDSExecutiveSummary.pdf>.
- 95 Vermont Outdoor Guide Association, "Vermont's Recreation and Adventure Travel Directory," accessed March 15, 2018, <http://www.voga.org/>.
- 96 Win Smith, Testimony in Support of Full Statutory Funding (\$20.4M) for Vermont Housing and Conservation Board, Delivered before the Senate Committee on Economic Development, Housing and General Affairs and House Committee on General, Housing, and Military Affairs, February 9, 2018.
- 97 American Farmland Trust, Farmland Information Center, *Cost of Community Services Studies*, Washington, DC: American Farmland Trust, 2016, accessed March 14, 2018, [http://www.farmlandinfo.org/sites/default/files/Cost\\_of\\_Community\\_Services\\_Studies\\_AFT\\_FIC\\_201609.pdf](http://www.farmlandinfo.org/sites/default/files/Cost_of_Community_Services_Studies_AFT_FIC_201609.pdf).
- 98 Deb Brighton, *Land Conservation and Property Taxes in Vermont*, Vermont Land Trust, 2009, accessed April 27, 2018, [http://www.farmlandinfo.org/sites/default/files/Land\\_Conservation\\_and\\_Property\\_Taxes\\_in\\_Vermont\\_1.pdf](http://www.farmlandinfo.org/sites/default/files/Land_Conservation_and_Property_Taxes_in_Vermont_1.pdf).
- 99 Ming Kuo, "How Might Contact with Nature Promote Human Health? Promising Mechanisms and a Possible Central Pathway," *Frontiers in Psychology* 6 (2015): 1-8.
- 100 A. T. Kaczynski and K. A. Henderson, "Parks and Recreation Settings and Active Living: A Review of Associations with Physical Activity Function and Intensity," *Journal of Physical Activity and Health* 5, no. 4 (2008): 619-632; Chenoweth and Associates, *The Economic Costs of Overweight, Obesity, and Physical Inactivity Among California Adults—2006*, California Center for Public Health Advocacy, 2009, accessed March 27, 2018, [https://saferoutescalifornia.files.wordpress.com/2012/06/costofobesity\\_brief.pdf](https://saferoutescalifornia.files.wordpress.com/2012/06/costofobesity_brief.pdf).
- 101 Janette Sadik-Khan and Seth Solomonow, "Improving Public Health by Making Cities Friendly to Walking and Biking," *Health Care Policy and Law* 177, no. 5 (2017): 613-614.
- 102 A. T. Kaczynski and K. A. Henderson, "Parks and Recreation Settings and Active Living: A Review of Associations with Physical Activity Function and Intensity," *Journal of Physical Activity and Health* 5, no. 4 (2008): 619-632.
- 103 A. H. Mokdad et al., "Actual Causes of Death in the United States, 2000," *Journal of the American Medical Association* 291 (2004): 1238-1245; Centers for Disease Control and Prevention, *The Burden of Chronic Diseases and Their Risk Factors: National and State Perspectives*, 2002, National Center for Chronic Disease Prevention and Health Promotion, 2003, accessed May 21, 2018, <https://stacks.cdc.gov/view/cdc/11317>.
- 104 Lincoln R. Larson, Viniece Jennings, and Scott A. Cloutier, "Public Parks and Wellbeing in Urban Areas of the United States," *PLoS One* 11, no. 4 (2016): e0153211.
- 105 Lincoln R. Larson, Viniece Jennings, and Scott A. Cloutier, "Public Parks and Wellbeing in Urban Areas of the United States," *PLoS One* 11, no. 4 (2016): e0153211; Ian Alcock et al., "Longitudinal Effects on Mental Health of Moving to Greener and Less Green Urban Areas," *Environmental Science and Technology* 48, no. 2 (2014): 1247-1255.
- 106 M. R. Marselle, K. N. Irvine, and S. L. Warber, "Examining Group Walks in Nature and Multiple Aspects of Well-Being: A Large-Scale Study," *Ecopsychology* 6, no. 3 (2014): 134-147; Claude Bouchard, Steven N. Blair, and William Haskell, *Physical Activity and Health* (Human Kinetics, 2012); Ronald Sturm and Deborah Cohen, "Proximity to Urban Parks and Mental Health," *Journal of Mental Health Policy and Economics* 17, no. 1 (2014): 19-24.
- 107 United Health Foundation, *America's Health Rankings*, 2017, accessed April 5, 2018, [https://assets.americashealthrankings.org/app/uploads/ahrannual17\\_complete-121817.pdf](https://assets.americashealthrankings.org/app/uploads/ahrannual17_complete-121817.pdf).
- 108 The Henry J. Kaiser Family Foundation, "Overweight and Obesity Rates for Adults by Gender," accessed January 26, 2018, <http://kff.org/other/state-indicator/adult-overweightobesity-rate-by-gender/>.
- 109 Sharon Begley, "As America's Waistline Expands, Costs Soar," *Reuters*, April 30, 2012, accessed January 4, 2018, <http://www.reuters.com/article/2012/04/30/us-obesity-idUSBRE83T0C820120430>.
- 110 Centers for Disease Control and Prevention, "Adult Obesity," accessed January 26, 2018, <http://www.cdc.gov/vitalsigns/adultobesity/>.
- 111 Tina Zuk, *Senate Health Welfare Testimony*, American Heart Association, 2016, accessed January 26, 2018, <https://legislature.vermont.gov/assets/Documents/2016/WorkGroups/Senate%20Health%20and%20Welfare/Obesity/W-Tina%20Zuk-Obesity%20Testimony~2-19-2016.pdf>.

- 112 Vermont Department of Public Health, "Lyme Disease," accessed May 24, 2018, <http://www.healthvermont.gov/disease-control/tickborne-diseases/lyme-disease>.
- 113 Brian F. Allan, Felicia Keesing, and Richard S. Ostfeld, "Effect of Forest Fragmentation on Lyme Disease Risk," *Conservation Biology*, 17, no. 1 (2003): 267-272.
- 114 Scott R Granter, Aaron Bernstein, and Richard S. Ostfeld, "Of Mice and Men: Lyme Disease and Biodiversity," *Perspectives in Biology and Medicine* 57, no. 2 (2014): 198-207; Brian F. Allan, Felicia Keesing, and Richard S. Ostfeld, "Effect of Forest Fragmentation on Lyme Disease Risk" *Conservation Biology*, 17, no. 1 (2003): 267-272; Cary Institute of Ecosystem Studies, "Biodiversity, Community Ecology, and the Dilution Effect: Habitat Fragmentation," accessed May 24, 2018, <http://www.caryinstitute.org/science-program/research-projects/biodiversity-community-ecology-and-dilution-effect/habitat>.
- 115 Vermont Housing & Conservation Board, "Local Conservation," accessed March 14, 2018, <http://www.vhcb.org/local-conservation.html>.
- 116 The Trust for Public Land, Conservation Almanac, [www.conservationalmanac.org](http://www.conservationalmanac.org).
- 117 Robert J. Johnston and Randall S. Rosenberger, "Methods, Trends and Controversies in Contemporary Benefit Transfer," *Journal of Economic Surveys* 24, no. 3 (2010): 479-510.
- 118 If more detailed data were available, it can be assumed that the analysis would result in a more specific estimate.
- 119 Kent Kovacs, Stephen Polasky, Erik Nelson, Bonnie L. Keller, Derric Pennington, Andrew J. Plantinga, Steven J. Taff, "Evaluating the Return in Ecosystem Services from Investment in Public Land Acquisitions," *PLoS ONE* 8 no. 6 (2013).
- 120 Randall S. Rosenberger and John B. Loomis, "Benefit Transfer" in *A Primer on Nonmarket Valuation*, ed. Patricia Champ, Kevin Boyle, and Thomas Brown (Norwell, MA: Kluwer Academic Publishers, 2003), 445-482.
- 121 David J. Nowak and Eric J. Greenfield, *Urban and Community Forests of New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*, Newtown Square, PA: U.S. Forest Service, Northern Research Station, General Technical Report NRS-38, 2008.
- 122 David J. Nowak et al., "Tree and Forest Effects on Air Quality and Human Health in the United States," *Environmental Pollution* 193 (2014): 119-129.
- 123 U.S. Department of Agriculture, Forestry Service, *i-Tree Vue User's Manual*, v. 5.0, accessed March 15, 2018, [https://www.itreetools.org/resources/manuals/Vue\\_Manual\\_v5.pdf](https://www.itreetools.org/resources/manuals/Vue_Manual_v5.pdf).
- 124 James E. Smith et al., *Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States*, U.S. Department of Agriculture, Northeastern Research Station, General Technical Report NE-343.
- 125 The Maple-Beech-Birch, and White Pine are the most prevalent forest type groups in Vermont. U.S. Department of Agriculture, Forestry Service, *Forests of Vermont*, 2016, accessed March 15, 2018, [http://www.srs.fs.usda.gov/pubs/ru/ru\\_srs069.pdf](http://www.srs.fs.usda.gov/pubs/ru/ru_srs069.pdf).
- 126 U.S. Environmental Protection Agency, "The Social Cost of Carbon," accessed March 30, 2018, [https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon\\_.html](https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html).
- 127 Michael G. Ryan et al., "A Synthesis of the Science on Forests and Carbon for U.S. Forests," *Issues in Ecology* 13 (2010).
- 128 James E. Smith et al., *Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States*.
- 129 James E. Smith et al., *Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States*.
- 130 Vermont Agency of Agriculture, "Conservation Reserve Enhancement Program (CREP)," accessed March 15, 2018, <http://agriculture.vermont.gov/water-quality/farmer-assistance/crep>.
- 131 The Trust for Public Land determined CERP payment values through correspondence with Vermont's CREP program coordinator. Ben Gabos, CREP coordinator, Vermont Agency of Agriculture, email message to author, February 22, 2018.
- 132 Keri B. Watson et al., "Quantifying Flood Mitigation Services: The Economic Value of Otter Creek Wetlands and Floodplains to Middlebury, VT," *Ecological Economics* 130 (2016): 16-24.
- 133 Vermont Agency of Natural Resources, *Vermont Wetland Rules*, 2017, accessed April 6, 2018, [http://dec.vermont.gov/sites/dec/files/documents/wsmc\\_Vermont\\_Wetland\\_Rules\\_2017.pdf](http://dec.vermont.gov/sites/dec/files/documents/wsmc_Vermont_Wetland_Rules_2017.pdf).

- 134 Vermont Agency of Natural Resources, "Wetland Functions and Values: Wildlife Habitat," accessed April 5, 2018, <http://dec.vermont.gov/watershed/wetlands/functions/wildlife>.
- 135 Richard T. Woodward and Yong-Suhk Wui, "The Economic Value of Wetland Services: A Meta-Analysis," *Ecological Economics* 37 (2001): 257-270.
- 136 Stephen Earsom et al., *Carbon Sequestration Pilot Program: Estimated Land Available for Carbon Sequestration in the National Highway System*, U.S. Department of Transportation, Federal Highway Administration, 2010, accessed March 29, 2018, [https://www.researchgate.net/publication/273138611\\_Carbon\\_Sequestration\\_Pilot\\_Program\\_Estimated\\_Land\\_Available\\_for\\_Carbon\\_Sequestration\\_in\\_the\\_National\\_Highway\\_System](https://www.researchgate.net/publication/273138611_Carbon_Sequestration_Pilot_Program_Estimated_Land_Available_for_Carbon_Sequestration_in_the_National_Highway_System).
- 137 U.S. Department of Agriculture, "Rental Rates for GRP," accessed March 15, 2018, [https://www.fsa.usda.gov/Internet/FSA\\_File/4grprentres.pdf](https://www.fsa.usda.gov/Internet/FSA_File/4grprentres.pdf).
- 138 U.S. Department of Agriculture, National Agricultural Statistics Service, *Northeastern Region Cash Rents Report*, 2017, accessed March 15, 2018, [https://www.nass.usda.gov/Statistics\\_by\\_State/New\\_York/Publications/Latest\\_Releases/2017/2017%20NER%20County%20Cash%20Rents%20Report.pdf](https://www.nass.usda.gov/Statistics_by_State/New_York/Publications/Latest_Releases/2017/2017%20NER%20County%20Cash%20Rents%20Report.pdf).
- 139 U.S. Department of Agriculture, Economic Research Service, *Farm Income and Wealth Statistics: Cash Receipts by State, Commodity Ranking and Share of U.S. Total*, accessed March 15, 2018, [https://data.ers.usda.gov/reports.aspx?ID=17843#P307b4fc961cf4064a7b04e0aa6c3fee\\_2\\_18iT0R0x45](https://data.ers.usda.gov/reports.aspx?ID=17843#P307b4fc961cf4064a7b04e0aa6c3fee_2_18iT0R0x45); John E. Losey and Mace Vaughan, "The Economic value of Ecological Services Provided by Insects," *BioScience* 56, no. 4 (2006): 311-323.
- 140 U.S. Department of Agriculture, "Rental Rates for GRP," accessed March 15, 2018, [https://www.fsa.usda.gov/Internet/FSA\\_File/4grprentres.pdf](https://www.fsa.usda.gov/Internet/FSA_File/4grprentres.pdf).
- 141 U.S. Department of Agriculture, National Agricultural Statistics Service, *Northeastern Region Cash Rents Report*, 2017, accessed March 15, 2018, [https://www.nass.usda.gov/Statistics\\_by\\_State/New\\_York/Publications/Latest\\_Releases/2017/2017%20NER%20County%20Cash%20Rents%20Report.pdf](https://www.nass.usda.gov/Statistics_by_State/New_York/Publications/Latest_Releases/2017/2017%20NER%20County%20Cash%20Rents%20Report.pdf).
- 142 David J. Nowak and Eric J. Greenfield, *Urban and Community Forests of New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*, Newtown Square, PA: U.S. Forest Service, Northern Research Station, General Technical Report NRS-38, 2008.
- 143 Molly Ingraham and Shonda Gilliland Foster, "The Value of Ecosystem Services Provided by the U.S. National Wildlife Refuge System in the Contiguous U.S.," *Ecological Economics* 67 (2008): 608-618.





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BACK: JERRY AND MARCY MONKMAN.

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