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# MASTER'S PROJECT: VERMONT TOWN FOREST RECREATION PLANNING AND COMMUNITY ASSISTANCE PROGRAM: THE FUTURE OF FOREST-BASED OUTDOOR RECREATION

Taylor M. Luneau

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MASTER'S PROJECT: VERMONT TOWN FOREST RECREATION PLANNING  
AND COMMUNITY ASSISTANCE PROGRAM: THE FUTURE OF FOREST-BASED  
OUTDOOR RECREATION

A Master's Project Presented

by

Taylor Luneau

to

The Faculty of the Graduate College

of

The University of Vermont

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for the Degree of Master of Science  
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## ABSTRACT

The Vermont Town Forest Recreation Planning Community Assistance Program (VTFRP) was a comprehensive community planning process held in ten diverse towns across Vermont. Led by the Urban and Community Forestry Program and the SE Group, the VTFRP helped towns develop a vision for the future management of their forests through open house workshops, site visits, steering committee meetings, and community surveys. The process provided towns with a forest recreation planning toolkit and an individualized action-based forest stewardship and recreation plan. By analyzing data from the community surveys and open house activities across all ten towns, my project considered the recreation trends and the statewide implications of the VTFRP.

Forest management practices on public and private land were analyzed to demonstrate the appropriate balance between active forest management and forest-based recreation. The role of recreation in sustaining rural economies, conserving forestland, and guiding future forest management in Vermont was evaluated. The outdoor recreation economy has outpaced the traditional forest products industry and offers new strategies for conservation of the working landscape in Vermont. This project highlights strategies in forest management with recreation to inspire future conservation and recreation initiatives across Vermont towns.

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b> .....	<b>iv</b>
<b>LIST OF TABLES</b> .....	<b>viii</b>
<b>LIST OF FIGURES</b> .....	<b>ix</b>
<b>INTRODUCTION</b> .....	<b>1</b>
<b>1.1 A Brief History of Town Forests in Vermont</b> .....	<b>5</b>
1.1.1. Trends in Outdoor Recreation and Demographics in the State of Vermont.....	8
<b>1.2. The Town Forest Recreation Planning Community Assistance Program</b> .....	<b>11</b>
1.2.1. Public Engagement and Planning Process.....	14
<b>1.3. Statewide Findings from the Town Forest Recreation Planning Project</b> .....	<b>15</b>
1.3.1. Research Methods.....	15
1.3.2. Survey Data .....	17
1.3.3. Open House Visioning Workshop Data .....	20
<b>1.4. Results of Statewide Findings From the Town Forest Recreation Planning Project</b> .....	<b>22</b>
1.4.1. Survey Results Historical Use Analysis .....	22
1.4.2. Forest Management Focus.....	24
1.4.3. Outdoor Recreation Activities Preference Analysis.....	26
1.4.4. Summary of Results.....	28
1.4.5. Discussion of Statewide Findings from the Town Forest Recreation Planning Project.....	29
1.4.6. Considerations for Data Error.....	31
<b>1.5. Economic Importance of Tourism and Outdoor Recreation in Vermont</b> .....	<b>33</b>
1.5.1 Mountain Biking in Vermont Towns.....	35
1.5.2. Backcountry Skiing in the Green Mountain National Forest .....	35
1.5.3. Case Study: Barre Town Forest.....	36
<b>1.6. The Effect of Conserved Land on Local Property Values</b> .....	<b>39</b>
1.6.1. Case Study: Asctuney Mountain and the West Windsor Town Forest .....	42
<b>1.7. Parcelization and Forest Fragmentation Trends in Vermont</b> .....	<b>44</b>
1.7.1. The Causes and Impacts of Forest Parcelization and Fragmentation in Vermont.....	47
1.7.2. Case Study: Saxon Hill Town Forest and Indian Brook Town Conservation Area .....	49
<b>1.8. The Future of the Working Landscape in Vermont</b> .....	<b>51</b>
1.8.1. Case Study: Hinesburg Town Forest.....	54
1.8.2. The Triad Model: Zoning of Forest Use in the Hinesburg Town Forest.....	57
1.8.3. Mountain biking and Trail Inventories in the Hinesburg Town Forest.....	59
1.8.4. A Note on Vernal Pools and Wetlands.....	61
<b>1.9. Forest Management with Recreation: Ensuring the Longevity of Vermont’s Working Landscape Through Providing Multiple Forest Products</b> .....	<b>62</b>

1.9.1. Moving Forward & Expanding the TFRP Into Management Practice .....	65
1.9.2. Ecological Impacts of Mountain Biking in Town Forests.....	67
1.9.3. Ecological Recreation Forestry: A Model for Vermont Town Forests .....	69
1.9.4. Classical Ecological Forestry .....	71
1.9.5. Structural Retention at Harvest: Maintaining Biological Legacies .....	72
1.9.6. Stand Manipulations Using Natural Disturbance Style Forestry.....	73
1.9.7. Appropriate Rotations and Return Intervals .....	74
1.9.8. Landscape Level Considerations: The Fourth Leg of the Stool .....	74
1.9.9. Fifth Spoke Forestry: Incorporating Recreation in Ecological Forestry .....	74
1.9.10. Case Study: Cady Hill Town Forest .....	76
<b>1.10. Conclusion .....</b>	<b>79</b>
<b>REFERENCES .....</b>	<b>85</b>
<b>APPENDIX.....</b>	<b>93</b>

LIST OF TABLES

Table 1: Estimated income from timber sales in five major forest stands of the Hinesburg  
Town Forest.....56

Table 2: The Triad Model of forest management as applied in the Hinesburg Town  
Forest. ....58



## LIST OF FIGURES

Figure 1: Town Forest Recreation Planning Flow Chart.....	15
Figure 2: Survey results from spectrum of need analyses on recreation type and forest management focus .....	20
Figure 3: Open House visioning board results from the Town of Hinesburg .....	21
Figure 4: Average historical visitation of Vermont town forests by survey respondents .....	22
Figure 5: Average reasons expressed by survey respondents across all towns for not visiting their town forest.....	22
Figure 6: Average amount of interaction Town Forest Visioning Survey respondents expressed with their town forests .....	23
Figure 7: Average Town Forest Visioning Survey Forest Management Focus preference .....	24
Figure 8: Depicts the average forest management focus preferred across all ten town Open House Visioning Workshops .....	25
Figure 9: Displays the variation of preference among Open House Visioning Workshop participants within each outdoor recreation activity in ten town forests across Vermont .....	26
Figure 10: Displays the variation of preference among Open House Visioning Workshop participants and Town Forest Visioning Survey responses within each outdoor recreation activity in ten town forests across Vermont .....	27
Figure 11: Vermont is renowned for the colorful foliage that appears each Fall season. .	33
Figure 12: Aerial photo of Vermont landscape taken in June of 2017.....	46

Figure 13: Multi-Use Bridge located in the Hinesburg Town Forest.....	59
Figure 14: The “Working Landscape” of the Northeast Kingdom of Vermont .....	62
Figure 15: Forest composition at Cady Hill Town Forest, September 2018.....	77
Figure 16: Multiple forest products. Northeast Kingdom, VT .....	94
Figure 17: Diagram exemplifying the construction of skid roads that cross recreation trails at a 90-degree angle. Cady Hill Town Forest, VT.....	96
Figure 18: A mountain biker navigates a berm in Cady Hill Town Forest, VT .....	97
Figure 19: A bridge crossing in the West Windsor Town Forest, VT.....	98
Figure 20: Merging point for a skid and mountain bike trail at Moose Haven, Kingdom Trails. East Haven, VT .....	99
Figure 21: Diagram demonstrating the aggregation of skid roads in order to cross a recreation trail only once and at a 90-degree angle before returning to the Log landing..	99
Figure 22: A snapped tree or “widow-maker” hangs over a multi-use trail in Morrisville, VT.....	100
Figure 23: Forest composition following a high intensity wind storm at Cady Hill Town Forest, VT .....	101
Figure 24: The forest-based economy .....	103



## INTRODUCTION

Outdoor recreation is a powerful economic sector in Vermont and contributes to the rural character of the state. Accounting for an estimated 34,000 jobs and \$2.5 billion in annual consumer spending, outdoor recreation in Vermont is a critical component of the state's economy and identity (VOREC 2017). Unlike many Western states which contain large swaths of Federal public land where outdoor recreation opportunities prevail, Vermont's landscape is largely one of private allotments. This raises challenges for the development of outdoor recreation opportunities and infrastructure in the Green Mountain State. With a growing demand for outdoor recreation opportunities in Vermont, as well as several governmental programs aiming to leverage recreation assets to grow the state's economy and appeal, land managers have turned their attention to Vermont's modest amount of public lands. Town forests are unique forms of public land owned and managed by municipalities throughout the state. Currently, 168 municipalities manage town forests comprising some 67,000 acres of Vermont's

landmass (Vermont Urban & Community Forestry Program). The Town Forest Recreation Planning and Community Assistance Program (TFRP), funded by the U.S. Forest Service, was a community based, collaborative planning process created to assist ten Vermont towns with recreation planning on their municipal forests. As an Intern with the Snow Engineering Group (SE Group), a community and forest planning firm, I was enlisted to aid the technical team and inter-governmental working group with the completion of this statewide planning process.

The TFRP utilized a variety of visioning activities to engage community members and provide individualized recreation plans for each town forest. While the TFRP focused on individualized needs of the ten towns at a site-specific level, this research focused on the statewide trends based on the aggregation of the collected data. Through assessing data collected in the Town Visioning Survey and the Open Houses Visioning Workshops, the TFRP data were utilized to understand the historical interaction of Vermont communities with their town forests and the overall interest of particular outdoor recreation activities in town forests across the state. Community preference of activities such as mountain biking, hiking, backcountry skiing and snowmobiling were assessed to identify areas of greatest demand. Conclusions from these assessments were utilized to inform land management strategies that met the outlined forest management focus areas preferred by communities and offer strategies in the development of preferred activity infrastructure.

Importantly, each of the outdoor activities studied in this research contribute greatly to the economic well-being of Vermont, as well as the states' character, its populations health and wellness, and the preservation of the states' rural landscape. Seventy five percent of Vermont's landmass is forested which inherently means that a

large majority of Vermont's outdoor recreation occurs in the forested landscape (Vermont Department of Forests 2015). However, several threats exist to Vermont forests. Of greatest concern are parcelization and forest fragmentation, which are largely caused by escalating property values and increased tax burdens on land owners. Several Vermont communities have responded to these forestland threats by leveraging their outdoor recreation assets to inspire long lasting conservation initiatives. Through a series of case studies, this work documents the impacts of forest parcelization and fragmentation and highlights the importance of forest-based recreation and other forest products in mitigating the loss of Vermont's aesthetic rural working landscape.

In order to maintain the rural character of Vermont and to meet future conservation goals of the state, it is necessary to promote policy initiatives that support forest-based economies. Several public and private organizations have supported a joint strategy which capitalizes on forest-based recreation and the consumptive use of woodlands, to ensure that forests remain economically self-sustainable and thusly, avoid threats of urbanization. Striking the appropriate balance between consumptive and passive uses of Vermont forests requires thoughtful management strategies by land managers. Particular guidance on how to accomplish this in town forests is currently lacking. This research supports a balanced approach to active forest management which harnesses principles from classical ecological forestry and combines them with thoughtful outdoor recreation planning. This style of forest management is herein referred to as Fifth Spoke Forestry, as it develops on ecological forestry theory and meets the growing demand of forest-based recreation activities, such as mountain biking. Forms of this style of forest management exist in Vermont, however, they have never been highlighted in this manner.

Through assessing land use history in Vermont town forests, collaborating with foresters and recreation professions, and investigating the statewide results of the TFRP, this research offers Best Management Practices (BMPs) for combining active forest management with outdoor recreation. The BMPs aim to provide Vermont towns with effective strategies on forest-based recreation and ensure that environmental degradation and user impacts are mitigated. Land managers have an opportunity to provide financial revenue from timber sales to towns and to enhance the recreational experience of visitors by focusing on the aesthetics of their harvest while prioritizing current and future trail networks. Through such management schemes, parcelization trends can be reversed by the aggregation of conserved recreation lands. Mountain biking in particular requires large swaths of land to sustain trail networks. Focusing conservation initiatives on the development and protection of trail networks of this sort, stands to de-fragment the landscape by weaving together protected parcels of open space. Through insightful and adaptive management, forest integrity can be preserved through outdoor recreation.

## 1.1 A Brief History of Town Forests in Vermont

Vermont town forests are unique forms of public land to New England, even though community-based forestry projects exist in many forms throughout the country. Currently, 168 Vermont municipalities manage town forests, which comprise some 67,000 acres of land (Vermont Urban & Community Forestry Program). With only 20.5% of Vermont's land being publicly owned, town forests comprise a significant public land holding where management decisions can be made by the public, for the public (Vermont Department of Forests 2017). Town forests were established as means to protect local water supplies, conserve wildlife habitat and open space, provide for public recreation, and deliver the community with economic returns from the consumptive use of forest products (The Vermont Town Forest Stewardship Guide 2015). In the early 1900's, much of New England defined itself by the forest industry. That still holds true today, although some may argue that forest-based outdoor recreation is currently of the greatest interest and growth.

Vermont has a long history with town-owned forests. Established in 1915, the Municipal Forest Act was passed by the Vermont legislature with the purpose of allowing towns to “grow wood and timber and designate them as school endowment forests” (McCullough 2015). Several restrictions accompanied this new municipal power, namely that the parcels must be forty acres or greater in size and the state forester must determine whether the parcel was suitable for purchase. After undergoing amendments in 1917, 45', 51', and 73', the Vermont legislature finally defined a municipal forest as:

“... a tract of land primarily devoted to producing wood products, maintaining wildlife habitat, protecting water supplies, providing forest recreation and conservation education. A municipal forest shall not be construed to include landscaped grounds and plantings around residential, industrial, institutional, municipal buildings or municipal areas devoted to off-street recreation” (10 V.S.A 2651).

Among the other important clauses resulting from the Municipal Forest Act, amendments included state funding for municipal lands purchased under the approval of the Commissioner of Forest, Parks, and Recreation, as well as public notice rules for future municipal land acquisitions and reforestation funding (McCullough 2015).

Early New England communities were characterized by their rugged individualism with a particular importance placed on the local culture and governance. Enabling laws in Vermont and other New England states, namely Massachusetts, established the idea of municipal land ownership with the directive of growing and cultivating saleable timber for the benefit of local communities (The Vermont Town Forest Stewardship Guide 2015). The Massachusetts Forestry Association, an early leader in New England community forest campaign, expressed the importance of local governance:

“...a community forest should grow out of local interest and meet local needs. We are opposed to any form of Federal or State control of such areas. We believe, however, that close cooperation should be maintained with state agencies in drafting and carrying out plans of management” (McCullough 1998).

Today, town forests offer a wide array of public benefits ranging from outdoor recreation to wood products and a wide array of ecosystem services. While the purpose of these community forests extends far beyond the provision of timber, access to forest products for the local community are still a part of their central goal. The multiplicity of town forest usage, including their historic use for timber, are central to their lasting conservation. User groups from a wide range of backgrounds and interests connect to these lands and generate a broad base of support for public ownership of these forests, supporting their protection well into the future.



The diversity of value that town forests provide the public was recognized early on in the town forest campaign. Specifically, the conservation of these municipal lands as forests, which provide a range of ecosystem services to the public, namely soil retention, carbon sequestration and water purification (Roman and Erickson 2015). As was recognized with the Green and White Mountain National Forests in the early 1900's, conservation of these federal preserves was critical to mitigating flood damage (Judd 2014). While the gradual topography and wide rivers of Maine were less susceptible to wide scale flooding and erosion, the steep terrain in Vermont and New Hampshire were more susceptible to flood events. Ecosystem services provided by Vermont and New Hampshire forests were recognized early on in their history and played a role in the conservation of town forest lands. This balance between ecosystem services and social uses of the forests persists today and pervades the issue of forest planning in New England.

With varied interest in these common lands, managers were, and continue to be, challenged by balancing their multiple uses. In response to this challenge, effective engagement of the public was deemed critical in public land management early in Vermont. In 1977, the Vermont legislature passed enabling legislation affording towns the right to create a conservation commission (24 V.S.A. §4501). These quasi-governmental organizations engage the public in a way that is unique from other regions, affording such powers to the commission as inventorying municipality-owned natural resources, recommending the purchase of new municipality lands, administering municipal lands and receiving appropriations, and even gifts to fund their conservation work (24 V.S.A. §4505). The creation of conservation commissions in many Vermont towns has led to a heavy value placed on forests as sanctuaries for wildlife and the

provision of clean water. Vermont conservation commissions serve as an important voice in local planning and decisions affecting the local environment and natural resources owned by the municipality. Conservation commissions are an example of Vermont's approach to planning which engages broad public participation. In many ways, Vermont's approach to land use planning maintains municipal autonomy in land management decisions, such as local zoning, and retains local sovereignty in the outcomes of their municipal forests. This style of collaboration is likely an outgrowth of the town forest movement "when people collaborated on stewardship, made decisions as a group, and reaped the rewards of all that work together" (Margolis 2008). Town Forest Committees, which exist in many towns today, support conservation commission efforts to manage these public lands. In Vermont, it is common for town Select Boards to elect certain individuals to serve on these committees, many of whom serve for long tenures and provide historical knowledge and relationships to the forest (The Vermont Town Forest Stewardship Guide 2015). The extended tenure of these committee members allows for long-term working relationships to develop between county foresters, loggers and town members to ensure the continued stewardship and management of these municipal lands (The Vermont Town Forest Stewardship Guide 2015). Many towns also possess active trail committees which oversee the maintenance of trail networks and the expansion of new town forest infrastructure.

#### 1.1.1. Trends in Outdoor Recreation and Demographics in the State of Vermont

Town forests have recently been called back into recognition due to renewed emphasis on the value of outdoor recreation in the state of Vermont. Outdoor recreation accounts for 34,000 jobs and \$2.5 billion in consumer spending in Vermont, although, the Outdoor Industry Association places those estimates significantly higher (VOREC 2017).

Vermont is over 70% forested and for that reason, much of the recreational use is occurring in Vermont's woodlands. Where Vermont's forest industry was once characterized by consumptive use of forest products, "forest-based recreation has outpaced forest products in value" (SCORP 2014 - 2018). With this information in mind, Vermont's Governor Phil Scott issued an Executive Order in 2017 to create the Vermont Outdoor Recreation Economic Collaborative (VOREC). VOREC is a quasi-governmental steering committee comprised of selected individuals from representative agencies, industries, and nonprofit organizations with the goal of "[l]everaging Vermont's outdoor recreation assets to stimulate and improve economic outcomes" in Vermont (VOREC 2017). The VOREC campaign is a bell-weather of a shifting forest-based economy, as outdoor recreation and tourism have become Vermont's primary forest product.

Among the many action points from Governor Scott, his Executive Order was to "[e]ncourage, incentivize and guide the development of community-oriented outdoor recreation assets increasing economic impacts" (VOREC 2017). Municipal forests are innately community oriented outdoor recreation assets and the unique form of public land, known as town forests, have received increased attention following the commencement of VOREC. Not only do town forests already provide healthy outdoor recreation opportunities, but they also increase the quality of life for nearby residents and visitors alike. In addition to tourists, 72 percent of Vermonters participate in outdoor recreation each year (Outdoor Industry Association 2017).

Vermont's rural character provides a wide array of outdoor recreation activities, including some of the best mountain biking in the country, highly productive trout streams, and miles of nordic and alpine skiing. Even with all of these outdoor amenities,

Vermont is facing a significant demographic challenge as more young people leave the state. To address this, new legislation from Governor Scott is enticing remote workers to move to Vermont by promoting the quality of outdoor amenities and incentivizing the move with \$10,000. This grant program would reimburse moving expenses, membership fees for a co-working space, and costs of computer software, hardware, and broadband access for those remote workers who are willing to relocate to Vermont (S.94 2018).

In recent years, Vermont has been challenged by a declining population in the state. The United States Department of Education predicts that by 2026 primary school enrolment in Vermont will have one quarter fewer students than in 1996 (Woolf 2018). Art Woolf, Ph.D., Associate Professor of Economics at the University of Vermont, has written extensively on this issue for the Burlington Free Press. Most recently, Wolf pointed out that Vermont is aging much more rapidly than other states and its population growth is near stagnate (Woolf 2017). Between 2010 and 2016 Vermont experienced the third largest state resident decline in the nation (Woolf 2017). The biggest problem is largely related to the number of people moving out of the state as opposed to in, which is what demographers call net domestic migration. Between 2010 and 2017, net domestic migration was negative every year and, in 2016, 2,200 more people left Vermont than moved in (Woolf 2017).

The Vermont Roots Migration Project, led by Cheryl Morse Ph.D. and Wendy Geller of the University of Vermont, has investigated this trend to attempt to identify why certain people remain in or leave Vermont. Appealing jobs and higher wages outside of the state have attracted many young professionals to leave Vermont, as well as to avoid the high cost of living (Morse and Geller 2015). For those who choose to stay in Vermont, fondness for the Vermont landscape and natural environment as well as

appreciation for Vermont's culture were ranked among the highest reasons (Morse and Geller 2015).

With a shifting population demographic, a changing forest industry, and a thirst for improved recreational infrastructure throughout the state, the stage is currently ripe for changes in Vermont's public land management. Public lands of all shapes and sizes, including town forests, offer a unique opportunity to encourage young Vermonters to remain and to incentivize others to become residents. Vermont's working landscape is incomparable and, when leveraged correctly, can stimulate rural economies, improve the quality of life for residents throughout the state, and add to the sustainability of Vermont's future.

### **1.2. The Town Forest Recreation Planning Community Assistance Program**

In June 2017, the Vermont Urban and Community Forestry Program (VTUCF) began reviewing applications for a community assistance program known as the Town Forest Recreation Planning and Community Assistance Program (TFRP). The TFRP was a collaborative planning process, funded by the Landscape Scale Restoration Grant Program from the United States Forest Service, to provide recreation-planning assistance to ten diverse communities in Vermont. In addition to VTUCF, the technical team was comprised of Snow Engineering Group (SE Group), a consulting firm specializing in community and forest planning, Arrowwood Environmental, a sub-consultant and an ecological planning firm, Vermont Forest Parks and Recreation (VTFPR), the Vermont Agency of Commerce and Community Development, and the UVM Extension. With guidance from the technical team, the TFRP provided technical community planning assistance to ten towns in Vermont, offering a value of up to \$10,000 per town, to

“address issues and opportunities in use and stewardship of their town forest” (Vermont Urban & Community Forestry Program 2017).

Communities throughout Vermont that possessed a town forest were eligible to participate in the TFRP. However, only ten towns were selected to participate in the trial program. To qualify for the program the community needed to meet at minimum three criteria:

1. The land of interest must have been publicly owned or in the process of becoming publicly owned.
2. In addition to submitting other application materials, the town needed to submit a letter of support from the “Select Board, municipal official, or board, that identifies willingness to fully engage in this effort and officially adopt the action plan developed through this program” (Vermont Urban & Community Forestry Program 2017).
3. The community needed to demonstrate the capacity for carrying out the planning process and the implementation of the developed plan by identifying leadership, volunteers, or steering committees dedicated to being engaged in the process.

The process provided each town with an individualized Town Forest Recreation Plan, highlighting the town’s vision for the forest resource through aggregating public comment and revising proposed action plans. Action steps and strategies for realizing those plans were identified and a consensus on a plan implementation was formed.

VTUCF selected a variety of towns throughout the state. Applications were selected based on their merit in meeting the criteria outlined in the application and the representation of the spectrum of needs throughout Vermont. A diversity of geographic

and demographic representation was valued during the selection process and consideration was given to the current stage of planning that the community was in. Towns that were selected are listed below by county. Two of the towns possessed multiple parcels that were enrolled in the planning process.

Addison County:

- Middlebury (two enrolled parcels)
  - Battell Woods
  - Chipman Hill

Caledonia County:

- Hardwick (two enrolled parcels)
  - Hazen Union Town Forest
  - Buffalo Mountain Town Forest

Chittenden County:

- Richmond – Andrews Community Forest
- Hinesburg Town Forest
- Huntington Town Forest

Orange County:

- Bradford – Wrights Mountain Devils Den Town Forest

Windsor County:

- Weathersfield Town Forest
- Hartford Town Forest

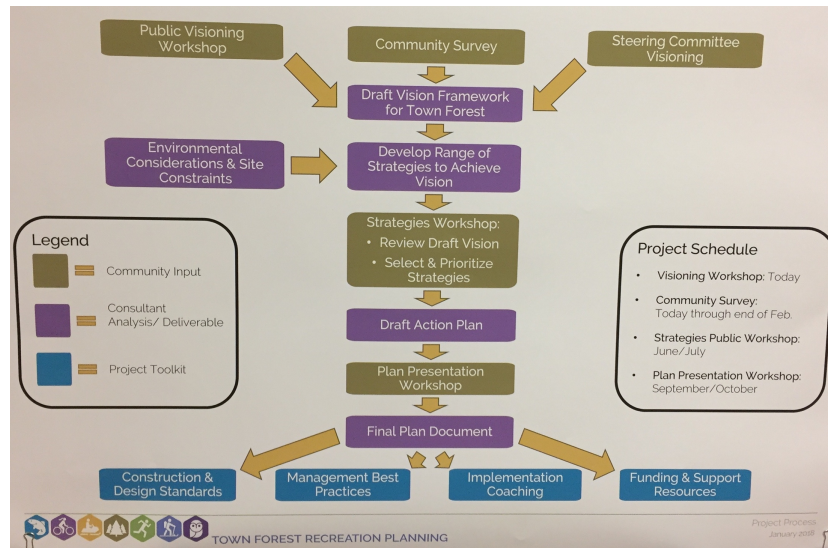
Washington County:

- Woodbury Town Forest
- Marshfield – Virginia Stranahan Memorial Town Forest

### 1.2.1. Public Engagement and Planning Process

The project leads, including Drew Pollak-Bruce, an associate planner at SE Group and Kate Forrer, Community Forestry Specialist from VTUCF, were accompanied by Ellie Watchel and myself (also from SE Group) in visiting each town to begin the robust planning process in January 2018. (I was only present for town forest visits and meetings in Hardwick, Marshfield, Middlebury, and Weathersfield.) At each town, a similar procedure was utilized to foster the community visioning process and drafting strategies for each unique parcel. A site visit occurred in each town where the project leads walked the forest accompanied by town leadership to identify areas of ecological and recreational importance. Following the site visit, a meeting was held with the Steering Committee from each town to analyze strengths, weaknesses, and identify opportunities for the town forest parcel. Steering Committees were comprised of members from a variety of backgrounds, including the public, town planners, local land trusts, local government officials, as well as, town conservation commissions and trails committees. A public workshop was hosted in each town in an open house format, inviting members of the town to express their concerns or interests for the parcel and engage in visioning activities to outline future uses of the forest. A public survey was disseminated, in paper and online format, to town citizens and local community members prompting the same visioning questions that were asked of visitors at the open house. Figure 1 outlines an example of the planning process for towns.





**Figure 1:** Town Forest Recreation Planning Flow Chart. The planning process outline set forth by the SE Group and Vermont Urban and Community Forestry. Planning occurred in four phases including, visioning, strategies development, plan development, and implementation.

Results from the Town Forest Community Visioning Open House Workshop, the Town Forest Visioning Survey, and the Steering Committee meetings were analyzed by SE Group staff and distilled in to Draft Forest Vision Plans, which identified a key vision framework for each town. This Vision Framework identified the community’s ideal conditions for the forest, speaking to the perspectives of public comment and outlined a management balance as well as key attributes of each town forest.

### 1.3. Statewide Findings from the Town Forest Recreation Planning Project

#### 1.3.1. Research Methods

While the TFRP focused on individualized needs of the ten towns at a site-specific level, this research focused on the statewide trends based on the aggregation of the collected data. Through assessing data collected in the Town Visioning Survey and the Open Houses Visioning Workshops, the TFRP data was utilized to understand the

historical interaction of Vermont communities with their town forests and the overall interest of particular outdoor recreation activities in town forests across Vermont. The TFRP was expansive in its questioning, prompting inquiries on previous experiences in the forest, what the future forest management focus should be and what activities, programs, and events the communities were interested in.

While this data is valuable to the towns and will be utilized by the consulting and inter-agency team to draft individualized town forest recreation management plans, my individual project looked solely at previous use trends, forest management focus, and public interest in a select group of outdoor recreation activities. Selected recreation activities were chosen to mimic those included in the Outdoor Industry Associations Outdoor Recreation Economy Report, which is the largest of its kind and documents the economic impact of outdoor recreation nationally (Outdoor Industry Association 2017). For that reason, specific recreation activities were drawn out from the TFRP including:

- Trail based recreation - hiking, trail running, and mountain biking
- Winter sports - backcountry skiing, cross-country skiing, and snowshoeing
- Equestrian sports - trail-based horseback riding
- Motorized sports - snowmobiling, dirt biking and all-terrain vehicle (ATVs) riding
- Wildlife viewing, hunting, and fishing

While Visioning Surveys and Open House visioning exercises prompted the same questions, the data have been separated into two distinct categories for interpretation here. In total, 1,047 surveys were received, and 283 people signed into a town forest Open House meeting, but an estimated 393 people attended. Open House data remained distinct from survey results due to potential sampling error occurring from dot exercises

where participants may have answered one question, but perhaps not others, or in the instance where participants placed several stickers, instead of just one, on one category.

### 1.3.2. Survey Data

The Town Forest Visioning Survey was made available to the public via the Vermont Urban and Community Forestry Website. Paper copies of the Visioning Survey were distributed to individual towns and made available to the public. SurveyGizmo was the online database for the Vermont Town Forest Visioning Survey and offered a variety of question formats from slider bar style answers, radio button, check boxes, and textbox questions. Survey data was collected, summed, and averaged for each town and then averaged across all of the ten town forest units. Questions that investigated historical interaction with town forest were included in the Survey, but not in the Open House Workshop. Those questions and their respective answers are included below:

Question 1: Have you visited our town forest before?

Answer: Yes / No

Question 2: Why haven't you visited?

Answer: Limited/Challenging Access; No public access; Unaware of the forest; Other.

Question 3: How often do you use your town forest?

Answer: Every day!; At least once a week; At least once a month; A few times a year; Rarely.

In calculating the average responses to these questions, the data from the town of Richmond was excluded due to the fact that the Andrews Town Forest was not officially a designated town forest, nor open to the public yet. The town was actively working with the Vermont Land Trust to secure the forest and open it to the public; however, it had not

been finalized at the commencement of this work. The data from the Richmond survey pertaining to previous use could have misrepresented the average outcomes when factored in with other town forest data across the state. For that reason, it was left out of the historical use analyses.

Other towns, including Huntington, Woodbury, and Weathersfield, possessed challenging circumstances for the public to interact with as well. For instance, the Woodbury Town Forest has no public parking lot or public trails. Similarly, access to the Weathersfield Town Forest is limited primarily to a small corridor from the Ascutney State Park, which links to a powerline and then to the town forest. Huntington Town Forest is also a challenge for the public to interact with, as it requires roughly a 3-mile snowshoe or ski to get to. While Huntington, Woodbury, and Weathersfield Town Forests have historically been challenging to access, the data from their survey results were included in the historical use analysis as they are in fact established town forests. The observations made by the public on these access issues were enlightening to the overall outcome of the research.

When considering forward thinking questions such as “what should be the management focus for the town forest in your community?” or “what type of activities do you envision in your town forest?” data from Richmond was included. These forward-thinking questions prompted participants to envision a future outcome for their forest and thus previous experience within the forest, or the finalization of the town forest designation was irrelevant. These questions required participants to select their preference for a particular management question along a gradient symbolizing least to most interest. Those questions were asked individually, but they are grouped below. The question and their respective answers are included here:

Question 4: “What should be the Management Focus for the Town Forest in your Community?”

- Recreation
- Education & Demonstration Projects
- Natural Resources and Habitat
- Timber & Forest Products

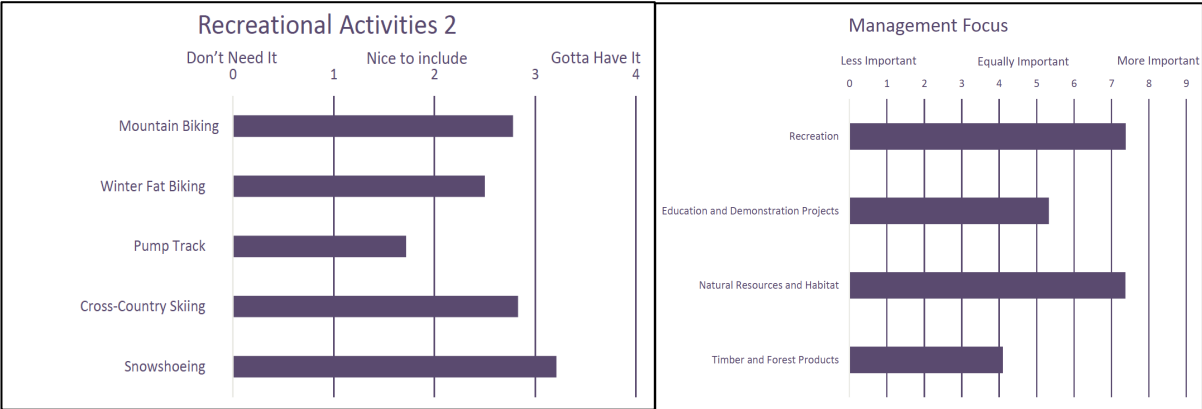
Answer: Less Important, Equally Important, More Important

Question 5: “What type of Activities do you envision in your Town Forest?”

- Hiking / running on rugged footpaths
- Hiking / running on ADA accessible paths (gravel or paved)
- Horseback Riding
- Dirtbiking / ATV
- Mountain Biking
- Winter Fat Biking
- Pump Track
- Cross Country Skiing
- Snowshoeing
- Backcountry / Glade Skiing
- Snowmobiling
- Hunting
- Fishing
- Bird and Wildlife watching

Answer: Don't Need it; Nice to Include; Gotta Have it!

Survey responses to Questions 4 and 5 were quantified along a spectrum of need from 0 (less important) to 9 (more important). Similarly, when responding to activity questions, survey responses were quantified as 0 (don't need it) to 4 (gotta have it!). Town averages were then calculated for each respective answer and then aggregated with other town averages to calculate the average answer across all ten towns. Examples of the individualized survey data are shown in Figure 2.

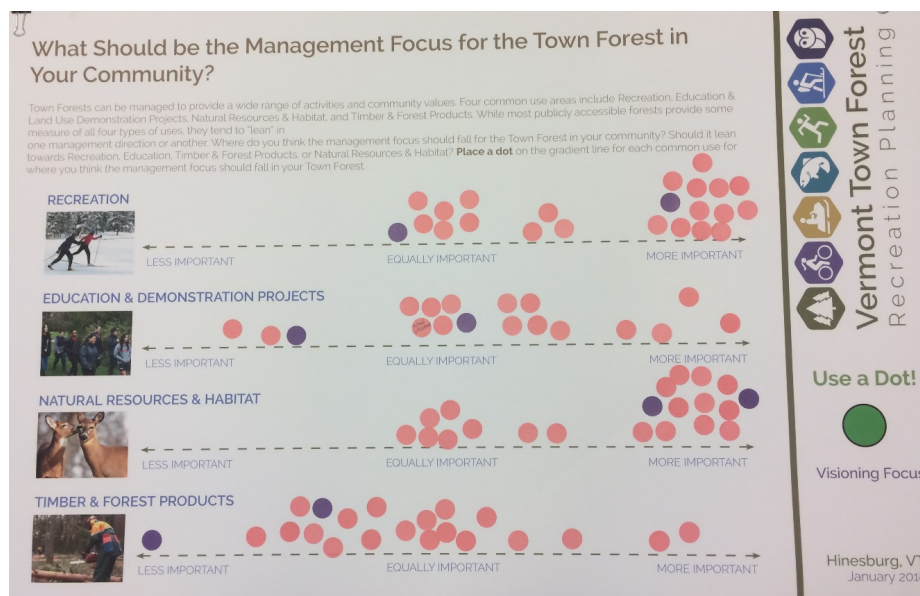


**Figure 2:** Survey results from spectrum of need analyses on recreation type and forest management focus. Online Surveys were completed with a slider bar from SurveyGizmo. As survey respondents interacted with the survey slider, positioning their answer closer or further from certain categories, they also slid their answer along a number scale. The number scale later quantified the position of their answer. Averages for individual towns were calculated and extrapolated to calculate averages across all ten towns.

1.3.3. Open House Visioning Workshop Data

Dot exercises, like the one shown in Figure 3, were utilized as a way for community members to communicate their interest of future management focus areas or recreation activities along a spectrum of need. At the Open House Visioning Workshops, visitors were given sheets of dot stickers and allowed to freely roam the room and place the stickers on Visioning Boards set up on easels. For each question, participants were allowed to place one sticker per answer. For instance, when responding to the management focus, a participant could place one sticker on the recreation, education and demonstration, natural resources and habitat, and timber and forest products spectrums, totaling four placed stickers on the Visioning Board. At the conclusion of the TFRP, dots were grouped in to one of three categories based on where it was placed on the

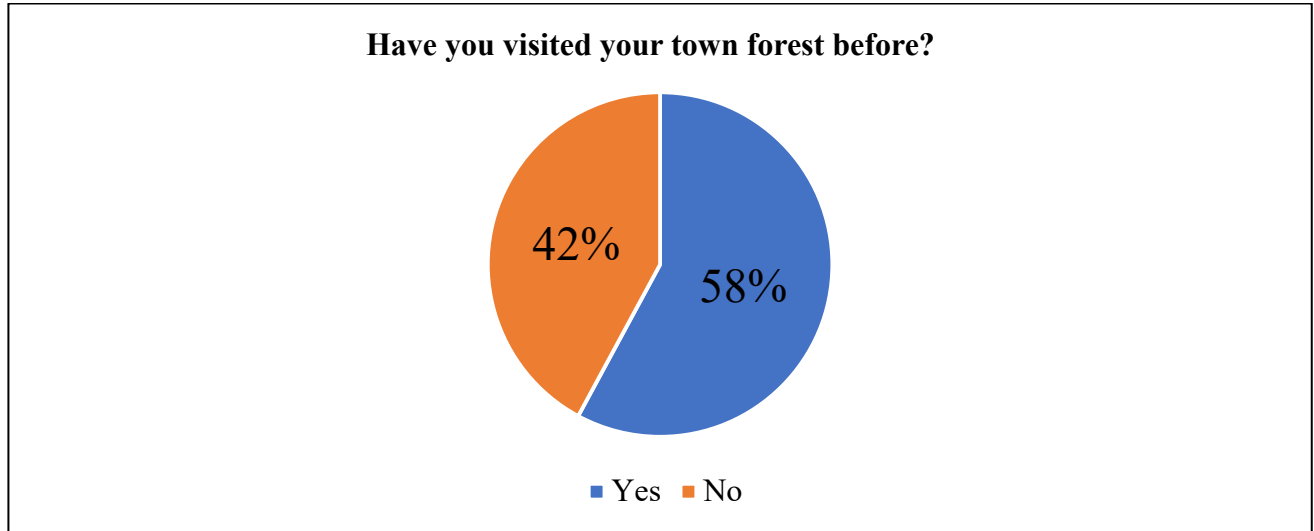
spectrum of need and then tallied for each town. Once dots were totaled, averages for each management focus category were calculated across all ten towns. Depending on the question, the three main categories were either “less important, equally important, more important” or “don’t need it, nice to include, gotta have it!” Dots that fell on the line separating two categories on the spectrum were averaged between the categories (e.g. where two dots were exactly placed equidistant from “Less Important” and “Equally Important” one dot would be tallied for each categories sum).



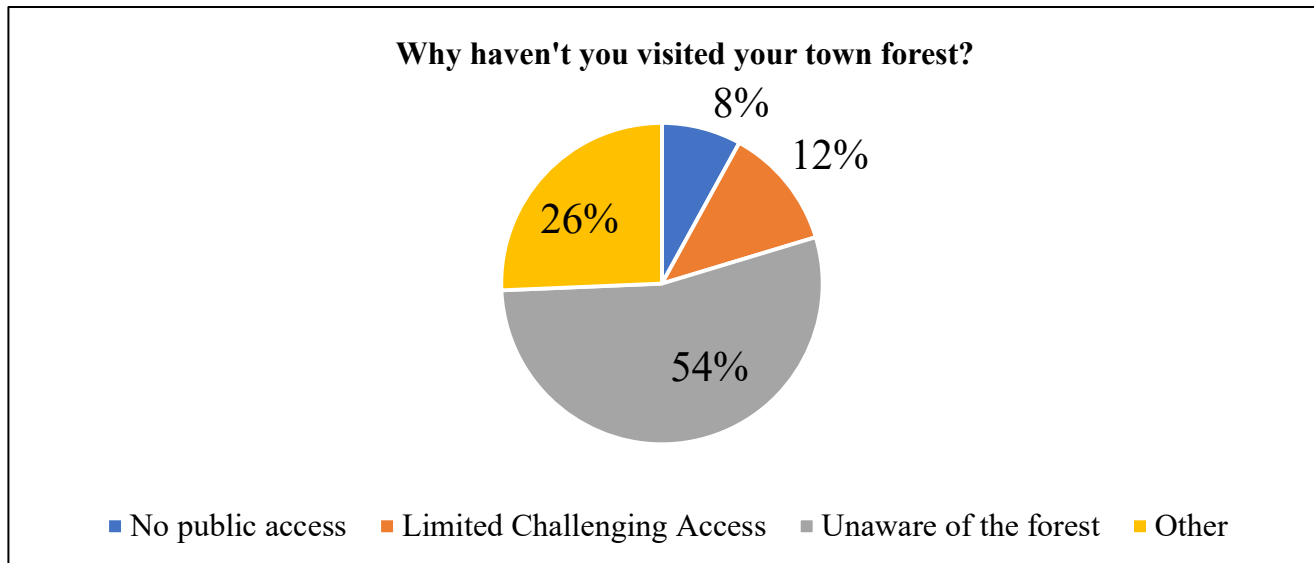
**Figure 3:** Open House visioning board results from the Town of Hinesburg. Participants placed one dot in each of the four Forest Management Focus areas along a spectrum of need. This was intended to communicate Open House participant interest in future management focus areas for their town forest.

## 1.4. Results of Statewide Findings From the Town Forest Recreation Planning Project

### 1.4.1. Survey Results Historical Use Analysis

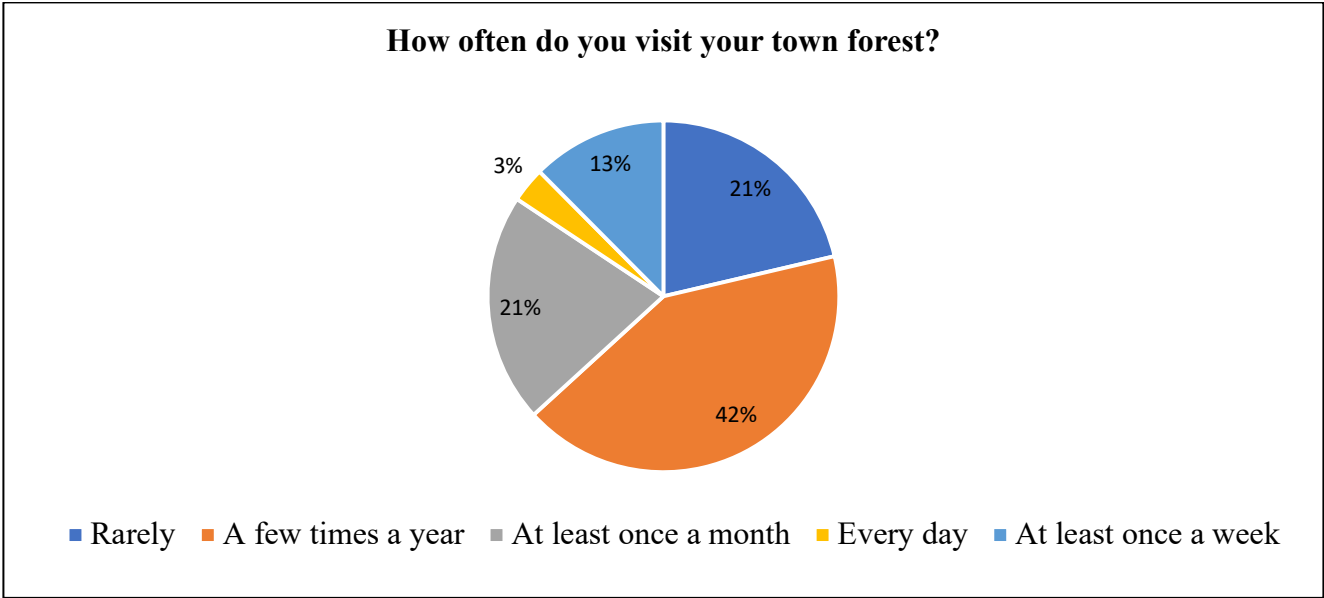


**Figure 4:** Average historical visitation of Vermont town forests by survey respondents. Data gathered from the *Vermont Town Forest Visioning Survey*. Note: Richmond Town Forest has been excluded from this data set.



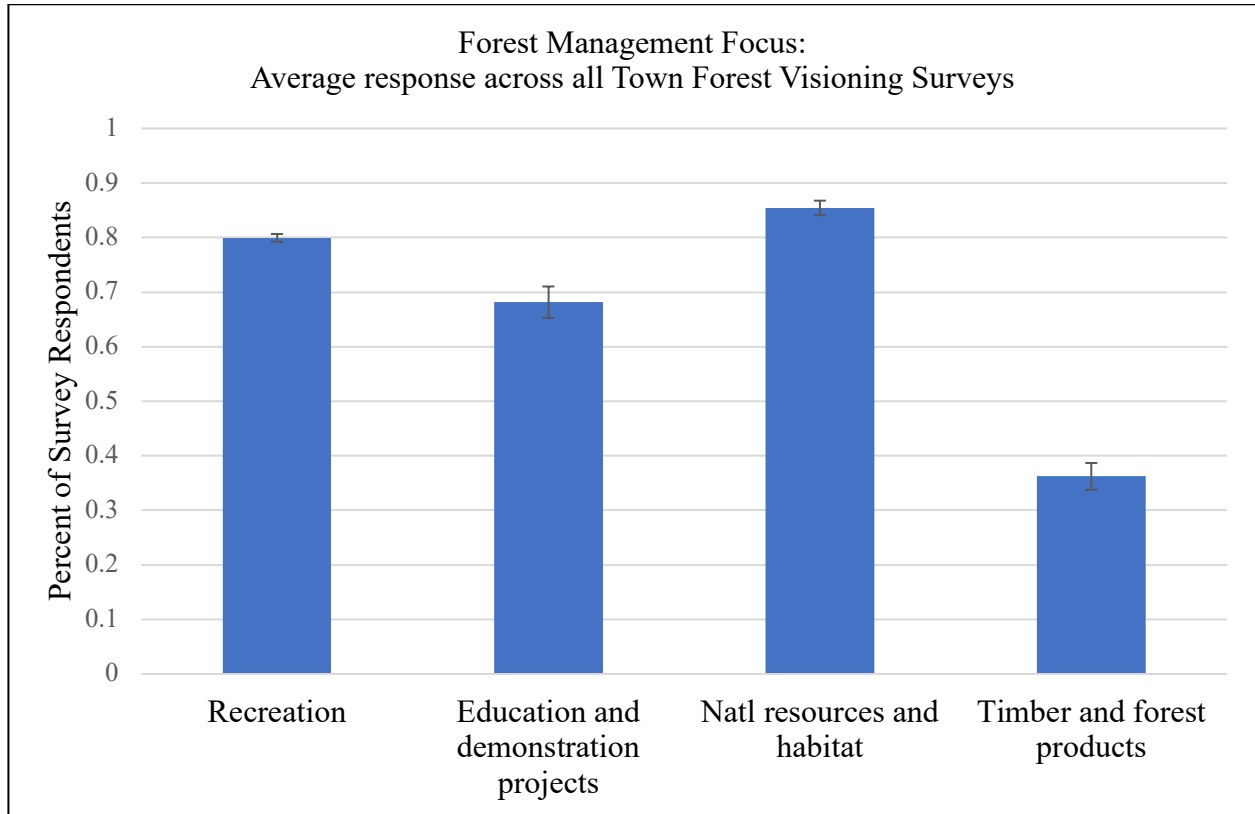
**Figure 5:** Average reasons expressed by survey respondents across all towns for not visiting their town forest. Respondents could select from three pre-written reasons including: No public access; Limited/Challenging access; Unaware of the forest; or respondents could select Other and write in their individual reason for having not visited. Data extrapolated from Vermont Town Forest Visioning Survey. Note: Richmond Town Forest has been excluded from this data set.



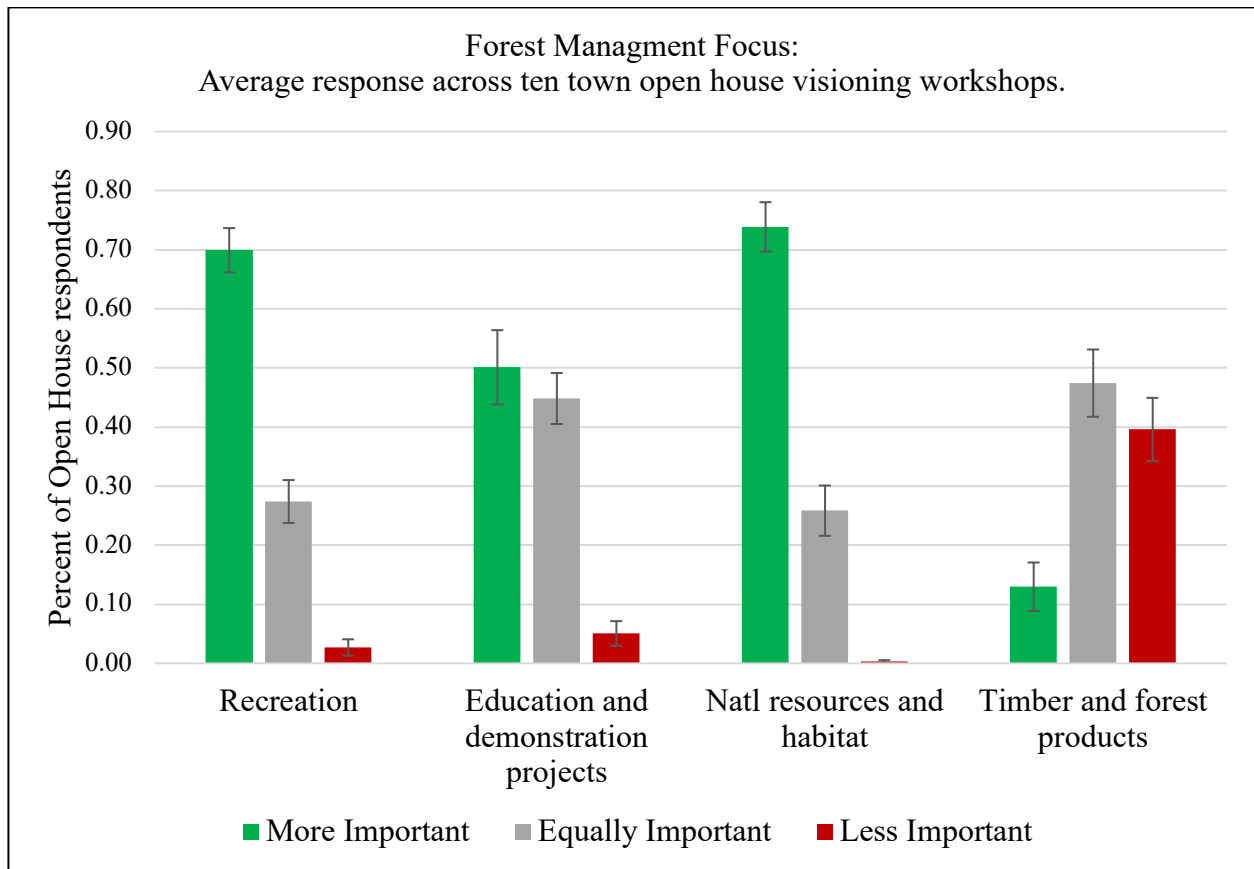


**Figure 6:** Average amount of interaction Town Forest Visioning Survey respondents expressed with their town forests. These categories were pre-written for respondents and the average was calculated across all towns. Note: Richmond Town Forest has been excluded from this data set.

### 1.4.2. Forest Management Focus

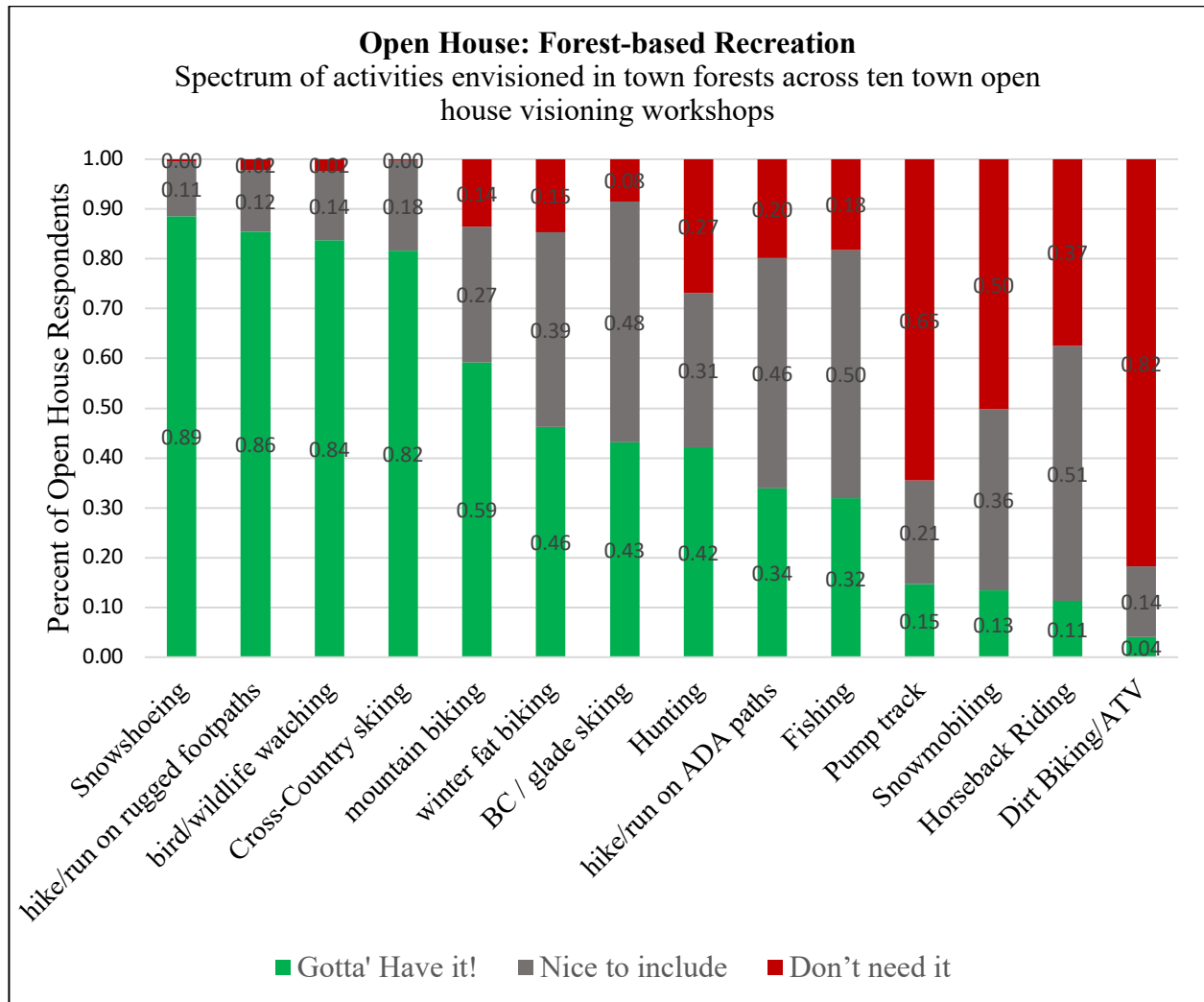


**Figure 7:** Average Town Forest Visioning Survey Forest Management Focus preference. Focus areas were summed within each town and then averaged across all ten town forest data sets. Data labels represent the percent of respondents that favored the individual focus area. The question asked was, “What should be the Management Focus for the Town Forest in your Community?”

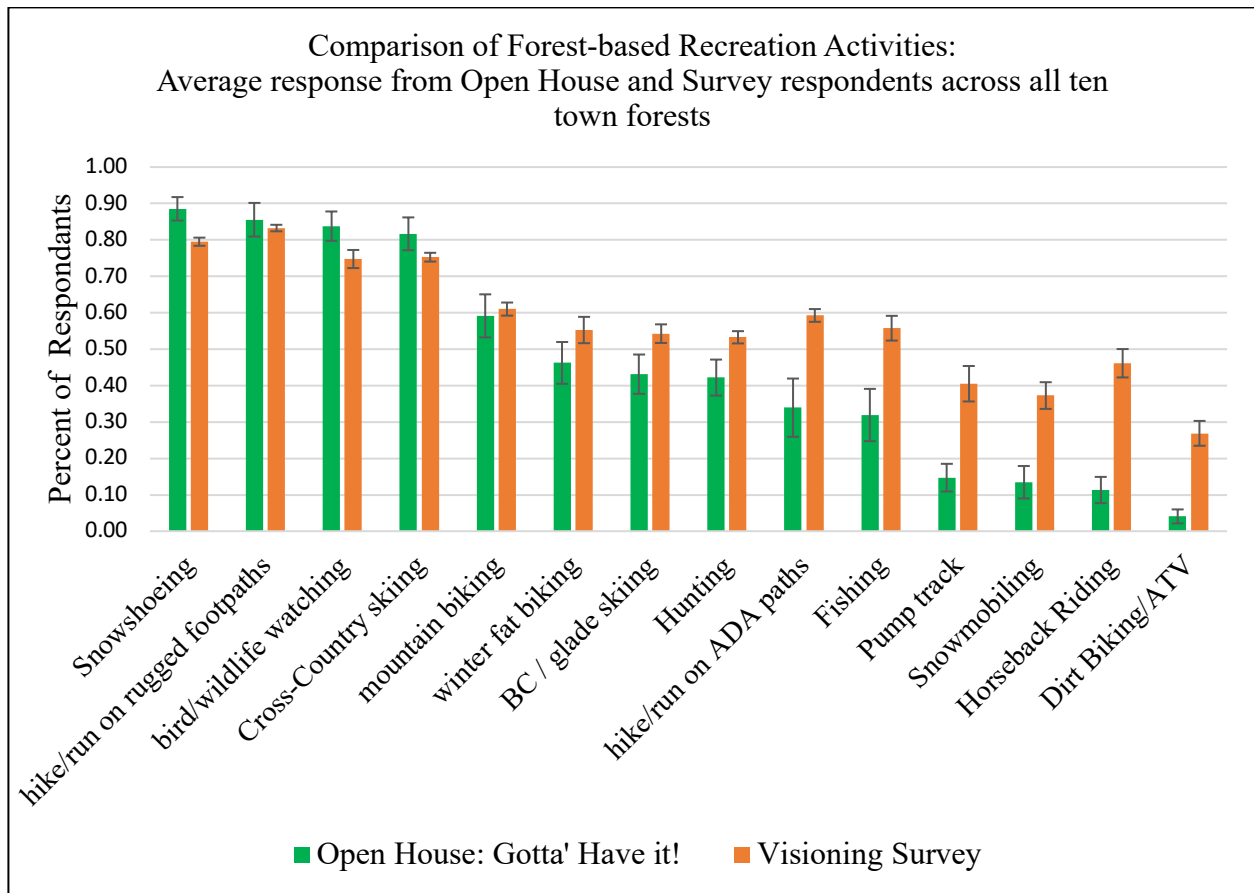


**Figure 8:** Depicts the average forest management focus preferred across all ten town Open House Visioning Workshops. Focus areas were calculated within each town by grouping and counting the total dots placed along a spectrum of need on the Visioning Boards. Averages from each town were then aggregated to calculate the preference across all ten town forests data sets. Data labels represent the percent of respondents that favored the individual focus area. The question asked was, “What should be the Management Focus for the Town Forest in your Community?”

### 1.4.3. Outdoor Recreation Activities Preference Analysis



**Figure 9:** Displays the variation of preference among Open House Visioning Workshop participants within each outdoor recreation activity in ten town forests across Vermont. The question asked, “What type of Activities do you envision in your Town Forest?” to which respondents placed a sticky dot along a spectrum of need ranging from “Gotta have it!” to “Don’t Need it.” Dots were summed within the three categories, and categorical averages were calculated for each town. Town averages were aggregated and an average for each outdoor recreation activity across all ten towns was calculated. Data labels represent the percent of respondents that favored the individual activity.



**Figure 10:** Displays the variation of preference among Open House Visioning Workshop participants and Town Forest Visioning Survey responses within each outdoor recreation activity in ten town forests across Vermont. The question asked, “What type of Activities do you envision in your Town Forest?” Here, only the “Gotta have it!” data from the Open House workshop is represented. Similarly, an average for each outdoor recreation activity across all ten towns was calculated from survey responses by extrapolating data from the Town Forest Visioning Survey.

#### 1.4.4. Summary of Results

Among all of the 1,047 survey respondents, 42% had never visited their town forest before and the primary reason for this was that the respondents were unaware of their town forests. For those who had visited their town forests, the majority of respondents (42%), only visited a few times a year. Forest management focus for survey respondents leaned heavily toward recreation and natural resources and habitat at 80% and 85% support respectively. This mirrored the results from the estimated 393 Open House Visioning Workshop participants who also favored recreation and natural resources and habitat. Among the Open House participants, 70% of respondents rated recreation as “more important” and 74% of respondents voted natural resources and habitat as “more important.” Interestingly, education and demonstration projects were ranked as more important by only 50% of Open House respondents, but 45% of respondents determined the focus as “equally important.” Both survey and open house respondents unilaterally ranked timber and forest products lower. Where only 36% of survey respondents favored it as the management focus, just 13% of open house participants labeled the focus as “more important” but 47% of open house respondents deemed the focus “equally important.”

In determining what types of activities respondents favored most in their town forests, snowshoeing received the highest percent of support across Open House Visioning Workshops while hiking and running on rugged footpaths received the greatest support among Survey respondents. Other trail based outdoor recreation forms including bird and wildlife watching, cross-country skiing and mountain biking, were among the most favored. While some difference existed between survey and open house respondents for a variety of activities, the top five activities envisioned in town forests across the state were the same for both survey and open

house respondents. The top five outdoor recreation activities that town forest open house respondents envisioned in their town forests included:

1. Snowshoeing
2. Hiking and running on rugged footpaths
3. Bird & Wildlife watching
4. Cross-Country Skiing
5. Mountain Biking

While the Survey respondents favored hiking and running on rugged footpaths over snowshoeing, they were still the two choices that received the greatest support.

#### 1.4.5. Discussion of Statewide Findings from the Town Forest Recreation Planning Project

The Town Forest Recreation Planning and Community Assistance Program (TFRP) worked with ten diverse towns to assist them in planning individualized, action-based, recreation and stewardship management plans for their town forests. While the TFRP focused on a wide array of forest-based activities, programs, and events for each community's forest, this research focused solely on the historical use of town forests, the envisioned forest management focus and the envisioned forest-based outdoor recreation activities in town forests across the state.

Collected data across all ten towns provides a regional perspective of use, forest management intentions, and types of forest-based recreation of highest interest across Vermont. Though communities across Vermont are diverse and their town forests offer a wide array of terrain, natural resources, and historical constrictions, understanding the broad interest of Vermonters can inform municipal, state and federal land managers on the needs of Vermonters as it pertains to the use of their town forests and the types of recreation that are in greatest demand.

These data support the notion that town forests are underutilized resources largely due to the public being unaware of their existence but partially due to challenging access issues.

Crafting intentional public awareness campaigns, such as the TFRP, will be essential to engaging the public in their municipal forests moving forward. Local, state and federal land managers should work with municipalities to address the challenging access to these areas by providing funding for infrastructure, such as parking lots or rights of ingress and egress like access easements. Vermont municipalities that are challenged by accessing their town forests should craft strategies to increase historically low usage of their town forests by addressing access and awareness related issues. Working with private land owners whose property abuts town forest parcels will be critical in this process, but consideration by municipalities must be given to the acquisition in fee of land if necessary, to solve this problem.

Assessing the regional interests of community forest management focus in town forests has demonstrated the need for balance between developing recreational infrastructure and safeguarding important natural resources and wildlife habitat. Striking the balance between these management focuses will be critical in meeting the outlined needs of communities as it pertains to the use of their town forest. Across all ten town forests, there is a desire to develop recreation and, specifically, human-powered trail-based recreation. Such trail infrastructure may be called bike optimized multi-use trails as the development of the trail is prepared for the most intensive use (mountain biking) but favors less intensive uses as well (bird/wildlife watching). This is not unlike inclusionary zoning, which allows for industrial and residential development within the same designated zone for instance. While the top five outdoor recreation activities across all town forest surveys and open house workshops were nearly the same, variation exists amongst the two groups of respondents on a variety of other activities. More intensive uses such as snowmobiling, horseback Riding and Dirt Biking and ATV were favored substantially more by survey respondents than open house participants. This conclusion may speak to the nature of the motorized and horseback riding communities which participated via survey rather than at



open houses or it may point to complex social dynamics at open house events which altered voting behavior on these issues. An important standard that the SE Group utilized during their drafting of the final forest recreation management plans was if at least half of the town was not in favor of the particular activity, then it is not a suitable priority for the town to develop or expand in the town forest at that time. Those activities were broadly motorized sports, horseback riding, and the development of a pump track for mountain bike riding.

#### 1.4.6. Considerations for Data Error

It is important to note the meaningful variables that may have led to misrepresented management conclusions from the TFRP. While the online and paper Town Forest Visioning Surveys allowed respondents to answer a particular question only once, I witnessed an Open House participant placing multiple stickers on the Timber and Forest Products category of the Forest Management Focus. Such duplication errors likely occurred more than once and could have led to misrepresented outcomes in the averaging across all ten town forest data sets. Importantly, one may wonder if this is a sign of problems with the public engagement process of the TFRP. While the TFRP provided multiple opportunities for public engagement, including a survey, several open house workshops, forest walks, comment boxes, and town forest Steering Committees for the public to communicate concerns, it is possible that the process still did not reach a broad enough base of the public to represent the actual community vision for the town forests. Consequently then, this project's ability to represent recreation and forest management interests across the state would be compromised. Interestingly however, town forest Visioning Survey respondent ages ranged from 16 to 86 years old, but the average age of respondents was 50 years old. The age of respondents could either speak to the average age of Vermont citizens affected by the TFRP or it may highlight a gap in engaging younger Vermonters in the process.

Further, the particular language that was chosen by the consultant team for the forest management focus may have been misleading or confusing to the public. In determining the forest management focus, respondents ranked their answers among “less important”, “equally important”, and “more important.” Such vernacular could be misleading as it requires the participant to weigh the management focus against either itself or other focuses. The language may cause one respondent to question “less important than what?” Recreation could therefore be more important than forest products but less important than natural resources. Recreation as a category in and of itself could have presented challenges as many participants may favor non-motorized recreation but needed to consider motorized recreation in casting their forest management focus vote. Different verbiage would be encouraged in future public visioning workshops.

Lastly, the research methods that were utilized in counting and totaling sticky dots from town forest visioning boards were an arduous task. While the method aimed to be as objective as possible, the sticky dots were placed along a spectrum of need and aggregating the dots into one of three categories could both misrepresent the respondents actual feeling about a particular activity as well as overestimate the actual total of dots in each category. The survey averages may for this reason be a more accurate portrayal of forest management focus areas and envisioned town forest activities. While this research aimed to understand the types of outdoor recreation that were of greatest support among town forest communities, future research may be required to understand the balance between the “Nice to Include” and “Gotta’ Have it!” categories. If voters in the “Nice to include” category, upon further consideration, were easily swayed to support a particular activity, such as Backcountry glade skiing, then the top five outdoor recreation activities list, aggregated above, may present different results. The conclusions of this research were based on the “Gotta Have it!” category of open houses and the

aggregation of survey data.



**Figure 11:** Vermont is renowned for the colorful foliage that appears each Fall season. Here, a mosaic of colorful northern hardwood species is complemented by the presence of softwood inclusions in the foreground. Photo credit: Taylor Luneau.

### **1.5. Economic Importance of Tourism and Outdoor Recreation in Vermont**

Community members across the state expressed interest in the potential for outdoor recreation in town forests to stimulate local economies. Ample research has pointed to the positive impact of outdoor recreation and tourism on local economies in Vermont. In 2015, more than 13 million people visited Vermont spending more than \$2.6 billion in the State (Vermont Department of Tourism & Marketing 2017). Spending by tourists supports the employment of 31, 000 Vermonters generating wages and income for businesses of nearly \$1 billion and \$750 million in economic activity in the state (Trust for Public Land 2018). Tourism can broadly be defined as the overall industry reliant on visitation from non-Vermont residents whereas outdoor recreation are activities that tourists and residents both participate in. This makes outdoor recreation a sub-component of the tourism sector in Vermont. Overall, Tourism represents eight percent of Vermont’s Gross Domestic Product (GDP) and unlike many other

industries in the state, the spending is largely generated by visitors from other states, and that means that outdoor recreation is stimulating a steady flow of money into the state (Vermont Agency of Administration Department of Taxes 2018). Many tourists visit Vermont to see the colorful fall foliage, as shown in figure 11, making the fall season an important one for tourism-based industries. Importantly, a large proportion of this consumer spending occurring in Vermont is directed at lodging, restaurants, and bars. Of the total spending in Vermont by tourists in 2015, the greatest amount was spent on lodging (\$475 Million), restaurants and bars (\$450 Million) as well as recreation and entertainment (\$340 Million) (Vermont Department of Tourism & Marketing 2017). Vermont imposes a nine percent tax on the sale of meals and rooms and a ten percent tax on the sale of alcoholic beverages served in restaurants, generating tax revenue for the state to invest in a variety of public programs (Vermont Agency of Administration Department of Taxes 2018). Eighteen municipalities across the state including Burlington, Middlebury, Rutland, and Montpelier, have also capitalized on this funding source by imposing local option taxes to generate municipality resources (Vermont Agency of Administration Department of Taxes 2018). In 2017 alone, Vermont collected \$1.08 billion in meal taxes, \$530 million in lodging taxes, and \$214 million in alcohol taxes (Vermont Agency of Administration Department of Taxes 2017).

Tourism is one of several economic sectors in Vermont and outdoor recreation is a major contributor to Vermont's overall economic well-being. While isolating outdoor recreation from tourism is challenging due to the overlap of the two economic sectors, spending that occurs at gear stores, on ski lift tickets or with guide and outfitters generally fall into the outdoor recreation bucket. In this way, recreation areas are essential to Vermont's tourism economy. In addition to tourists, 72 percent of Vermonters participate in outdoor recreation each year (Outdoor Industry Association 2017). Findings published by the Outdoor Industry Association

conclude that consumer spending on outdoor recreation total \$5.5 billion annually in the state, creating 51,000 direct jobs, generating \$1.5 billion in wages and salaries, and \$505 million in state and local tax revenue (Outdoor Industry Association 2017). Scaling down from the state level, several regional economic impact studies have been conducted on trail-based activities. A 2016 report on the Vermont Trails and Greenways Council (VTGC) provided findings on the economic and fiscal impact of four regional trail associations throughout Vermont. The four trail systems included the Catamount Trails Association, the Kingdom Trails Association, the Vermont All-Terrain Sportsman's Association, and the Green Mountain Club. Researchers found that the VTGC had 410,000 annual trail users who generated \$30.8 Million in total annual economic activity and \$15 million in new sales in Vermont as a result of trail visitors spending on travel expenses such as food, lodging, and equipment (N'dolo, Selsky et al. 2016).

#### 1.5.1 Mountain Biking in Vermont Towns

Several other studies have been completed on trail systems throughout the state. Research conducted by the SE Group on the Blueberry Lake Trail, a popular segment of the Mad River Valley Trail System in Washington County, VT, concluded that the trail resulted in \$1.2 million in annual and direct spending related to trail use (Mad River Valley Active Transportation Plan 2016). Similarly, a 2014 study of mountain bikers at Kingdom Trails in East Burke, VT estimated the annual economic impact of the trails to the region was \$6.5 million (Trust for Public Land 2018).

#### 1.5.2. Backcountry Skiing in the Green Mountain National Forest

Backcountry skiing, a winter tradition in many parts of Vermont, has exploded with the advent of new backcountry ski touring equipment. Backcountry skiing can be defined as an activity which takes place in remote areas that exist off the defined trail system and/or outside the boundaries of a developed ski area (US Forest Service 2015). As a result of unregulated and

illegal cutting of backcountry ski trails in the Green Mountain National Forest, the USFS decided to implement a trial project to delineate four backcountry skiing zones totaling 210 acres.

Through the provision and enhancement of these backcountry skiing zones the USFS intention was to “enhance access; disperse backcountry ski use; and establish management standards that are in alignment with both Forest Plan objectives and silvicultural practices” (US Forest Service 2015). Research on the backcountry ski zone was later completed by SE Group in 2017. The analysis reported that on one “powder day” (a day where large amounts of fresh snow falls and creates enjoyable skiing conditions) at Brandon Gap in 2017, approximately 171 people visited the new ski zones which generated \$200,000 in sales, supporting three jobs and contributing \$29,000 in federal, state, and local taxes (SE Group 2017).

### 1.5.3. Case Study: Barre Town Forest

*History of the parcel, public process, and financial support.* The Barre Town Forest is a 381-acre forested parcel, located in the villages of Graniteville and Websterville of Barre Vermont. The parcel was purchased and conserved with the help of the Trust for Public Land (TPL) in 2013. The seven parcels that make up the Barre Town Forest were once home to the first granite quarries in Barre, established in 1790. The historic quarry area of Millstone Hill was the heart of Barre’s boomtown economy and played an important role in shaping the character of the region. By the 1940’s the granite industry had begun to slow and the small quarries in Millstone were abandoned (Brown 2012). No longer an active quarry, this property has slowly returned to a forested landscape and currently supports a variety of outdoor recreation activities ranging from mountain biking to cross-country skiing.

The Millstone Trails Association (MTA), founded in 2005, is a nonprofit group that oversees the development and maintenance of what is now 1,500 acres of biking, hiking and nordic ski trails across the Millstone Hill area (Pogge 2009). Currently there are over 70 miles of

trails on and around Millstone Hill. In 2008, MTA was contacted by the Rock of Ages, the previous owner of Millstone Hill, and notified that a substantial portion of the quarry would soon be placed on the market for private sale. Noting the importance of the parcel to nearby communities for local recreation, MTA worked with the TPL and Town of Barre to secure the funding to purchase the \$1.3 Million property.

In 2010, the Barre Select Board appointed a Barre Town Forest Study Committee, which investigated the benefits of owning a Town Forest. This investigation resulted in a strong recommendation by the committee to the Select Board to purchase the property and to preserve the recreational and culturally significant parcel. When put to a vote in the Town of Barre, 63% of residents supported the measure to acquire the property and further to contribute \$100,000 to the acquisition. MTA agreed to match the towns financial commitment with private fundraising and the TPL secured the final \$400,000 for the purchase with grant funding from the federal Community Forestry Program, totaling \$1.3 Million in fundraising (The Barre Town Forest Manamgent Plan 2013).

After approval by the Select Board and the town voters, the Barre Town Forest Management Plan Committee was created in 2011, to develop a management plan for the parcel and make management decisions for the new town forest. The acquisition of the Barre Town Forest was finalized in 2013. In total, 355 acres of the 381-acre Barre Town Forest is protected by a Conservation Easement co-held by Vermont Land Trust and Vermont Housing and Conservation Board (The Barre Town Forest Manamgent Plan 2013). The easement seeks to conserve managed forest, wildlife habitat, and scenic beauty, protect water quality, encourage sustainable management of soil resources, and provide recreational opportunities to the public (The Barre Town Forest Manamgent Plan 2013).

*Economic Impact of the Barre Town Forest.* The Barre Town Forest Community Plan states that “the most direct beneficiaries of the Barre Town Forest will be the 8,000 citizens of Barre Town, who treasure this property for its historic quarries and recreation offerings” (The Barre Town Forest Management Plan 2013). Darren Winham, leader of the Barre Area Development, Inc., a non-profit economic development group states, “the town forest will have an immense positive impact on the economy of the region” (Brown 2012). Drafters of the plan who pointed to the local and regional significance of the Barre Town Forest were supported by a recent economic impact study completed by the Gund Institute at the University of Vermont. The study outlined two major objectives: “1) assess potential impacts associated with the recreational visits and tourist spending, and 2) assess potential impacts to revenues and new jobs in the regional economy” (Posner and Ceroni 2011).

Researchers calculated visitor spending in the local economy based on visitation trends and the extent that visitors purchased goods from businesses in the region. For instance, lodging, restaurant services, and locally grown produce all contribute to the local economy where as imported goods like gasoline contribute very little to local economies. Considering all of this, the study predicted an economic impact of \$2.3 million between 2012 and 2015 from visitor expenditures on goods and services (Brown 2012). The contribution of this by mountain bikers and winter use visitors alone was predicted to jump from \$481,000 to \$640,000 by 2015 (Posner and Ceroni 2011). Under a higher growth scenario, the Barre Town Forest is expected to generate 142 tourism jobs by the year 2020 and a total sales effect of \$4.48 million in 2020 (Posner and Ceroni 2011).

*Timber and Pulp Value of Barre Town Forest.* In addition to the estimates of trail users, additional economic potential exists in Barre Town Forest in the quality timber stand. In September 2010, Washington County Forester Russ Barrett conducted a survey of the Barre



Town Forest to assess management options. Barrett concluded that more than 70% of the Barre Town Forest had good to excellent potential for sustainable forest management (Posner and Ceroni 2011). The forest contained relatively young but high-quality species such as Sugar Maple, White Ash, Yellow Birch, and Eastern Hemlock. With the necessary timber stand improvement applications, Barrett predicted that the forest could produce a steady flow of revenue that could be invested back into the forest. At the time of the timber cruise, estimates of the timber and pulp value reached \$143,000. Four harvests were planned for the forest including three improvement harvests and one uneven aged harvest (Posner and Ceroni 2011).

### **1.6. The Effect of Conserved Land on Local Property Values**

Of greatest concern among opposition to land conservation in municipalities is the potential for environmental regulation or conservation initiatives to limit property value. Land use regulations can affect the market value of property in a variety of ways but have often been misinterpreted as an invariable reduction in value, as is the case in some Vermont towns that are leery of removing more land from the towns tax base. While municipal land does not contribute to the direct tax base if located in the town of ownership, town forests are taxed if the parcel is located in an adjacent town. For this reason, several towns have enrolled their properties in the State's Use Value Appraisal program (UVA), also known as Current Use, which provides tax abatements to approved landowners conducting forestry or agricultural practices on their lands. Established in 1980, UVA aims to conserve Vermont's working landscape while promoting active forest stewardship, including timber harvesting (Vermont Department of Forests 2010). Enrollment in the UVA program lessens property tax burdens on forest landowners possessing twenty five acres or more, in return for the properties active management including a forest management plan approved by the County Forester. Tax burdens relieved by the property owner

from the UVA program are compensated to the town by the State, however, and properties in the Current Use program do not cost the town a significant tax loss.

In comparison to properties enrolled in the Current Use program, town forests within a municipality's tax district are not taxed at all. "Because town land doesn't pay property taxes, the municipal (not school) taxes that would ordinarily be paid on the land must be made up by other taxpayers in town. In a town with an average municipal tax rate of 50 cents, a 100-acre parcel listed at \$2,000/acre would pay \$10/acre in municipal taxes per year" (The Vermont Town Forest Stewardship Guide 2015).

Similarly, properties with deed restrictions like conservation easements, which often exchange development rights for tax reductions, reduce the properties assessed value, often known as the "Highest and Best Use" and limit the tax return to the town. While these forms of environmental regulation do restrict the tax base of the town, they provide a host of amenities that are often overlooked. It is imperative to both understand and effectively communicate the economic theory behind land use regulation. Importantly the three main fiscal effects of regulation on property value are as follows:

- 1) The Restriction Effect: where the allowable uses of the parcel have been limited in some way.
- 2) The Amenity Effect: when certain benefits have been created for the property owner or nearby property owners by the regulation.
- 3) The Scarcity Effect: when the regulation has created a limit in the supply of developable land (Echeverria 2007) (Jaeger 2006) (Marlow 2008).

To summarize, while the Restriction Effect will cause property values to decrease by limiting what the allowable uses of the parcel are, this decline in market value may be offset by the increase in property values provided by the Amenity and Scarcity Effects. It is certainly true

that some environmental regulation can limit what an owner could otherwise do with her property for profit. But often these regulations also increase property values through the amenity of open space and an increased demand caused by scarcity in the market.

In a 2009 study, Deb Brighton, a tax policy consultant and Board of Trustees Member for the Vermont Land Trust, conducted an investigation into the impact of permanently conserving land on local property taxes. Analyzing short- and long-term impacts of land conservation in Vermont, the report found generally that open space required fewer public services whereas areas with more development and people required greater public services resulting in higher taxes (Brighton 2009). While developed land pays more in taxes than conserved land does, it also requires more in municipal services. Brighton concluded that “[o]n average, the tax bills are lower – not higher - in towns with the most conserved land” (Brighton 2009). Brighton explains that this is not because of the conserved land in general but rather that towns where the conservation is occurring tend to be more rural and require fewer municipal services. Supporting research from the American Farmland Trust found after sampling 151 communities across the United States that the median cost to provide public services for each dollar of revenue raised was \$1.16 for residential and \$0.37 for working and open land (American Farmland Trust 2016). While working lands may provide less revenue than commercial or industrial properties, they also “require little public infrastructure and few services” (American Farmland Trust 2016).

Looking beyond the tax incentives of open space and conserved land, property values are greatly affected by a variety of community amenities. A National Association of Homebuilders study found that trails are the second most important community amenity that potential homeowners cite when choosing a new community (National Association of Realtors and National Association of Homebuilders 2004). The 2004 study found that 57 percent of prospective buyers looked for trails in their community and those homebuyer preferences

translated into increased tax revenue for communities that incorporated trails in their town planning. Several other studies have demonstrated that trails and greenspace in particular, spur economic development, home ownership and community revitalization (US Forest Service: Southern Research Center 2007).

#### 1.6.1. Case Study: Ascutney Mountain and the West Windsor Town Forest

The West Windsor Town Forest is a municipally owned and managed forestland consisting of 1,342 acres (in 2012) but is not officially designated as a municipal forest under 10 V.S.A. §2653 (Town Forest Management Plan for the Cross and Glebe Lots 2012). The West Windsor Select Board established the Town Forest Committee which has recommended that the forest be managed for multiple uses, but primarily for its scenic value, recreational uses, and to protect ecological functions. The West Windsor Town Forest is immediately adjacent to the remnants of the Ascutney Mountain Resort, which filed bankruptcy in 2010. An extensive trail network had been developed in the lower elevations of the town forest by the Sports Trails of Ascutney Basin (STAB), which reached beyond the town land and incorporated a 25-mile trail system for hiking, skiing, mountain biking, and other recreational uses on to the resorts property. Due to the closure of the resort, the town began considering how the trail network played an important role in the economic development of West Windsor. Planning for this was documented in the 2012 forest management plan. After the resort failed to reopen and began selling off their chairlifts in 2014 the town decided that more serious action needed to occur (Dartmouth College Environmental Studies Class 2017). Although the town had an agreement with the current property owner to use the trail system on Ascutney Mountain Resort a new owner could revoke this permission which would result in the loss of half the trail system (West Windsor Town Plan 2014). With this in mind, the 2014 West Windsor Town Plan states

“securing the infrastructure, through purchase or long-term lease, is therefore a key component of our local recreation and economic development strategy” (West Windsor Town Plan 2014).

*Financial Trouble of a Closing Resort and Community Planning for Success.* Once a profitable ski destination, Ascutney Mountain Resort closed amid financial problems in 2010 marking the end of 70 years of skiing at Mount Ascutney. This resulted in a rippling effect throughout the community. “Between 2010 and 2013, condos on the mountain lost, on average, 45 percent of their value and single-family homes lost 12 percent of their value, combining for a total decline of nearly \$13 million in the town’s grand list, or about \$50,000 in property tax revenue, according to the West Windsor Select Board” (O’Grady 2018). The loss of the resort hit West Windsor hard and to make matters worse, significant capital improvements were needed to update the mountains water and sewer systems (O’Grady 2018). Like many towns with important, concentrated recreation sites, Ascutney Mountain was the lifeblood of the community and it was quickly disappearing.

Although the town owned a portion of the STAB trails, which had come to be nationally recognized for their quality mountain biking singletrack trails, the overall network was at extreme risk when the portion on the resort’s property went up for private sale. Searching for an alternative to the resort or private development, the town voted in the fall of 2014 to purchase the 470 acres of Ascutney Mountain Resort property. Once the approval of the purchase was finalized, the town worked with the Trust for Public Land (TPL) and the Vermont Housing and Conservation Board (VHCB) to fund and plan for the property. A \$303,000 grant from VHCB was matched with funds from the town of West Windsor and more than a half million dollars in private donations (Trust for Public Land 2018).

*The Economic Resurgence of Mount Ascutney and West Windsor.* Since the completion of the purchase in December 2015, the town of West Windsor has revitalized its standing as a

four-season recreation destination offering exciting mountain biking trails in the summer and great backcountry skiing opportunities in the winter. Reports show that the real estate market has been positively impacted by these improvements. On the mountain itself, where around 100 condominiums and several private homes exist, Dana Waters of Dark Horse Realty in Reading, Vermont notes “before, [the properties] were literally not selling at all, but they are selling now.... the Select Board made some great decisions, those decisions made the area nontoxic. Now people want to buy into the sense of community here” (O’Grady 2018). Many of the condo sales have been directly attributed to the expansion of the town forest and the amenities provided by the recreation infrastructure on the mountain. Other transformations have happened like the reopening of the former Brownsville General Store and an upsurge in a variety of outdoor events at the mountain such as the Vermont Mountain Bike Association Festival. The expansion of the West Windsor Town Forest through the acquisition of the Ascutney Mountain Resort has provided great returns to the community through a variety of economic, ecological, public health, and community building aspects.

### **1.7. Parcelization and Forest Fragmentation Trends in Vermont**

In 2014, the Vermont general assembly enacted Act 118 (s.100). Act 118 relates to forest integrity, which requires the Commissioner of Forest, Parks, and Recreation to submit a report on or before January 15, 2015 assessing the effects of fragmentation on Vermont’s forests and making recommendations for how to protect their integrity. Known as the Vermont Forest Fragmentation Report (VFFR), the report sheds light on the uniqueness of Vermont’s forested landscape of which 80 percent is held by private landowners (Vermont Department of Forests 2015). Seventy five percent of Vermont’s landmass is forested, making it the fourth most forested state in America; a stark contrast to when, in 1860, less than one half of the state remained forested due to forest clearing for agricultural products (Vermont Department of

Forests 2015). Vermont's forests were eventually reclaimed and a widescale transformation of our forested landscape has occurred largely from the early 1900's to current day. Alarminglly however, "the rate of development (measured in units and developed acres) in Vermont is increasing twice as fast as the state's population" (Vermont Department of Forests 2015). The VFFR notes that the impact of this rate of development is compounded by the fact that most of the development is occurring in rural areas where there are fewer than 2,500 residents and large amounts of forest land. "Although Vermont remains the second least populated and second most rural state in the United States," it is predicted that the population growth rate is likely to increase (Vermont Department of Forests 2015). While net migration is down in Vermont, the VFFR has predicted that by 2030, "Vermont is expected to have an additional 85,000 residents compared with 2013" (Vermont Department of Forests 2015). Whether it is more people coming to the state in the future, or people dispersing outward more in the state, these population and development trends point to a clear threat for future forest fragmentation in Vermont.

Forest fragmentation is defined as "the breaking of large, contiguous, forested areas into smaller pieces of forest. Typically, these pieces are separated by roads, agriculture, utility corridors, subdivisions or other human infrastructure" (Vermont Department of Forests 2015). A closely related issue is forest parcelization. The Vermont Natural Resource Council defines forest parcelization as "when forestland is broken up into smaller parcels...the result is typically an increase in the number of people who own the original piece of land" (Fidel and McCarthy 2013). Due to the increased density and varied ownership pattern caused by parcelization, infrastructure development (such as roads, septic and utility lines) are usually required and result in fragmenting the landscape. In this way, parcelization often leads to fragmentation. This chain of events has been shown to have adverse impacts on wildlife habitat, water quality, and the

viability of Vermont’s rural economy, which often relies on large areas and contiguous ownership.

Vermont’s remarkable 150-year history of forest regrowth has slowed in recent years with a second wave of forest development from threats such as suburban sprawl. The United States Forest Service National Forest Inventory and Analysis Program (FIA) publish periodic reports on the character of Vermont’s forest. FIA figures from 2013 show a continual but gradual loss of forest land totaling around 75,000 acres since 2007 (Vermont Department of Forests 2015). The most recent figures show a 1.9 percent loss in total forestland area in Vermont equating to 72,000 acres of forestland lost between 2010 and 2017 (Morin 2016). Development in New England broadly consumes 65 acres of forestland per day and in Vermont accounts for 1,500 acres of forest loss every year (David Foster et al. 2017). Forest parcelization trends are also dramatic. In Vermont, the number of parcels increased from 61,900 in 1983 to 88,000 in 2008 with an increase in smaller parcel sizes (Fidel and McCarthy 2018). This is



**Figure 12:** Aerial photo of Vermont landscape taken in June of 2017. Parcelization of the land can be seen due to the wide spread development of residential areas and pre-existing agricultural allotments. Photo credit: Taylor Luneau.



consistent with research from the VFFR, which notes the increased number of forestland owners and the decrease in average forest lot size (Vermont Department of Forests 2015).

#### 1.7.1. The Causes and Impacts of Forest Parcelization and Fragmentation in Vermont

There are many causes of parcelization in Vermont but the VNRC has concluded that the greatest driver of the phenomenon is the result of “escalating property values and land prices” (Fidel and McCarthy 2013). Largely associated with residential development on previously undeveloped forestland, parcelization of forestlands have resulted in the diminishment of parcels 50 acres or larger in Vermont (Vermont Department of Forests 2015). Faced with the economic challenges associated with landownership, subdivision and development of properties has offered incentives to people who may be “land rich and cash poor” to escape a variety of debt imposed by high market values. Increasing property taxes, a lack of estate planning, ex-urbanization and inadequate land use planning and regulation are suggested as causes of parcelization of Vermont forestlands (Fidel and McCarthy 2013). Although many municipalities value forestland, few towns possess regulatory strategies for addressing the increasing development trends on our states working lands.

Forest parcelization and fragmentation pose many problems not only to the sustainability of the outdoor recreation economy in Vermont, but to the health and resilience of Vermont’s natural communities. Such forms of fragmentation lead to isolation between forest communities, which can lead to biodiversity loss, water quality issues and create edge effects resulting in the increased spread of invasive plants and forest pests and diseases. Forest fragmentation can also have a deleterious effect on the forest products economy, where the size of a landowner’s woodlot often determines the economic feasibility of harvesting timber and other forest products. According to the VFFR, “as forest fragments become even smaller, practicing forestry within them becomes operationally impractical, economically non-viable, and culturally unacceptable”

(Vermont Department of Forests 2015). Forest fragmentation poses many challenges to outdoor forest-based recreation too. Varied land ownership patterns generate restrictions on access to public lands and present challenges in mitigating variable private land owner requests. Certain recreational activities also require large swaths of land such as mountain biking, nordic and backcountry skiing, and even hunting and wildlife watching. Healthy, intact forests attract tourists and recreators by providing colorful fall foliage, remote settings, interactions with wildlife and valuable trail systems that comprise the Vermont brand. Not only does forest-based recreation add significantly to the quality of life for many Vermont residents, it is the foundation for tourism-based businesses.

Vermont's aesthetic appeal as a rural working landscape is at risk under current parcelization and forest fragmentation trends. Although agriculture was a main driver of parcelization and fragmentation in the past, today the strongest pressures on Vermont forests come from infrastructure development such as buildings, roads and utility corridors (Roman and Erickson 2015). Alterations to the scenic quality of Vermont, owing to urbanization and the loss of open space, degrades recreational experiences many have come to love about Vermont. Not only can residential and industrial development impact the aesthetic experience of recreationists but the noise pollution that accompanies roads and other development can impair the rural feeling of Vermont woodlands. This reality was codified in Act 250, Vermont's state-wide land use planning criteria which provides specific environmental standards to evaluate the impacts of development and subdivision applications (10 V.S.A. §6086). Criteria eight of Act 250 states that "before granting a development permit, the District Commission shall find that the subdivision or development...Will not have an undue adverse effect on the scenic or natural beauty of the area, aesthetics, historic sites or rare and irreplaceable natural areas" (10 V.S.A. §6086). Such impacts were also codified in Title 30 section 248 which requires the analysis of

potential aesthetic impacts from energy generation facilities before granting a permit for new energy investments. (30 V.S.A §248). Criteria 5 of Act 248 requires that “an in-state [energy] facility, will not have an undue adverse effect on aesthetics, historic sites, air and water purity, the natural environment, and the public health and safety...” (30 V.S.A §248). These laws exist as a recognition that development can have an adverse impact on the aesthetic quality of the Vermont landscape and that such impacts should be mitigated or averted in order to maintain the quality of Vermont’s rural character. The VFFR has concluded that “forest fragmentation results in a decline in public access to private lands for forest-based recreation, including hunting, fishing, biking and skiing” (Vermont Department of Forests 2015). The long-term impacts of development include the loss of wildlife habitat, adverse impacts to public services and damages to landscape aesthetics. While Act 250 requires an impact assessment of certain development and subdivision projects, “of the 600 to 700 applications submitted each year, about 96% are approved” (Roman and Erickson 2015). For this reason, municipal review and local land use regulations are critical in maintaining the aesthetic quality of rural communities.

#### 1.7.2. Case Study: Saxon Hill Town Forest and Indian Brook Town Conservation Area

Founded in 1763, the Town of Essex, or Essex Junction, Vermont maintained a relatively small population of around 2,000 people until the early 1900’s (Essex Town Plan 2016). It was during this time that the population of the town began to increase exponentially. Prior to 1950, the town of Essex Junction contained 6 percent of Chittenden County’s population but as growth rates peaked in the 60’s Essex Junction now accounts for 13 percent of the County (Essex Town Plan 2016). With the growth of the Essex Junction came an increased need for municipal water supply. This high demand resulted in the establishment of the Saxon Hill and Indian Brook reservoir forests “as water conservation areas for the Village of Essex Junction” (Drayton, Frayer et al. 2017). Yet by the early 1970’s, growth of the town outstripped the water supply capacity

of Indian Brook and Saxon Hill and the town decided to connect to the Champlain Water District (CWD), a regional public water utility that could meet the areas growing water demand.

Connecting to CWD relinquished the water supply burden placed on Indian Brook and Saxon Hill but in return it created a massive debt for the town to repay. The Village had assumed \$220,000 in bond debt and \$110,000 for water from CWD itself (Drayton, Frayer et al. 2017).

To compensate for the incurred costs, the town decided to sell all 1,300 acres of both properties to private landowners. The Town of Essex would later re-acquire Indian Brook as a recreation area in 1986 and following a decade of contentious debate over rezoning, 250 acres of the original 800-acre Saxon Hill.

*Indian Brook Town Conservation Area.* During the period of private ownership at Indian Brook, several logging harvests of Hemlock, Pine, Maple, and Oak occurred which have left old stumps, skid trails, and other signs of extraction throughout the property (Forest Management Plan For the Indian Brook Town Conservation Area 2018). During an assessment by the Vermont Agency of Natural Resources (VANR) in 1990, the presence of “severely degraded” trails was found due to lack of erosion control and misuse by off-road vehicles (Drayton, Frayer et al. 2017). To compensate for these damages, as well as to pay for maintenance of the dam, the town invested in a bond of \$750,000, purchasing the property with help from The Nature Conservancy (TNC) for \$435,000 (Drayton, Frayer et al. 2017).

*Saxon Hill Town Forest.* The original size of Saxon Hill Town Forest has been diminished by 88% since its establishment (Drayton, Frayer et al. 2017). “Originally around 800 acres, most of the area is now zoned as a semi-industrial district and predominantly owned by private landowners” (Drayton, Frayer et al. 2017). Until 2015, only 90 acres of Saxon Hill were under public ownership, which was endowed to the Essex Junction school district after Forestdale Heights, Inc. acquired the property from the town of Essex in 1978 (Drayton, Frayer

et al. 2017). Under Forestdale Heights' ownership, several logging operations occurred in the forest as well as minor development. During a highly contentious legal battle with the town of Essex over extraction of sand in the forest, Forestdale sold the property to Allen Brook Development, Inc.

Recently, the town re-acquired 245 acres of the historic Saxon Hill Forest from Allen Brook in return for allowing sand extraction on 27.5 acres of the parcel zoned for industrial use, conservation, and recreation purposes (Dover 2015). Allen Brook also agreed to build a 15-space parking lot on Thompson Drive, which is the main entrance for public access to the mountain bike trails maintained by the Fellowship of the Wheel, a local mountain biking access and stewardship group. Because of ongoing litigation with Forestdale, which eventually ended in the Environmental Division of Vermont Superior Court, the decision with Allen Brook was made in an executive session rather than at public meeting. A majority of residents were appalled by the private decision as many worried about the negative precedent that it set for future development decisions (Dover 2015). Currently, Saxon Hill is home to a popular mountain biking trail network with a variety of loops for different abilities. The forest contains at least 12 miles of trails with public access easements existing over some of them (Essex Town Plan 2016).

### **1.8. The Future of the Working Landscape in Vermont**

With the recognized challenges of a changing landscape in Vermont and New England, a group of scientists published the *Wildlands and Woodlands, Farmlands, and Communities* report in 2017. The report offers a vision for the future of the working landscape in Vermont and New England, outlining goals for conservation and strategies to achieve ambitious conservation initiatives.

“The Wildlands and Woodlands vision calls for retaining and permanently protecting at least 70 percent of the landscape (30 million acres) in forestland and another 7

percent (2.8 million acres) in farmland by 2060....Most of the forests would be managed as woodlands for wood products and other benefits, while at least 10 percent (3 million acres) would be designated as wildland reserves. Such a landscape with interconnected natural and cultural infrastructure would support and enrich the lives of New Englanders and provide the capacity for nature and society to adapt to future environmental change” (David Foster et al. 2017).

To realize the Wildlands and Woodlands vision, it would require a tripling of the current pace of conservation and raising substantial sources of conservation funding (David Foster et al. 2017). At the conservative rate of \$1,000 per acre, “an intact future New England landscape will require an investment of approximately \$23 billion over the next five decades” (David Foster et al. 2017). An example of the “Working Landscape” is highlighted in Figure 14. With these ambitious goals in mind the authors provide a variety of strategies through analyzing regional initiatives in New England. In order to meet these goals, the authors point to the need for substantial changes in regional planning and development. “Creative development and support of local forest-based economies will be critical in achieving this goal. Tourism and nature-based recreation are rapidly growing and will certainly be one major solution” (David Foster et al. 2017).

The *Wildlands and Woodlands* vision challenges residents and policy makers to go beyond conserving “special” landmarks and habitats and to consider solutions that protect the public health and welfare, in order to support both “economic activity and community vitality” as well as “ biodiversity and ecological health” (David Foster et al. 2017). Town forests meet these objectives perfectly and have been shown to manage forestland in a manner that provides social, environmental, and economic values to the region. The 2017 Vermont Forest Action Plan, a report and assessment composed by the Vermont Department of Forest, Parks and Recreation, supports this strategy as well. The report is a “proactive, comprehensive, and balanced approach to the management of Vermont’s forests” (Vermont Department of Forests 2017). Through assessing a variety of issues facing the working landscape of Vermont, the

Forest Action Plan points to recreation as an important component to mitigating future threats to the state's outdoor economy and landscape. Among the many strategies outlined to ensure the sustainable future of Vermont's forests, the Forest Action Plan states notably,

“...[m]aintaining focus and investment in Vermont's working lands will grow forest business, improve our economy, and keep forests as forests. In Vermont, forest-based recreation has outpaced forest products in economic value. The demands on public land stretch staffing resource concerns. Private lands represent an opportunity to provide forest-based recreation but will require support and guidance” (Vermont Department of Forests 2017).

Sustainable forest management requires long-term commitment from landowners but provides major economic and social returns in the forms of timber and outdoor recreation. Since their establishment in Vermont, town forests have provided a diverse array of services including recreation, affordable firewood, valuable timber, and a variety of other revenue streams to municipalities. While town forests have had a mediocre return from commercial timber harvest when compared to federal forestlands, town forests have contributed to town revenues significantly since their establishment. Whether leasing out a sugarbush for maple syrup production, selling firewood, holiday decorations, or a full timber harvest; funds from these endeavors go directly back to municipalities. As is stated in the municipal forest bylaws:

“All moneys received for the sale of lumber, wood or other products from a municipal forest shall be paid into the treasury of the municipality. In the event any of the lands held by a municipality for municipal forest purposes are sold, advances made by the state or federal government in the purchase thereof shall be repaid to the state by the municipality. (Added 1977, No. 253 (Adj. Sess.), § 1.)” (10 V.S.A. §2655).

In a recent New England Forest Foundation (NEFF) Report entitled *New England Forests: The Path to Sustainability*, the authors note the importance of active forest management and harvesting as “an important element in assuring private landowners can continue to realize a return from forest management and thereby keep their forests as forests” (New England Forestry Foundation 2014). Policy initiatives that support making forest management profitable for both

private and public entities are therefore critical in ensuring the future of forestland conservation in Vermont. While not all forestland owners choose to “manage and harvest timber...for many who do it represents the income stream that pays land management costs, taxes and return on investment” (New England Forestry Foundation 2014). For this reason, a joint strategy mixing timber harvest and outdoor recreation could provide the greatest amount of stability in future forestland management and conservation. NEFF supports the conservation strategy that capitalizes on both forest-based recreation and the consumptive use of woodlands for forest products. Such a model holds potential in meeting the goals outlined by Woodlands and Wildlands, the Forest Action Plan, and other forest policy reports. A Policy Agenda for Conserving New England’s Forests, a report recognized and signed by 85 New England Organizations, outlines the importance of conserving New England Forestland (Policy Priorities for Conservation: New England Partners 2012). To strike the appropriate balance between forest-based recreation and active forest management will require thoughtful government policies, community engagement and diligent land management planning.

#### 1.8.1. Case Study: Hinesburg Town Forest

The Hinesburg Town Forest (HTF) is a well-documented and actively managed town forest in Hinesburg, Vermont, located east of Hinesburg village. The forest encompasses 837 acres of mixed woodlands containing 18 distinct forest stands (Hinesburg Town Forest Management Plan 2012). The HTF developed in several phases over the period of 20 plus years between 1936 and 1958 (McCullough 2016). Many of the original parcels that comprise the HTF were acquired by the town via acquisition or forfeiture due to landowner default on taxes during the Great Depression (McCullough 2016). Like many other forests in Vermont, the HTF is the result of agricultural land abandonment and “municipal forestry became a means to convert these otherwise barren lands to economic productivity, and forest conservation became a civic



priority – albeit one rooted in economic practicality” (Donath 2016). While cultivating timber was regarded as the most important feature of the New England town forest campaign, many town forests in Vermont and New England broadly never “developed a profitable record of timber production” (National Register of Historic Places Registration Form: Hinesburg Town Forest 2016). This is likely due to fluctuations in the wood market, lack of interest by local governing bodies or shifting public perspectives about meeting the multiple uses of public lands.

Nevertheless, the HTF has been managed “primarily for timber, firewood, wildlife habitat, and recreation through projects such as tree plantings, planned timber harvests, apple tree release, road and trail rehabilitation and erosion control...” and the production of a robust trail network (Hinesburg Town Forest Mangment Plan 2012). The State of Vermont assisted the Town of Hinesburg in planting Norway Spruce and White Pine in the 1940’s with a goal of growing a lucrative and productive woodlot (Roen 2017).

The first officially recorded harvest in the HTF was conducted in 1958 by the County Forester and consisted of roughly 50.3 million board feet (MBF) and 22.3 cords of white birch (Roen 2017). Since the 1950’s “there are records of 547.5 MBF and 457.2 cords harvested under direction of State and/or County Foresters” (Roen 2017). While harvests occurred often in the 1960’s, the period of 1973 to 1986 were comparatively quiet in the HTF (National Register of Historic Places Registration Form: Hinesburg Town Forest 2016). This may be due to the rise in popularity of local conservation commissions, which placed a larger emphasis on preserving open spaces, ecological reserves and providing opportunities for passive recreation than on timber harvest. The HTF would occasionally return to extractive programs such as the fuelwood cutting program or the Forest to Floor project when in 2007, the Chittenden County Forester, Mike Snyder, conducted a timber harvest of White Ash which was then used to replace the Town Hall floor (Hinesburg Town Forest Mangment Plan 2012).

A timber harvest is currently planned for the winter of 2018 across five stands and the estimated stumpage value, net of any management costs or fees, is predicted at \$20,800 total (Roen 2017). While the actual revenues will likely vary due to fluctuations in the market, timber quality, mill prices, trucking costs, weather conditions, and other factors, the Town of Hinesburg will undoubtedly benefit from the timber sale income.

**Table 1:** Estimated income from timber sales in five major forest stands of the Hinesburg Town Forest. All data was extrapolated from *the Draft Forest Management Plan for The Hinesburg Town Forest, for the 10 years beginning October 2017* (Roen, 2017). Estimates for timber value are likely to vary however treatment type and species favored for retention were strategically chosen and included in the Draft Plan (Roen, 2017).

<b>Stand #</b>	<b>Estimated income from timber sale</b>	<b>Stand Cover Type</b>	<b>Treatment</b>	<b>Species favored for retention and regeneration</b>
1	\$4,000	White pine plantation, Norway spruce component	Irregular Shelterwood	White pine, black cherry
2	\$1,800	Norway spruce plantation, white pine component	Irregular Shelterwood	Sugar maple, white pine, black cherry
3	\$9,000	Intermediate northern hardwoods	Small Group and Single Tree Selection	Sugar maple, yellow birch, red oak
6	\$4,500	Early northern hardwood	Small Group and Single Tree Selection	Sugar maple, red oak, black cherry
7	\$1,500	Mixed northern hardwoods	Small Group and Single Tree Selection	Sugar maple, black cherry, red spruce
<b>Total</b>	<b>\$20,800</b>			

The planned harvest in the HTF has identified two particular silvicultural treatments including the Irregular Shelterwood and the Small Group and Single Tree Selection. Each of these treatment types possess particular goals and have been strategically chosen for the stands they will be applied in. Important goals and outcomes of each treatment are outlined below but

are stand specific. These silvicultural treatments could be replicated in other town forests where a similar stand composition, trail network and land use goals are identified.

*Irregular Shelterwood Goals in HTF:*

- Goal: diversify stand conditions and vary rotation age. This will be completed by removing groups of trees, which are at risk from windthrow and capturing value from overstory stems while releasing new regeneration.
- Long-term vision: revert the forest structure from an even aged forest to a diverse and complex composition comprised of native species.

*Small Group and Single Tree Selection Goals in HTF:*

- Goal: increase structural diversity in the stand and establish a “new age class of trees while capturing value in low quality and declining stems and to encourage the growth of the highest quality stems in the stand” (Roen 2017).
- Long-term Vision: “maintain a diverse healthy forest with a degree of structural and species diversity, while producing a sustained flow of high-quality forest products from periodic timber harvesting” (Roen 2017).

### 1.8.2. The Triad Model: Zoning of Forest Use in the Hinesburg Town Forest

An important component of the HTF Forest Plan is the overall management philosophy. Unlike many other town Forests, the HTF utilizes the Triad Model, first outlined by Seymour and Hunter, by designating zones of variable intensity of use including: production and intensive use zones, mixed use zones of variable intensity, and ecological reserve zones (Seymour and Hunter 1992). This model acknowledges the fact that every use cannot occur on every acre. Instead, zones have been designated to match where opportunities exist in the forest by inventorying and acknowledging ecological constraints such as water quality, wildlife habitat, and general ecosystem function. “The zones are based on the ability of the terrain to

accommodate various forest uses without compromising the integrity of the ecosystem” (Hinesburg Town Forest Management Plan 2012). The HTF Management Plan provides a table explaining the management goal of each zone as well as the compatible uses within those zones. The details of that table have been included below and may be a suitable tool for managing a variety of uses in other town forests across the state. Importantly, reserves have been directed to be left alone, unless intervention is necessary to “protect ecological integrity of a natural community (i.e. invasive species removal)” (Hinesburg Town Forest Management Plan 2012).

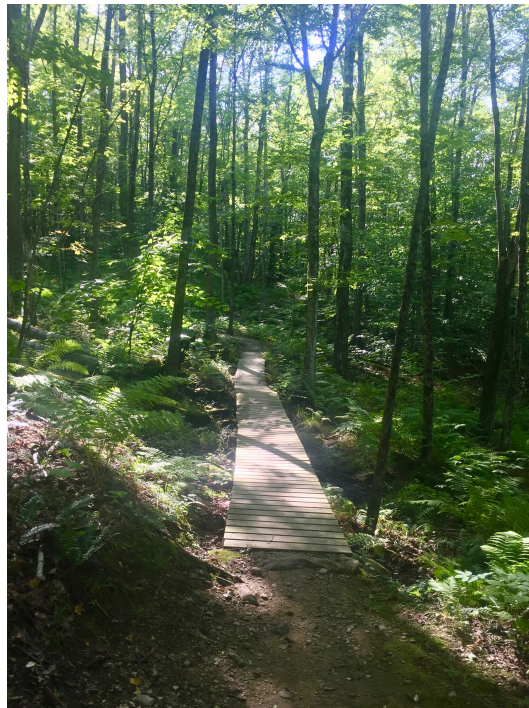
**Table 2:** The Triad Model of forest management as applied in the Hinesburg Town Forest. This table offers an example of forest zoning based on use intensities. Zone intensities are paired with management goals and examples of compatible uses. Table cited from *Hinesburg Town Forest Management Plan, Hinesburg, Vermont, 2012, P. 14.*

Zone	Management Goal	Compatible Practices/Uses
Low Intensity Use / reserves	Protect forest biodiversity and ecologically sensitive sites.	No timber management – unless needed to protect ecological integrity. Limit access to wetlands and vernal pools. Low-density single track sustainably-built hike/bike trails where appropriate.
Intermediate Use	Protect and enhance biodiversity (primary) through timber management (secondary).	Timber management, which mimics small-scale natural disturbance events. Any openings created should be <1 acre. Single-track, sustainably-built hike/bike trails.
Intensive Use	Protect and enhance biodiversity through timber management.	Timber management, which mimics natural disturbance events. Range of recreational opportunities.

“Good forest management should increase the overall health of trees in the forest, in addition to increasing structural and species diversity whenever possible. It incorporates long-term thinking about how to foster and maintain a healthy, diverse forested ecosystem into the indefinite future, including accounting for the needs of wildlife, the potential future and/or current impacts of invasive species, climate change, and interactions with humans. Part of encouraging high-quality forest management is through connecting people with the land --- and the way that most people connect with their land is through some form of recreation. In this way, encouraging recreation can be an important part of forest management” (J. Ethan Tapper, Caledonia County Forester) (Tapper 2018).

### 1.8.3. Mountain biking and Trail Inventories in the Hinesburg Town Forest

The Hinesburg Town Forest is an important local and regional source for recreation, specifically mountain biking. The HTF possesses 18 miles of single-track, primarily old school “rake and ride” spread over the 850-acre forest (Fellowship of The Wheel). The HTF trail



**Figure 13:** Multi-Use Bridge located in the Hinesburg Town Forest. Photo credit: Taylor Luneau.

network is one of eight in Chittenden County, across seven towns, that the Fellowship of the Wheel (FOTW) has built and maintains. FOTW is a Williston-based non-profit that “builds and maintains responsibly-built sustainable multi-use single-track for human powered recreation in

Chittenden County, Vermont” (Fellowship of The Wheel). Many riders will start longer rides at the HTF and connect to nearby trail networks such as the Carse Hill or Sunny Hollow networks, making the HTF trails an integral portion in a much larger trail system.

The HTF Management Plan allows for recreation which is consistent with other goals laid out in the plan including “quiet solitude, demonstration of sustainable forestry, water quality and wildlife habitat protection, carbon storage, and public education, while not adversely affecting the rural residential nature of the neighborhood” (Hinesburg Town Forest Management Plan 2012). The HTF strives to ensure that recreational activities are consistent with the protection of natural systems. Recreational use has been inventoried in the forest as early as 2006 by UVM Field Naturalist and Ecological Planning Students (UVM Field Naturalist and Ecological Planning Students 2006). The inventory documented the following items:

- Many of the wooden and stone bridges (Figure 18) built by FOTW are examples of ecologically conscious trail development but there are areas throughout the forest that could benefit from more drainage and erosion maintenance. (Figure 13).
- Logging roads are an important component of the trail system, connecting the single-track network throughout the forest, but they are prone to rutting.
- Rutting is particularly heavy in areas where trails cross-streams without bridges. Bridges will prevent sedimentation in streams and were suggested.
- Erosion hazards are greatest on steep slopes of Lyman and Marlow Soils, while severe rutting occurs at the base of slopes where water collects.

The most recent inventory and assessment of the Hinesburg Town Forest was completed in 2017. In reviewing the trail system, researchers noted a few muddy spots on three popular mountain biking trails, however overall, observed that the trails were being well-managed by the FOTW. “Field investigations showed that trail structures such as water bars, bridges, and

hardened surfaces are doing much to check erosion and other impacts” (Roen 2018). These are encouraging conclusions as erosion from trails can cloud waterways with sediment, adversely impacting stream wildlife or may even result in braiding stream channels, which can change an areas natural hydrology.

#### 1.8.4. A Note on Vernal Pools and Wetlands

Vernal pools and wetlands were also elements of concern in the 2006 UVM inventory, noting “the animals that use these areas are particularly sensitive to disturbance by logging, drainage modification, and heavy sediment loads due to erosion” (UVM Field Naturalist and Ecological Planning Students 2006). Vernal pools are seasonally flooded, forested wetlands that hold water in the spring and typically dry out by mid to late summer (Calhoun and deMaynadier 2004). They provide critical habitat for a wide array of amphibians and invertebrates and are therefore regulated by the state of Vermont as Class II wetlands by the Vermont Wetland Rules (Vermont Agency of Natural Resources 2018). Land alteration within a 100 feet of a vernal pool has been suggested to adversely impact amphibian populations due to restricted movement to and from the pool (Calhoun and deMaynadier 2004). While the Vermont Wetland Rules require a 50’ buffer around these pools, non-motorized paths in the 100’ buffer are typically acceptable so long as they do not lead to rutting and standing water.



**Figure 14:** The “Working Landscape” of the Northeast Kingdom of Vermont. This region of the state is notorious for its rural character and communities which rely on agricultural and forest products. The landscape shown here provides an example of the “Working Landscape” and a visual definition to the rural character and charm of the state of Vermont. Molly’s Pond, Danville, Vermont. Photo credit: Taylor Luneau.

### **1.9. Forest Management with Recreation: Ensuring the Longevity of Vermont’s Working Landscape Through Providing Multiple Forest Products**

Vermont’s forested landscape is changing at an increasing rate. Forest parcelization, fragmentation and subdivision are threatening the economic and ecological integrity of Vermont’s forests and rural character (Figure 16.). Land development as a result of subdivision has been shown to have deleterious effects on not only forest ecosystem function but on the ability of communities to draw much needed value from the productivity of their forest. While it is generally accepted that forest fragmentation has an adverse effect on the quality of wildlife habitat, it also impacts the outdoor recreation economy in Vermont. With an increase in owners of forest parcels, land management strategies can vary drastically from one owner to the next, making it difficult to keep intact working landscapes aesthetically and recreationally valuable.



While municipal forests make up a small fraction of forestland in Vermont, they offer unique opportunities for local management and a variety of returns on community investment. Municipal forests also offer a key strategy to combatting the loss of forestland in the state. While the amount of forestland in Vermont has decreased, a survey of major land trust organizations in Vermont has determined that 5,455.30 acres were transferred to municipalities between 2004 and 2016 (Fidel and McCarthy 2018). The total increase in municipal public land may be actually significantly greater due to the study not including municipal acquisitions that occurred without land trust assistance (Fidel and McCarthy 2018). Municipalities play a large role in discouraging parcelization and fragmentation of Vermont forests by participating in community forestry or managing municipal lands. While municipal regulatory actions, such as imposing local subdivision and zoning regulations or designating conservation districts offer creative land conservation strategies, town forests have, and continue to advance conservation in Vermont by supporting working forests containing both, forest-based recreation and the provision of forest products.

Recent research by the Vermont Natural Resource Council found that across the state the value of woodland nearly doubled between 2004 and 2016, but on average woodland remains less expensive than other land (Fidel and McCarthy 2018). While lower costs of woodland ownership may encourage forestry uses, they also may be targeted as low-cost investments for development in the future. Although Vermont woodlands are less expensive than other types of land, in general, the per acre value exceeds the use value. The fair market value on average for an acre of woodland in Vermont was priced at \$1,064 in 2016 (Fidel and McCarthy 2018). However, the forestry use value was only \$135 per acre (Fidel and McCarthy 2018). In addition, while the per acre value of woodland increased 83% from 2004 to 2016, the forestry use value remained relatively the same, increasing only 18.4% (Fidel and McCarthy 2018). While the cost

of woodlands is in fact cheaper than other types of land in Vermont, the discrepancy between the fair market value and the forestry use value makes owning woodland with the intention of forest management a challenging financial proposition.

Vermont forests are vulnerable to conversion due to the cost of private woodland ownership where active forest management is the goal. With forest development moving forward in Vermont, efforts to boost land conservation have been encouraged at a variety of levels and scales. Through the creation of town forests, community members have a direct say in the outcome of the Vermont landscape and the potential to benefit from the natural, cultural, and physical assets of their woodlands. Tactful investments in the management of town forests will offer positive returns on investment in the form of local economic prosperity, but also community development, quality of life and ecological protection. Vermont has a unique history with, and connection to woodlands. However, a fundamental contradiction now exists, where the working lands of Vermont have defined our character and communities, they too have become economically arduous to retain. A strategic action plan which recognizes the new recreational interests in our forests and balances that with the ecological needs of the natural communities in addition to the economic challenges of local residents, may offer a path for future stewardship and conservation of Vermont forests.

Town forests are an important component in the working landscape of Vermont. The TFRP has demonstrated that Vermonters value the multiple recreational, ecological, aesthetic, and cultural benefits that town forests provide. Across all ten towns participating in the TFRP, survey respondents and open house participants favored recreation, as well as natural resources and habitat in their forest management focus. From this we may conclude that communities want recreational infrastructure expanded in their town forests but not in a way that adversely impacts the ecological integrity of the forest resource. Cautious development of forest-based

recreation requires appropriate strategies in forest management to ensure the longevity of ecosystem health and community prosperity. Specific direction for municipal land managers does not yet exist.

#### 1.9.1. Moving Forward & Expanding the TFRP Into Management Practice

The remainder of this document is dedicated to outlining a model of successful forest management for recreation in Vermont, specifically, through a discussion about mountain biking and trail related outdoor recreation. Vermont's most recent State Comprehensive Outdoor Recreation Plan (SCORP) identified that "trail-based recreation were some of the most popular types of recreation in Vermont" (SCORP 2014 - 2018). The SCORP identified that memberships to Kingdom Trails had increased by 140 percent from 2001 to 2014, adding 2,000 new people to its membership (SCORP 2014 - 2018). In addition, memberships to the Vermont Mountain Bike Association (VMBA), the statewide nonprofit serving regional mountain bike club chapters, jumped 370% since 2013 (Vermont Mountain Bike Association 2018). In reviewing the TFRP, we found that 59% of open house respondents and 61% of survey respondents strongly favored Mountain Biking in their Town Forest. Because of this, and the ability of mountain bike trails to be used for a multitude of purposes such as trail running, hiking, cross-country skiing, snowshoeing, as well as wildlife and bird watching, attention on mountain bike optimized multi-use trails serves a variety of user groups. Furthermore, many town forests already have existing mountain bike trail networks and provide suitable examples for municipal forest management.

It is important to establish practices for incorporating active forest management, which can not only provide towns with the needed capital to develop trail infrastructure but create wildlife habitat and ensure overall forest ecosystem health. Recent work by the New England Forestry Foundation has outlined a "path to sustainability" for the Northern Forest of New

England, pointing to the need to support making forest management as profitable as possible in order to keep forests as forests. NEFF notes the need to ensure continued access to these forests for public recreation, improving regional capacity to grow forest-based recreation infrastructure and providing high quality amenities for visiting tourists and locals to capture revenue from forest based recreation (New England Forestry Foundation 2014). A focus on mountain bike optimized multi-use trails stands to achieve these goals and attract the greatest amount of visitor spending where motorized forms of recreation are not encouraged or prioritized (N'dolo, Selsky et al. 2016).

While private landowners may feel increased pressure to turn a monetary profit on their forestlands, municipalities feel this pressure as well. Although town forests provide a host of benefits and ecosystem services, several town forests have experienced one or several campaigns to sell the land by town citizens who believed the conserved land represented a lost opportunity for development, which would otherwise expand the town's tax base. While this theory is fundamentally flawed, due to reasons explained earlier in this work, pressure has historically existed to privatize these common assets. Saxon Hill Town Forest and Indian Brook Conservation Area are two prime examples, but they are not the only municipal forests to have experienced pressure for sale. Even the long-standing Hinesburg Town Forest has undergone town discussion for private sale. In March 1962, the Select Board put forth an article to sell the forest in the annual town meeting, but the town voted 93-16 to keep the forest (National Register of Historic Places Registration Form: Hinesburg Town Forest 2016). Town voters would rebuff campaigns to sell the forest on several other occasions including in 1966, 1986, and, again, in 1990 (National Register of Historic Places Registration Form: Hinesburg Town Forest 2016). Land management strategies, which focus on the needs of the local community and on providing some source of self-sustaining revenue, will create the most durable and long-lasting solutions

for forestland conservation. This occurs by educating the general public on the value of forest management and the intricacies of ecosystem function through engaging them in forest-based recreation. Recreation is now considered one of our forest products and, when combined with other traditional products, such as timber, maple syrup, etc., active management can be beneficial to local communities and the overall forest ecosystem. Strategic management of this sort keeps forests as forests by ensuring a sustainable use pattern into the future.

"While we understand the economic value of recreation trails and we do want to support our local economy, we also want to preserve and maintain the health and intrinsic values of this forest for generations to come" (WCAX-TV 2017) (Nancy Jones, Bradford Conservation Commission).

#### 1.9.2. Ecological Impacts of Mountain Biking in Town Forests

Research conducted at the Hinesburg Town Forest, including the ecological inventory assessments, have provided valuable insight for land managers who strive to maintain a sustainable recreation carrying capacity in the forest. With increased interest in human powered trail-based recreation through-out Vermont, the ecological impacts of these forms of outdoor recreation have been called into question. Concerns range from increased incidence of erosion, to the spread of invasive species, pathogens and vegetation trampling caused by humans and their pets. While this paper is not an authoritative source on the ecological impacts of recreation, it is important to address these concerns briefly, to inform land managers interested in developing recreation resources in their town forests. A common concern shared among town forest meetings was the potential impact of mountain biking on the environment. As with all recreational pursuits, mountain biking does contribute some form of environmental degradation however the actual amount is poorly understood (Marion and Wimpey, 2007). In the absence of detailed research relating to the impacts of mountain biking on forest and ecosystem health in Vermont, land and trail managers have been cautious and even restrictive in some instances.

In recent years, research completed by Jeff Marion and Jeremy Wimpey (2007), provided a literature review on the ecological impacts of mountain biking. Broadly, the work found that vegetation loss, soil and water quality degradation as well as disruption to wildlife are “common environmental impacts associated with recreational use of trails” (Marion and Wimpey, 2007). Importantly, the research found that impacts caused by mountain biking to vegetation, soil structure, water quality and wildlife were “similar to those of hikers and other non-motorized trail users” (Marion and Wimpey, 2007). Research conducted by Marion and Olive (2006) concluded that the amount of soil loss on mountain bike trails was less than on hiking, horse and ATV trails and two studies reported that impacts to wildlife caused by hikers and mountain bikers had no significant difference (Taylor and Knight 2003, Gander and Ingold 1997). Further, the research supports that well managed mountain biking trails can minimize these environmental impacts and trail design is the key to their mitigation.

“Environmental degradation can be substantially avoided or minimized when trail users are restricted to designated formal trails....The best trail alignments avoid the habitats of rare flora and fauna and greatly minimize soil erosion, muddiness, and tread widening by focusing traffic on side-hill trail alignments with limited grades and frequent grade reversals” (Marion and Wimpey, 2007).

A critical first step to mitigating environmental impacts from recreation is identifying the ecological constraints of the forest through an ecological inventory assessment. Resources such as water quality, wildlife habitat and soil structure must be documented, and findings should be utilized in planning forest use according to what the resources can accommodate. Determining the recreational carrying capacity of the forest can be done by developing measurable impacts to ecological resources, determining stewardship benchmarks and goals, and finally utilizing a monitoring program to document the result of management decisions. Goal setting during the ecological monitoring program will vary between forest communities, however the resource goals will account for ecological protection and balance that with recreation demand to

determine limits of acceptable impacts to resources. Utilizing these goals allow land managers to assess the conditions of the recreation resource and adjust management decisions accordingly, a strategy known as adaptive management.

Importantly, many environmental impacts can be avoided or mitigated by planning well designed multi-use trails. For instance, Marion (2006) found that erosion rates on trails in the Big South Fork National River and Recreation area were similar between trails with grades of 0-6 percent and 7-15 percent but were significantly higher with grades of 16 percent or more. Limiting higher percent grade trails will reduce incidence of erosion and likely favor user experience as well. Other trail design practices like the out-sloping of trails to shed water, maintaining a buffer between trails and water bodies, minimizing stream crossings and building trails on well-draining soils will limit impacts to water quality and mitigate soil loss. Working with experienced trail planners and builders will empower local communities to build sustainable mountain bike optimized multi-use trails and mitigate adverse environmental impacts before they occur. This can be costly however, and one estimate for high end, machine-built mountain bike trails could cost communities \$20,000 per mile (Langlais 2018). For this reason, communities should seek out a variety of significant funding sources including those provided by timber resources where applicable.

### 1.9.3. Ecological Recreation Forestry: A Model for Vermont Town Forests

A form of forestry that accounts for the needs of mountain bike trails is no different than other forms of ecological forestry. It does add a new layer of complexity, that being the required space and infrastructure for trails. The trails themselves come in all shapes and sizes, and those seeking guidance on the specifics of trail building should refer to *Managing Mountain Biking: IMBA's Guide to Providing Great Riding* or *the Bureau of Land Managements (BLM) Handbook Guidelines for a Quality Trail Experience: mountain bike trail guidelines*. The Vermont

Mountain Bike Association has also provided a wide array of materials to its regional chapters, to inform the sustainable construction of mountain bike trails such as the *New Trail Playbook*, which outlines the proposing, funding, and construction of new trails on state, federal and private land in Vermont. Importantly, working with a consulting forester and local, state, and federal recreation representatives are encouraged in each of these contexts.

Where municipal forests are the focus of future trail development, planning can benefit by incorporating holistic forest management practices. Without good planning, the ecological function and health of the forest resource could be compromised, legal and financial issues could arise, and conflicts between different users could lead to long-term challenges. Where short-term benefits are chosen over the long-term investment in the community forest, it stands to reason that the sustainability of the forest use will be compromised. Forests possess a variety of interconnected natural communities and planning for recreation cannot independently be conducted from wildlife habitat considerations. A forest management strategy that draws on classical ecological forestry practices and combines a thoughtful recreational component is advised.

While actual site-specific practices should be based on the present and expected conditions of individual forest stands, a broad discussion of stand development and forest management will prove useful for land managers. Forest stands are “defined and delineated based on ecosystem criteria such as soil, topography, vegetation structure, and landscape pattern and position in addition to management considerations” (Kohm and Franklin. 1997). Thompson and Sorenson’s work, *Wetland, Woodland, Wildland: A guide to the Natural Communities of Vermont* is a useful companion for identifying the biophysical regions and natural communities in Vermont. It is important to remember that “silvicultural practice is essentially a local consideration, varying in important details from forest to forest” and this document does not



attempt to prescribe a simple formula to be applied over equally across broad areas (Evans 2006). Instead, this work considers the implications of Ecological Forestry in a state that is 67% dominated by a Northern hardwood forest type and highlights examples of sustainable forest-based recreation management practices (Wharton, Widmann et al. 2003).

“From my perspective as a County Forester, recreation is an integral part of forest management just as is harvesting, protection, economics, aesthetics, silviculture, wildlife, etc. Telling the story that recreation can benefit from timber harvesting and that harvesting can benefit from recreation is one I share often. Considering that most people’s recreational access to forests is via roads and trails developed by and for timber harvesting is a primary example of where recreation has benefited from timber harvesting. Furthermore, a carefully planned harvest can create or enhance recreational access, improve aesthetics, and generate the income to develop a recreational trail” (Langlais 2018) (Matt Langlais, Caledonia County Forester).

#### 1.9.4. Classical Ecological Forestry

Ecological Forestry became popular in the mid-1980’s following the recognition that the traditional Multiple-Use Sustained Yield approach to production forestry gave little attention to biodiversity when weighed with the value of extracting wood products. Since its introduction, ecological forestry has become a popular management protocol on public lands where a greater value has been placed on aesthetics, recreation, and conservation biology. Although forestry has placed an importance on ecology since its inception, ecological forestry as a concept has been an evolving one following when Spurr and Cline coined the term in 1942 (Evans 2006). Seymour and Hunter provided an in-depth discussion on ecological forestry in 1999, highlighting the principles of the phrase and its application (Seymour and Hunter 1999). Building on the concepts of stand development put forth by Oliver and Larson and several other forest ecologists, Seymour and Hunter define ecological forestry as “the emphasis placed on natural patterns and processes: understanding them, working in harmony with them, and maintaining their integrity...” (Seymour and Hunter 1999). Explaining further, Seymour and Hunter state that the central axiom of ecological forestry is that “manipulation of a forest system should work within the limits established by natural disturbance patterns prior to extensive human alteration of the

landscape” (Seymour and Hunter 1999). Ecological forestry can be understood as using our understandings of natural disturbance regimes and ecological processes to make management decisions about stand structure, forest age distribution, species composition, and regeneration methods.

The key assumption made by Seymour and Hunter about ecological forestry is that native species evolved with forest disturbances that created particular forest conditions across the landscape. For instance, a severe wind disturbance may create a canopy gap in the forest resulting in the establishment of early successional habitat which is suitable for neo-tropical birds. Such is the concept behind *Silviculture with Birds in Mind*, a document prepared by the Vermont Department of Forests, Parks and Recreation and Audubon Vermont (Audubon Vermont & Vermont Department of Forests 2011). *Silviculture with Birds in Mind* provided options for integrating timber management with songbird habitat management, by investigating the structure necessary for suitable songbird habitat and determining how to mimic the type, intensity, scale and frequency of natural disturbances which create these structural conditions. In this way ecological forestry can also be known as natural disturbance-based silviculture.

Forest ecologist Jerry Franklin, an early proponent of ecological forestry, has described the components through the analogy of a three-legged stool. In a notable report for the United States Forest Service entitled *Natural Disturbance and Stand Development Principles for Ecological Forestry*, Franklin et. al states:

“[b]y analogy, ecological forestry (the seat of the stool) depends on each of its three principles (legs of the stool) to fully succeed. These legs or principles for management include (1) retention of biological legacies at harvest; (2) intermediate treatments that enhance stand heterogeneity; and (3) allowances for appropriate recovery periods between regeneration harvests” (Franklin, Mitchell et al. 2007).

#### 1.9.5. Structural Retention at Harvest: Maintaining Biological Legacies

Biological legacies can be broadly known as “the organically derived structures and chemical patterns persisting from a previous ecosystem through a period of disturbance and

incorporated into a recovering ecosystem” (Keeton 2017). Legacies are diverse and include whole organisms, reproductive structures, snags, soil organic matter, which act as lifeboats allowing organisms to recover following a disturbance. Retention of these structures is critical to enriching structural diversity within a forest. How much structure is left behind following a harvest and the distribution of this retention varies due to ecological and economic constraints. Often times, larger and more dispersed retention patterns can be more economically and procedurally challenging for loggers, so clear goals on the amount and type of retention is important to include in forest management plans.

#### 1.9.6. Stand Manipulations Using Natural Disturbance Style Forestry

Ecological forestry attempts to emulate the natural disturbances that have occurred on the landscape in order to create or maintain heterogeneity and complexity in the forest. Emulating these fine scale disturbances ultimately enhances structural habitat. This is accomplished by first identifying what type of disturbance is common in the region of interest. In Vermont forests, like many in New England, wind has been the major form of forest disturbance from hurricanes and microbursts but damage from ice storms, insects, and pathogens exist as well (Boose 2001). Natural disturbances from wind often result in the creation of patches of open areas throughout the forest creating spatial patterns in horizontal and vertical structure and broadly an uneven-aged forest. In Vermont, partial gap creating disturbances are frequent whereas stand replacing disturbances, such as a mega fire, are very infrequent. Mimicking the intensity, frequency, and scale of these disturbances has varied yet many land managers look to the use of historical range and variability (HRV) as a means to identify appropriate reference conditions, prioritize areas for treatment and design suitable treatments (Keane, Hessburg et al. 2009)

### 1.9.7. Appropriate Rotations and Return Intervals

The recovery periods between disturbances vary throughout the landscape. By identifying the frequency of natural disturbances, such as windstorms in the northern hardwoods, ecological forestry attempts to mimic the return intervals of silvicultural treatments to natural cycles. Disturbance rates often oscillate with a variation around a mean. While natural disturbance regimes often occur outside of any clearly identifiable pattern, ecological forestry attempts to mimic these regimes through a comparability index by outlining the spatial scale and frequency of these regimes (Seymour and Hunter 1999).

### 1.9.8. Landscape Level Considerations: The Fourth Leg of the Stool

Recently, Franklin has described a fourth leg of the ecological forestry stool analogy, pointing to the importance of landscape level considerations in forest management (Franklin 2013). Franklin outlines the thesis that forest resource management issues involve large spatial scales and the planning and silvicultural treatments implementation must consider the landscape level view. Habitat connectivity for wide ranging species and watershed health are two examples of resources that benefit from functional landscapes. Forest management that does not consider implications beyond the stand level bares the risk of impacting broader ecological processes. Attention to landscape level concerns can confer increased resilience and resistance to global environmental change and enhance forest connectivity.

### 1.9.9. Fifth Spoke Forestry: Incorporating Recreation in Ecological Forestry

The broad principles outlined in the ecological forestry movement are not diametrically opposed to the incorporation of recreation. Biological legacies can be retained alongside thoughtful trail development. Vertical and horizontal heterogeneity in forest structure can accommodate winding mountain bike trails. Natural recovery intervals from disturbances can be

maintained with thoughtful recreation planning and forest management. Striking this balance offers the chance at providing critical wildlife habitat, a source of forest revenue and a location for forest-based recreation. Foresters and land managers are already incorporating the elements of ecological forestry with forest-based recreation management and design. Recreation could be the fifth leg of Franklin's ecological forestry stool analogy, or as defined here, it is the fifth spoke in the wheel. Fifth Spoke Forestry recognizes the inherent benefits of managing a forest with the principles of ecological forestry but recognizes the capability to accommodate recreation such as trail infrastructure in its forest planning. Rick Morrill, the consulting forester for the Craftsbury Outdoor Center (COC), is doing just this. The COC is a world-renowned nordic ski center in Craftsbury, Vermont. Made famous by their robust ski trail network and reliable snowpack, the COC has added 40+ mountain bike trails across the centers forested property in the recent decade. The COC is privately owned and enrolled in the Current Use program; Morrill assists the COC with their forest management plan.

Recently, Morrill and a private contractor have conducted several harvests in the COC owned forest at the heart of the mountain bike and ski trail network. Utilizing an Irregular Group Shelterwood treatment, the harvest objectives included, creating a healthy mixed-wood forest, enhancing the complex canopy structure, retaining the presence of snags and downed woody debris as wildlife habitat, and producing a stock of high-quality trees for the future (Craftsbury Outdoor Center 2015).

To accomplish these goals, forest management included removing low quality stems to reallocate growing space to the best stems of long lived species, creating partially shaded ground conditions and utilizing scarification tactics to stimulate the growth of new seedling classes (Craftsbury Outdoor Center 2015). While the forest was laced with single-track mountain bike trails and valuable Nordic racing trails, through thoughtful planning, the forest management team

at COC was able to retain important forest structure while harvesting valuable timber and maintaining the important trail network that characterizes the Craftsbury Outdoor Center.

#### 1.9.10. Case Study: Cady Hill Town Forest

The Cady Hill Town Forest is a parcel of land in Stowe, Vermont comprised of 320 acres that has been identified as one of the highest priority areas for conservation in the Stowe region (Cady Hill Town Forest Management Plan 2015). “The combination of wildlife habitat, scenic view shed and recreation trails within walking distance of Stowe Village has made this area popular with the community...” (Cady Hill Town Forest Management Plan 2015). While the Town of Stowe owns the forest, the Stowe Land Trust (SLT) and the Vermont Housing and Conservation Board hold a conservation easement over the property. Since the easement was secured in 2012, SLT has ensured that all activities on the property conform to the terms of the conservation easement, but the Stowe Conservation Commission is responsible for the stewardship of the property. In addition, the Stowe Mountain Bike Club (SMBC) has a long-established Memorandum of Understanding with the Town of Stowe, which empowers SMBC as the mountain bike trail corridor manager on the property (Cady Hill Town Forest Management Plan 2015). Roughly 11 miles of single and double track multi-use trails exist in the forest and the mountain biking network has gained regional fame for its quality mountain biking terrain over recent years (Stowe Land Trust 2018). The primary objective of the town forest is to “provide and maintain access to a system of sustainable multi-use recreation trails” (Cady Hill Town Forest Management Plan 2015). However, ensuring that biodiversity, quality wildlife habitat and a healthy forest ecosystem are also important forest management objectives.

While most of the forest management focus pertains to the maintenance of the recreational resources, “timber harvests to maintain a healthy forest and generate income to offset management expenses” is included in the forest management plan (Cady Hill Town Forest Management Plan 2015). Active forest management in Cady Hill Town Forest had not occurred for over 20 years until a devastating windstorm occurred in October 2017 (Figure 20) and demolished over 2 miles of the state-of-the-art trail network (Town of Stowe 2018). The windstorm resulted in a massive tangle of downed trees and the Town of Stowe eventually needed to begin contracts with two separate logging contractors to salvage the downed timber and clear the way for trail reconstruction. The salvage plan called for “removing most – but not all – of the fallen trees and cutting some additional standing low-vigor, high risk trees in a



**Figure 15:** Forest composition at Cady Hill Town Forest, September 2018. The Cady Hill Town Forest experienced a powerful wind event in October 2017, which created large canopy gaps resulting from blowing down of wide swaths of trees. A lone mountain bike trail can be seen navigating the downed woody debris in the center left of the frame. Photo credit: Taylor Luneau.

configuration that creates a new variety of more complex growing and habitat conditions in a forest that, up until the windstorm, was fairly simple and uniform” (Stowe Land Trust 2018). The help of the Lamoille County Forester, Rick Dyer, and consulting forester, Allen Thompson, was enlisted to coordinate between the land managers and the contractors clearing the trails.

Utilizing a mechanized harvester, three 2 – 5 acre openings were salvaged during the process. However, the town forest did not become a tidy “park-like” forested landscape. Treetops and a wide array of downed woody debris were left on site for bird and wildlife habitat structure. For instance, tip up mounds created by the overturned root balls of larger trees have been shown to make great habitat for Winter Wren (Stowe Land Trust 2018). These intentional reserves will limit deer browse of advance regeneration and release a younger aged stand class in open canopy gaps. Outside of the heavily effected wind disturbance gaps, foresters advised the use of thinning’s and shelter wood harvests to remove low quality or “commercially-mature trees, leaving behind a tall, broken forest canopy of more vigorous, healthy trees” (Stowe Land Trust 2018). While the large openings created by the October wind disturbance can give invasive plants like the Japanese barberry (currently an issue in the Cady Hill Forest) suitable growing conditions to outcompete natives, the economic value of the salvage harvest could prove to fund restoration efforts. Further, “the very trees that are blocking the trails at Cady Hill Forest are helping to pay for clean-up efforts” (Sharpless 2017). What started as a devastating wind storm, the chaos in Cady Hill Town Forest has come to exemplify the form of timber management which can generate revenue for recreation infrastructure and access improvements.

According to Lamoille County Forester Dyer, the salvage harvest began in December 2017 and was completed by May 2018 (Dyer 2018). While the trails were closed during the harvest, they were re-opened by the start of the mountain bike season. During and following the harvest, several forest walks occurred which were open and free to the general public, with the



purpose of providing education on the value of the forest management protocol taking place in the town forest. Dyer, SLC representatives, the contractor and the Commissioner of the Vermont Department of Forest, Parks, and Recreation, Michael Snyder joined public visitors to tour the forest and investigate the damage of the wind disturbance, discuss the forestry practices being applied during the salvage and identify how those practices related to the benefit of the overall ecosystem (Stowe Land Trust 2018). The harvest tours provided an important educational component to the salvage and demonstrated the value of sustainable timber harvest to restore and enhance recreational resources as well as provide important wildlife habitat structure and safeguard soil and water resources.

### **1.10. Conclusion**

Vermont's working landscape is unique to the state. The abundance of productive farmlands, lush meadows, northern hardwood stands, and abundant ponds and rivers are all set to the backdrop of rolling green mountains. The aesthetic quality of the state has played an immense role in the development of the Vermont brand. But the rich character that defines the working landscape is tied to the conservation of our farmland and woodland. While Vermont's economy has largely been defined through the ages by its agrarian and forest products, changes in land use and demographics are driving industry, and development changes throughout the state. The outdoor recreation and tourism industry support a wide range of Vermont communities and has outpaced the forest products industry. Various public programs, such as VOREC, have been established to address this change in the state and leverage the outdoor recreation amenities that exist in Vermont. However, parcelization trends have increased in Vermont and there now exist more small parcels and fewer intact large types of woodland than ever. As parcelization trends usually precede land development, the character of Vermont forests is currently at risk of being changed or lost forever.

The economic burden of woodland ownership is emphasized by the drastic variation between the fair market value and the forestry use value. Such variation makes it economically challenging to retain large tracts of forestland for sustainable forest management. The rise in property values is not expected to slow in the near future and for many forestland owners, subdivision development offers a powerful incentive to escaping properties burdened by debt. These realities coupled with an aging demographic and high rate of migration out of the state, point to the challenges facing the future of the working landscape. While conservation easements, estate planning, and public land fee acquisitions offer some forms of defense against the changing land use in Vermont, a revitalized focus on forest-based recreation provides new strategies for keeping forests as forests. Not only has forest-based recreation proven to be economically beneficial, such as in the cases of Barre Town Forest and West Windsor Town Forest, outdoor-recreation connects people to their forested landscapes, enhancing the quality of life for residents and encouraging a new land ethic among a younger generation (Hanna 2005).

If Vermonters are to combat the deforestation and parcelization trends that currently exist in Vermont; local, state, and federal land managers need to leverage Vermont's outdoor recreation and tourism economies to provide jobs in the forest products and tourism industry. Municipal bylaws addressing forestland conservation districts and subdivision regulations will assist in the goals set forth by Act 250, the state's comprehensive land use planning statute (10 V.S.A. § 6086 Act 250). In addition, state programs such as the Current Use tax abatement program must be overseen closely and continue to work with forestland owners to ease the burden of rising property taxes. However, if Vermont is to reach the lofty conservation goals set forth by the *Wildlands and Woodlands* report, conservation initiatives must go beyond these measures and ensure that rural working landscapes are both economically beneficial for communities and maintain important natural resources and wildlife habitat.

Town forests offer a unique opportunity for municipalities across the state to both maintain the character of their homes and enhance the quality of their residents' lives. Town forests contribute to regional landscape connectivity and encourage forest product and outdoor recreation industries to thrive close to home. Beyond this, town forests secure important habitat, ensure the longevity of Vermont's water quality, and provide a location for school demonstrations and education projects. Striking the appropriate balance between developing outdoor recreation, maintaining the important character of Vermont's woodlands and ensuring the economic stability of Vermont's residents is precisely what the TFRP aimed to help communities work towards. By aggregating the data from the TFRP, this research ascertained that Vermont's town forests are largely underutilized, primarily due to resident's simply being unaware of these important resources. Educational campaigns could quickly address this issue, but broader planning will be necessary to correct plaguing access issues to these parcels across the state. Working with land trusts has proven successful in Vermont and towns like Richmond, Weathersfield, and Marshfield have successfully secured their town forests, in perpetuity for all to enjoy.

Importantly, this research found that there is a unilateral interest in developing human powered trail-based recreation in town forests of Vermont. Bike optimized multi-use trail development and expansion could meet this need in town forests across the state and encourage residents, and visitors alike, to frequent downtown districts and spend needed dollars in rural businesses. This is not to say that outdoor recreation should be developed at any cost. Mindful planning by land managers will alleviate potential harm to important ecological functions and health of Vermont's northern forest. Historically, resources have been lacking for local and municipal planners who hope to use forest-based recreation to revitalize their communities. By not meeting this growing need, unfortunate acts of illegal glading and trail development has

plagued many regions of Vermont including Jay Peak, Camels Hump, Brandon Gap, and a variety of town forests (Leo 2007) (Camels Hump Management Unit Draft LRMP). To avert the potential ecological harm of wanton trail development, insight into forest management which favors a reasonable balance between natural resource conservation and outdoor recreation development, is needed.

Ecological forestry has been demonstrated as a suitable forest management model on public lands where consumptive use is secondary to recreation and ecological preservation. Through managing the forest to mimic natural disturbance regimes, forest managers can replicate the conditions many wildlife species have evolved to thrive in. Identifying the pertinent disturbance type, like wind bursts in Cady Hill Town Forest, and the frequency, intensity, and spatial scale of these events, will allow land managers to tailor their prescriptions to the ecological needs of the forest. Historical land use trends are apparent in Vermont's town forests, which have seen variable stewardship since many were high graded or converting out of pastureland. Even-aged forest structure has been the target of many foresters who hope to use their prescriptions to create heterogeneity in forest structure, age, and species diversity. When combining these tools with thoughtful approaches that favor trail-based outdoor recreation, multiple benefits are recognized by Vermont forests, forest-based recreation and forest-based tourism. This is the foundational concept behind Fifth Spoke Forestry which strikes the balance between active forest management and forest-based recreation management. Best Management Practices (BMPs) have been developed during this research, as a compilation of advice and best practices provided by a wide array of County and private foresters. The BMPs are available in the Appendix of this document. When using these BMPs in conjunction with other land management strategies like the Triad model, which thoughtfully plans out zones of use in a

forest, such as in the Hinesburg Town Forest, town forests across the state can replicate valuable forest management for social, environmental, and economic purposes.

Outdoor recreation is a valuable forest product in Vermont, and it can be leveraged in a way that does not degrade the character of our ecologically important woodlands while also preserving the important working landscape that defines Vermont and its residents. Importantly the following forest management recommendations can help land managers meet the multiple use goals of their forest while sustaining long-term conservation and stewardship objectives.

### **Forest Management Strategies for Recreation in Vermont Town Forests**

1. *Incorporate the Triad Model of Forest Management and Planning:*  
Utilize the Triad model of forest zoning by designating areas within the forest of variable intensities of use including intensive, mixed intensity, and ecological reserves. This model acknowledges that not every use can occur on every acre.
2. *Identify levels of sustainable recreation:*  
Identify the ecological constraints of the forest through an ecological inventory assessment of resources such as water quality, wildlife habitat and soil structure. Utilize these findings to plan forest use according to what the forest resources can accommodate. Determining the recreational carrying capacity of the forest can be done by developing measurable benchmarks to impacts to ecological resources and utilizing a monitoring program to document the result of management decisions. Adaptive management allows land managers to assess the conditions of the recreation resource and adjust management decisions accordingly.
3. *Focus on Mountain Bike Optimized Multi-Use Trails:*  
A focus on Mountain Bike optimized multi-use trails stands to achieve forest management goals by balancing the needs of variable trail users during trail infrastructure improvements. Further, such trail design can attract the greatest amount of visitor spending in local communities where motorized forms of recreation are not encouraged or prioritized.
4. *Work with Local, State and Federal Forest Recreation Professionals:*  
Work with a County or private consulting forester as well as local, state and federal recreation offices to secure infrastructure funding and the necessary expertise in sustainable trail design. Working with Foresters early in planning stages will ensure a balance of active forest management and recreation that can benefit local forest economies, recreation demand and ecological security.

5. *Utilize Fifth Spoke Forestry:*  
A forest management strategy that draws on classical ecological forestry practices and combines a thoughtful recreation component, will safeguard long-term investments in the community forests. Fifth Spoke Forestry addresses this need.
6. *Plan at the stand and landscape levels:*  
While site-specific practices should be based on the present and expected conditions of individual forest stands, forest planning should account for the landscape scale. Thompson and Sorenson's work, *Wetland, Woodland, Wildland: A guide to the natural communities of Vermont* is a useful companion for identifying biophysical regions and natural communities of Vermont. Utilizing this forest mapping technique allows managers to understand the biodiversity in a given area based on the biophysical region.
7. *Target increasing structural and species diversity:*  
Town forests are a relic of historical land use and often suffer from poor forest management since these forests were high graded or converting out of agricultural use. For that reason, many foresters have targeted removing low quality stems to reallocate growing space to the best, long lived species, in order to generate diversity in age, structure and species.

## REFERENCES

- 10 V.S.A § 2651. Municipal Forest; Definition.
- 10 V.S.A. §2655. Receipts.
- 10 V.S.A. §6086. Issuance of permit; conditions and criteria
- 24 V.S.A. §4501. Creation of Conservation Commissions.
- 24 V.S.A. §4505. Powers and Duties of Conservation Commissions.
- 30 V.S.A. §248. New gas and electric purchases, investments, and facilities; certificate of public good.
- American Farmland Trust. "Cost of Community Services Studies." Farmland Information Center, 2016. <https://www.farmlandinfo.org/cost-community-services-studies>
- Audobon Vermont & Vermont Department of Forests, Parks and Recreation. "Silviculture with Birds in Mind: Options for Integrating Timber and Songbird Habitat Management in Northern Hardwood Stands in Vermont." 2011.
- Boose, Emery R., Kristen E. Chamberlin, and David R. Foster. . "Landscape and Regional Impacts of Hurricanes in New England." *Ecological Monographs*, vol. 71, no. 1, 2001.
- Brighton, Deb. "Land Conservation and Property Taxes in Vermont." Vermont Land Trust, 2009.
- Brown, Joshua. "A Milestone for Millstone Hill " *Land & People*, 2012. <https://www.tpl.org/magazine/milestone-millstone-hill-%E2%80%94-landpeople#sm.000117c74xcqkcutq4n1tnwpka6yy>. Accessed September 2018.
- "Cady Hill Town Forest Management Plan." edited by Town of Stowe and Stowe Selectboard, 2015. [https://www.townofstovevt.org/vertical/sites/%7B97FA91EA-60A3-4AC6-8466-F386C5AE9012%7D/uploads/CHFMP\\_5.26.15\\_adopted.pdf](https://www.townofstovevt.org/vertical/sites/%7B97FA91EA-60A3-4AC6-8466-F386C5AE9012%7D/uploads/CHFMP_5.26.15_adopted.pdf)
- Calhoun, Aram J.K. and Phillip deMaynadier. "Forestry Habitat Management Guidelines for Vernal Pool Wildlife." MCA Technical Paper No. 6, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York. pp. 1-26. 2004.
- Craftsbury Outdoor Center. "Craftsbury's Forestry Plan." <https://www.craftsbury.com/general/about-us/green-initiatives/craftsburys-forestry-plan/>. Accessed Septmeber 2018.
- Dartmouth College Environmental Studies Class. "Mount Ascutney and the West Windsor Town Forest: Linked Conservation and Recreation Planning at Mount Ascutney." 2017.

- David Foster et al. "Wildlands and Woodlands. Farmlands and Communities. Broadening the Vision for New England." 2017. Harvard University Press.
- Donath, David. "National Register of Historic Places Registration Form: Hinesburg Town Forest Citing: David Donath, Pond Brook and the Development of Mechanicsville (Hinesburg, Vt: Published by the Author,1975), 7, 17; edited by US Department of the Interior NPS, 2016.
- Dover, Haley. "Essex Residents: Land Settlement Is Apalling." *Burlington Free Press*, 2015. <https://www.burlingtonfreepress.com/story/news/local/2015/06/23/essex-residents-land-settlement-appalling/29179301/><https://www.burlingtonfreepress.com/story/news/local/2015/06/23/essex-residents-land-settlement-appalling/29179301/>.
- Drayton, C., Frayer, A., Gerry, L., Lizotte, G., Mitchell, M., Tapper, E., 2017. "Historical Analysis of Two Town Forests in Essex, Vermont." University of Vermont. edited by Darren Schribler, 2017.
- Echeverria, John D. "Property Values and Oregon Measure 37: Exposing the False Premise of Regulation's Harm to Landowners." Georgetown University Law Center, pp. 1-35. 2007.
- "Essex Town Plan." edited by Town of Essex, Vermont. 2016, p. 25. <https://www.essex.org/?SEC=0F129ED0-599B-44D2-9943-F4143DC1699C>
- Evans, Zander. "What Is Ecological Forestry? Citing: Hawley, R.C. 1929. The Practice of Silviculture, 2nd Edition. John Wiley and Sons, New York, Ny." Forest Guild, 2006.
- Evans, Zander. "What Is Ecological Forestry? Citing: Spurr, S. H., and A. C. Cline. 1942. Ecological Forestry in Central New England. *Journal of Forestry* 40(5):418-420. ." 2006, [https://www.forestguild.org/ecological\\_forestry/Ecological\\_Forestry\\_evans\\_06.pdf](https://www.forestguild.org/ecological_forestry/Ecological_Forestry_evans_06.pdf).
- Fellowship of The Wheel. "Fellowship of the Wheel Trail Networks." <http://www.fotwheel.org/trails/>. Accessed September 2018.
- Fidel, Jamey and Kate McCarthy. "Communtiy Strategies for Vermont's Forests and Wildlife: A Guide for Local Action." Vermont Natural Resource Council. 2013.
- Fidel, Jamey and Kate McCarthy. "Tracking Parcelization over Time: Updating the Vermont Database to Inform Planning and Policy. Phase III Report." 2018.
- "Forest Management Plan For the Indian Brook Town Conservation Area." edited by Ethan Tapper and Essex Conservation and Trails Committee, 2018.
- Franklin, Jerry F. "Ecological Forestry – a Global View." 2013. <https://www.youtube.com/watch?v=uf7RbIu7kXc> Accessed September 2018.
- Franklin, Jerry F. et al. "Natural Disturbance and Stand Development Principles for Ecological Forestry." edited by US Department of Agriculture, pp. 1-35. 2007.



- Gander, H. Ingold, P. "Reactions of Male Alpine Chamois *Rupicapra r. rupicapra* to Hikers, Joggers and Mountain bikers." *Biological Conservation*. 79: 3. 1997.
- Hanna, B. "The Role of Town Forests in Promoting Community Engagement and Fostering Sense of Place." Natural Resource, University of Vermont. Master of Science. 2005.
- "Hinesburg Town Forest Mangment Plan." Hinesburg, Vermont. edited by Hinesburg Town Forest Committee., 2012.  
[http://www.hinesburg.org/townforest/town\\_forest\\_management\\_plan\\_sept2012-amended2017.pdf](http://www.hinesburg.org/townforest/town_forest_management_plan_sept2012-amended2017.pdf)
- Jaeger, William K. "The Effects of Land-Use Regulations on Property Values." *Environmental Law*, vol. 36, no. 105, 2006, pp. 105 - 130.
- Judd, Richard. "Science, Conservation, and the Commons." *Second Nature*. 2014, pp. 179-209.
- Keane, Robert E. et al. "The Use of Historical Range and Variability (HRV) in Landscape Management." *Forest Ecology and Management*, vol. 258, no. 7, 2009, pp. 1025-1037.
- Keeton, William S. "Biological Legacies Definition." Forest Ecosystem Dynamics Class, Univerity of Vermont. 2017.
- Kohm, Kathryn A. and Jerry F. Franklin. *Creating a Forestry for the 21st Century. The Science of Ecosystem Management*. Island Press, pp. 11-27. 1997.
- Langlais, Matt. Interview by Taylor Luneau, September, 2018.
- Leo, R. "Illegal Trail Cut at Jay Peak." *On the Snow*. 2007. Retrieved October 12, 2018, from <https://www.onthesnow.com/news/a/1421/illegal-trail-cut-at-jay-peak>.
- Mad River Valley Active Transportation Plan. *MRV Moves*, edited by Mad River Valley Planning District & SE Group, Planning Document, 2016.  
[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)
- Mrion, J. Olive, T. "Assessing and Understanding Trail Degradation: Results from Big South Fork National Recreation Area." USDI, National Park Service. USGS Patuxent Wildlife Research Center, Virginia Tech. 2006.
- Marion, J. Wimpey, W. "Environmental Impacts of Mountain Biking: Science Review and Best Management Practices." *Managing Mountain Biking: IMBA's Guide to Providing Great Riding*. 2007.  
[https://www.imbacanada.com/sites/default/files/Marion\\_Wimpey\\_Review%20and%20Best%20Practices.pdf](https://www.imbacanada.com/sites/default/files/Marion_Wimpey_Review%20and%20Best%20Practices.pdf)
- Margolis, Anne. "A Forest for Every Town." *Northern Woodlands*, no. 57, 2008.

- Marlow, Josef E. "Economic and Fiscal Impacts of Smart Growth Policies." Lincoln Institute of Land Policy - Sonoran Institute Joint Venture, 2008.
- McCullough, Robert. "National Register of Historic Places Registration Form: Hinesburg Town Forest. Citing: Robert Mccullough, the Landscape of Community. A History of Communal Forests in New England (Hanover,Nh: University Press of New England, 1995)." edited by US Department of the Interior NPS, 2016.
- McCullough, Robert. "A Regional Town Forest Timeline."  
[https://vtcommunityforestry.org/sites/default/files/pictures/Resource/new\\_england\\_town\\_forest\\_timeline.pdf](https://vtcommunityforestry.org/sites/default/files/pictures/Resource/new_england_town_forest_timeline.pdf). Accessed September, 2018.
- McCullough, Robert. "Town Forests: The Massachusetts Plan" Chapter in "Stepping Back to Look Forward". Petersham, MA: Harvard University for Harvard Forest, 1998. ed. Charles H. W. Foster.
- Morin, R.S.; Domke, G.M.; Walters, B.F.; Wilmot, S. 2017. "Forests of Vermont." Forest Service Department of Agriculture, Northern Research Station. 2016.
- Morse, C. and W. Geller. "Vermont Roots Migration Project." The University of Vermont: Center for Research on Vermont, vol. 1, 2015.
- N'dolo, M., Selsky, R., Decarlo, D. "Economic and Fiscal Impact Analysis of the Vermont Trails and Greenway Council Member Organizations." Camoin Associates, 2016.
- National Association of Realtors and National Association of Homebuilders. "Consumer's Survey on Smart Choices for Home Buyers." 2004.
- National Register of Historic Places Registration Form: Hinesburg Town Forest. "Hinesburg Town Forest Historic Site Application." US Department of the Interior NPS, 2016.  
<https://www.nps.gov/nr/feature/places/pdfs/15001037.pdf>
- National Register of Historic Places Registration Form: Hinesburg Town Forest Citing: Cooperator's Woodland Record (January, 1959; June, 1962; and July 25, 1966)." US Department of the interior NPS, 2016.
- New England Forestry Foundation. "Provide More Recreation." *New England Forests: The Path to Sustainability*. pp. 2-47. 2014, [https://newenglandforestry.org/wp-content/uploads/2016/04/3.\\_Provide\\_More\\_Recreation\\_061714-SMALL\\_FILE.pdf](https://newenglandforestry.org/wp-content/uploads/2016/04/3._Provide_More_Recreation_061714-SMALL_FILE.pdf).
- O'Grady, Patrick. "A New Future for Mount Ascutney." *Upper Valley Business News*.  
<https://enterprise.vnews.com/2018/07/20/a-new-future-for-mount-ascutney/>. Accessed September 2018.
- Outdoor Industry Association. "The Outdoor Recreation Economy " 2017.  
[https://outdoorindustry.org/wp-content/uploads/2017/04/OIA\\_RecEconomy\\_FINAL\\_Single.pdf](https://outdoorindustry.org/wp-content/uploads/2017/04/OIA_RecEconomy_FINAL_Single.pdf) Accessed December 2017.

- Outdoor Industry Association. "Vermont Outdoor Recreation Economy Report." 2017.  
<https://outdoorindustry.org/resource/vermont-outdoor-recreation-economy-report/> Accessed September, 2018.
- Pogge, Drew. "The Second Coming of Millstone Hill: Recreation Replaces Mining in the Granite Capital of Vermont." *Vermont Magazine*, pp. 59-61. 2009.  
<http://www.millstonetrails.org/wp-content/uploads/2018/05/millstone-vt-mag.pdf>.
- Policy Priorities for Conservation: New England Partners. "A Policy Agenda for Conserving New England's Forests." 2012.  
<http://www.newenglandwild.org/images/protect/A%20Policy%20Agenda%20for%20Conserving%20New%20Englands%20Forests-FY13%20Priorities.pdf>
- Posner, S. and M. Ceroni. "Potential Economic Impact of Outdoor Recreation in the Barre Town Forest, Vermont." University of Vermont Gund Institute for Ecological Economics, 2011.
- Roan, Harris. "Draft Forest Management Plan for the Hinesburg Town Forest. For the 10 Years Beginning October 2017." Supplement to the Hinesburg Town Forest Management Plan. Adopted September 2012. 2017.
- Roman, J. and J. Erickson. "Economics of Conservation in Vermont" Gund Institute for Ecological Economics, University of Vermont. 2015.
- Roan, Harris. "Draft Inventory and Assessment for the Hinesburg Town Forest. Hinesburg. For the Years Beginning in January 2018." edited by Ethan Tapper, 2018.
- S.94. "An Act Relating to Promoting Remote Work." edited by General Assembly of the State of Vermont, 2018. <https://legislature.vermont.gov/assets/Documents/2018/Docs/BILLS/S-0094/S-0094%20As%20Passed%20by%20Both%20House%20and%20Senate%20Unofficial.pdf> Accessed October, 2018.
- SE Group. "Memorandum: Catamount Trail 2017 Backcountry Ski Use Economic Impact Analysis." edited by Drew-Pollak Bruce, 2017.
- Seymour, Robert S. and Malcolm L. Hunter, Jr. "Principles of Ecological Forestry." University of Maine, pp. 22-56. 1999.
- Seymour, Robert S. and Malcolm L. Hunter, Jr. "New Forestry in Eastern Spruce-Fir Forests: Principles and Applications to Maine." *Miscellaneous Publication 716*, edited by Maine Agricultural and Forest Experiment Station, pp. 2-30. 1992.
- Sharpless, Kristen. "Logging Clears the Way for Trails at Cady Hill."  
<https://www.stowelandtrust.org/news/detail/news/logging-clears-the-way-for-trails-at-cady-hill/>. Accessed October 2018.

- Stowe Land Trust. "Cady Hill Forest "  
<https://www.stowelandtrust.org/conserved/properties/cadyhillforest/>. Accessed September 2018.
- Stowe Land Trust. "Cady Hill Forest Salvage & Harvest Tour #2."  
<https://www.stowelandtrust.org/news/detail/news/cady-hill-forest-salvage-harvest-tour-2/>. Accessed September 2018.
- Stowe Land Trust. "The Good of Wood: Logging Has Cleared the Way for Trails at Cady Hill." 2018. <https://www.stowelandtrust.org/news/detail/news/the-good-of-wood-logging-has-cleared-the-way-for-trails-at-cady-hill/>. Accessed September 2018.
- Tapper, Ethan. Email Interview with Taylor Luneau, 2018.
- Taylor, R. Knight, R. "Wildlife Responses to Recreation and ASsociated Visitor Perceptions." Ecological Applications. 13 4: 12. 2003.
- The Barre Town Forest Managment Plan. "Barre Town Forest Plan." edited by Barre Town and Barre Town Forest Management Committee, 2013.  
[http://www.barretown.org/Budget\\_And\\_Plans/Town\\_Forest\\_Plan/Final\\_BarreTownForest\\_ManagementPlan\\_Full.pdf](http://www.barretown.org/Budget_And_Plans/Town_Forest_Plan/Final_BarreTownForest_ManagementPlan_Full.pdf), Accessed September, 2018.
- "The Vermont Town Forest Stewardship Guide: A Community User's Manual for Town Forests." edited by Northern Forest Alliance, 2015.  
<http://www.communitiescommittee.org/pdfs/TownForestStewardshipGuide.pdf>, Accessed June 20, 2018.
- "Town Forest Management Plan for the Cross and Glebe Lots." edited by Town of West Windsor Vermont Town Forest Committee, West Windsor Select Board. 2012.  
<http://swcrpc.org/wp-content/uploads/2013/11/Town-Forest-Management-Plan-03-06-2012.pdf>, Accessed September, 2018.
- Town of Stowe. "Cady Hill Reconstruction Bid Award. Agenda Item No. 3b." edited by Stowe Selectboard, 2018. [https://www.townofstowevt.org/vertical/sites/%7B97FA91EA-60A3-4AC6-8466-F386C5AE9012%7D/uploads/Agenda\\_Summary\\_-\\_Cady\\_Hill.pdf](https://www.townofstowevt.org/vertical/sites/%7B97FA91EA-60A3-4AC6-8466-F386C5AE9012%7D/uploads/Agenda_Summary_-_Cady_Hill.pdf), Accessed September, 2018.
- Trust for Public Land. "Vermont's Return on Investment in Land Conservation." edited by Joe Roman. 2018.
- US Forest Service. "Trial Backcountry Skiing Project Decision Memo." edited by US Department of Agriculture, Green Mountain National Forest. pp. 1-12. 2015.  
[https://www.fs.usda.gov/nfs/11558/www/nepa/98581\\_FSPLT3\\_2575081.pdf](https://www.fs.usda.gov/nfs/11558/www/nepa/98581_FSPLT3_2575081.pdf) Accessed August, 2018.
- US Forest Service: Southern Research Center. "The Economic Benefits of Recreational Trails: Factsheet." <https://www.srs.fs.usda.gov/factsheet/pdf/rectrails.pdf>. Accessed September, 2018.

- UVM Field Naturalist and Ecological Planning Students. "The Hinesburg Town Forest: Inventory, Assessment, and Management Consideration." 2006. [https://www.hinesburg.org/townforest/lia\\_htf.pdf](https://www.hinesburg.org/townforest/lia_htf.pdf).
- Vermont Agency of Administration Department of Taxes. "2017 Meals and Rooms Statistical Reports." <https://tax.vermont.gov/research-and-reports/statistical-data/meals-and-rooms/2017-meals-and-rooms-tax-statistical-reports>, edited by Department of Taxes, 2017. Accessed October, 2018.
- Vermont Agency of Administration Department of Taxes. "Participating Municipalities: Local Option Sales Tax." 2018. <https://tax.vermont.gov/business-and-corp/sales-and-use-tax/local-option-tax/municipalities>. Accessed September, 2018.
- Vermont Agency of Natural Resources. "Vermont Wetland Rules." vol. Vt. Code R. 12 004 056, 2018. [https://dec.vermont.gov/sites/dec/files/documents/wsmd\\_VermontWetlandRules\\_2018.pdf](https://dec.vermont.gov/sites/dec/files/documents/wsmd_VermontWetlandRules_2018.pdf)
- Vermont Agency of Natural Resources Department of Forests, Parks and recreation and the Fish and Wildlife DEpartment. "Camel's Hump Management Unit Long Range Mangement Plan." 7<sup>th</sup> Draft. October 2017. Accessed October 2018. [https://fpr.vermont.gov/sites/fpr/files/State\\_Lands\\_Administration/Lands\\_Management\\_Planning/Library/CHMU\\_DRAFT\\_LRMP.pdf](https://fpr.vermont.gov/sites/fpr/files/State_Lands_Administration/Lands_Management_Planning/Library/CHMU_DRAFT_LRMP.pdf)
- Vermont Departement of Forests, Parks and Recreation, Agency of Natural Resources. "2015 Vermont Forest Fragmentation Report. Report to Vermont Legislature." 2015. [https://fpr.vermont.gov/sites/fpr/files/About\\_the\\_Department/News/Library/FOREST%20FRAGMENTATION\\_FINAL\\_rev06-03-15.pdf](https://fpr.vermont.gov/sites/fpr/files/About_the_Department/News/Library/FOREST%20FRAGMENTATION_FINAL_rev06-03-15.pdf), Accessed September, 2018.
- Vermont Department of Forests, Parks and Recreation. "2017 Vermont Forest Action Plan." edited by Division of Forests, 2017. [https://fpr.vermont.gov/forest/vermonts\\_forests/action\\_planhttps://fpr.vermont.gov/forest/vermonts\\_forests/action\\_plan](https://fpr.vermont.gov/forest/vermonts_forests/action_planhttps://fpr.vermont.gov/forest/vermonts_forests/action_plan), Accessed September, 2018.
- Vermont Department of Forests, Parks and Recreation. Forestry Division, County Forestry Program "Use Value Appraisal: Program Manual." Vermont Agency of Natural Resources, Montpelier, Vermont. 2010.
- Vermont Department of Tourism & Marketing. "2015 Benchmark Report: Tourism in Vermont." 2017. <https://www.uvm.edu/~snrvtdc/publications/VDTM-Research-2015BenchmarkStudyFullReport.pdf>, Accessed September 2018.
- Vermont Department of Forests, Parks and Recreation. "Vermont Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2014 - 2018." Accessed September 2018. [https://www.recpro.org/assets/Library/SCORPs/vt\\_scorp\\_2014.pdf](https://www.recpro.org/assets/Library/SCORPs/vt_scorp_2014.pdf)

- Vermont Mountain Bike Association. "Vermont Outdoor Innovation Coalition." <https://vmba.org/voice/>. Accessed September 2018.
- Vermont Urban & Community Forestry Program. "Town Forests " *Forests for the People, People for the Forests*. <https://vtcommunityforestry.org/places/town-forests>. Accessed August 10 2018.
- Vermont Urban & Community Forestry Program. "Vermont Town Forest Recreation Planning Community Assistance Program: Overview Document." edited by Parks and Recreation Vermont Department of Forests, 2017. [https://vtcommunityforestry.org/sites/default/files/pictures/tf\\_community\\_assistance\\_program\\_overview.pdf](https://vtcommunityforestry.org/sites/default/files/pictures/tf_community_assistance_program_overview.pdf)[https://vtcommunityforestry.org/sites/default/files/pictures/tf\\_community\\_assistance\\_program\\_overview.pdf](https://vtcommunityforestry.org/sites/default/files/pictures/tf_community_assistance_program_overview.pdf), Accessed June, 2018.
- VOREC. "Executive Order 11-17: Vermont Outdoor Recreation Economic Collaborative." Executive Office: Governor Scott, 2017.
- WCAX-TV. "Town Forests: Recreation & Stewardship Action Plans." *Across The Fence*, with Judy Simpson, 2017. <https://www.youtube.com/watch?v=0hRDak-lweg><https://www.youtube.com/watch?v=0hRDak-lweg>. Accessed January, 2018.
- Wharton, E., et al. "The Forests of the Green Mountain State." N. R. Station. Resource Bulletin NE-158, USDA Forest Service. 2003.
- West Windsor Town Plan. edited by Windsor Planning Commission., 2014. <http://swcrpc.org/wp-content/uploads/2015/03/2014-West-Windsor-Town-Plan-Final-approved-052714.pdf> Accessed June, 2018.
- Woolf, Art. "Cheers! Vermont Sees First Population Increase since 2013." *Burlington Free Press*, December 27 2017. <https://www.burlingtonfreepress.com/story/money/2017/12/27/cheers-vermont-sees-first-population-increase-since-2013/982957001/><https://www.burlingtonfreepress.com/story/money/2017/12/27/cheers-vermont-sees-first-population-increase-since-2013/982957001/>, Accessed October, 2018.
- Woolf, Art. "Vermont Paradox: While School Enrollment Falls, Costs Go Up." *Burlington Free Press*, April 25, 2018. <https://www.burlingtonfreepress.com/story/money/2018/04/25/vermont-school-enrollment-falls-costs-go-up-art-woolf/547894002/><https://www.burlingtonfreepress.com/story/money/2018/04/25/vermont-school-enrollment-falls-costs-go-up-art-woolf/547894002/>, Accessed October, 2018.

## APPENDIX

### **Suggested Best Management Practices for Timber Harvests in High-Priority Recreational Trail Use Areas: Concepts in Managing for Multiple Forest Products.**

When planning and conducting a timber harvest, minimizing the disruptive effects of cutting and removing timber will mitigate adverse public perception of active forest management. When done well, timber harvesting can enhance forest function, construct meaningful wildlife habitat, retain carbon and provide a multitude of other economic, social, and ecosystem services. However, where the disruptive effects of active forest management spill into recreational paths or leave ugly forest conditions behind, those who recreate in the forest will inevitably be turned off from the harvesting process. Land managers have an opportunity to provide financial revenue from timber sales to towns but also to enhance the recreational experience of visitors by focusing on the aesthetics of their harvest and prioritizing current and future trail networks. Forest-based recreation and logging are a symbiotic relationship and the practices outlined below have been gathered from knowledgeable foresters throughout the state who are managing for multiple forest products including Vermont's outdoor recreation. This document is only a starting point for balancing recreation with timber in order to benefit the forest, mountain bikers, trail users, and land managers. These Best Management Practices (BMPs) are intended to encourage foresters to utilize harvest practices that meet each of these standards and there are a multitude of ways to accomplish these goals.



**Figure 16:** Multiple forest products. Northeast Kingdom, VT. Photo credit: Taylor Luneau

### **Planning Ahead: Identifying Pinch-points in the Forest and Marking Reserves:**

*Consider using mapping software like Arc-GIS, Avenza, Gai-Gps or Strava to map current or future bike optimized multi-use trails prior to harvest activities.*

- Mapping the existing trail network is essential to limiting damage to the trail system. A good plan will also create connectivity with other trails in the network and provide structure for new trails.

*Prioritize minimizing impact to the soil structure and water resources in the forest.*

- In Vermont, like other New England States, harvests are encouraged in the winter season as opposed to other seasons of the year. This ensures that the coldest temperatures of the year will freeze the soils and minimize erosion or rutting.
- Identify hydric soils, seeps, wetlands and vernal pools, and avoid these sensitive ecological areas by rerouting trails to avoid them. Refer to *Vermont Acceptable Management Practices for maintaining Water Quality on Logging Jobs in Vermont* (AMPs) (2018) for further detail on water quality.



*Show intentionality through the use of flagging, tree marking paint, etc.*

- Strive to flag the edges of the trail so that the trail corridor is well marked for contractors.
- Have an intentional color scheme that:
  - Identifies important biological legacies to retain on site.
  - Identifies bike optimized multi-use trails.
  - Identifies significant natural and ecologically sensitive features.
- Identify stonewalls, cellar holes and other cultural and historic resources to avoid.
- When smaller order streams exist on the site, which may be covered by dense vegetation, attempt to flag the center of the stream and maintain a riparian buffer outlined in the AMPs.

### **Ecological Forestry and Treatment types:**

*Utilize Ecological Forestry Practices to mimic natural disturbance events in your prescriptions.*

- Identify common natural disturbance regimes in your forest and aim to replicate their scale, frequency, and intensity in your silvicultural treatments.
- Retain biological legacies on site, such as snags and downed woody debris.
- Aim to create heterogeneity in forest age, species and vertical and horizontal stand composition.
- Consider landscape and watershed implications from your treatment.

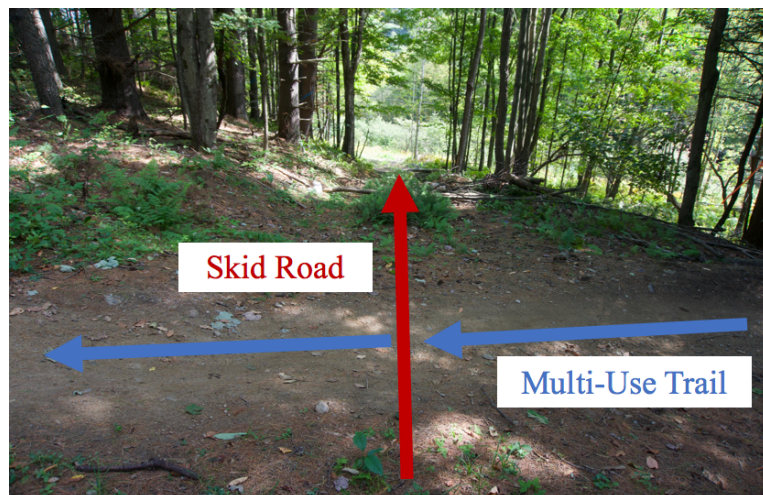
*Consider utilizing an Irregular Shelterwood or single tree and small group harvests where appropriate.*

- This treatment can develop complexity in the forest by creating spatial variability and delaying rotations to mimic natural disturbance return intervals.

## Logging Roads: Considerations for Crossing Trails and Creating Connectivity in the Trail Network:

*Aggregate skid trails that minimize number of crossings on existing recreation trails and attempt to cross the trail only once.*

- If the contractor does need to cross existing mountain bike trails then they should:
  - Cross at a 90-degree angle to minimize damage to the trail.
  - Once trail has been crossed at a 90-degree angle, aim to angle away from the trail so as to minimize line of sight down the skid roads.
- Pad existing berms or trail features with brush to minimize the damage to the feature if you expect to come into contact with it.



**Figure 17:** Diagram exemplifying the construction of skid roads that cross recreation trails at a 90-degree angle. Cady Hill Town Forest, VT. Photo credit: Taylor Luneau.



**Figure 18:** A mountain biker navigates a berm in Cady Hill Town Forest, VT. Photo credit: Evan Kay.

*If skid roads need to cross streams, identify the appropriate stream crossing first and then utilize the Vermont AMPs to develop appropriate bridging infrastructure.*

- Consider building bridges that favor connectivity in the recreation trail network and are bike optimized multi-use bridges for the future recreational use.

*Use skid trails and/or groups and patches to highlight large attractive trees or views.*

- Capitalize on important intersections to highlight snags, old growth trees or other important ecological features.
- Utilize these opportunities to provide signage and other educational material as to the importance of the ecological feature that has been retained.



**Figure 19:** A bridge crossing in the West Windsor Town Forest, VT. Photo Credit: Aiden Gilbert.

*Avoid running skid trails parallel to existing recreation trails that can result in aesthetically damaging impacts.*

- Attempt to angle skid roads away from the line of sight of mountain bike and other recreation trails.

*Lay out skid trails so that they may be used for future recreation trails.*

- Consider the future use of these skid trails as access roads for harvest equipment and maintain their potential as such.
- Strive to use these roads for connectivity between single-track networks.
- Consider using skid roads as cross-country skiing or fat-bike terrain in the winter.

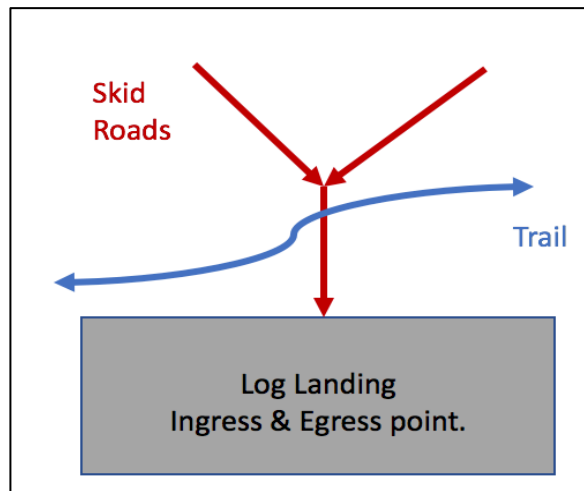


**Figure 20:** Merging point for a skid and mountain bike trail at Moose Haven, Kingdom Trails. East Haven, VT.  
Photo credit: Taylor Luneau.

### **Log Landings and Closing Up Shop:**

*Create a log landing that utilizes as small a space as possible and is close to an existing ingress and egress point.*

- Funnell aggregated skid roads into one road that feeds to the log landing.
- Where possible, plan to use the log landing as a future parking lot for recreational trail users.



**Figure 21:** Diagram demonstrating the aggregation of skid roads in order to cross a recreation trail only once and at a 90-degree angle before returning to the Log landing.

*After harvest is completed remove damaged trees along trails that lean, have large broken tops or branches, or have excessive bark loss.*

- Public safety along the trail corridors is paramount and any remaining trees that are likely to fall onto the trail should be felled and removed from the trail corridor.
- Do not girdle trees near recreational use trails. While girdling trees is a suitable practice used for the creation of wildlife habitat in the form of snags, it increases the odds that the dying structure may fall on to the trail and therefore increases public safety concerns.



**Figure 22:** A snapped tree or “widow-maker” hangs over a multi-use trail in Morrisville, VT.  
Photo credit: Taylor Luneau

**Education. Utilize Management to Tell the Story of the Multiple Benefits of Forestry:**

*During the harvest, be explicit with the public about which trails, or areas of the trail network that are closed for harvest operations.*

- Provide adequate signage on the trail network to both inform recreationalists of the closure and further educate visitors on the ecological, social, and economic values of the harvest.

- Consider using graphics and simple verbiage to identify the goals and the objectives of the harvest, how it will benefit the recreation community, and what to expect for a timeline of operations and post-harvest forest structure.

*Opportunities exist for educational signage around the value of downed woody debris for carbon retention, nutrient cycling, and soil structure.*

- Included in the signage and other educational materials, consider including descriptions of the value of downed woody debris for the ecosystem.
- Consider offering a “forest walk and talk” to describe to the recreation community the value of woody debris and the multiple benefits it provides. This process aids in changing the “park like aesthetic” which many have come to observe as a clean and well-kept forest. Share the phrase “Mess is Best” when describing the retention of woody debris.



**Figure 23:** Forest composition following a high intensity wind storm at Cady Hill Town Forest, VT.  
Photo credit: Taylor Luneau

*Minimize slash left on high use recreation trails.*

- While downed woody debris has many benefits in the forest, it can adversely affect trail networks and endanger mountain bikers or skiers using the trail. Do your best to plan where you will leave the woody debris post-harvest.
- Strive to remove the logging debris (slash) from existing trail networks or work with a local mountain bike club to gather volunteers and accomplish this post-harvest completion.
- When dealing with tree tops, lop them to within two feet of the ground; or
  - Consider whole tree harvesting to eliminate most of the slash; or
  - Educate the public on the value of slash for wildlife habitat, nutrient retention, soil productivity, and decrease deer browsing. Celebrate this option!

*After harvesting employ best practices on skid trails by smoothing ruts, seeding exposed mineral soils and installing water control measures, such as waterbars, that take into consideration recreational use of the trail.*

- Vermont AMPs suggest a waterbar on skid roads, after logging, every 135 feet on a road grade with a 5 percent slope and every 80 feet on a 10 percent slope. See Vermont AMPs for more detail (2018).
- If using the log road as a biking trail, attempt to create natural sheeting of water off the trail to minimize the aggregation of water, which will accelerate in speed on slopes and increase erosion of the trail. The same is true and equally important for the mountain bike trails.





**Figure 24:** The forest-based economy. East Burke, VT. Photo credit: Taylor Luneau

**“Boards, Cords and Miles of Smiles.”**

**It’s what we do here in the Northern Forest.**

~ Matt Langlais, Caladonia County Forester, VT.

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