State of Vermont
Agency of Natural Resources
Department of Forests, Parks and Recreation
Department of Fish & Wildlife
Department of Environmental Conservation

Castleton Management Unit

DRAFT Long Range Management Plan

Including:
Birdseye Wildlife Management Area
Blueberry Hill Wildlife Management Area

Castleton, Ira, Poultney, Vermont

4,725 acres

Prepared by: Rutland Stewardship Team

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Approved by: _____ _____
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Fish & Wildlife Department

Reviewed by: _____ _____
Danielle Fitzko, Commissioner — Date
Department of Forests, Parks & Recreation

Approved by: _____ _____
Julie Moore, Secretary Agency of Natural Resources — Date

(Date of LRMP Template: 2/13/2020 TM/LT/MMC)

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[1] The District Stewardship Team (DST) is an inter-disciplinary group of natural resource professionals from the Departments of Forests, Parks & Recreation, Fish and Wildlife, and Environmental Conservation. The DST is responsible for planning and management of ANR lands in the district. When necessary, this group seeks input from other ANR professionals.

Mission Statements

Vermont Agency of Natural Resources

The mission of the Agency of Natural Resources is "to protect, sustain, and enhance Vermont's natural resources, for the benefit of this and future generations."

Four agency goals address the following:

- To promote the sustainable use of Vermont's natural resources;
- To protect and improve the health of Vermont's people and ecosystems;
- To promote sustainable outdoor recreation; and
- To operate efficiently and effectively to fulfill our mission.

Departments

Vermont Department of Environmental Conservation
Mission Statement

To preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations.

Vermont Fish & Wildlife Department
Mission Statement

The mission of the Vermont Fish & Wildlife Department is the conservation of all species of fish, wildlife, and plants and their habitats for the people of Vermont. To accomplish this mission, the integrity, diversity, and vitality of their natural systems must be protected.

Vermont Department of Forests, Parks and Recreation
Mission Statement

The mission of the Department of Forests, Parks and Recreation is to practice and encourage high quality stewardship of Vermont's environment by monitoring and maintaining the health, integrity, and diversity of important species, natural communities, and ecological processes; managing forests for sustainable use; providing and promoting opportunities for compatible outdoor recreation; and furnishing related information, education, and services.

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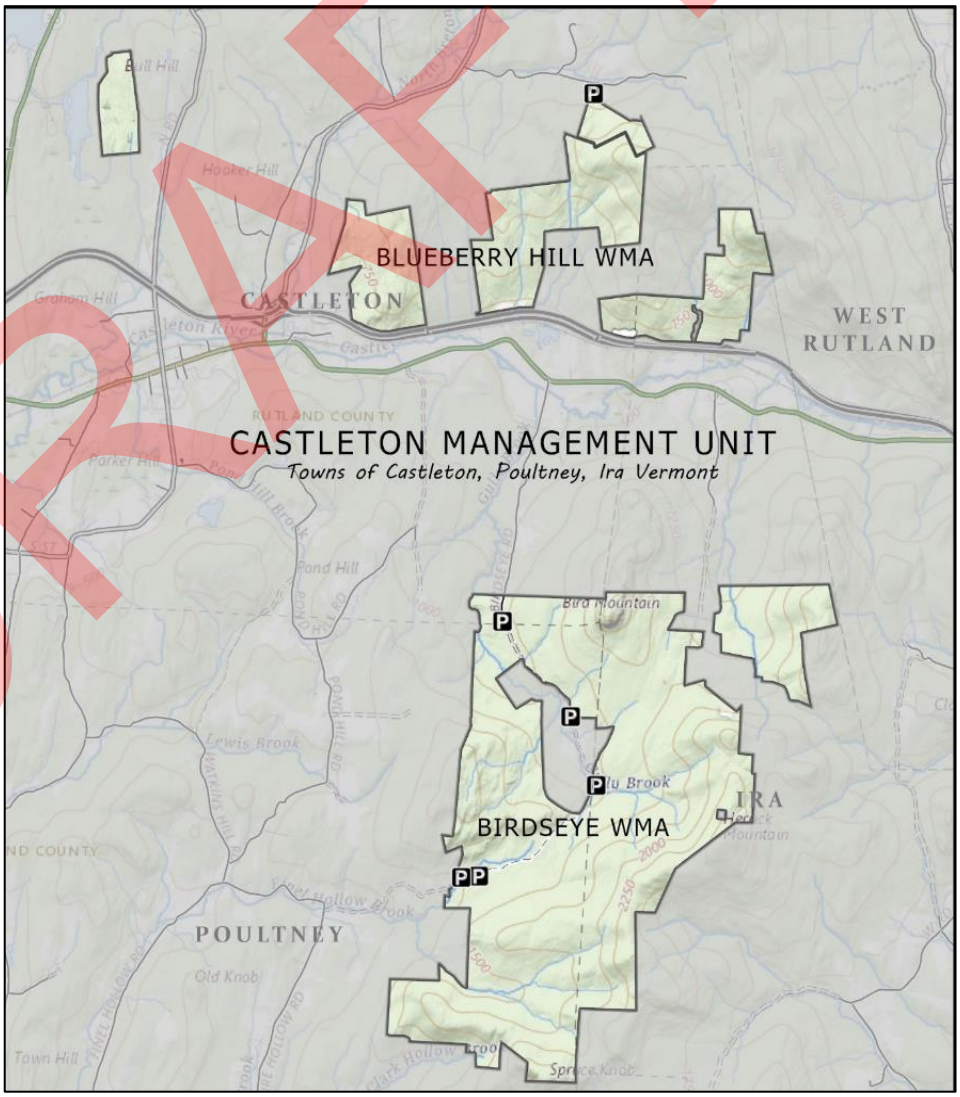
EXECUTIVE SUMMARY

Long-Range Management Plan (LRMP) Development

The Castleton Management Unit is an important place – valued by many, for many reasons. These lands are significant to many for scenery, recreation, hunting, landscape connectivity, wildlife and wildlife habitat, carbon storage and sequestration, climate mitigation, forest products, and more. Management is purposefully balanced and carefully calibrated to achieve these multiple goals to the best of our ability.

The 4,725-acre CMU is in the Taconic Mountain towns of Castleton, Poultney, and Ira, just 6 miles west of the City of Rutland. Blueberry Hill WMA (1,152 acres) consists of four separate parcels with limited legal public and management access. The much larger Birdseye WMA (3,573 acres) lies to the south and is made up of two parcels, the largest including nearly 3000 acres, and with five parking areas to support public access.

The parcels that make up the CMU were acquired by the State of Vermont between 1970 and 2016. Blueberry Hill WMA (BBHWMA) was created in 1970 with conveyances from the Vermont Agency of Transportation associated with US Route 4. Access to these properties was impacted by the construction of the highway and was transferred to the Vermont Fish and Wildlife Department to be managed as wildlife habitat. Birdseye WMA was created in 1976 with just 580 acres. An acquisition in 2009 increased the size to just over 700 acres. The WMA reached its current size in 2016 with the acquisition of over 2800 additional acres.



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Management Goals and Objectives for Castleton Management Unit

Priorities of management for the CMU are to protect and conserve natural, cultural, and scenic resources, to provide wildlife-based recreation including hunting, fishing, trapping and wildlife observation, to maintain and enhance diverse wildlife habitats, and to continue to harvest forest products sustainably. Management priorities will also vary depending on the Land Management Classification (LMC) described below and on page 81.

The following describes broad management strategies and actions that will help achieve each management goal. These goals are overarching and relevant across the entire management unit. The Land Management Classification that is described below and on page xx will have more site-specific priorities and management actions.

The unit wide goals are to:

- Protect the ecologically functional landscape and natural and cultural resources of the Castleton Management Unit.
- Promote climate adaptation and carbon resilience on the landscape to address climate change impacts.
- Provide high quality wildlife habitat for a diversity of species.
- Provide opportunities for dispersed, sustainable fish- and wildlife-based recreation.
- Manage forests through sustainable management and harvest practices to achieve wildlife habitat goals, support a healthy and resilient forest, and support the production of an array of wood products and local economy.

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Priority strategies and focus areas for Castleton Management Unit

	Strategies	Focus Areas
Natural Communities	• Protect sensitive & maintain quality of state significant natural communities & rare, threatened, and endangered species. • Allow natural processes and disturbance regimes to prevail and old forest conditions to develop in designated areas across 25% of CMU. • Preserve, enhance, and restore natural community habitat features, structure, and species composition through targeted silviculture practices. • Promote native species, manage invasive species.	Unique oak communities, Herrick ridgeline, significant natural communities, Bird Mountain summit
Wildlife Habitat	• Enhance habitat through management of all vegetative stages. • Increase young forest to aid in meeting 3-4% VCD targets for Taconic Mountains. • Use passive & active management to develop old & structurally complex forest. • Enhance hard and soft mast components and winter habitat. • Protect habitat for rare, threatened & endangered species protections.	Winter habitat – softwood & hardwood, young forest & old forest habitat, old fields, mast stands
Water Quality	• Enhance forest cover in riparian areas & wetland buffers to maintain natural stream temperatures, wildlife corridors, & to mitigate flooding impacts. • Follow riparian guidance to protect all wetlands, seeps, streams, & vernal pools. • Design roads, trails, & other infrastructure for aquatic organism passage & flood resiliency. Improve exiting road and trail infrastructure to minimize erosion.	Gully Brook, vernal pools, small wetlands, seeps, riparian zones
Climate Adaptation	• Promote & protect areas with diverse tree species, sizes, ages, & spacing for forest structural complexity to moderate impacts of severe disturbance & to aid in maintaining forest processes & ensure carbon resilience through both active & passive management. • Protect soil quality, nutrient cycling & hydrology. • Reduce the number of trees that serve as host species for invasive insects & diseases in a manner that considers the overall health & function of the forest (considering regeneration and understory plant communities). • Promote the establishment of well-adapted species and consider future-adapted species. • Maintain forest corridors to promote movement and dispersal of species over time.	Throughout CMU
Forest Management	• Develop & maintain a resilient forest that fosters natural communities with a range of tree densities, gap sizes, plant species, and tree ages. • Provide sustainable, periodic timber harvesting to promote wildlife habitat & forest productivity. • Utilize diverse types of forest management to create age and structural complexity. • Develop silvicultural prescriptions that consider likely climate change scenarios and focus on building resiliency and complexity.	LMC 2.0 & 3.0
Recreation	• Partner with VAST to provide enjoyable & safe trail user experience & an ecologically sound trail system. • Support opportunities for dispersed, sustainable, fish and wildlife-based recreation. per easements, funding requirements, and department mission. • Provide landscape for remote, dispersed recreation. • Ensure proper planning for and implementation of new trails where appropriate.	Throughout CMU
Public Access	• Maintain existing parking areas, kiosks, & signage to support public access. • Continue to seek opportunities for public access to BBHWMA. • Develop public access opportunities where lacking, needed, and appropriate.	Along town roads adjacent to CMU
Roads, trails & Historic Resources	• Maintain roads, trails & infrastructure responsive to likely climate change impacts. • Promote resiliency, water quality, and erosion control. • Plan water crossings on roads & trails to withstand increasing frequency & intensity of storm events, enhancing flood resilience & mitigating downstream impacts. • Document, interpret and protect historic resources. • Consult with Division of Historic Preservation on ground disturbing activities.	Throughout CMU

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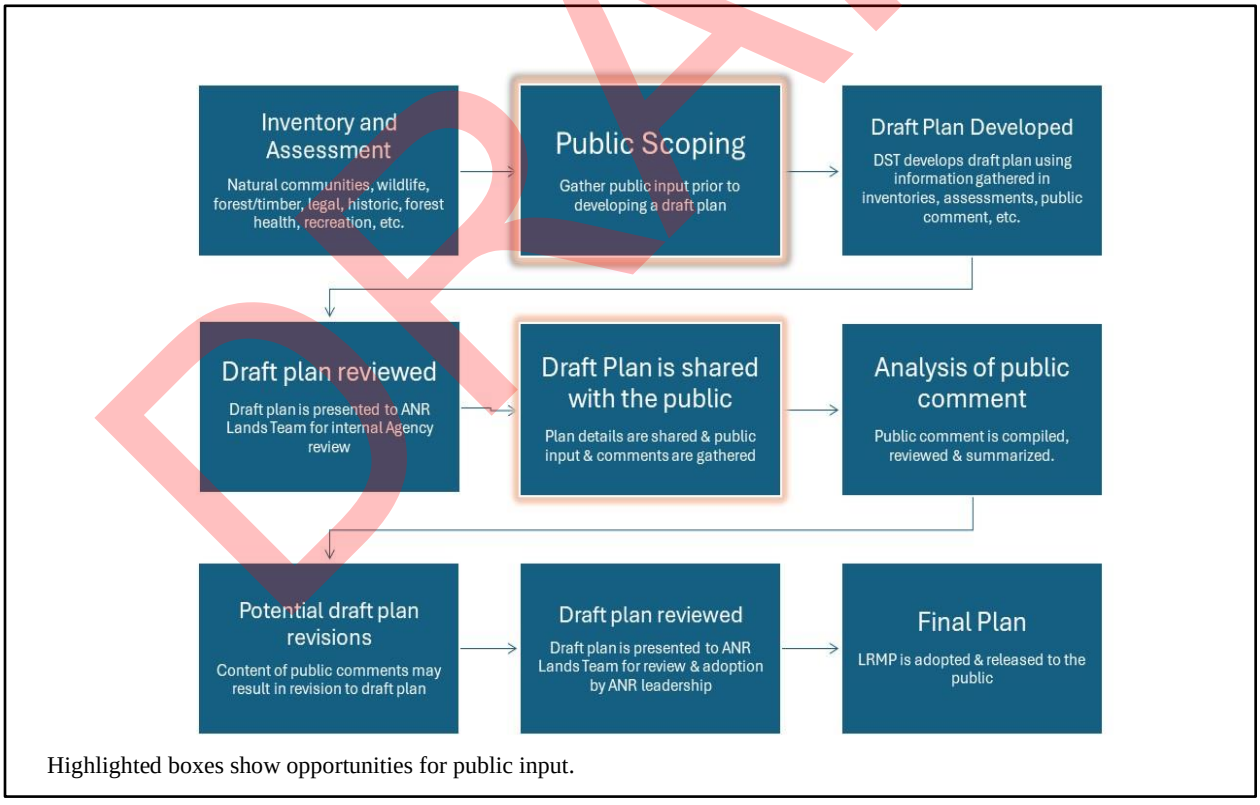
Why Are Long-range Management Plans Needed?

On behalf of the State of Vermont, the Agency of Natural Resources (ANR) manages state-owned land for a variety of purposes, ranging from the protection of important natural resources to public uses of land. The Agency of Natural Resources plans for the management of its state-owned lands through the development of long-range management plans (LRMP). Planning processes are important for guiding the management of multiple uses, such as where and what types of recreation occur, where and how timber is harvested, and the management of wildlife habitats. The planning process is also a critical tool to ensure the public has a voice in the management of valued public assets. A management planning process ensures that diverse social interests are considered within the natural and cultural context of the land base.

The development of a long-range plan for the Castleton MU was catalyzed by the acquisition of nearly 3000-acre addition and the expiration of the previous plan for Birdseye WMA developed in 1986. This long-range management plan for Birdseye and Blueberry Hill Wildlife Management Areas, collectively referred to as the Castleton Management Unit (CMU), will guide management for the next 20 years.

Developing a long-range management plan includes many steps. This process is summarized below and is further detailed in FPR Policy #21: State Lands Management Planning, available in Appendix 8.

Long-Range Management Planning Process:



Highlighted boxes show opportunities for public input.

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The Vermont Agency of Natural Resources (ANR) plans for the management of state-owned lands through the development of parcel or unit-specific Long-range management plans (LRMP) developed by the Agency's District Stewardship Teams (DST). These teams are inter-disciplinary groups of natural resource professionals from the Departments of Forests, Parks and Recreation, Fish and Wildlife, and Environmental Conservation. The development of long-range management plans follows a robust process that includes resource inventories and assessments, goal setting, public involvement, and development of implementation strategies and actions. Resource and biodiversity conservation based on sound science are important goals in the development of LRMPs and management decisions take into consideration the purposes for which the land was acquired, and legal restrictions associated with the land.

Public Involvement in LRMP Development

Public input is an important part of the development of a robust LRMP and the ANR is committed to a planning process which offers the opportunity for the public to participate. The public input process for this LRMP was purposefully varied and included open-house style meetings, a widely shared digital Story Map, public input surveys, and conversations with partner organizations, neighbors, and interested public to encourage meaningful dialogue of value and context. Public scoping was conducted in 2017 and 2021. All public comments were received, reviewed, and summarized by the DST and considered in the development of the LRMP. Every effort was made to incorporate suggestions and comments into the plan to resolve user conflicts and create opportunities that are compatible with ANR and Department missions, ANR management principles and stewardship goals for the property. More information on the public process for the CMU LRMP can be found on page 15. While public input is not driven by majority rule, ANR welcomes suggestions that align with the missions and goals of the agency and departments, as well as the principles guiding the management of ANR lands. We also take into consideration what is financially feasible. A summary document of public comment received and ANR response can be found in Appendix 4. Public involvement on ANR-owned lands is guided by a policy of the same name, which is available in Appendix 9.

Legal Considerations and Public Access

Pittman-Roberston Act funding was used to acquire the BWMA. Conditions related to use of that funding require that management activities and land uses must be consistent with objectives of protecting, restoring, or improving habitat for wildlife and wildlife-based recreation. The 2016 addition to BWMA is encumbered by a perpetual conservation and public access easement co-held by the Vermont Land Trust and the Vermont Housing and Conservation Board. The purpose of this easement is to "*conserve and protect present and future biological diversity, important wildlife habitat and natural communities, wildlife-based recreation, and natural resource and scenic values."*

Access is critical for management and public use of state land. There is limited legal access to BBHWMA, however, through a Memorandum of Understanding with the Vermont Federation of Sportsmen's Clubs the public can access the Middle Block of the WMA from a parking area on Belgo Road. There are also several management-only access agreements to the West and Middle Blocks of the WMA. The Agency continues to explore viable prospects for increased public access. Opportunities for public access to Birdseye WMA are more numerous and several

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parking areas exist on town roads. See page 15 for more information and Map 5 showing public access to the WMAs.

Vermont Conservation Design

Vermont Conservation Design[2] (VCD) is a scientific vision for maintaining the state's ecologically functional landscape which includes forest blocks, riparian areas, natural communities, and habitats that are highest priority for sustaining Vermont's biodiversity now and into the future. State lands are critical to achieving the vision in VCD, and VCD is a key tool that informs the parcel- and unit-specific strategies included in the Management Strategies and Actions section of the CMU long-range management plan on page 79.

The Long-Range Management Plan considers and is consistent with VCD proposing multiple objectives that contribute to its vision. The inclusion of these and many other strategies ensures that the Castleton Management Unit contributes to maintaining the ecologically functional landscape envisioned by Vermont Conservation Design.

Both Blueberry Hill WMA and Birdseye WMA are situated within large (approximately 18,600 and 23,600 acres, respectively) forest blocks that have been identified in Vermont Conservation Design as highest priority interior forest blocks and highest priority connectivity blocks. One specific example in this plan is the strategy to promote wildlife movement and ecological connectivity. This includes the most important north-south and east-west connectivity in the southwest region of the state. This is part of the regionally critical "Adirondack to Greens" corridor identified by the Staying Connected Initiative. Another specific example includes the management to promote the development of structurally complex old forest conditions and early successional habitat that contribute to meeting the old and young forest targets in Vermont Conservation Design. Old and young forests are essential components of an ecologically functional landscape and are identified as highest priority targets in Vermont Conservation Design. Old forests require long time frames to develop, and the full expression of old forest characteristics requires continuity of ecological processes over many centuries, making old forest restoration a long-term commitment. State lands currently make no contribution to the old forest target in the Taconic Mountain biophysical region, but managing for future old forests in the CMU in state-significant natural communities can help to achieve old forest targets and increase carbon storage. Conversely, young forest habitat is created primarily by timber harvesting and natural disturbances that take place over a 15-20-year timeline. Some areas of the CMU currently support young forests, and additional management can help to meet regional goals and increase carbon sequestration.

The inclusion of these and many other strategies ensures that the Castleton Management Unit contributes to maintaining the ecologically functional landscape envisioned by Vermont Conservation Design.

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[2] Zaino, R., Sorenson, E., Morin, D., Hilke, J., & Thompson, K. *Vermont Conservation Design Part 2: Natural Communities and Habitats Technical Report*. State of Vermont, Department of Fish and Wildlife; Department of Forests, Parks and Recreation, Montpelier, 2018.

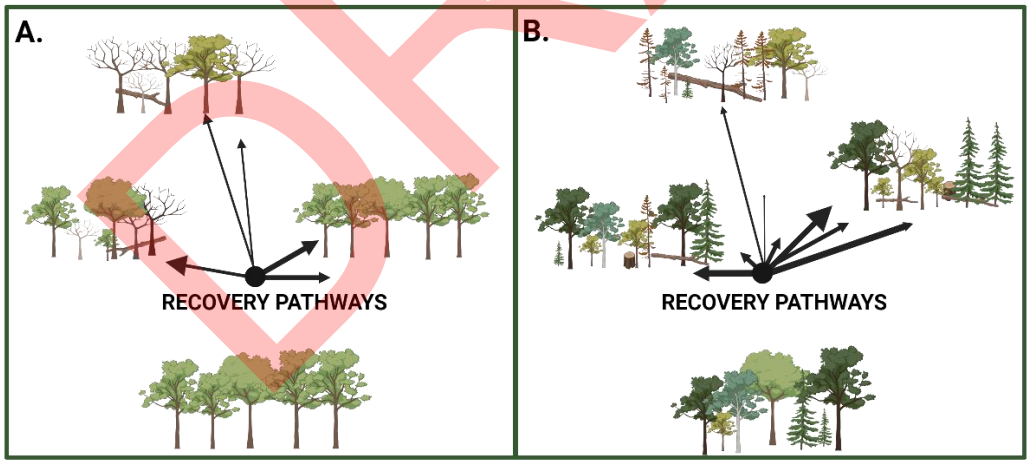
Wildlife and Wildlife Habitat

With its large unfragmented forests, the CMU, and the surrounding area, provide significant wildlife habitat for many types of wildlife to live, reproduce, and move throughout a wide area. In combination, the wetlands, vernal pools, stream and riparian habitat, winter habitat, mast stands, and cliff habitats contribute to a vibrant mix of conditions within CMU. Forests of varying ages contribute structural conditions required by wildlife for their varying habitat needs. Forest management that supports the development of young and old forests ensures that these habitat conditions are met on CMU. Using timber harvesting to create 3-4% in young forest will meet VCD targets for the Taconic Mountains biophysical region, the amount needed to reverse the declining trend and reach a level that at one time supported all of Vermont's native species that require young forest. Management will also release important mast species, enhance deer wintering habitat, promote cavity, snags and den trees and downed wood – all important habitat, and use a combination of passive and active forest management strategies to promote the development of old forest characteristics over time. More information about wildlife and wildlife habitat can be found on page 32. A map of wildlife habitat resources can be found on pages 40 and 41.

Climate Change and Adaptation

Vermont forests have undergone significant changes over the past century due to land use and the introduction of invasive plants, insects, and diseases. Compounding these impacts, climate change poses a significant threat to forest ecosystem function, including those found in CMU, through changes in temperature, precipitation patterns, growing season length, ranges of insect pests and pathogens, and frequency of natural disturbances. To adequately account for the uncertainty and adaptability to future climate change, forests should be managed as complex adaptive systems, with the goal to maintain or enhance stand structural and compositional diversity as well as functional redundancy across multiple temporal and spatial scales.

Figure 1: Recovery Pathways:



Greater diversity in ecosystems provides increased recovery and resilience pathways to maintain forest function under future climate conditions (Figure 1). This can be achieved through both active and passive management to create a resilient landscape that improves and maintains an array of ecosystem services and addresses social and ecological needs.

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Figure 1 – Recovery Pathways: Forests (dot) adapt to changes in conditions (e.g., drought and extreme precipitation, mortality due to pests and pathogens) through altered stand structure and composition. Recovery pathways in response to climate change are depicted as arrows for an even-aged forest with minimal species diversity (Panel A) and an uneven-aged forest with greater species diversity (Panel B). Arrow length is an indicator of the amount of change while arrow thickness is the likelihood of that pathway.[3]

Forest Carbon

Carbon resilience is an important aspect of managing the forests in the CMU. Carbon stocks and rates are measured through permanent forest inventory plots. Vermont forests accumulate carbon from the atmosphere and store it in aboveground biomass and soil and confer landscape and community resilience, even while being vulnerable to climate change impacts themselves. The ability of a forest to store carbon and the rate at which forests accumulate carbon peak at different stages of forest development. Young forests accumulate carbon at a higher rate but have less storage, while old forests have a lower rate of accumulation but can store greater amounts carbon (Figure 4).[4]

Both the rate of accumulation and storage of carbon are critical pieces of the equation for carbon mitigation and resiliency, emphasizing the importance of having a range of forest structural and compositional diversity across the landscape. It's important to note that forests are more than their carbon content or the timber products they provide; they are complex systems that provide an array of ecosystem services and should be managed tactfully to achieve a balanced-approach and not through the narrow lens of a single-objective approach to maximize one service over the other (e.g., carbon, timber, etc.). The CMU LRMP utilizes sustainable forest management to enhance or maintain forest and carbon resilience through diversifying both species and structural composition while addressing social and ecological needs (e.g., wildlife habitat, forest products, carbon storage and accumulation, recreation, etc.). More information can be found on page 50.

The CMU management plan utilizes muti-objective forestry/adaptive management to enhance or maintain forest and carbon resilience through diversifying both species and structural composition while addressing social and ecological needs.

Natural Communities

With its forests of oaks and hickories, rocky outcrops and cliffs, shaded hemlock ravines, and spruce-clad summits, the CMU encompasses a remarkable range of physical, biological, and ecological diversity. The CMU is in the Taconic Mountain biophysical region—a variable region characterized by extremes of elevation, precipitation, and climate—and this variability is reflected on the CMU. Elevations range from about 500 feet along Route 4 in Blueberry Hill

[3] Adapted from Puettmann, K. J. and Messier, C., "Simple Guidelines to Prepare Forests for Global Change: The Dog and the Frisbee," *Northwest Science* 93(3-4), 209-225, (28 January 2020).
[4] Hoover, C.M., Smith, J.E., *Aboveground Live Tree Carbon Stock and Change in Forests of Conterminous United States: Influence of Stand Age*, Carbon Balance Manage 18, 7 (2023).

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WMA, up to just over 2,600 feet near the summit of Herrick Mountain in Birdseye WMA. Underlying bedrock includes both acidic and calcareous (calcium-rich) rocks. This physical diversity is the foundation for the CMU's biological and ecological diversity.

Twenty-eight natural community types have been mapped on the CMU. Sixteen of these are rare or uncommon in Vermont, such as Dry Oak Woodland, Red Pine Forest, and Temperate Calcareous Cliff.

There are one or more state-significant occurrences of at least 23 natural community types. Many of these occurrences are some of the very best examples of their type in the state. These include exceptional examples of Dry Oak-Hickory-Hophornbeam Forest, Dry Oak Woodland, Northern Hardwood Talus Woodland, Open Talus, Red Maple-Black Ash Seepage Swamp, and Temperate Calcareous Cliff. In addition to these small-patch communities, there are high quality examples of three widespread forest types on the unit: Dry Oak Forest, Mesic Maple-Ash-Hickory-Oak Forest, and Northern Hardwood Forest.

Managing natural communities to support their ecologic function on the landscape will be achieved by implementing strategies on the CMU that: maintain and restore native species composition and natural processes, and through both passive and active management encourage climate adaptation, carbon storage and sequestration. See table of priority strategies for a summary of management strategies for natural communities.

Forest Health

It is the combination of natural disturbance processes – weather, climate, insects, and diseases that continually shape Vermont's forests and landscapes. In general Vermont's forests are influenced by frequent small-scale disturbances such as individual tree death and resulting canopy gap dynamics. At larger scales blowdown, ice damage and insect outbreaks are characteristic disturbances but occur less frequently.

While not widespread, invasive plants are found across the CMU, many of which are at low densities or occupy only highly disturbed sites. These species can spread quickly and represent a serious threat to the ecological integrity of natural communities and to the persistence of native species. The relatively low populations and current distribution of invasive plants on the management unit make this the best time to implement effective management to control them. There are several common forest insects and diseases that impact forests within CMU. Most occur throughout Vermont's forests and do not have substantial, long-term impact. However, Emerald Ash Borer, an invasive insect, causes mortality in all ash species and is expected to kill nearly all ash in Vermont as it works its way through the state. The trees have no natural defenses and there are no treatments that are effective at this scale. The EAB infestation has only been identified in Vermont since 2018 and much of Vermont's forests are still free of this pest. Careful planning and movement of infested or potentially infested ash can slow the spread and provide greater protection for forests that have not yet been infested.

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Forest Management

CMU is nearly entirely forested and is managed to meet a variety of goals and objectives. Forest management strategies are designed to produce high-quality forest products while providing for habitat, biodiversity, healthy and vigorous forests, protection of water resources, opportunities for research, and the demonstration of forest management techniques to the public. Managed forests contribute to the sustainable production of forest products, improvement of forest health conditions, management of quality wildlife habitat, control of invasive species, contributions to forest resiliency and climate adaptation.

The diverse topography and site conditions within CMU include many acres that are suitable for active wildlife and forest management. There is a history of forest management in those areas to produce a diverse array of wood products through sustainable management and harvest practices while also achieving wildlife habitat goals. This history is particularly strong on Birdseye WMA much of which was owned and managed by private timber companies for many decades. Forest management will include strategies used to create old forest conditions and enhance climate adaptation while also creating and maintaining functional wildlife habitat and healthy and productive forests. There will also be areas where forests will be left to passively develop old forest characteristics over time.

The Agency of Natural Resources (ANR) will employ a range of tools from passive to active forest management to meet management goals for forests, wildlife, water quality, natural community integrity and recreation. Passive management allows natural processes to dominate. Active forest management encompasses numerous activities that manipulate trees, shrubs, and other plants. Active forest management includes:

- Invasive plant treatments to reduce or eliminate invasive plants that can compete with native vegetation and degrade ecological function and natural community integrity.
- Mast tree release that opens light and space for certain trees such as oaks, hickories and beech that provide valuable food sources for a range of wildlife species, allowing more vigorous growth and mast production.
- Forest stand improvement that removes certain trees to give healthy trees more space to grow and supports a more resilient stand structure.
- Prescribed fire that can stimulate growth of fire-adapted species and maintain or restore stand characteristics of fire-adapted systems.
- Forest management timber harvests that support the structure, diversity, resilience and/or health of forest stands. When justified by the conditions on the ground and the latest science, timber harvests are a tool that can be combined with other techniques to achieve many land management goals and maintain the benefits and services of healthy forests.

The mix of active and passive management approaches proposed within the LRMP are tailored to conditions on the ground that will be used to achieve a range of goals. Active forest management of CMU contributes to the sustainable production of forest products, improvement of forest health conditions, management of quality wildlife habitat, controls of invasive species, contributions to forest resiliency, and climate adaptation.

Vermont is home to a vital forest products industry, of which ANR lands are a small yet important component. While revenue generation is never the primary reason to conduct forest

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harvesting activities on ANR land, it is still an important consideration as timber-derived revenues are reinvested in public land. Furthermore, commercial timber harvests are often the only affordable way to accomplish certain types of wildlife habitat management and to achieve management objectives related to landscape diversity and resilience at a scale needed to meaningfully address these goals.

To achieve the various ecological, forest resource and wildlife resource goals of this plan, twelve timber harvest analysis areas have been identified for potential harvesting. Areas identified for further harvest analysis will receive additional review and inventory. A detailed review of special wildlife habitat (e.g. habitat for rare, threatened, or endangered species), significant natural communities, important historic or cultural sites, and sensitive natural features (e.g., streams, steep slopes, wetlands, etc.) will be conducted on each timber harvest analysis area. A more detailed pre-sale inventory will also be conducted to gather data and information related to forest health, species composition, stand age, forest structure, soil characteristics, wildlife habitat, and information on forest product quality, value, and distribution. These reviews and inventories will be used to develop silvicultural prescriptions that are consistent with the management goals for the CMU. More information can be found on page 54.

Water Resources

Located within both the Castleton and Poultney River watersheds, the CMU is in the Southern Lake Champlain Tactical Basin Planning region. The Tactical Basin Plan was updated in 2022.[5] Gully Brook in Birdseye WMA is the most prominent stream in the management unit. It provides year-round habitat for a healthy, naturally reproducing, self-sustaining wild brook trout populations. The associated forested riparian zones are to continue to protect this cold-water resource. Wetlands are notably sparse – just 1% of CMU has mapped as wetland communities. These wetlands are important features and contribute disproportionate habitat diversity to the CMU. There are a few areas of groundwater seepage, and several vernal pools are found in otherwise dry hilltops and in small benches on slopes.

Roads and Water Quality

Enhanced resiliency of roads and trails is a primary management focus and is critically important for protecting water quality, preventing soil erosion, and providing sustainable recreation and management. access, it is especially important in light of increasing large-scale precipitation events. Increasing the size and capacity of structures (i.e., culverts, bridges, ditches), installing disconnection practices to avoid stream sedimentation, and closing or relocating unsustainable segments of road are some of the practices that are being implemented. Over the past several years, ANR has implemented many of these practices to stabilize unsustainable legacy roads and will continue implementation of these actions as part of the management of a sustainable road network. These practices align with Vermont's Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont[6] which are implemented to protect both

[5] Allen, R. Angie. *South Lake Champlain Basic 2 – 4: Tactical Basin Plan*, Report by the Vermont Department of Environmental Conservation, December 2022.
[6] Vermont Department of Forests, Parks & Recreation. 2019. Acceptable Management Practices, Manual for Logging Professionals.

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infrastructure and maintain high water quality standards and ANR Riparian Management Guidelines for Agency of Natural Resources Lands. More information about water resources within the Castleton Management Unit can be found on page 42. Additional information regarding infrastructure is found on page 77.

Recreation on CMU

Just 6 miles from Rutland, CMU offers recreation opportunities that add to the portfolio of opportunities in the region. Like WMAs across Vermont, the two WMAs within the CMU are managed to support opportunities for a variety of fish and wildlife-based recreation. CMU's location in remote areas of the Taconic Mountains supports those recreational pursuits that rely on and benefit from remote areas (i.e., hunting, wildlife observation). The diverse terrain and road access offer varied opportunities including those that are easily accessible and those that are remote and rugged.

The southern block of Birdseye WMA, acquired in 2016, is subject to a public access easement held by the Vermont Land Trust and Vermont Housing and Conservation Board. In addition to conservation goals, this acquisition has stated goals promoting non-commercial recreational activities that include non-motorized, low impact, low density, dispersed wildlife-based activities including hunting, fishing, trapping, bird watching, cross-country skiing, snowshoeing, walking, and wildlife observation. Snowmobile use is along existing, designated VAST trails. There are over 8 miles of designated snowmobile trails maintained by VAST and many opportunities for dispersed hiking and walking. There are parking areas on the Belgo Road for BBHWMA and along the Castleton-Birdseye and Ames Hollow Roads for BWMA that support public access. Recreational uses on WMAs are guided by rules governing public use of Vermont Fish and Wildlife Lands (10 APPENDIX V.S.A. app. Sec 15) found in Appendix 6.[7]

Summary of Authorized Activities on Wildlife Management Areas

Activity	Description	Location
Hunting, fishing, trapping	Permitted on all state land unless otherwise designated. Governed by state-wide rules and regulations established by the Vermont Fish and Wildlife Board.	throughout CMU
Wildlife observation and photography	Includes birdwatching, wildlife viewing, collecting shed antlers,	throughout CMU
Dispersed, pedestrian activities	Includes hiking, walking, snowshoeing, cross-country skiing	throughout CMU, including along gated roads and trails
Collecting edibles for personal use	non-commercial picking of berries, nuts, fungi, & other edibles (except ginseng)	throughout the CMU
Snowmobiling	Permitted on designated VAST trails only	Birdseye WMA & Powder Lot Block of Blueberry Hill
Guiding	For purposes of hunting, fishing, trapping	throughout CMU
Camping	For purposes of hunting, fishing, trapping – following VFWD guidance	Designated areas only on selected WMAs.

[7] Vermont Fish and Wildlife Department, *Regulation: Public Activities at Wildlife Management Areas, Riparian Lands, Conservation Camps, and Fish Culture Stations of the Vermont Fish and Wildlife Department*, 2009.

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Prohibited activities under the Rule include:

- operation of motorized vehicles including ATVs,
- horseback riding,
- dog sledding,
- non-motorized cycle riding, or
- use of motorized vehicles except on designated corridors
- and all other activities not specifically authorized (i.e., hang-gliding, recreational rock climbing, geocaching).

More information about recreation opportunities within the CMU can be found on page 69.

Historic and Scenic Resources

The importance of scenic values of CMU has long been recognized. The forests and mountains are viewed daily by commuters along US Route 4, from neighboring properties, and by visitors to the WMAs. The Conservation Easement on Birdseye WMA has among its statements of purpose the goal to *"conserve and protect the property's undeveloped character and scenic and open space resources for present and future generations."* These lands have been culturally significant for many generations of people. Careful consideration will be given to all activities on CMU to ensure that historic, cultural, and scenic values are protected.

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Land Management Classification

The ANR planning process includes a Land Management Classification that allocates lands based on a thorough understanding of resources and application of over-arching land management standards. This allows the public and land managers to have a common understanding of the overall level of use or type of management to occur on sections of ANR lands.

The Agency's Land Management Classification uses four categories of use or types of management to be emphasized on the land. After completion of inventories and assessments the lands, resources, and facilities held by the ANR are evaluated and assigned to appropriate Land Management Classification categories based upon knowledge and understanding of resources and appropriate levels of management. This enables land managers to allocate use and management by area minimizing conflicts between competing objectives and facilitating a common understanding of the overall use or type of management to occur in particular areas of the Castleton Management Unit.

The four categories as they are applied to Castleton Management Unit and percent of land area are:

- Highly Sensitive (24%)
- Special Management (26%)
- General Management (50%)
- Intensive Management (0%)

The table below summarizes management strategies. More detailed information is provided within the Land Management Classification beginning on page 93 where management goals are organized by both Unit Wide Goals and Site-Specific Goals. Site-specific goals are more

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targeted to discrete locations within the CMU and tied to the Land Management Classification categories listed above. Unit wide goals are those that apply broadly across the CMU and include:

- Protect the ecologically functional landscape and natural and cultural resources of the Castleton Management Unit.
- Promote climate adaptation and carbon resilience on the landscape to address climate change impacts.
- Provide high quality wildlife habitat for a diversity of species.
- Provide opportunities for dispersed, sustainable, fish and wildlife-based recreation.
- Manage forests through sustainable management and harvest practices to achieve wildlife habitat goals, support a healthy and resilient forest, and support the production of an array of wood products and local economy.

An overview of priority strategies and a map showing the distribution of the classification across CMU are shown in the Land Management Classification descriptions above. Their distribution across the CMU is shown on the maps below.

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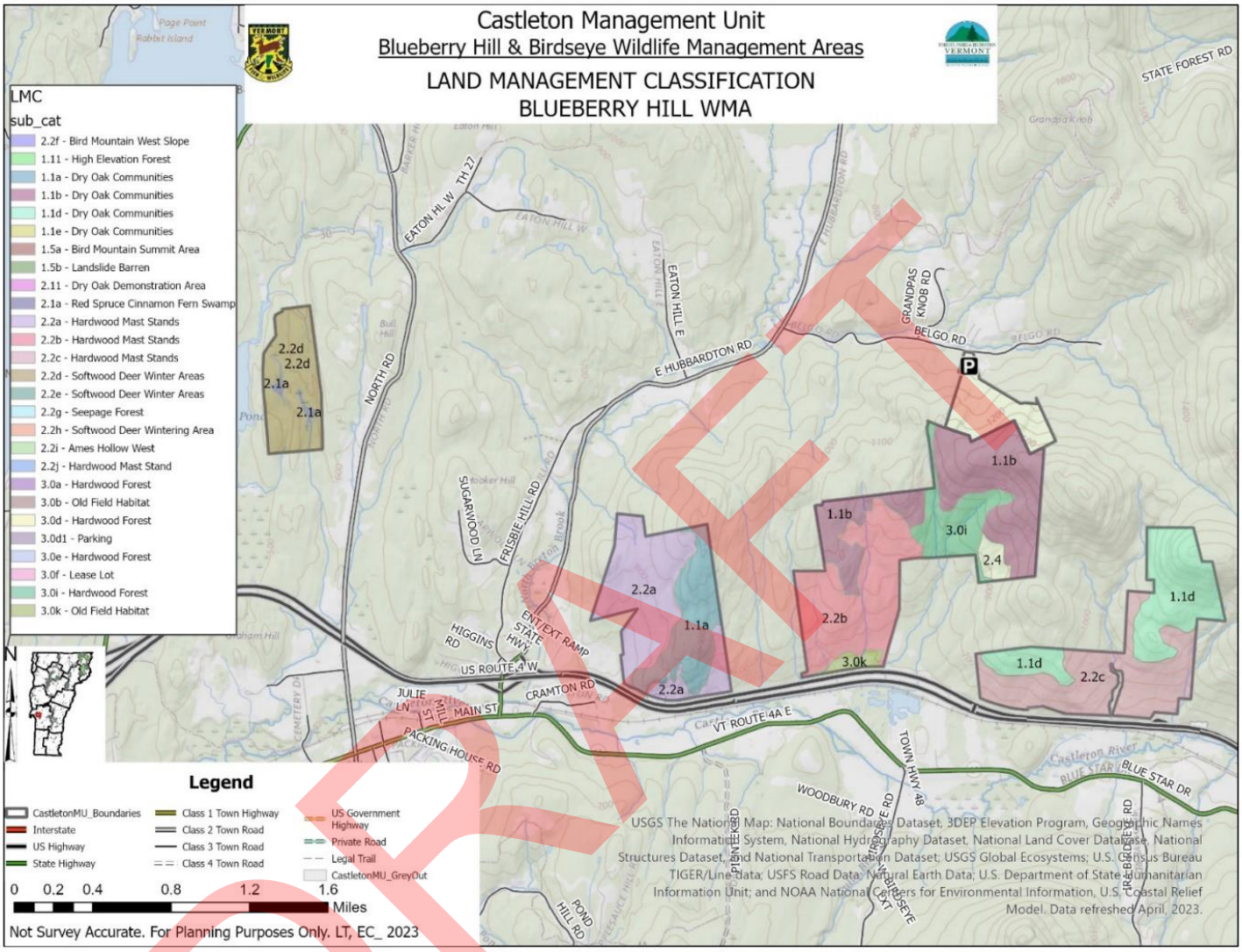
Land Management Classification as it is allocated across Blueberry Hill Wildlife Management Area and Birdseye Wildlife Management Area



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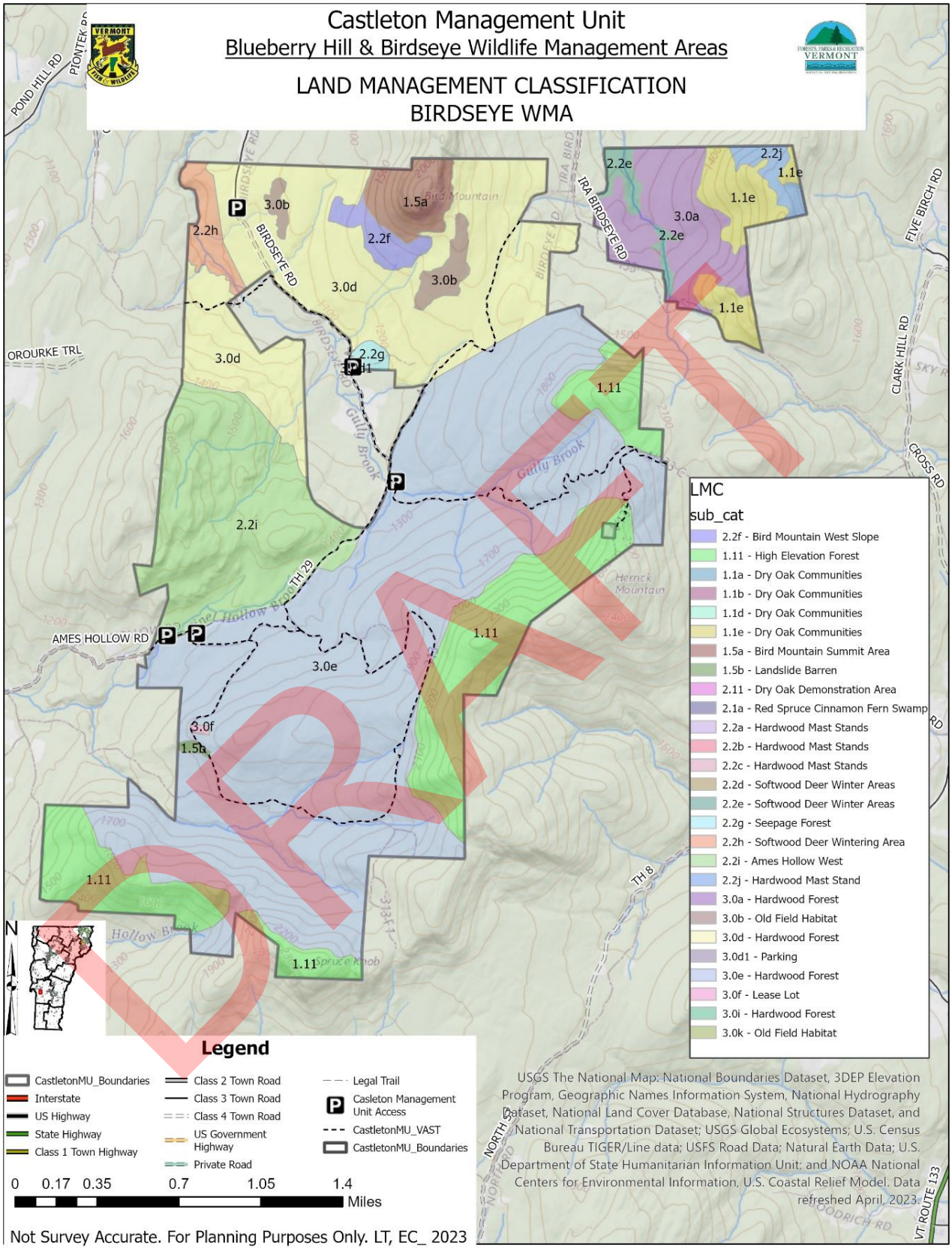
Castleton Management Unit
Blueberry Hill & Birdseye Wildlife Management Areas
LAND MANAGEMENT CLASSIFICATION
BIRDSEYE WMA
POND HILL RD
PIONTEK PR
BIRDSEYE RD
IRA BIRDSEYE RD
FIVE BIRCH RD
CLARK HILL RD
CROSS RD
OROURKE TRL
AMES HOLLOW RD
TH 29
TH 8
NORTH ST
VT ROUTE 133
GOODRICH RD
Bird Mountain
Gully Brook
Hemick Mountain
Spruce Knob
Hollow Brook
LMC
sub_cat
2.2f - Bird Mountain West Slope
1.11 - High Elevation Forest
1.1a - Dry Oak Communities
1.1b - Dry Oak Communities
1.1d - Dry Oak Communities
1.1e - Dry Oak Communities
1.5a - Bird Mountain Summit Area
1.5b - Landslide Barren
2.11 - Dry Oak Demonstration Area
2.1a - Red Spruce Cinnamon Fern Swamp
2.2a - Hardwood Mast Stands
2.2b - Hardwood Mast Stands
2.2c - Hardwood Mast Stands
2.2d - Softwood Deer Winter Areas
2.2e - Softwood Deer Winter Areas
2.2g - Seepage Forest
2.2h - Softwood Deer Wintering Area
2.2i - Ames Hollow West
2.2j - Hardwood Mast Stand
3.0a - Hardwood Forest
3.0b - Old Field Habitat
3.0d - Hardwood Forest
3.0d1 - Parking
3.0e - Hardwood Forest
3.0f - Lease Lot
3.0i - Hardwood Forest
3.0k - Old Field Habitat
N
Legend
CastletonMU_Boundaries
Interstate
US Highway
State Highway
Class 1 Town Highway
Class 2 Town Road
Class 3 Town Road
Class 4 Town Road
US Government Highway
Private Road
Legal Trail
Casleton Management Unit Access
CastletonMU_VAST
CastletonMU_Boundaries
0 0.17 0.35 0.7 1.05 1.4
Miles
Not Survey Accurate. For Planning Purposes Only. LT, EC_ 2023
USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed April, 2023.
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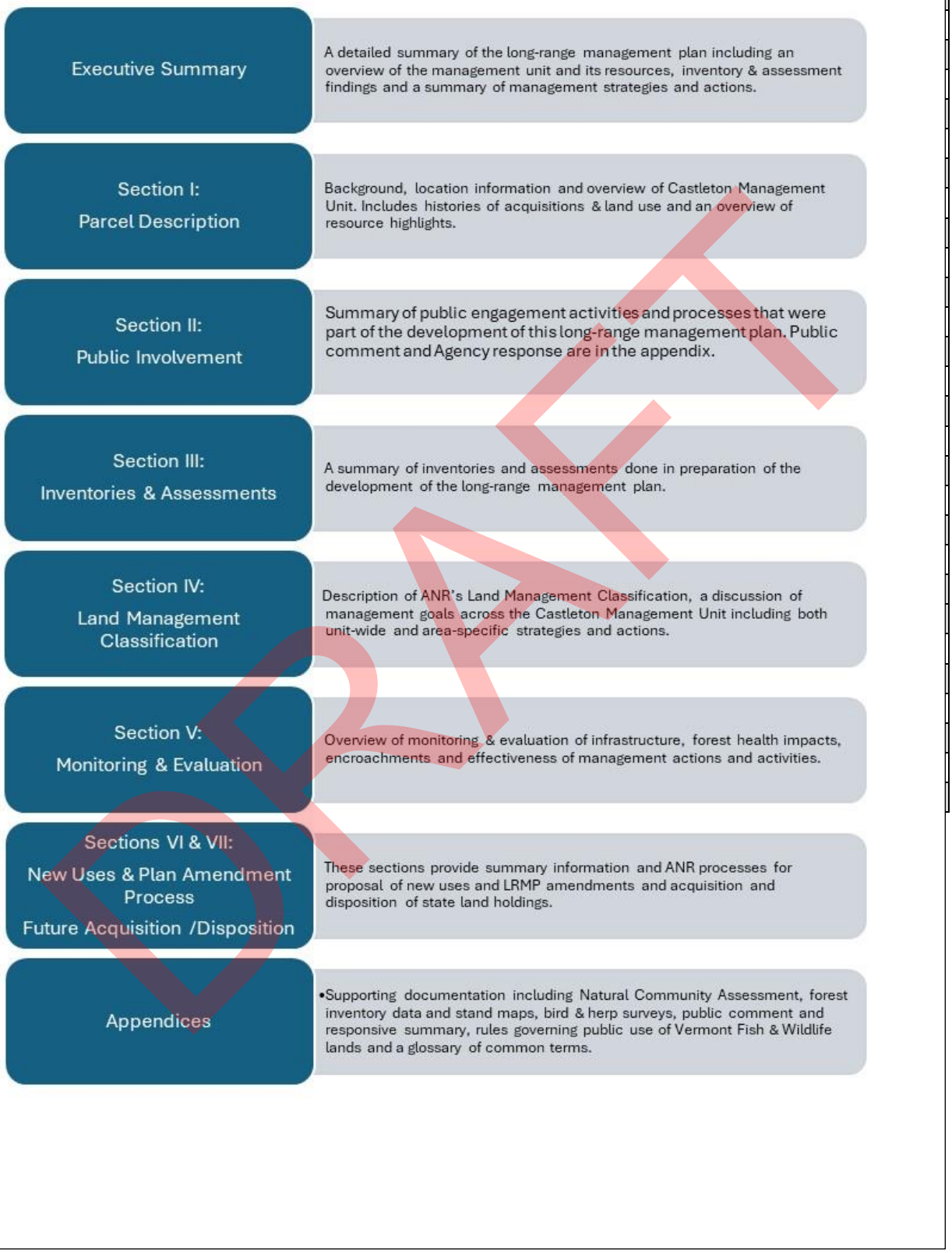
Reading the Long-Range Management Plan



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I. PARCEL DESCRIPTION

A. Parcel Description and Location Information

The 4,725-a.re Castleton Management Unit (CMU) includes Blueberry Hill and Birdseye Wildlife Management Areas and is in the Taconic Mountains biophysical region in the towns of Castleton accessible to one of Vermont's larger population centers. The Vermont Fish and Wildlife Department (VFWD) has primary management, Poultney, and Ira in Rutland County, Vermont (Table 1). Located just 6 miles west of the City of Rutland, the Management Unit is responsibility for the lands within CMU.

Blueberry Hill WMA (BBHWMA) consists of four separate parcels (known administratively as *Blocks*) with limited legal public and management access. Three of those Blocks are located proximate to each other, north of US Route 4. Public access to the Middle Block of the WMA is from the Belgo Road over lands owned by the Vermont Federation of Sportsmen's Clubs through an agreement with VFWD. There is no deeded legal access to the East or West Blocks and there is no access from US Route 4 since this is a limited access highway.

Birdseye WMA (BWMA) consists of two parcels located south of US Route 4 and can be accessed via Castleton-Birdseye Road, Ira-Birdseye Road, and Ames Hollow Road.

Table 1: Castleton Management Unit Acres by Town

Parcel	Town	Acres
Birdseye WMA	Castleton	115.0
	Ira	1,704.0
	Poultney	1,754.0
		3,573.0
Blueberry Hill WMA	Castleton	935.8
	Ira	216.1
		1,151.9
	TOTAL	**4,724.9**[8]

[8] Acreages based on Payment in Lieu of Taxes (PILOT payments) and represents the official acreage of parcels by town.

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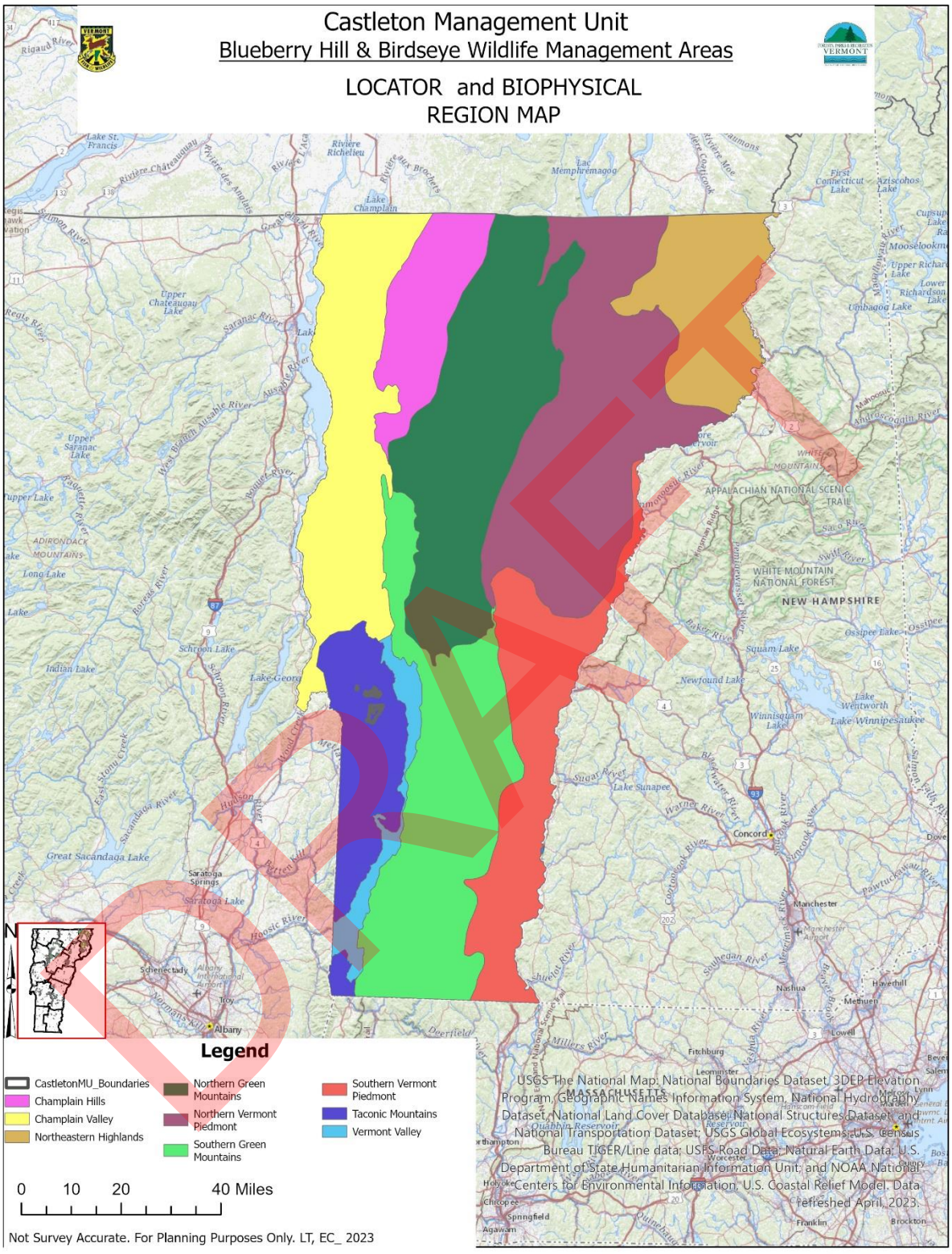
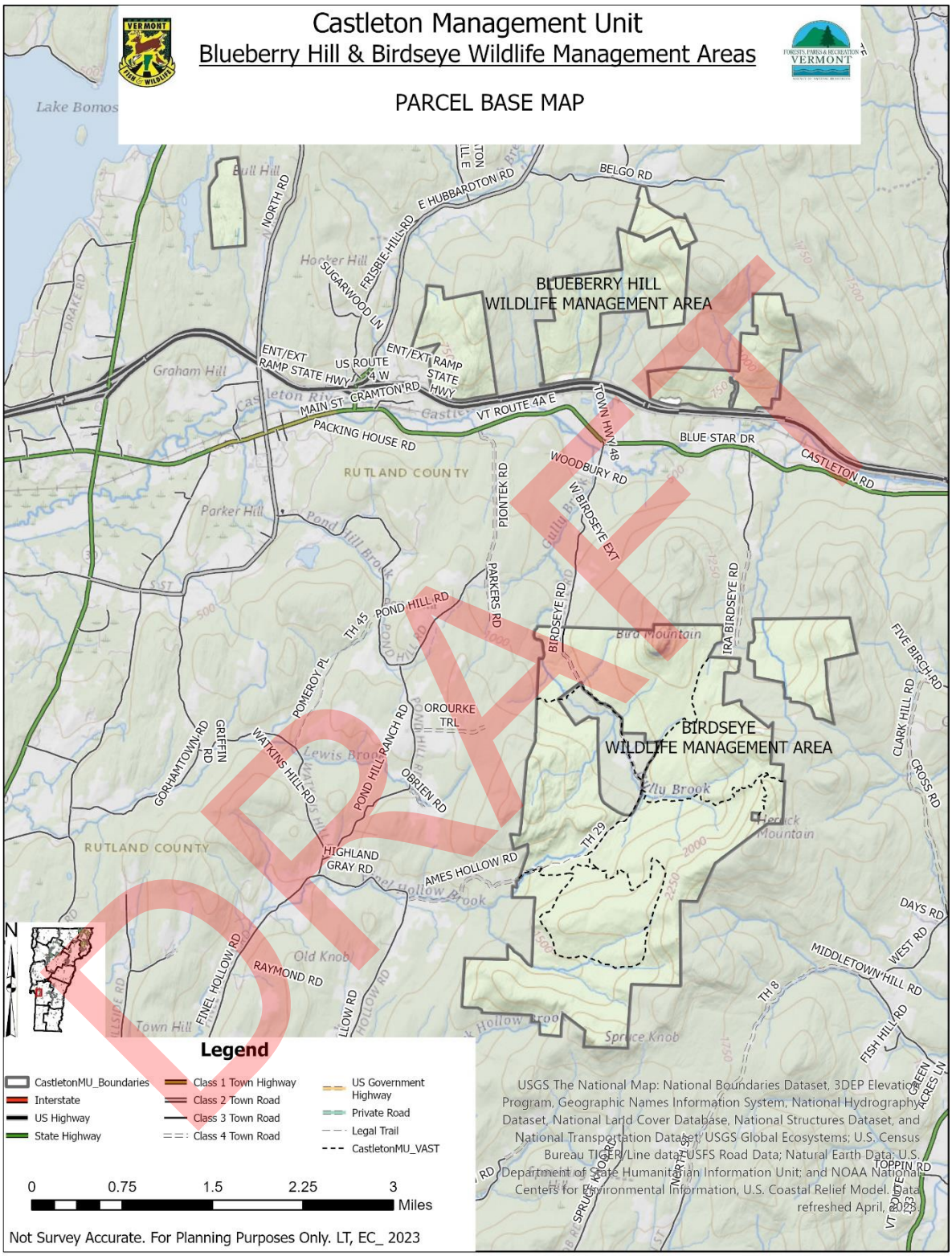
Map 1: Locator and Biophysical Region Map



Map 2: Parcel Base Map – Castleton Management Unit



B. Purpose of Ownership

Wildlife Management Areas (WMA) are managed by the Vermont Fish & Wildlife Department to meet a variety of goals. Wildlife management objectives include game species such as white-tailed deer, turkey, grouse, and beaver as well as nongame species such as songbirds, small mammals, amphibians, and birds of prey. Multiple objectives are accomplished by a combination of commercial and non-commercial vegetative management practices applied over time in a manner that protects unique habitats.

Use and management of Castleton Management Unit including Blueberry Hill and Birdseye WMAs is designed to:

- Protect and enhance rare, threatened, and endangered species and their habitat.
- Maintain or enhance the condition of natural communities.
- Protect and improve the condition and resiliency of important biological and natural resources.
- Protect and promote climate adaptation and carbon resilience on the landscape to address climate change impacts.
- Protect and enhance wetland function.
- Protect and enhance wildlife habitat through management of all vegetative stages; creation of early successional growth; improvement of deer wintering areas; and protection of unique habitat.
- Demonstrate exemplary wildlife management practices so that practices applied here may find broader application on private lands.
- Provide sustainable, periodic timber harvesting in appropriate areas to promote wildlife habitat and forest productivity.
- Enhance opportunities for wildlife-based recreation, particularly hunting, trapping, and wildlife viewing.
- Protect and improve public access.

C. History of Acquisition

Parcels that make up the WMAs of the Castleton Management Unit were acquired by the State of Vermont between 1970 and 2016. Refer to Figure 3 and Figure 4 for details of individual parcel acquisition.

Blueberry Hill WMA was created in 1970 when VFWD acquired excess property from the Vermont Agency of Transportation (VTrans) in the towns of Ira and Castleton. VTrans acquired these parcels at the time of the construction of US Route 4 in the 1960s. During that same time, other parcels were sold directly to VFWD. Many of the original conveyances included language *"that portion of the owner's land severed by the construction of US Route 4."*

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Birdseye WMA was created in 1976 with the initial acquisition of 580 acres. In 2016 the WMA was significantly expanded with the acquisition of 2874 acres. The Conservation Fund (TCF) in partnership with VFWD, the Vermont Land Trust, the U.S. Fish and Wildlife Service, and the Vermont Housing and Conservation Board conserved those additional acres with the acquisition of Yankee Forest LLC lands. Some of the public support for this acquisition was due in part to the potential for large-scale wind power development on this mountain range.

Known as Bird Mountain WMA for many years, the name was officially changed to Birdseye Wildlife Management Area in 2017 to reflect the more commonly used reference to its namesake mountain.

View of Bird Mountain
Photo: Ethan Crumley, VFPR

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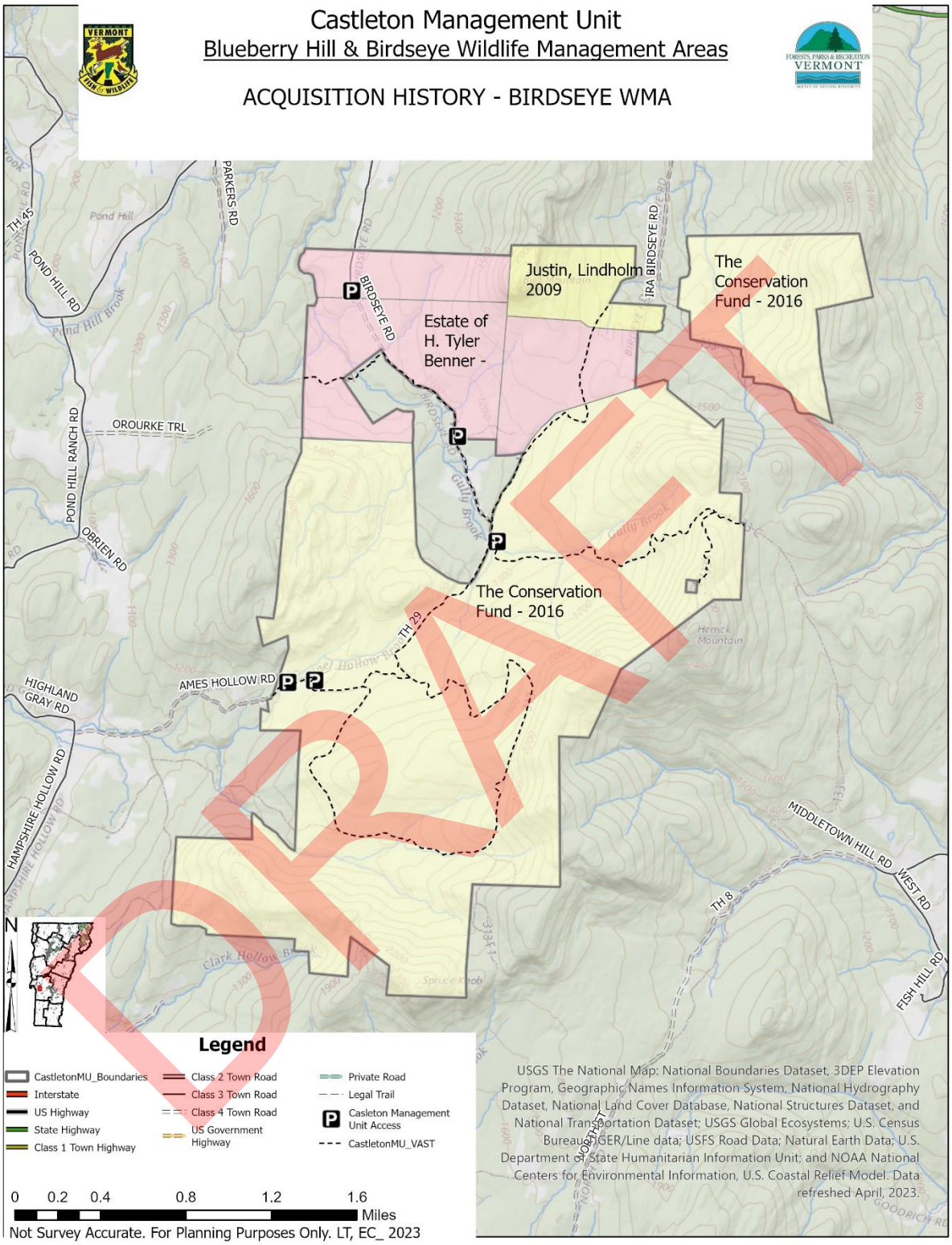
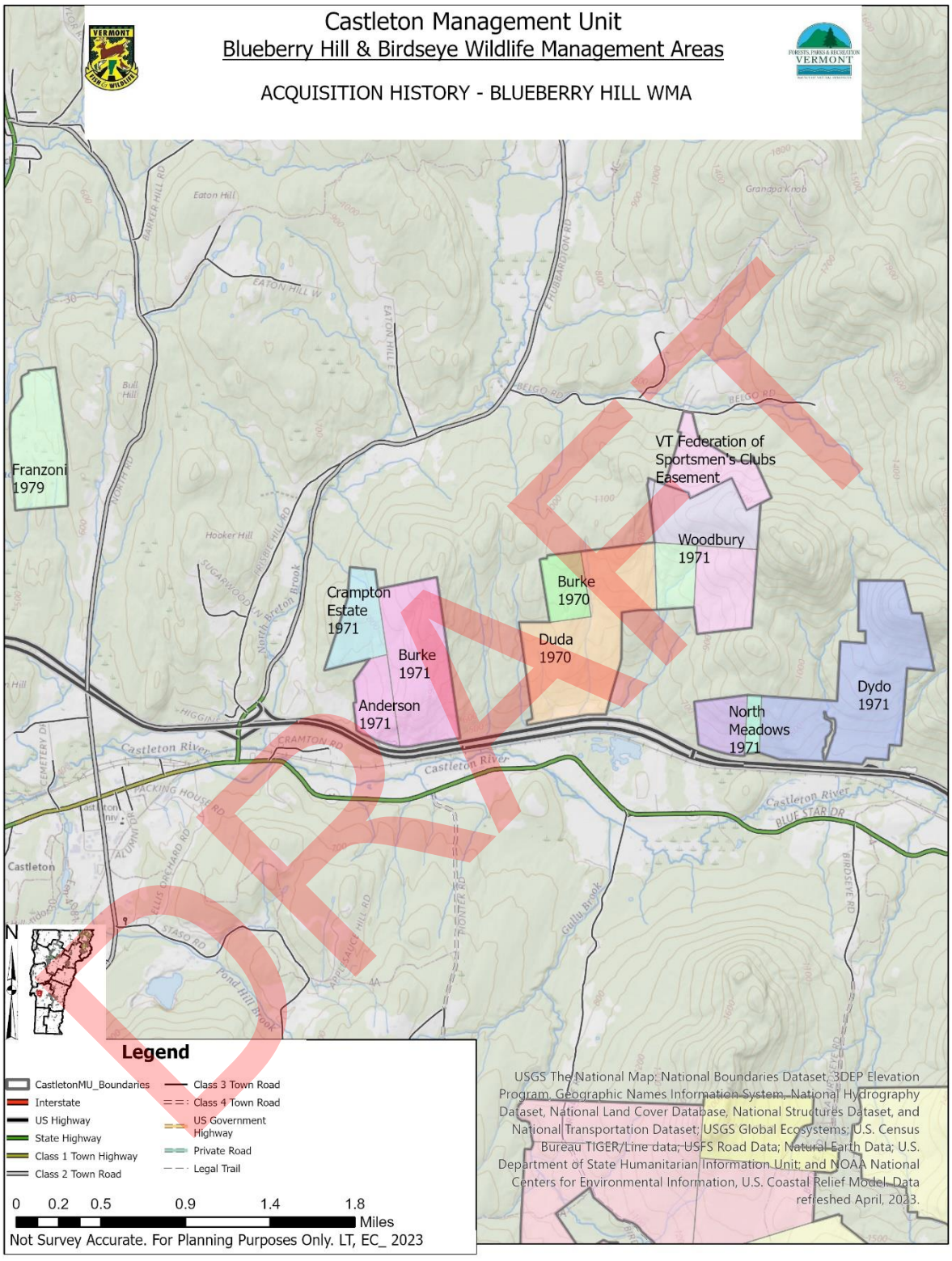
Map 3: Acquisition History – Birdseye Wildlife Management Area



Map 4: Acquisition History - Blueberry Hill Wildlife Management Area



D. Land Use History

The land use history of CMU includes both agriculture and timber harvesting. Lower slopes indicate a history of clearing, likely for pasture. Some of the oak forests may have a history of grazing. Past grazing can have lasting effect on forest structure and may also have increased soil erosion and caused bedrock exposures. Old aerial imagery shows clearing in the Ames Hollow area in the valley and on lower slopes. Current vegetation including patches of white pine, apple trees and hawthorns point to this history of clearing and likely agriculture. There is at least one foundation related to past use on the CMU. Much of the Management Unit appears to have been forested for a long time and may never have been cleared for agriculture. The southern acreage within Birdseye WMA acquired in 2016 has been owned and managed as timberland for many decades, by Mettowee Lumber, International Paper Timberlands Operating Company, and others and most recently by Yankee Forest LLC.

E. Management Unit Highlights

The Castleton Management Unit is nearly entirely forested with oak and hickory dominated forests on Blueberry Hill and northern hardwood forests of sugar maple, beech and birch dominating on Birdseye WMA. The diverse landscape and forest composition provides opportunity for management and habitat for a variety of wildlife. Approximately 4% of CMU supports young forest habitat currently. Two fields have been maintained for decades as open habitat through periodic prescribed fire. These fields host early successional vegetation, apples, and aspen and support a variety of wildlife. Some vegetation management practices have occurred in the last 20 years on the parcels that have been in state ownership since the 1970s although lack of functional access has limited activity on BBHWMA.

The CMU encompasses a remarkable range of physical, biological, and ecological diversity. Twenty-eight natural community types have been mapped on the CMU. Sixteen of these are rare or uncommon in Vermont. Many are some of the best examples of their type in the state. The generally steep, dry landscape contains limited surface water. Wetlands are notably sparse. The area receives approximately 46” of precipitation annually. Gully Brook is the most prominent stream within the MU. The brook provides year-round habitat for wild, naturally reproducing brook trout populations. Several vernal pools were mapped and there are a few areas of groundwater seepage. The CMU is located within the Southern Lake Champlain (Basin 2 & 4) Tactical Basin.

The Wildlife Management Areas that make up the CMU are managed to support opportunities for a variety of fish- and wildlife-based recreation. The diverse terrain and road access offer areas that are both easily accessed and those that are more remote and rugged. There are approximately over 8 miles of snowmobile trail on CMU, however not all recreational use is trail-based. While there is a limited network of snowmobile trails and hiking occurs on many roads within the CMU, many activities (e.g., hunting, fishing, trapping, wildlife observation) occur off-trail as well and many seek the remote areas of the MU for these activities.

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F. Relationship to Town, Regional, and Other Pertinent Planning Efforts

CMU LRMP is not the sole document that guides management on the two Wildlife Management Areas that make up the Castleton Management Unit. Various Agency, Department and conservation plans influence the management of the Castleton Management Unit. Management actions are implemented following current agency and department guidance, policy, and procedure. CMU LRMP is compatible with regional and town plans. Some of these planning documents are shown in Table 2 below.

Table 2: Local and Regional Planning Efforts

Plan Type	Plan Scope	Plan & Development Date
Watershed Planning	Tactical Basin plans are developed by VTDEC as strategic guidebooks for protecting and restoring Vermont's surface waters.	Southern Lake Champlain (Basin 2 & 4) Tactical Basin (2022)
Regional Planning	Provides guidance for managing change within the region and a decision-making framework regarding growth and develop	Rutland Regional Plan (2018)
Town Planning	Provides process and opportunity for citizens to establish a shared community vision.	Castleton 2018
		Ira 2020
		Poultney 2022
Conservation Planning	Identifies goals and strategies to guide conservation and sustainable use of Vermont's fish and wildlife resources.	Fish and Wildlife Strategic Plan 2022-2026
	Guides conservation projects including land acquisition and management.	Wildlife Action Plan 2015
	Landscape-level approach to protecting and enhancing ecological function into the future.	Vermont Conservation Design (2018)

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II. PUBLIC INPUT

The public participation process for Castleton Management Unit Long Range Management Plan was conducted in accordance with Agency of Natural Resources (ANR) policies, procedures, and guidelines. Public involvement or citizen participation is a broad term for a variety of methods through which the public has input into public land management decisions. The ANR is committed to a planning process which offers the opportunity for all citizens and stakeholders to participate. These include letters, surveys, personal comments, telephone calls, e-mails, and more formal methods such as public meetings and workshops. All public input received concerning the future stewardship of Castleton Management Unit has been considered in the preparation of this plan.

Following the initial public meeting for Blueberry Hill WMA, the planning effort was broadened to include Birdseye WMA and a significant addition to the WMA in 2016. As a result, a second public scoping effort was undertaken in the fall 2021 for the entire Castleton Management Unit.

Table 3: Public Input Opportunities

Date	Location	Opportunity Type	Description
3/29/2017	ANR District Office, Rutland	Open-House and 30-day comment period	Presentation of inventory and assessment information and to receive public comment for draft plan development
9/29/2021	Kehoe Conservation Camp	Open-house and 60-day comment period	Presentation of inventory and assessment information and to receive public comment for draft plan development
9/29/2021-12/3/2021	Story Map	Online resource – concurrent to open house and 60-day comment period	Online presentation of information including maps. Presented the same information as open house. Options to comment via online survey and email.
5/21/2024	On-line resources	Opportunity for public review of draft plan materials.	Release of draft plan and on-line resources for review ahead of the public meeting.
6/12/2024	Kehoe Conservation Camp	Open-house and 60-day comment period	Presentation of draft plan and opportunity to review maps and plan details.

A summary of the comments received during the public involvement process, a summary of the Department's response to comments, and additional information about the public involvement process are in the Appendix.

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III. RESOURCE ANALYSIS

A. Legal Constraints Assessment

There are a variety of legal constraints that affect stewardship of the Castleton Management Unit. Refer to Table 4 below, and Figures 3 and 4 on preceding pages for a summary of major legal constraints that impact or direct management on CMU. A list of additional legal constraints are on file at the district office.

Table 4: Summary of Legal Constraints

Location	Legal Constraint	Description
Birdseye WMA –The Conservation Fund acquisition 2016	***Perpetual conservation and public access easement*** co-held by Vermont Land Trust and Vermont Housing and Conservation Board	to conserve and protect present and future biological diversity, important wildlife habitat and natural communities, wildlife-based recreation, and natural resource and scenic values. Management Plan must be consistent with the purposes of this easement, coordinated with the U.S. Fish and Wildlife Service, and copies provided to VLT and VHCB.
Birdseye WMA – Lindholm and The Conservation Fund acquisitions	Federal Aid in Wildlife Restoration Act – Pittman Robertson Act (PR) – ***funding-related conditions.*** Grant Agreements: W-60-L-1 and W-64-L-1.	Management activities and land uses must be consistent with objectives of protecting, restoring or improving habitat for wildlife and wildlife-based recreation.
Birdseye WMA – 2016 acquisition	***Long-term license*** (2-acre camp lease)	Life lease plus 20 years for intermittent use limited non-commercial purposes, annual fee
Birdseye WMA – Lindholm acquisition	***Lifetime Lease*** agreement (non-transferable)	for management of 4 acres for wildlife habitat and views.
Blueberry Hill WMA – Middle Block	***Memorandum of Understanding*** with Vermont Federation of Sportsmen's Clubs	For public access to the Middle Block from the Belgo Road
Blueberry Hill WMA – Middle and West Blocks	***Access right-of-way***	For forest management only, right-of-way exchange
Birdseye WMA – Herrick Mountain	***Access right-of-way*** across WMA to private land	Right-of-way along 20' wide woods road to privately owned parcel on Herrick Mountain currently managed as communication site
Birdseye WMA – 2016 acquisition	***Access right-of-way*** across WMA to private land	20' easement over existing road for purposes of conservation management, noncommercial agriculture, silviculture & recreation
Birdseye WMA – 2016 acquisition	***Access right-of-way*** across WMA to private land	20' easement over existing road for purposes of forest management

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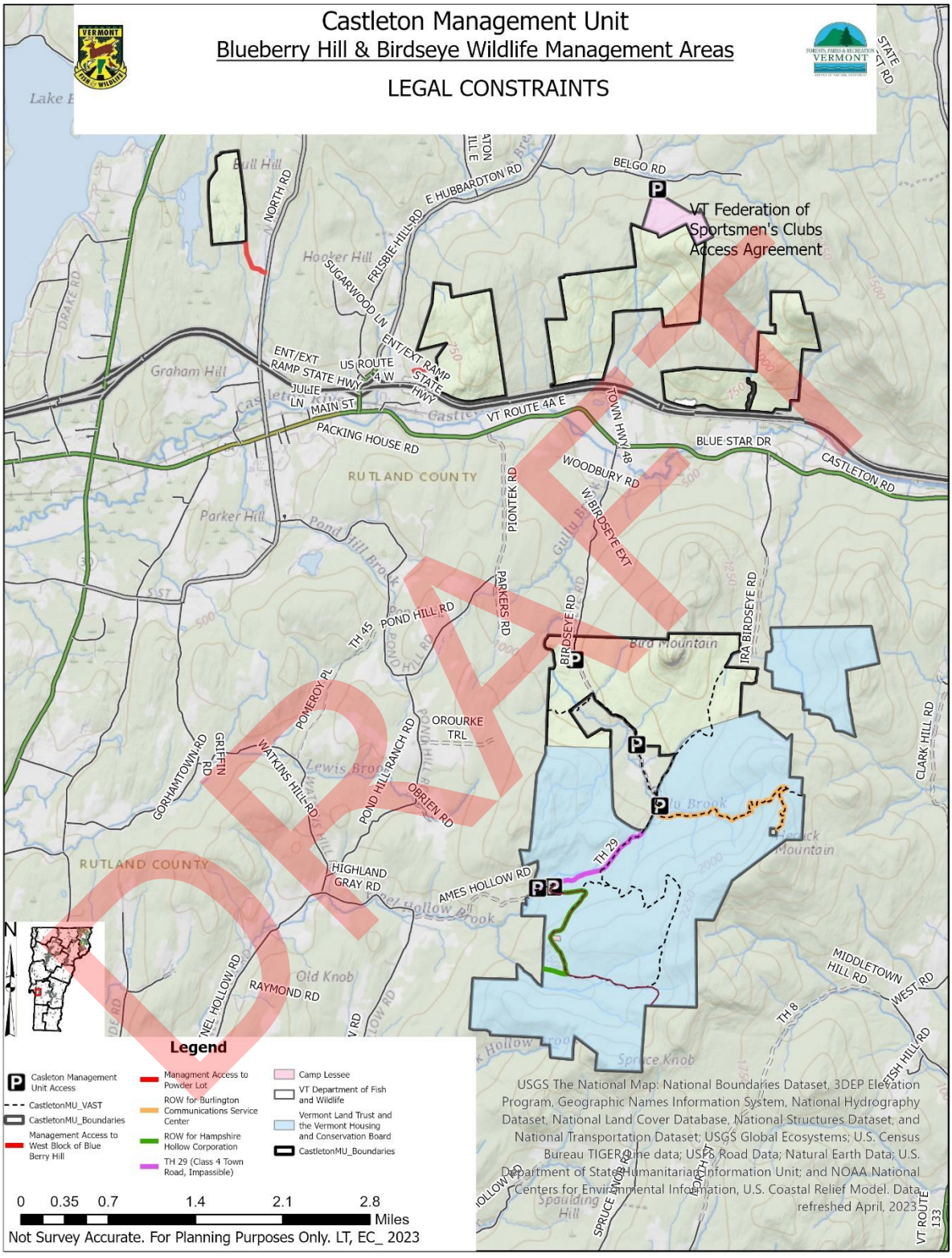
Map 5: Legal Constraints Map



B. Ecological Assessment of Castleton Management Unit

This ecological assessment of Castleton Management Unit applies a "coarse filter/ fine filter" approach to inventory and assessment. A detailed description of this approach, and of inventory and assessment methods, is available upon request from the Vermont Fish and Wildlife Department.

Ecological Summary

With its forests of oaks and hickories, rocky outcrops and cliffs, shaded hemlock ravines, and spruce-clad summits, the Castleton Management Unit (CMU) encompasses a remarkable range of physical, biological, and ecological diversity.

Wildlife Summary

Wildlife species known from CMU reflect the habitats and natural communities summarized below. The most common wildlife species on CMU are those that generally rely on the oak and hardwood-dominated forests for some or all their needs (e.g. a variety of songbirds including hermit thrush, ovenbird, scarlet tanager, and game species such as deer, turkey, bear, and gray squirrels, along with bats, peregrine falcon, and relatively common amphibian and reptile species.

Coarse Filter Assessment

Physical Setting and Landscape Context

Biophysical Region, Topography, and Climate

The CMU is in the Taconic Mountain biophysical region—a variable region characterized by extremes of elevation, precipitation, and climate—and this variability is reflected on the CMU. In Vermont, this region includes the northern end of the Taconic Mountains geological formation, which extends south into New York, Massachusetts, and Connecticut. Despite a shared geological history, the landscape is quite variable, and extremes in elevation, precipitation, and vegetation are found across the region.

Aspect and elevation are particularly influential on climate and vegetation, and this is evident even within the relatively small area of the CMU. Elevations range from about 500 feet along Route 4 in Blueberry Hill Wildlife Management Area (WMA), up to just over 2,600 feet near the summit of Herrick Mountain in Birdseye WMA. The average annual precipitation in the CMU is location dependent, with lower-elevation areas receiving as little as 37 inches annually, while the highest elevations receive up to 46 inches. Bedrock underlying the CMU includes both acidic and calcareous (calcium-rich) rocks. This physical diversity is the foundation for the CMU's biological and ecological diversity.

Bedrock, Surficial Geology, and Soils

The bedrock of CMU is metasedimentary rock dating to the Neoproterozoic era and Lower Cambrian period, roughly 1 billion to 500 million years ago. The MU is primarily underlain by Bull Formation phyllites that contain local beds and pockets of limestone or dolostone, and Biddie Knob Formation slate and quartzite and conglomerate. For the most part, these rocks do

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not result in substantial nutrient enrichment in the soils and growing conditions, however there are exceptions. Where limestone and slate are at the surface, there is increased evidence of nutrient enrichment. This enrichment can affect the distribution of some natural communities. Temperate Calcareous Cliffs, enriched Transition Hardwood Talus Woodlands, semi-rich and Rich Northern Hardwood Forests, and possibly Dry Oak-Hickory-Hophornbeam Forest on ridgetops, are driven by these enriched bedrock conditions, though some enriched sites may be driven primarily by colluvial enrichment processes, from the downslope movement of eroding bedrock, surficial materials, and soils.

The degree to which these bedrock types affect growing conditions in the CMU is mediated by the depth of the surficial materials deposited at the end of the last continental glaciation. As the glacier ice melted, rock fragments of all sizes, from boulders to clay, fell in an unsorted jumble known as glacial till. Almost the entire MU features a layer of this till over the bedrock, although in places it can be just a few inches deep. Post-glacial accumulations of sediments are uncommon in the MU and are limited to small areas of riparian sediment deposition; additionally, post-glacial accumulations of peat and muck can be found in the scattered wetlands.

The soils of CMU are primarily products of these surficial deposits. The Natural Resource Conservation Service (NRCS) soil mapping indicates that till-derived soils are the most widely distributed. The Taconic, Macomber, and Hubbardton complexes are prevalent on slopes and ridges; these can be quite shallow, especially on the ridges and summits, mildly to extremely steep, and are typically described as rocky or very rocky. Bomoseen and Pittstown soils are prevalent mainly in lower slope positions in association with some of the larger valleys; these are often also described as very stony. The only wetland soils mapped by the NRCS are one small pocket of Lyons silt loam in Ames Hollow in Birdseye WMA in an area with deep peat soils and on the Powder Lot Block in Blueberry Hill WMA. However, there are numerous other small inclusions of wetland soils present in the CMU. More detailed soil descriptions can be found in the natural community summaries.

Hydrology/Streams/Rivers/Ponds

Respectively, Birdseye WMA and Blueberry Hill WMA receive around 41-46” and 37-40” of precipitation annually, which is intermediate for the state. The southern half of Birdseye WMA drains to the Poultney River, while the northern half drains to the Castleton River, with a small portion to the east off Herrick Mountain draining to the Clarendon River towards Otter Creek. The generally steep, dry landscape contains limited surface water, and the streams are small and ephemeral, often drying out by late summer. There are scattered small areas of groundwater seepage, a few vernal pools, and several small, forested swamps. These likely provide important seasonal sources of water for a wide variety of wildlife species, whereas a small beaver pond in Ames Hollow offers a more permanent water source. The entirety of Blueberry Hill WMA is within the Castleton River watershed. The dry landscape contains very little surface water, with only small streams found on the WMA. There are a few areas of groundwater seepage and several vernal pools present.

Landscape-Scale Ecological Context

Both Blueberry Hill WMA and Birdseye WMA are situated within large (approximately 18,600 and 23,600 acres, respectively) forest blocks that have been identified in Vermont Conservation

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Design as highest priority interior forest blocks and highest priority connectivity blocks. These two WMAs anchor some of the most important north-south and east-west connectivity in the southwest region of the state. These forest blocks are part of the regionally critical "Adirondack to Greens" corridor identified by the Staying Connected Initiative. Thus, the ecological connectivity value of the CMU is very significant.

The convergence of all these qualities means the CMU plays a key role in Vermont's long-term climate resilience. Large, topographically diverse forest blocks will allow many plants and animals to shift ranges and find new suitable habitat within a forest block in response to climate change. In addition, because the CMU is part of a regional connection, it plays a key role in the larger shifts in species distributions. If, as generalized predictions suggest, warm-climate species will tend to move northward and upward in elevation, the CMU will help to facilitate these shifts from the lower elevations of the Taconic Mountains and Champlain Valley to the Green Mountains, and beyond to New Hampshire, Maine, and Quebec.

Natural Disturbance

Natural disturbance processes, such as wind, fire, and flooding, continually shape landscapes and define their natural communities. In general, Vermont's forests are characterized by frequent small-scale disturbances, such as individual tree death and the resulting canopy gap dynamics. At larger scales, blowdown, ice damage, and insect outbreaks are normal disturbances, but these would be expected to occur infrequently. In general, Vermont's forests are characterized by frequent small-scale disturbances, such as individual tree death and the resulting canopy gap dynamics. At larger scales, blowdown, ice damage, and insect outbreaks are normal disturbances, but these would be expected to occur infrequently. The warm and dry landscape of CMU may support naturally occurring forest fires, particularly on the south-facing slopes and ridges. The natural communities on some of those slopes likely developed with fire as an important ecological factor. Broadly speaking, a frequent fire regime would favor certain fire-adapted species, such as chestnut oak (*Quercus montana*) and red pine (*Pinus resinosa*) over others; these two species are abundant on the upper slopes in the northeastern parcel of Birdseye WMA.

The warm and dry landscape of Blueberry Hill WMA may also support naturally occurring forest fires, particularly on the south-facing slopes. The natural communities on those slopes possibly developed with fire as an important ecological factor. Similar to Birdseye, a frequent fire regime would likely favor certain species (such as Chestnut Oak, *Quercus montana*) over others. However, the specific role of fire in maintaining the Dry Oak Woodland, Dry Oak Forest, and Dry Oak-Hickory-Hophornbeam Forest natural communities in Vermont is still not well understood. Thus, at present these sites are poor candidates for applying prescribed fire as an ecological management strategy.

In Birdseye WMA several areas show evidence of relatively recent landslide disturbance that has strong, if highly localized, effects on site conditions. All cliff and talus complexes indicate a history of rockfall disturbances, but the large north-facing cliff at the WMA is particularly unstable, shedding a nearly continuous stream of small debris and showing strong evidence of a geologically recent major collapse. This debris plume is mapped as both Open Talus and Northern Hardwood Talus Woodland. Elsewhere, south of Ames Hollow, there is an unusual landslide scar, now cloaked in young forest. This slide appears to have occurred before 1942, and

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its mark on the landscape persists, creating a unique habitat setting that has been colonized by several rare plant species. The steep slopes with thin soil veneers over bedrock may be especially prone to future landslide disturbances.

Human Disturbance
Human uses of the land can also greatly influence the present-day distribution of natural communities. Few areas of the Vermont landscape have escaped the effects of agriculture and timber harvesting, and CMU is no exception.

East of the beaver pond in Ames Hollow within Birdseye WMA, patches of white pine, old apple trees and hawthorns indicate a history of clearing, probably for pasture; this clearing is readily apparent in 1942 aerial imagery which shows the Ames Hollow valley bottom and lower slopes as entirely cleared. Clearing is also evident at that time on the broad slopes south of Bird Mountain, surrounding the present-day clearings. An old cellar hole with large, open-grown trees was noted near the stream in the northeast parcel and probably had larger clearings around it. Beyond these areas, however, the remainder of the WMA appears to have been forested as of 1942 and may never have been cleared. On the lower slopes of the Middle Block of Blueberry Hill WMA, extensive pine stands indicate a history of clearing, probably for pasture. On both Birdseye and Blueberry Hill, some oak forests may have a history of grazing by cattle or sheep, and often grazing can have a lasting effect of simplifying forest structure by removing sapling and shrub layers. Past grazing may also have increased soil erosion and caused some of the exposed rock outcrops found on both WMAs.

On Birdseye, many of the steeper slopes and more remote areas appear to have avoided clearing, but most show at least some evidence of past timber harvesting, including old stumps and logging trails cut into the slopes. The lower, more accessible slopes show recent evidence of logging, including a large regenerating clear-cut (cut about 2011), stands of pole-timber, and extensive areas of selective harvesting.

On both WMA's, all the forementioned activities are past disturbances except for the relatively recent timber harvesting and some road maintenance activities. Present human disturbance is minimal and largely confined to the network of trails used by VASA and communications tower servicers on Birdseye. Additionally, there are several open areas on the lower slopes around Bird Mountain, which receive periodic treatments to maintain early successional conditions.

Natural Communities

A natural community is an assemblage of biological organisms, their physical environment (e.g., geology, hydrology, climate, natural disturbance regime, etc.), and the interactions between them (Thompson et al. 2019). The 97 natural community types described in Vermont repeat across the landscape in patches (or "polygons") of various sizes. These patches (or groups of patches near each other) are referred to as natural community occurrences and are to be distinguished from broad descriptions of community types.

Natural communities in CMU were identified through field surveys and aerial photograph and Lidar imagery interpretation. Because some natural communities occur at very small scales (e.g., less than ¼ acre), this mapping effort is probably incomplete. Natural community mapping is an iterative process, and our knowledge improves with each mapping effort. Thus, the map

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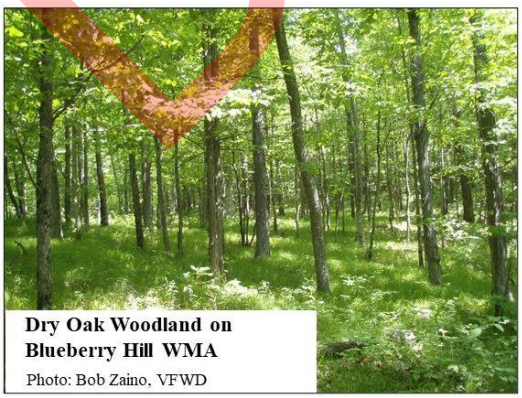
presented here should not be viewed as a final statement on community distribution in CMU; instead, it should be treated as a first attempt at describing natural communities in this area.

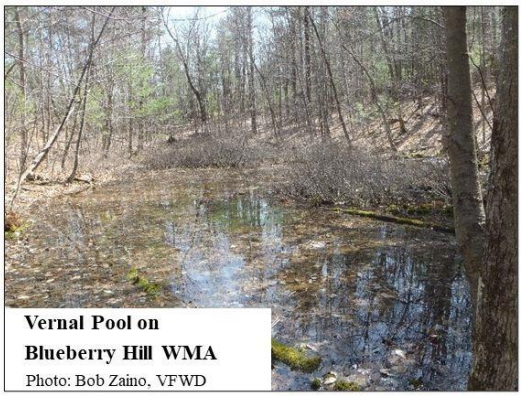
Twenty-eight natural community types have been mapped on the CMU. Sixteen of these are rare or uncommon types in Vermont, such as Dry Oak Woodland, Red Pine Forest, and Temperate Calcareous Cliff. There are one or more state-significant occurrences of at least 23 natural community types. Many of these occurrences are some of the very best examples of their type in the state. These include exceptional examples of Dry Oak-Hickory-Hophornbeam Forest, Dry Oak Woodland, Northern Hardwood Talus Woodland, Open Talus, Red Maple-Black Ash Seepage Swamp, and Temperate Calcareous Cliff. In addition to these small-patch communities, there are A-ranked examples of three widespread forest types on the unit: Dry Oak Forest, Mesic Maple-Ash-Hickory-Oak Forest, and Northern Hardwood Forest. The topography, soils, vegetation, and wildlife associations of each natural community in CMU are described in Appendix 1.

Birdseye Wildlife Management Area

Twenty-four natural community types and three landcover types were identified and mapped within Birdseye WMA (Table 5). Some broad patterns emerged from this mapping effort. The landscape of Birdseye WMA shows striking contrasts based largely on the aspect of its slopes. South and west facing slopes are especially warm and dry and are characterized in large part by natural communities and plant species near the northern edges of their distributions. Northern Red Oak (*Quercus rubra*) is abundant or dominant in most of these forests, and Chestnut Oak (*Quercus montana*) and Shagbark Hickory (*Carya ovata*) make sporadic appearances, creating a habitat matrix that is unusual for Vermont. Dry Oak Forest, Dry Red Oak-White Pine Forest, Dry Oak-Hickory-Hophornbeam Forest, and Red Pine Forest are found on these slopes embedded in a matrix of Mesic Red Oak-Northern Hardwood Forest. By contrast, north-facing slopes are relatively cool and moist, supporting the typical matrix of Northern Hardwood Forest. Although the higher ridgetops are only about 2,000 to 2,600 feet in elevation, they support distinctive Red Spruce-Heath Rocky Ridge Forests and the sugar maple variant of Montane Yellow Birch-Red Spruce Forest, which are strongly shaped by the heightened exposure of these ridgetop settings. Much of the WMA is on very steep and rocky ground with small cliff and talus patches found throughout the area, in addition to the larger cliffs on Bird Mountain and the north end of Herrick Mountain. Wetlands are notably sparse over the 3,600-acre WMA. Only 41 acres (1.1%) are mapped as wetlands. These wetlands are important features that contribute disproportionately to habitat and species diversity on the WMA.



Dry Oak Woodland on Blueberry Hill WMA
Photo: Bob Zaino, VFWD



Vernal Pool on Blueberry Hill WMA
Photo: Bob Zaino, VFWD

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Table 5: Natural Communities of Birdseye Wildlife Management Area

Natural Communities of Birdseye Wildlife Management Area				
Natural Community		**Acres**	**Vermont Distribution**	**Example of Statewide Significance?**
Wetlands	Red Spruce-Cinnamon Fern Swamp	7	Uncommon	Yes
	Seepage Forest	15	Uncommon	
	Seep	12	Common	Yes
	Vernal Pool	<1	Uncommon	Maybe
Uplands	Dry Oak Forest	93	Uncommon	Yes
	Dry Oak-Hickory-Hophornbeam Forest	67	Uncommon	Yes
	Dry Red Oak-White Pine Forest	71	Uncommon	Yes
	Erosional River Bluff	<1	Rare	
	Hemlock Forest	54	Common	Yes
	Hemlock-Northern Hardwood Forest	18	Very Common	
	Mesic Maple-Ash-Hickory-Oak Forest	164	Uncommon	
	Mesic Red Oak-Northern Hardwood Forest	1,234	Common	Yes
	Montane Yellow Birch-Red Spruce Forest	34	Uncommon	Yes
	Northern Hardwood Forest	1,573	Very Common	Yes
	Northern Hardwood Talus Woodland	33	Uncommon	Yes
	Open Talus	3	Rare	Yes
	Red Pine Forest	3	Rare	Yes
	Red Spruce-Heath Rocky Ridge Forest	110	Uncommon	Yes
	Red Spruce-Northern Hardwood Forest	27	Very Common	
	Rich Northern Hardwood Forest	66	Common	Yes
	Temperate Acidic Cliff	4	Common	Yes
	Temperate Calcareous Cliff	6	Uncommon	Yes
	Temperate Hemlock-Hardwood Forest	1	Uncommon	Yes
	Transition Hardwood Talus Woodland	8	Uncommon	Yes
Other*	Landslide Barren (variant of Open Talus)	1	Rare	Yes
	Open Land	33		
	Beaver Wetland	7		

*These land cover type descriptions are not currently recognized natural community types. For more information on these and other natural communities, see Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont, by Elizabeth Thompson, Eric Sorenson, and Robert Zaino. Information may also be found online at: https://vtfishandwildlife.com/conserve/conservation-planning/natural-community-inventory.

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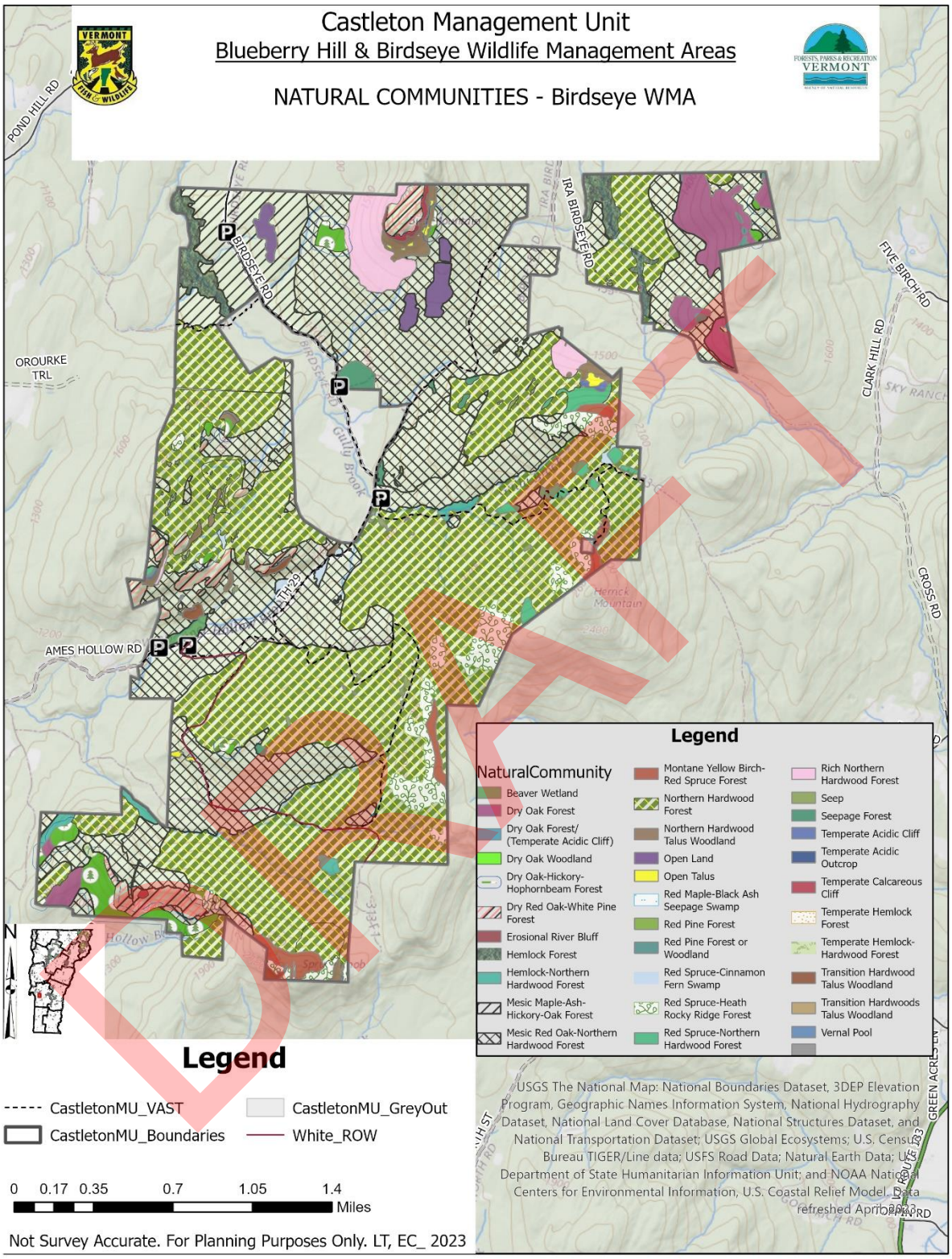
Map 6: Natural Communities of Birdseye Wildlife Management Area



Blueberry Hill Wildlife Management Area

Sixteen natural community types were identified and mapped within Blueberry Hill WMA (Table 6). Some broad patterns emerged from this mapping effort. The landscape of Blueberry Hill WMA is warm and dry, and characterized in large part by natural communities and plant species near the northern edges of their distributions. The extensive forests of Northern Red Oak (*Quercus rubra*), Chestnut Oak (*Quercus montana*), Eastern White Oak (*Quercus alba*), and Shagbark Hickory (*Carya ovata*) create a habitat matrix that is unusual for Vermont. Indeed, the 400+ acre occurrence of Dry Oak Forest may be the largest example of this natural community type in Vermont. Much of the management unit is on steep and rocky ground, and small cliff and talus patches are found throughout the unit. Wetlands are notably sparse – on a total of over 1300 acres, just 9 acres (<0.01%) are mapped as wetland natural communities. These wetlands are important features and contribute disproportionate habitat diversity to the WMA.

A detailed Natural community assessment for both Birdseye WMA and Blueberry Hill WMA can be found in the Appendix.

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Table 6: Natural Communities of Blueberry Hill Wildlife Management Area

Natural Communities of Blueberry Hill Wildlife Management Area				
Natural Community		**Acres**	**Vermont Distribution**	**Example of Statewide Significance?**
Wetlands	Red Maple-Black Ash Seepage Swamp	8	Common	Yes
	Seep	0.2	Common	
	Vernal Pool	0.6	Uncommon	
Uplands	Dry Oak-Hickory-Hophornbeam Forest	54	Uncommon	Yes
	Dry Oak Forest	415	Uncommon	Yes
	Dry Oak Woodland	42	Rare	Yes
	Dry Red Oak-White Pine Forest	4	Uncommon	
	Mesic Maple-Ash-Hickory-Oak Forest	474	Uncommon	Yes
	Mesic Red Oak-Northern Hardwood Forest	170	Common	Yes
	Northern Hardwood Forest	11	Very Common	
	Red Pine Forest	1	Rare	Yes
	Temperate Acidic Cliff	0.5	Common	Yes
	Temperate Acidic Outcrop	0.5	Common	Yes
	Temperate Hemlock-Hardwood Forest	26	Uncommon	
	Temperate Hemlock Forest	91	Common	Yes
	Transition Hardwood Talus Woodland	0.7	Uncommon	
For more information on these and other natural communities, see Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont, by Elizabeth Thompson, Eric Sorenson, and Robert Zaino. Information may also be found online at: https://vtfishandwildlife.com/conserve/conservation-planning/natural-community-inventory.				

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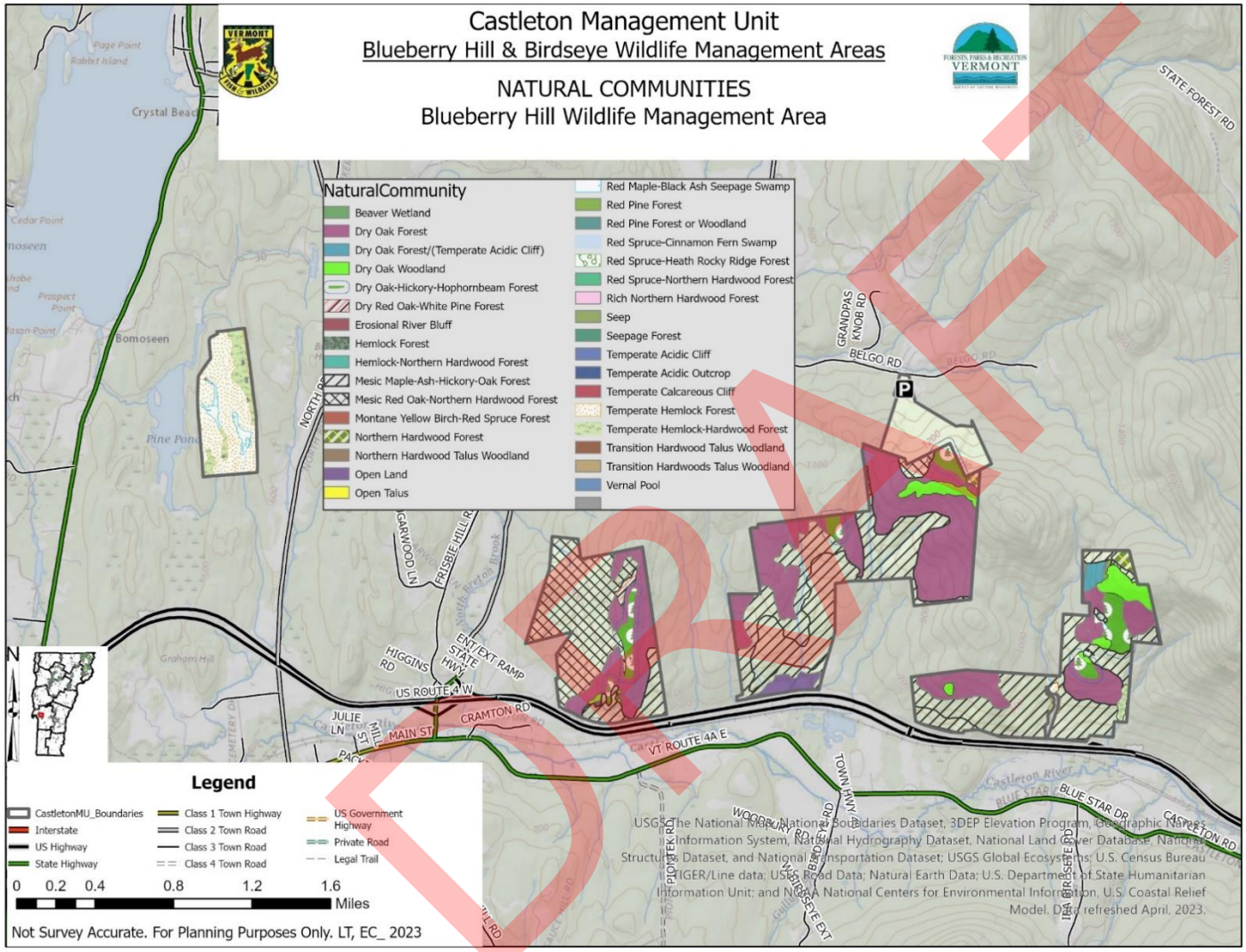
Map 7: Natural Communities of Blueberry Hill Wildlife Management Area



Meso-filter / Special Habitats

Structural Diversity

The CMU provides myriad habitats for a wide variety of wildlife. The large, unfragmented forest habitat that makes up the CMU along with the surrounding area, provides significant wildlife habitat for many types of wildlife to live, reproduce and move throughout a wide area. Habitat conditions within CMU range from spruce forests at some of the highest elevations to hemlock groves and more common mesic and northern hardwood forests. Smaller wetlands, vernal pools and seeps are scattered throughout.

All species require habitats of sufficient size to meet their life requirements. Wide-ranging species (e.g., fisher, bobcat) must travel throughout large areas to gather food. Even amphibians and reptiles require minimum acreages of suitable habitat but at a smaller scale. Habitat fragmentation (i.e., the breaking up of large habitat blocks into smaller, isolated patches) reduces habitat block sizes and may affect the ability of an area to support particular wildlife species. Negative effects of forest fragmentation on wildlife include an increase in predation by species such as skunks, crows, and cowbirds; alteration of habitat conditions for invasive exotic species (e.g., honeysuckle, buckthorn, purple loosestrife); and creating barriers to wildlife movement between habitats. Roads, power lines, development, and open fields are some examples of land uses that fragment Vermont forests.

Table 7: Forest Composition

Forest Cover Type	Blueberry Hill WMA	Birdseye WMA	Castleton MU
Northern Hardwoods	8%	68%	51%
Dry site oak	42%	3%	14%
Mixed hardwood	22%	11%	12%
White Pine	16%	4%	7%

The diversity of forest wildlife is partially related to the variety of structure provided within the forest communities – from leaf litter and ground cover, through the low herbaceous layer, the smaller shrub layer, and the taller mid-story, each level of vegetation provides nesting, foraging, and cover for a range of forest wildlife. Generally, the variety of species and conditions observed across the CMU will provide adequate habitat for many species. This structure is naturally patchy and uneven in distribution, so areas will favor different species based on habitat structure.

The following information provides a summary and overview of the various wildlife habitat conditions within the CMU based on recent and historic inventories and assessments.

Of the 4,725 acres comprising the CMU, only approximately 44 acres (~1%) have been identified as ***wetlands***. Although limited in size and scope, these wetlands provide significant habitat for species that rely on them for all or part of their life cycle requirements. For instance, black bears use forested wetlands and seeps as feeding sites, particularly during the spring as sedges and other early emerging vegetation appear and many amphibian species utilize the vernal pools and seeps to reproduce.

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Forested swamps, seeps and vernal pools comprise the majority of the wetland acreage and support a variety of breeding songbirds as well as a number of amphibians. Where present softwood swamps may also serve as wintering grounds for white-tailed deer (*Odocoileus virginianus*). Isolated seeps serve as feeding sites for black bears (*Ursus americanus*) emerging from hibernation. Many of the forested wetland habitats within CMU provide some or all these functions.

A statewide project to identify and map potential ***vernal pools*** was conducted by a team from the Vermont Center for Ecostudies to support conservation planning efforts.[9] Vernal pools are important wetland habitats for a variety of wildlife, and as breeding habitat for certain amphibians such as spotted salamanders, wood frogs, and spring peepers. They are also used by other wildlife as areas to find food and water. Two vernal pools have been mapped on BBHWMA and none on BWMA. However, more may be identified and mapped during subsequent field visits.

Stream and riparian habitat provide important contributions to ecological and physical processes which significantly influence water quality, stream channel equilibrium, aquatic and terrestrial habitats, and the diversity of populations and natural communities they support.[10] Approximately 12 miles of streams, many of which are seasonal or intermittent, are located within or adjacent to the CMU. Many species of wildlife rely on riparian areas for a variety of life-stage requirements. Wide-ranging mammals use riparian areas to travel between habitats within their home range. Moving from one feeding or breeding area to another is critical to maintaining populations and genetic diversity. Areas of habitat connectivity align in some cases with riparian habitat. Some species of amphibians and reptiles' nest and forage in and along streams.

White-tailed deer and moose have evolved and adapted to survive in northern environments by relying on specific habitat features known as wintering areas. These areas of ***winter habitat*** are comprised of varying age classes of softwood cover (spruce, fir, hemlock, cedar, white pine) that create a canopy resulting in reduced snow depths and higher mean daily temperatures during the winter months. Or in the case of BBHWMA this can also include areas which contain a high volume of mast producing trees, situated on steeper south facing slopes which provide enough solar gain throughout the winter that they mimic similar conditions in a hardwood stand. This habitat is essential for the survival of these species in Vermont and throughout the northern part of their range.

There are 4 areas of deer wintering habitat totaling approximately 510 acres documented on the CMU, based on recent and historic field assessments. Most of this acreage is documented on BBHWA and this larger deer wintering area spreads a total of 1300 acres to the north of route 4. These 510 acres represent roughly 10% of the total acreage of the CMU and will be carefully maintained. Wintering areas will be assessed, and management will follow the *Management*

[9] Faccio, Steven D., Lew-Smith, Michael, & Worthley, Aaron. *Vermont Vernal Pool Mapping Project: Using Aerial Photo Interpretation and Field-Verification to Map State-Wide Distribution of Vernal Pools*. Vermont Center for Ecostudies and Arrowwood Environmental, 2013.
[10] Vermont Agency of Natural Resources. *Riparian Management Guidelines for Agency of Natural Resources Lands*, 2015.

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Guide for Deer Wintering Areas in Vermont (VDFPR and VDFW 1990) which emphasizes the implementation of area regulation for treatments in a variety of softwood cover types.

Moose winter habitat has not been inventoried on the CMU; however, moose are not as selective in their winter habitat preferences as deer, and it is likely that any mature softwood cover above 2000 feet in elevation may support wintering moose.

Early successional or young forest habitat are regenerating forests dominated by dense seedlings and saplings less than 15-20 years old. This condition is created following forest disturbances by natural forces (wind, ice, beaver, etc.) and through forest management. A forest of diverse ages is also better positioned for resilience in a changing climate. Dense seedlings and saplings quickly grow into disturbed sites, providing cover, browse, soft mast, and other resources common in closed forests. Within 15-20 years, however, trees typically have grown enough to create a closed canopy, shading the understory, and reducing their value for young forest-dependent wildlife. Without a cycle of repeated disturbance this habitat is lost. These early successional habitats are important for species including the ruffed grouse, chestnut-sided warbler, eastern towhee, wild turkey, moose, eastern cottontail, red fox, bobcat, American woodcock, and white-tailed deer including many species in decline regionally. According to Vermont Conservation Design, about 3-4% of the highest priority forest blocks in the Taconic Mountain biophysical region should be young forest. This is the amount of young forest needed to reverse the declining trend and reach a level that at one time supported all of Vermont's native species that require young forest. Areas of young forest can be found throughout the CMU, most prominently in managed areas across Birdseye WMA. Approximately 200 acres or 4% of CMU is in young forest habitat, as described in Table 20: in the Timber Resource Assessment on page 50. However, over time without management, as the forest ages, the percentage of available young forest will decline and within five years will fall below the target for this area, no longer supporting habitat for the species that rely upon it. Managing 3-4% of CMU as young forest through forest management will maintain this young forest component and enhance structural diversity of stands, support important wildlife habitat, and help to meet VCD targets.

Late successional or old forest habitats are biologically mature forests, generally with trees exceeding 150 years of age. But these forests are more than just old trees. They include large trees, abundant dead and downed wood, canopy gaps as well as areas with closed canopies, and complex structure – trees of all sizes and heights. Many species rely on old forests including martens, fisher, barred owl, and scarlet tanager. Like young forests, these conditions can be created by natural processes over time or enhanced by forest management to speed development of these characteristics. VCD identifies the need for increasing old forests as a priority for maintaining an ecologically functioning landscape and highlights that old forests should operate under natural disturbance regimes. VCD also advises that old forests are maintained in patches large enough to accommodate natural disturbance regimes without compromising old forest characteristics dominating the patch.[11]The VCD's statewide target for old forests is 9% or 419,000 acres. The target for old forest in the Taconic Mountain biophysical region, where the CMU is located is 33,000 acres. An additional 23,789 acres is needed to meet the 100% of the

[11] Zaino, R., Sorenson, E., Morin, D., Hilke, J., & Thompson, K. *Vermont Conservation Design Part 2: Natural Communities and Habitats Technical Report.* State of Vermont, Department of Fish and Wildlife; Department of Forests, Parks and Recreation, Montpelier, 2018.

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target.[12] While these targets cannot be met on CMU alone because of matrix forest type and size limitations, areas have been identified on the CMU for old forest management. Patches of old forest that are smaller than the minimum preferred patch size also provide important ecological functions and contribute to the VCD's targets for each biophysical region, but with the acknowledgement that these small patches are more susceptible to stand-replacing natural disturbance events and likely do not provide all the functions of larger, connected patches.[13] Some areas within the CMU are approaching this condition and can be enhanced using either passive or active management strategies. To get closer to the minimum patch size for old forest targets, passively managed state-significant natural communities within the CMU that are smaller, will be connected to matrix community types under active old forest management, creating a contiguous area of old forest conditions.

Mast stands consist of large amounts of nut/fruit bearing tree species within CMU these are typically dominated by oak, hickory and/or beech. Acorns, hickory, and beechnuts provide essential fats and nutrients to black bear as they prepare for winter hibernation, as well as wild turkey, white-tailed deer, and a host of small mammals and birds. A majority of the CMU is composed of northern hardwood, mesic or dry oak forest types all of which support significant mast producing tree species.

Trees that host viable ***raptor nests*** are generally preferred sites for repeated breeding success. These sites were noted during forest stand inventory, as well as during planning and implementation of management activities. These surveys will be a routine part of preparing for timber harvest or other activities within the CMU.

Cliff habitats range across CMU but are most prominent on the southern facing slope of Bird Mountain. These cliff areas provide nesting habitat for peregrine falcons and turkey vultures. Some of these rocky features may also provide denning sites for bobcats. While the ledges and lower talus areas of the cliffs are often favorite sites for many snakes to sun themselves.

Standing dead and dying trees as well as ***downed dead trees*** are vital components of the forest structure and provide food and shelter for wildlife ranging from mammals to invertebrates. With the declining statewide bat population, dead and dying trees could play a critical role in preventing further collapse of threatened and endangered species. More common species also depend on these features, and a full range of wildlife species is best accommodated by variation in size, species, location, aspect, and condition of tree and wood. Forest inventory methods incorporate data collection on frequency of snags and den trees. The presence of these features is an important consideration when creating silvicultural prescriptions.

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[12] Zaino, R., & Sorenson, E. *Progress Towards Achieving the Vermont Conservation Design Old and Young Forest Targets*. State of Vermont, Department of Fish and Wildlife, Montpelier, 2021.
[13] Zaino, R., Sorenson, E., Morin, D., Hilke, J., & Thompson, K. *Vermont Conservation Design Part 2: Natural Communities and Habitats Technical Report.* State of Vermont, Department of Fish and Wildlife; Department of Forests, Parks and Recreation, Montpelier, 2018.

Table 8: Summary of Habitat on Castleton Management Unit

Habitat	Approx. Acres	Some Associated Species
Northern Hardwood Forests	1,700	Wood frog, eastern newt, porcupine, black bear, white-tailed deer, hermit thrush, barred owl
Mesic Forests	2,000	Dekay's brownsnake, gray treefrog, southern flying squirrel, gray fox, wild turkey, wood thrush
Dry Oak Forests	750	Black bear, southern flying squirrel, wild turkey, oven bird
Hemlock Forests	200	White-tailed deer, southern red-backed vole, porcupine, red-breasted nuthatch, northern saw-whet owl
Red Spruce Heath – Rocky Ridge Forest	110	Red squirrel, snowshoe hare, dark-eyed junco, ruffed grouse
Montane Yellow Birch-Red Spruce Forest	30	Moose, winter wren, blackburnian warbler
Red Spruce-Northern Hardwood Forest	30	Fisher, black bear, Canada warbler, hermit thrush
Red Maple-Black Ash Seepage Swamp	10	Northern dusky salamander, American beaver, masked shrew
Red Spruce-Cinnamon Fern Swamp	10	Red squirrel, southern red-backed vole, winter wren, northern waterthrush
Seeps/Vernal Pools	30	Wood frog, spotted salamander, spring peeper, northern two-lined salamander
Cliffs/Outcrops	10	Raven, peregrine falcon, northern junco, rock shrew, bobcat, many bird species

Wildlife

The CMU supports a wide variety of ***bird species*** from common game species such as wild turkey and ruffed grouse to raptors including peregrine falcons to various common songbirds such as song sparrows and scarlet tanagers. In total over 80 species have been observed on the CMU. The diversity of habitat types seen across the CMU help to support a wide variety of bird species that are adapted to different areas. Including forest interior birds and early successional habitat species. This mix of habitat types across the landscape of the CMU provides for multiple uses including foraging and nesting by these species. The complete list of birds found on CMU can be found in the appendix. Ruffed grouse and Turkey are found throughout the CMU. Both species enjoy great habitat diversity including mature forest, larger dense pockets of young forest and other early successional openings as well as ample food sources provided by the myriad of mast producers across the unit.

Nine species of ***amphibians and reptiles*** have been detected on the CMU with an additional 12 species noted as being possibly present across the unit. While relatively few wetlands and streams exist within the CMU, amphibian and reptile species thrive where water is found as well as within the rocky slopes of both Blueberry Hill and Birdseye.

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Table 9: Amphibians and Reptiles on Castleton Management Unit

Common Name	Species Name	Rarity	Detected on CMU	May be Present on CMU
Eastern Newt	*Notophthalmus viridenscens*	S5	X	
Eastern Red-backed Salamander	*Plethodon cinereus*	S5	X	
Jefferson Salamander	*Ambystoma jeffersonianum*	S2, SC	X	
Northern Dusky Salamander	*Desmognathus fuscus*	S4	X	
Northern Two-lined Salamander	*Eurycea bislineata*	S5	X	
Spring Salamander	*Gyrinophilus porphyriticus*	S4	X	
Spotted Salamander	*Ambystoma maculatum*	S5	X	
Wood Frog	*Lithobates sylvaticus*	S5	X	
American Toad	*Anaxyrus americanus*	S5		X
Blue-spotted Salamander	*Ambystoma laterale*	S3		X
Gray Treefrog	*Hyla versicolor*	S5		X
Jefferson Blue Spotted Complex	*Ambystoma jeffersonianum x A. laterale complex*	S2		X
Spring peeper	*Pseudacris crucifer*	S5		X
Green Frog	*Lithobates clamitans*	S5		X
Common Gartersnake	*Thamnophis sirtalis*	S5	X	
Eastern Milksnake	*Lampropeltis Triangulum*	S5		X
DeKay's Brownsnake	*Storeria dekayi*	S4		X
Red-bellied Snake	*Storeria occipitomaculata*	S5		X
Ring-necked Snake	*Diadophis punctatus*	S4		X
Smooth Greensnake	*Opheodrys vernalis*	S3		X
Wood Turtle	*Glyptemys insculpta*	S3, SC		X

Mature forest found in CMU provides suitable roosting for forest dwelling ***bats species***. Also, forest roads, streams and forested wetlands provide important foraging for bats. Bat mist-netting surveys (2007-2009) conducted in the area of CMU identified 104 bats.

Table 10: Bats on Castleton Management Unit

Common Name	Species Name	Rarity*		# Animals
		State	Federal	
Little Brown Bat	*Myotis lucifgus*	Endangered	UR	62
Northern Long-eared Bat	*Myotis septentrionalis*	Endangered	Endangered	21
Big Brown Bat	*Eptesicus fuscus*	Not listed		17
Small-footed Bat	*Myotis leibii*	Threatened		2
Red Bat	*Lasiurus cinereus*	Not listed		2

*Listed on Vermont state endangered species statute (10 V.S.A. 123)

White-tailed deer are common throughout the state and evidence including tracks, droppings and browse can be found throughout the CMU, especially within the prominent wintering areas covering much of Blueberry Hill WMA and the wide variety of habitat types across Birdseye WMA. Particularly many of the young forest areas provide valuable cover and browse to deer. These areas also provide the same value to moose. ***Moose***, while a rare sight on the CMU and southern Vermont in general, do have their presence particularly in roaming Birdseye WMA and the surrounding forest and wetlands outside of the WMA.

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The large blocks of forest including and surrounding the WMA's making up the CMU provide ample habitat for ***black bear***. Large mast stands of oak, hickory and to a lesser extent beech provide great food sources as well as many young forest and semi-open areas which provide a myriad of berry bushes and apple trees. Older trees, downed woody material and openings around the cliffs provide potential winter dens as well.

Habitat components within the CMU are such that a variety of ***furbearer populations*** are supported including eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus),* fisher (*Pekania pennanti*), and bobcat (*Lynx rufus*). All these species are wide ranging and utilize the CMU to meet various habitat needs.

Fine Filter Assessment of Plants

Rare, Threatened, and Endangered (RTE) Species

Rare and uncommon plant species are frequent on the CMU. Ten rare and uncommon plant species have been documented at Blueberry Hill WMA, and 25 rare and uncommon plant species have been documented at Birdseye WMA. Many of these are warm-climate species approaching their northern range limits in the WMA. Four species are legally protected by Vermont state endangered species statute (10 V.S.A. 123):

- Flowering dogwood (*Cornus florida*)
- White adder's-mouth (*Malaxis monophyllos* var. *brachypoda*)
- Drummond's rock cress (*Boechera stricta*)
- Bronze sedge (*Carex foenea*)

While most of these rare and uncommon plant species are restricted to habitats unlikely to be disturbed by visitation or management, a few are found in widespread natural community types and warrant special consideration during habitat management activities.

Blueberry Hill WMA

Six species of rare or very rare plants have been located within Blueberry Hill WMA, as well as four uncommon plant species. These are summarized in Table 11. Several rare species are of note. Two species are listed as "threatened" by Vermont state endangered species statute (10 V.S.A. 123); one of these species may only persist in Vermont within the WMA. The presence of these plants is thus very important on a statewide basis.

The only known extant population of Flowering Dogwood (*Cornus florida*) is found on the West Block of Blueberry Hill WMA. There is evidence from USFS Forest Inventory and Assessment data that Flowering Dogwood is declining across its range in the eastern United States.[14] These range-wide declines mirror what has been observed in Vermont, where populations have succumbed to dogwood anthracnose (*Discula destructiva*). Samples collected from the Blueberry Hill population and sent to the US Forest Service for analysis did not have evidence of the *Discula* fungus. It is likely the absence of anthracnose is a result of this population's relative isolation from other Flowering Dogwoods. At this time no active management is needed to

[14] Oswalt, C.M., S.N. Oswalt, and C.W. Woodall. 2012. An assessment of flowering dogwood (*Cornus florida* L.) decline in the eastern United States. Open Journal of Forestry 2(2): 41-53.

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perpetuate this species in the WMA; however, regular monitoring is needed to ensure that appropriate management could be taken if anthracnose or other threats are detected.

The remaining rare and uncommon plant species are found in habitats that are unlikely to be disturbed by extensive management. Maintaining the ecological integrity of dry oak natural communities, cliffs, wetlands, and riparian zones is probably the best strategy for protecting these species.

Birdseye WMA

Fourteen species of rare or very rare plants have been located within Birdseye WMA, as well as 11 uncommon plant species and one of uncertain rarity status. An additional rare species, pignut hickory (*Carya glabra*), may be present but needs further confirmation. Except for one sensitive species, these are summarized in Table 11. While the sensitive species is not described in this report, land managers are aware of its location and management needs.

Several rare species are of particular note. Two species, bronze sedge (*Carex foenea*) and Drummond's rock cress (*Boechera stricta*), are listed as "Endangered" by the Vermont state endangered species statute (10 V.S.A. 123). For one species variety, small skullcap (*Scutellaria parvula var. missouriensis*), BWMA contains the only known site in the state. Additionally, a very rare thallose liverwort, *Metzgeria crassipilis*, found on several calcareous cliffs, is only the second known location for the species in Vermont. The presence of these plants is very important on a statewide basis.

Many of these species, including both endangered species, are associated with distinctive habitat features of limited occurrence on the landscape; most commonly at BWMA these features are cliffs, talus, and outcrops, but also include enriched coves and seeps, the landslide barren area, the moist pond shore mudflats, and dry oak settings. In many cases the physical features involved (e.g. cliffs) provide a measure of inherent protection for the species since they are unlikely to receive extensive or intensive management. However, a few of the uncommon species, especially summer sedge (*Carex aestivalis*) and two-rayed Poa (*Poa saltuensis var. saltuensis*) are more broadly adapted, occurring sporadically in a relatively wide range of microsites and community types, including the matrix forests. These species are more likely to be exposed to management activities, but their broader tolerances suggest that maintaining the ecological integrity of these areas is probably the best strategy for protecting these species.

Several sites at BWMA are hotspots for rare species. These include the cliffs, talus, and summit area of Bird Mountain which are collectively known to support at least six rare and uncommon plant species as well as two rare and uncommon animal species. The landslide barren area south of Ames Hollow is another concentrated site, supporting five rare and uncommon plant species. The scattered cliff and talus zones on the slope north of Ames Hollow also collectively support five rare and uncommon plant species.

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Table 11: Rare, Threatened, and Endangered Plants of Castleton Management Unit

Species Name	Common Name	Sites Where Found	State Rarity Rank[1]	Rarity[1]
Blueberry Hill WMA				
Asclepias quadrifolia	Four-Leaved Milkweed	dry forests	S3	Uncommon
Aureolaria flava var. flava	Smooth False Foxglove	Dry Oak Forest	S2	Rare
Cornus florida[2]	Flowering Dogwood	Dry Oak Forest	S1	Very Rare
Hieracium venosum	Rattlesnake Hawkweed	dry forests	S3	Uncommon
Lilium philadelphicum	Wood Lily	Dry Oak Forest	S3	Uncommon
Malaxis monophyllos var. brachypoda[2]	White Adder's-Mouth	Red Maple-Black Ash Swamp	S2S3	Uncommon to Rare
Phegopteris hexagonoptera	Broad Beech Fern	slightly enriched coves	S2S3	Uncommon to Rare
Uvularia perfoliata	Perfoliate Bellwort	dry forests	S2	Rare
Viburnum rafinesquianum	Downy Arrowwood	dry forests	S3	Uncommon
Viola palmata var. triloba	Northern 3-lobed violet	Dry Oak Forest	S2	Rare
Birdseye WMA				
Anemone cylindrica	Long-Headed Thimbleweed	landslide barren	S1S2	Very Rare to Rare
Boechera stricta[3]	Drummond's Rock Cress	calcareous cliffs and outcrops in dry forest	S1S2	Very Rare to Rare
Carex aestivalis	Summer Sedge	widespread	S3	Uncommon
Carex argyrantha	Silver-Flowered Sedge	cliffs and outcrops	S2S3	Rare to Uncommon
Carex backii	Back's Sedge	dry, semi-rich forest	S3	Uncommon
Carex foenea[3]	Bronze Sedge	cliffs and outcrops	S2	Rare
Carex laxiculmis	Loose-Flowered Sedge	Seepage Forest	S3	Uncommon
Carya cf. glabra (needs confirmation)	Pignut Hickory	dry ridgetop	S2	Rare
Celastrus scandens	American Bittersweet	Open Talus	S3	Uncommon
Clematis occidentalis ssp. occidentalis	Purple Virgin's-Bower	cliffs and talus	S3	Uncommon
Draba arabisans	Rock Whitlow-Mustard	cliffs and ledges on Bird Mountain	S2S3	Uncommon to Rare
Drymocallis arguta	Tall Cinquefoil	near Bird Mtn summit	S3	Uncommon
Elymus trachycaulus ssp. trachycaulus	Slender Wheatgrass	cliffs, talus, landslide barren	S3	Uncommon
Gentianopsis crinita	Fringed Gentian	landslide barren, edges of moist openings	S3	Uncommon
Homalosaurus pycnocarpos	Glade Fern	enriched seeps, coves, and talus woodlands	S3	Uncommon
Huperzia x protoporophila4	a hybrid clubmoss	ledges on acidic cliff	SNR[4]	Uncommon
Malaxis unifolia	Green Adder's-Mouth	ledges on acidic cliff	S2	Rare
Metzgeria crassipilis	a thallose liverwort	calcareous cliffs	S1	Very Rare
Moehringia macrophylla	Large-Leaved Grove-Sandwort	near Bird Mtn summit	S2	Rare
Poa saltuensis var. saltuensis	Two-Rayed Poa	slightly enriched forests, widespread	S3	Uncommon
Pycnanthemum muticum	Short-Toothed Mountain Mint	landslide barren, gravel landing, openings, open road edges	S1	Very Rare
Riccia cf. huebeneriana ssp. sullivantii	a thallose liverwort	moist mud flats around beaver pond	S1	Very Rare

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Species Name	Common Name	Sites Where Found	State Rarity Rank[1]	Rarity[1]
Scrophularia marilandica	Figwort	moist forest gap	SU	Uncertain
Scutellaria parvula var. missouriensis	Shale Barren Skullcap	roadside	S1	Very Rare
Sisyrinchium angustifolium	Blue-Eyed Grass	gravel landing area	S2S3	Uncommon to Rare
Solidago squarrosa	Stout Goldenrod	talus woodlands, dry forests, cliffs	S2S3	Uncommon to Rare
Symphyotrichum laeve var. laeve	Smooth Aster	landslide barren and adjacent forests	S2S3	Uncommon to Rare

[1] For a full explanation of these rarity ranks, visit the Vermont Natural Heritage Inventory website: http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=7927382
[2] Legal status threatened.
[3] Legal status endangered.
[4] An unranked hybrid form of interest.

Fine Filter Assessment of Animals

Rare, Threatened, and Endangered (RTE) and Uncommon Animal Species

Two rare animals, including one state-threatened species, are known to occur at ***Birdseye Wildlife Management Area*** along with 3 uncommon animal species. These are summarized in the table below. The large cliff on Bird Mountain is known to provide habitat for two of these species. It is a nesting site for peregrine falcons, with nesting attempts almost every year since 1990. In 2009, an eastern small-footed bat (*Myotis leibii*) was radio-tracked to a roost on the cliff's south face. This species has rapidly declined in recent years due to white-nosed syndrome and is now considered very rare and is state-threatened. The numerous other cliff areas within the WMA may provide additional important habitat for these species. During this inventory effort a peregrine was observed perching on the lip of the large cliff at the north end of Herrick Mountain; this area no doubt provides hunting and resting habitat for the peregrines but may be too close to the Bird Mountain nest to support an additional nesting pair/site.

While not yet documented on the WMA, the hickory hairstreak (*Satyrium caryaevorus*), an uncommon butterfly, has been documented nearby and may be present, since its preferred larval foods, the leaves of hickory, butternut, and oak, are prevalent.

Table 12: Rare, Threatened, and Endangered Animals of Castleton Management Unit

Species Name	Common Name	Sites Where Found	WMA Where Found	State Rarity Rank[1]	Rarity[1]
Ambystoma jeffersonianum	Jefferson salamander	Moist forest, vernal pools	BWMA BBHWMA	S2	Rare
Falco peregrinus	Peregrine falcon	Bird Mountain cliffs	BWMA	S3B	Uncommon breeder
Myotis leibii	Eastern small-footed bat	Cliffs and talus fields	BWMA	S1	Very Rare
Opheodrys vernalis	Smooth Greensnake	Open burned fields	BWMA	S3	Uncommon
Polioptila caerulea	Blue-gray Gnatcatcher	No details	BWMA	S3	Uncommon breeder
Setophaga cerulea	Cerulean warbler	Older hardwood forests	BBHWMA	S1S2B	Rare

[1] For a full explanation of these rarity ranks, visit the Vermont Natural Heritage Inventory website: http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=7927382
[2] Federally threatened.

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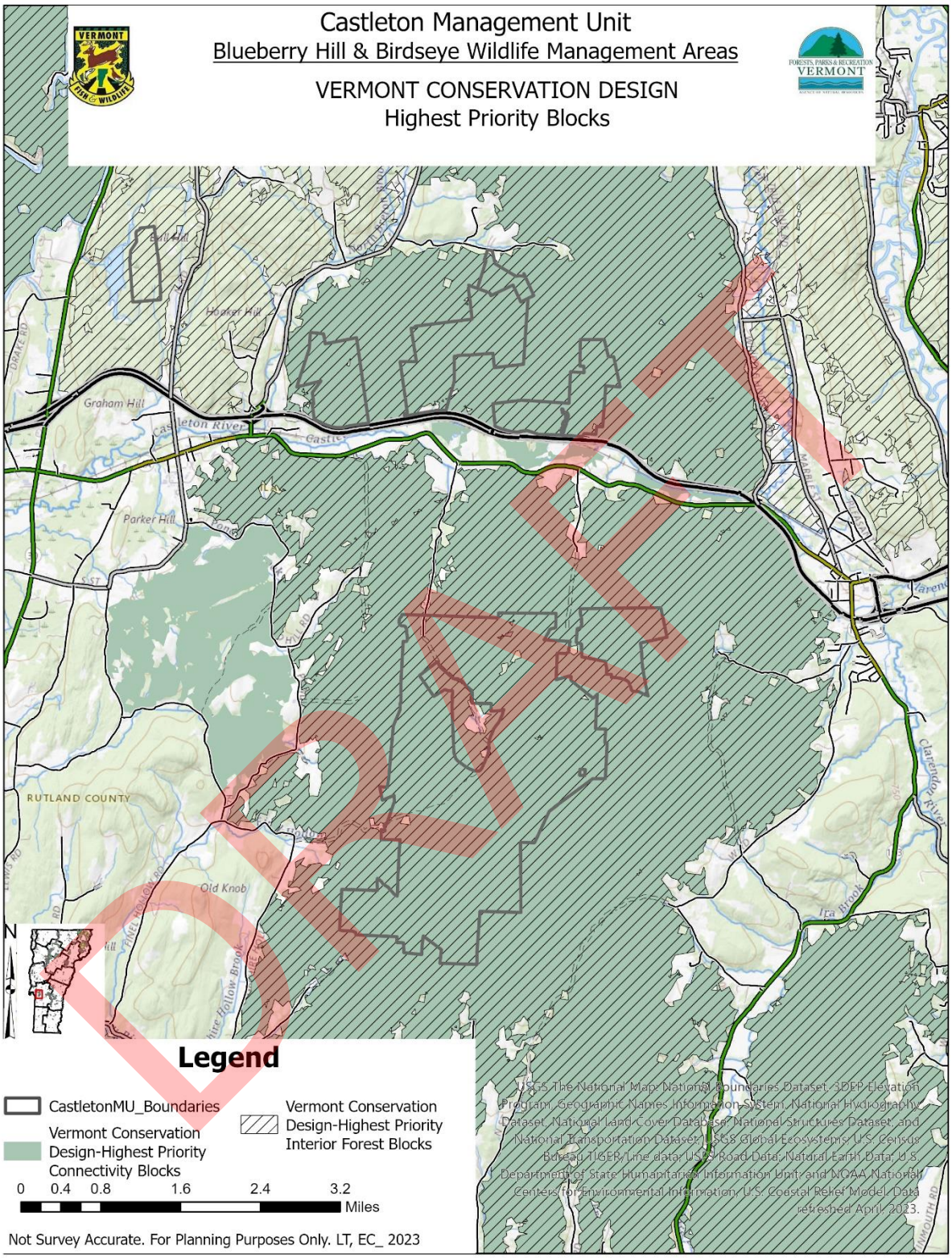
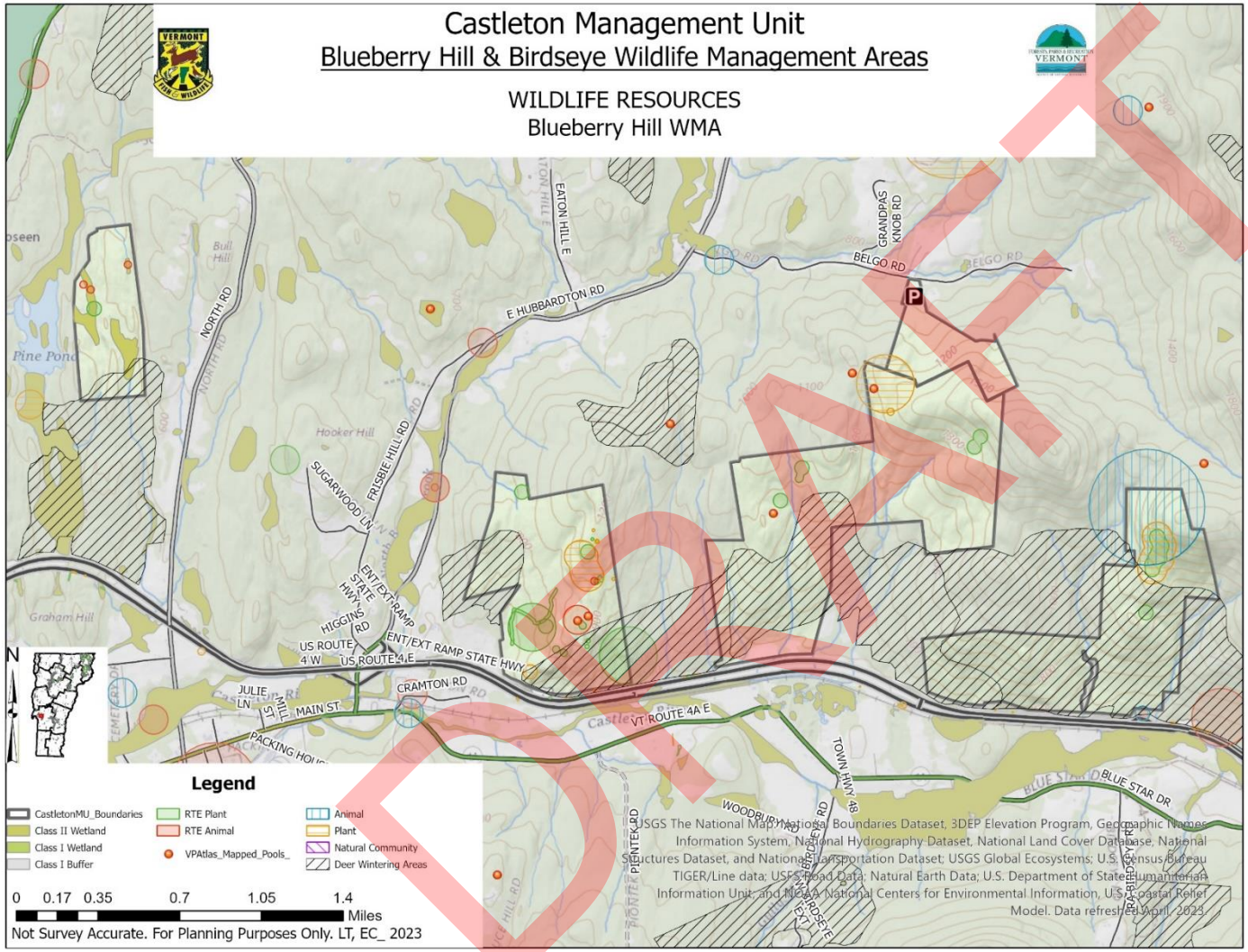
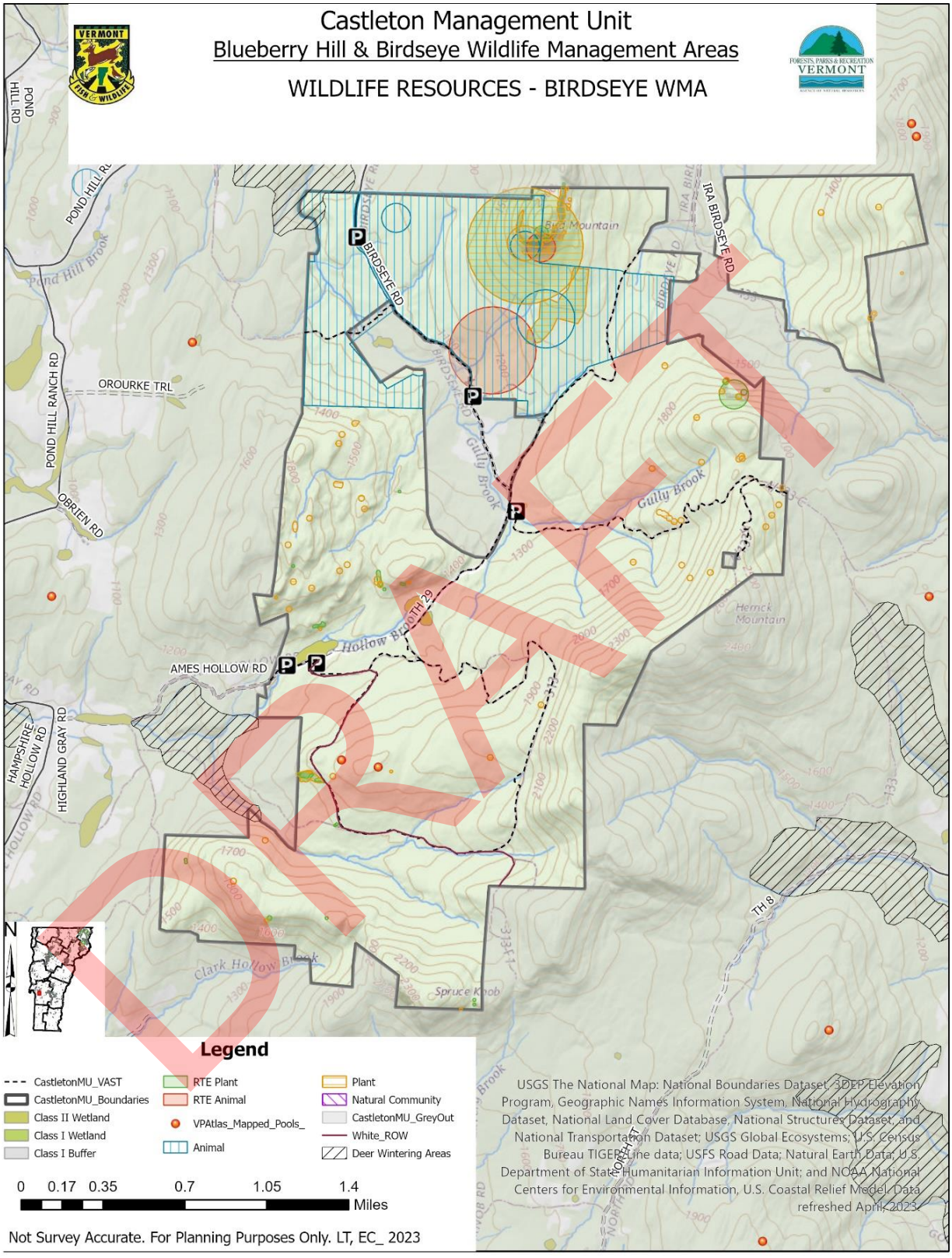
Map 8: Highest Priority Forest Block & Highest Priority Connectivity Block



Map 9: Wildlife Habitat on Blueberry Hill Wildlife Management Area



Map 10: Wildlife Habitat on Birdseye Wildlife Management Area



C. Water Resource and Fisheries Assessment

The CMU is located within both the Castleton and Poultney River watersheds. The southern half of Birdseye WMA drains to the Poultney River, while the northern half drains to the Castleton River, with a small portion to the east off of Herrick Mountain draining to the Clarendon River towards Otter Creek. The dry landscape contains very little surface water. Gully Brook in Birdseye WMA is the most prominent stream in the CMU. There are a few areas of groundwater seepage in the CMU, but none are state-significant. Several vernal pools, however, are found in otherwise dry hilltops and in small benches on slopes.

Headwater streams and ephemeral flowpaths in the CMU drain mature forest mainly composed of northern hardwoods or mixed hardwoods. As a result, these waters typically have partially-fully closed forest canopies, which moderate stream temperatures and provide woody material that creates important aquatic habitat for macroinvertebrates and fish. CMU streams flow into the Castleton River, which confluences with the Poultney River before draining into Southern Lake Champlain. The CMU is located within the Southern Lake Champlain Tactical Basin Planning region. The Tactical Basin Plan was updated in 2022.[15] Wetlands are notably sparse –just 1% are mapped as wetland natural communities. These wetlands are important features and contribute disproportionate habitat diversity to the WMA. Land managers and members of the public should be aware that additional, unmapped examples of small patch natural communities (e.g., vernal pools and seeps) probably occur on the management unit. As subsequent inventories and site visits are conducted, this map will be improved.

Historic Uses Impact Today's Surface Waters

With the exception of the steepest areas of the unit, most forests were logged or cleared for grazing livestock. Extensive pine stands on the lower slopes likely indicate a history of clearing for pasture and past grazing. These past disturbances may have increased soil erosion and caused some of the exposed rock outcrops found on BWMA. With the exception of recent timber harvesting, habitat management activities, ATV trails, and roadways, present human disturbance is minimal. Historical land use from as long ago as 100 years has caused some alteration of stream channels and the flow of water through the CMU. The majority of these legacy impacts from human activity are a result of poorly designed and maintained forest and farm roads, undersized and poorly maintained stream crossing structures, compaction of soil, and lack of erosion control measures.

The Department of Forest Parks and Recreation (VFPR) implements projects that benefit water quality and adhere to the Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont. VFPR regularly maintains State Forest Highways to a standard that both protects infrastructure and maintains high water quality standards. These projects range from handwork clearing culverts and ditches, to excavation projects that upsize culverts, stabilize ditches, and better distribute water run-off into forest buffers. An example of erosion control and infrastructure mapping on the Birdseye WMA is below and can be used to guide projects over the lifespan of the CMU LRMP.

[15] Allen, R. Angie. *South Lake Champlain Basic 2 – 4: Tactical Basin Plan*. Report by the Vermont Department of Environmental Conservation, December 2022.

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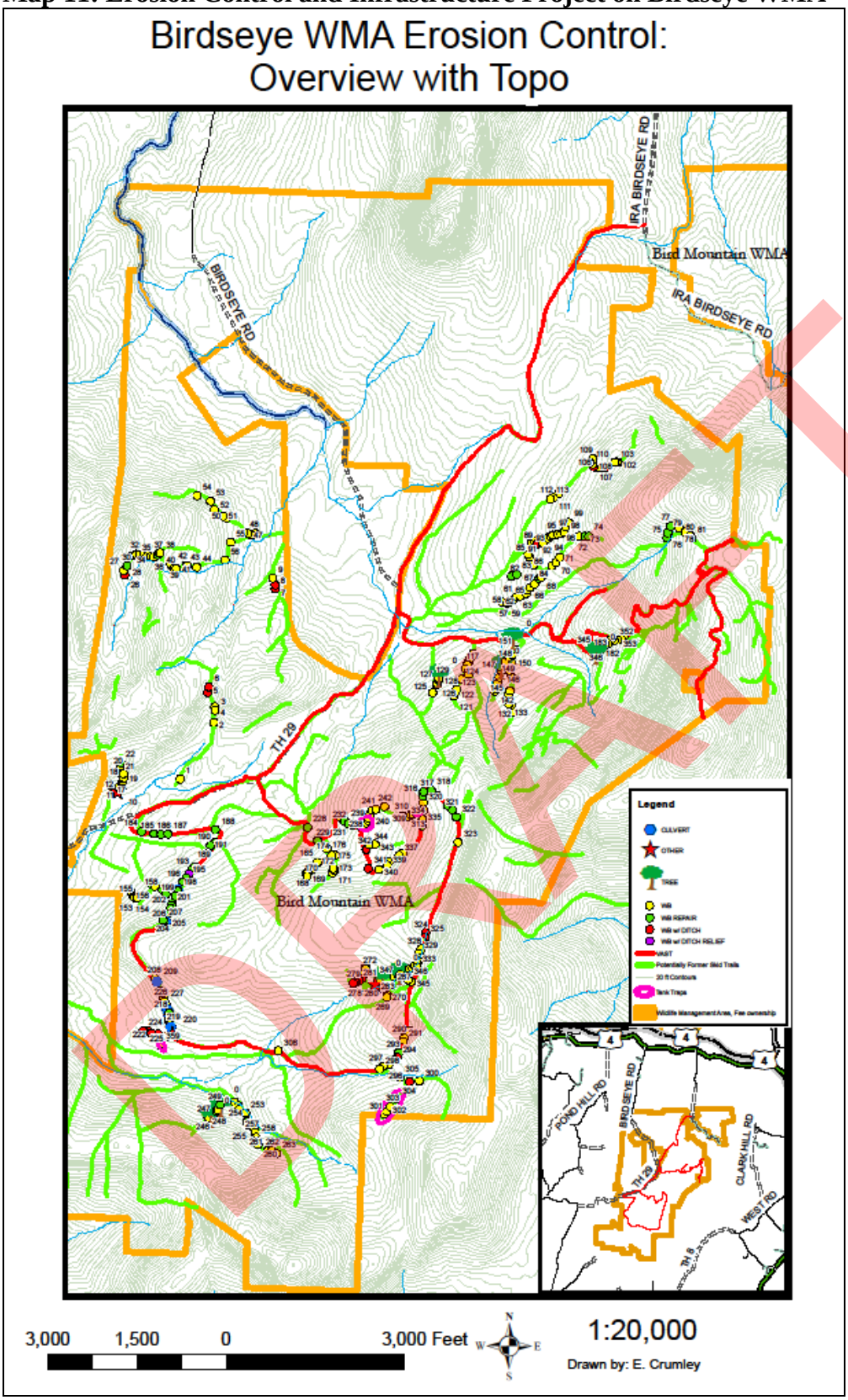
Map 11: Erosion Control and Infrastructure Project on Birdseye WMA



The proper management of CMU's water resources provides value downstream of its boundaries in the form of drinkable, swimmable, fishable, and boatable waters in the towns of Castleton, Ira, and Poultney.


Gully Brook, Birdseye WMA
Photo: Angie R. Allen, VDEC


Culvert Crossing, Birdseye WMA
Photo: Angie R. Allen, VDEC

Fisheries

Gully Brook provides year-round habitat for wild, naturally reproducing brook trout populations. Deep pools provide a habitat for adult trout and gravel riffles provide suitable spawning habitat. Sampling by electrofishing has found multiple age classes of brook trout in the upper section of Gully Brook, indicating that a healthy self-sustaining population exists.

Gully Brook and the other smaller streams in the CMU (shown on Figure 9) provide important cold-water contributions to the main stems of the Castleton and Poultney Rivers. During the summer when water temperatures increase in the Castleton River, Gully Brook serves as an area of thermal refuge for trout, which will migrate up into these cold headwater tributaries. The riparian zones are forested, and it is important to maintain them to continue to protect this cold-water resource. Riparian areas provide physical, hydrological, and ecological functions including water temperature moderation, sediment and nutrient filtration, large wood and organic material recruitment, streambank stability and wildlife travel connections. Riparian areas are managed following the Agency's Riparian Management Guidelines for Agency of Natural Resources Lands.[16]

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[16] Vermont Agency of Natural Resources. *Riparian Management Guidelines for Agency of Natural Resources Lands*, 2015.

D. Forest Health and Resiliency Assessment

Forest health is influenced by both individual abiotic factors such as weather and climate and biotic factors including insects and diseases. But it is the combination of natural disturbance processes - weather, climate, insects, and diseases that continually shape Vermont's forests and landscapes. In general, Vermont's forests are influenced by frequent small-scale disturbances such as individual tree death and resulting canopy gap dynamics. At larger scales blowdown, ice damage, and insect outbreaks are characteristic disturbances but occur less frequently. The warm, dry landscape of the CMU may support naturally occurring forest fires, particularly on south-facing slopes and ridges. Natural communities on some of these slopes likely developed as a result.

Site conditions are varied across the CMU with dry, oak-dominated, south-facing slopes on many areas of BBHWMA and deeper soils, more landscape variety, and steep ridgelines on BWMA. Elevations range from 500 feet along Route 4 on BBHWMA to just over 2600 feet on the ridgeline near the summit of Herrick Mountain on BWMA.

Several common ***forest insects and diseases*** can be found within CMU. As in most other forests in Vermont these include beech bark disease (*Cryptococcus fagisuga and Neonectria* spp.), butternut canker disease (*Sirococcus clavigignenti-juglandacearum*) and eutypella canker (*Eutypella parasitica*). Typically, these pests and diseases are not a large problem, but rather run their course with minimal impacts on the forest. White ash does quite well in some areas of the forest and shows considerable decline in others. Mortality in white ash is higher on sites with high variation in moisture supply than on sites that are dry with less variability. Deeper soils show less variation in soil moisture during drought events. The condition of ash is better in upslope areas where soil is deeper. The trees in decline are on the poorest microsites. White pine weevil (*Pissodes strobi*), a native insect, impacts white pine resulting in a reduction in growth, stem deformation, increased susceptibility to rot and potential mortality.

Emerald Ash Borer (*Agrilus planipennis*) (EAB) is a non-native wood-boring beetle and is an emerging and significant threat to Vermont's forests. EAB attacks and kills all native ash (*Fraxinus)* trees. All BBHWMA and much of the northern half of BWMA are within the EAB infested area as shown on www.vtinvasives.org. Management of ash follows the *Procedure for the Management of Ash on ANR Lands in Response to Emerald Ash Borer (*February 1, 2021). It is the intent of ANR to continue to recognize the value of ash for its cultural, economic, and ecological contributions. Ash management will follow guiding principles that protect public safety, retain ash on the landscape, mitigate the ecological impacts related to the decline of ash, and harvest ash for educational, cultural, economic, and ecological values.

Forest health specialists from VFPR conduct aerial surveys to assess more widespread forest health conditions across the state. ***Forest tent caterpillar*** (*Malacosoma disstria*) is a native insect. Outbreaks tend to occur cyclically (~ 10 years) lasting an average of 3 years. While forest tent caterpillar populations and associated defoliation have been increasing in areas of the state, no defoliation has been mapped at CMU for the past several years. In 2018 nearly 35 acres of forest tent caterpillar defoliation was mapped on the West Block of BBHWMA. Impact to tree health is influenced by the severity of outbreak – light defoliation has little long-term impact

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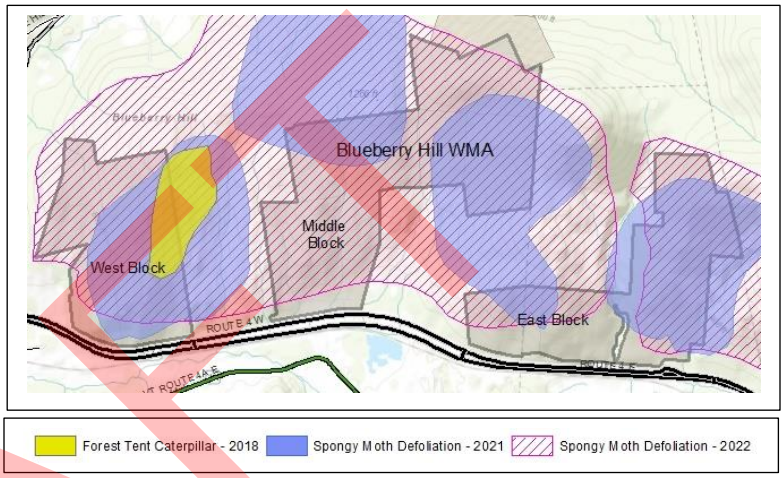
whereas heavy defoliation can lead to tree mortality. ***Spongy moth*** (*Lymantria dispar dispar*) is an invasive insect whose numbers have increased over the past several years resulting in defoliation of their preferred hosts – oaks, although they will feed on other species too. The severity of the defoliation is influenced by spring moisture levels and the success of fungal and viral pathogens on the caterpillars. In 2021, nearly 51,000 acres of defoliation were mapped during aerial surveys in Vermont. Most defoliation occurred in oak and maple forests in the Champlain Valley. No defoliation was mapped on BWMA. However, nearly 45% of BBHWMA was defoliated in 2021 with the highest impact on the West and East Blocks. In 2022, nearly 78% of the WMA was defoliated.

Forest defoliation on Blueberry Hill WMA
Photo by: FPR Staff



An ***assessment of browse pressure*** can be an indicator of impact on forest condition. During forest inventory and while conducting other regular management activities, qualitative observations were made of deer browse pressure as one indicator of deer population densities. Generally, browse pressure is low to moderate throughout the CMU, although some of the dry oak forests of BBHWMA exhibit locally higher levels of deer browse. ANR will continue to monitor browse pressure and may need to adjust silvicultural methods should deer densities increase.

Non-native, invasive species are widespread at low densities across the Management Unit and, while many remain at low densities or occupy only highly disturbed sites they can spread quickly. These species represent a serious threat to the ecological integrity of our natural communities and to the persistence of native species. An extensive survey of non-native invasive plants was not conducted but those noted during surveys are included in the table below. The low level of invasive plant infestation reflects the limited fragmentation of this large block of forest and the limited history of agricultural land use, which can predispose sites to invasion following agricultural abandonment. Areas along road corridors or on lower slopes have the greatest density of invasive species, while most of the areas that appear to have been continuously forested have very few or no invasive species. The low densities and current distribution of invasive plants on CMU make this the best time to implement effective management to control these populations.

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Table 13: Invasive Exotic Plants of Castleton Management Unit

Species Name	Common Name	Sites Where Found at Castleton Management Unit	Abundance	Present Threat to Native Plant Communities?
Non-Native Invasive Species of Blueberry Hill WMA				
Frangula alnus or Rhamnus cathartica**	Glossy Buckthorn or Common Buckthorn	Powder lot in Red Maple-Black Ash Seepage Swamp, West lot in Dry Oak Forest	Seedlings observed, larger plants in Dry Oak Forest	Unknown, moderate threat in Dry Oak Forest
Rosa multiflora	Multiflora Rose	West Lot in Mesic Red Oak-Northern Hardwood Forest in skid trail	Low	unknown
*Berberis thunbergia**	Japanese Barberry	East lot in seep and Dry Oak-Hickory-Hophornbeam Forest	At least one individual in each	unknown
Non-Native Invasive Species of Birdseye WMA				
*Frangula alnus**	Glossy buckthorn	A forested swamp in Ames Hollow (Poly ID 67)	extremely low	low
*Lonicera morrowii**	Morrow's honeysuckle	Road and pond edges, early successional forests and talus woodlands, especially in Ames Hollow	locally high	locally high, low overall
*Rhamnus cathartica**	Common buckthorn	Bird Mountain talus areas, edges, early successional forests	low	low
Rosa multiflora	Multiflora rose	Edges, early successional forests, and a swamp (Poly ID 97)	low	low
* Class B Noxious Weeds as reported by Vermont Invasives https://vtinvasives.org/				

E. Climate Assessment and Anticipated Impacts

There are many sources of evidence to show that both globally and locally the climate is changing. Because the climate of a location affects nearly all aspects of ecosystem processes, climate change has the potential to negatively impact Vermont's forests and natural ecosystems including those found in the Castleton Management Unit.[17] Changes in the climate at CMU could alter water availability, decomposition rates and nutrient cycling, tree growth, prevalence and severity of insect and disease outbreaks, abundance of invasive plants, food availability for wildlife, and the timing of seasonal events. Increases in extreme weather events also pose a threat to road and trail networks, operational capacity, and recreational opportunities. Because of these potential impacts, it is critical to include climate change in the planning and management of the CMU. By understanding how the climate has changed and how it is projected to change in the future, we can anticipate the possible impacts and manage accordingly.

Climate Change in Vermont

Vermont has experienced substantial increases in both temperature and precipitation over the last 100 years, with the most dramatic changes occurring in the last few decades. While there is

[17] Janowiak, et al. *New England and northern New York forest ecosystem vulnerability assessment and synthesis: a report from the New England Climate Change Response Framework project*. Department of Agriculture, Forest Service, Northern Research Station. 234p. Newtown Square, PA: Gen. Tech. Rep. NRS-173, 2018.

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considerable variability in weather from year-to-year, long-term records from weather stations around Vermont show that all regions within the state are experiencing higher temperatures and changing precipitation patterns.[18]

According to the *Vermont Climate Assessment,*[19] the following changes have been observed:

- Vermont's average annual temperature has increased by 1.5°F since 1960
- Winter temperature has warmed more than the other seasons (+3.1°F since 1960).
- The freeze-free period (temp. >28°F) is over three weeks longer than it was in the 1960s.
- Vermont has about 10 fewer cold winter nights (temp. <0°F) now compared to the 1960s.
- Annual precipitation has increased nearly 7 inches since 1960, with the largest increases occurring in the summer.
- Heavy rainfall events (> 1 inch) are becoming more common, especially in the summer months.
- Precipitation increased 15-20%, with 67% from "heavy precipitation" events.

Climate Change in Castleton Management Unit

Because mountainous terrain affects weather patterns and long-term climatic trends, the observations noted above have not been uniform throughout the state. Therefore, it is helpful to look at weather data specific to the CMU.

Similar to the statewide trends, the CMU has experienced a significant increase in mean annual temperature (Figure 2). Unlike the statewide average, the data does not show an increasing trend in annual precipitation for the CMU. Within the CMU, there is spatial variability in both temperature and precipitation. The higher elevation areas of the CMU experience lower temperature and greater amounts of precipitation (Figure 3). Some of the higher elevation areas receive, on average, more than 50 inches of rainfall in a year – approximately 20% more rain than the statewide average.

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[18] Galford, G. L., Faulkner, J., Dupigny-Giroux, L. A., Posner, S., & Edling, L. *The Vermont Climate Assessment 2020*. Gund Institute of Environment, University of Vermont, Burlington, VT: 2021.
[19] Galford, G. L., Faulkner, J., Dupigny-Giroux, L. A., Posner, S., & Edling, L. *The Vermont Climate Assessment 2020*. Gund Institute of Environment, University of Vermont, Burlington, VT: 2021.

Table 14: Historic Climate Data (Mean temperature (degrees Fahrenheit) and precipitation (inches) for the entire state of Vermont (VT) and the CMU (30-year normal [1990-2023], 800 m resolution,).[20] The difference between the statewide values and CMU are shown in the last column.)

Climate variable	VT *Mean ± SD*	CMU *Mean ± SD*	CMU vs. VT *Difference*
Annual mean temperature (°F)	44.6 ± 1.0	44.6 ± 0.7	-0.04
January mean temperature (°F)	17.0 ± 2.5	20.3 ± 0.2	3.30
July mean temperature (°F)	67.0 ± 2.2	67.7 ± 1.1	0.66
Annual precipitation (in)	47.2 ± 6.5	45.5 ± 2.7	-1.65
Spring precipitation (in)	11.1 ± 1.6	10.9 ± 0.7	-0.24
Summer precipitation (in)	13.9 ± 1.5	13.8 ± 0.5	-0.14
Fall precipitation (in)	12.3 ± 1.7	11.6 ± 0.7	-0.91
Winter precipitation (in)	9.8 ± 2.0	9.3 ± 0.8	-0.52

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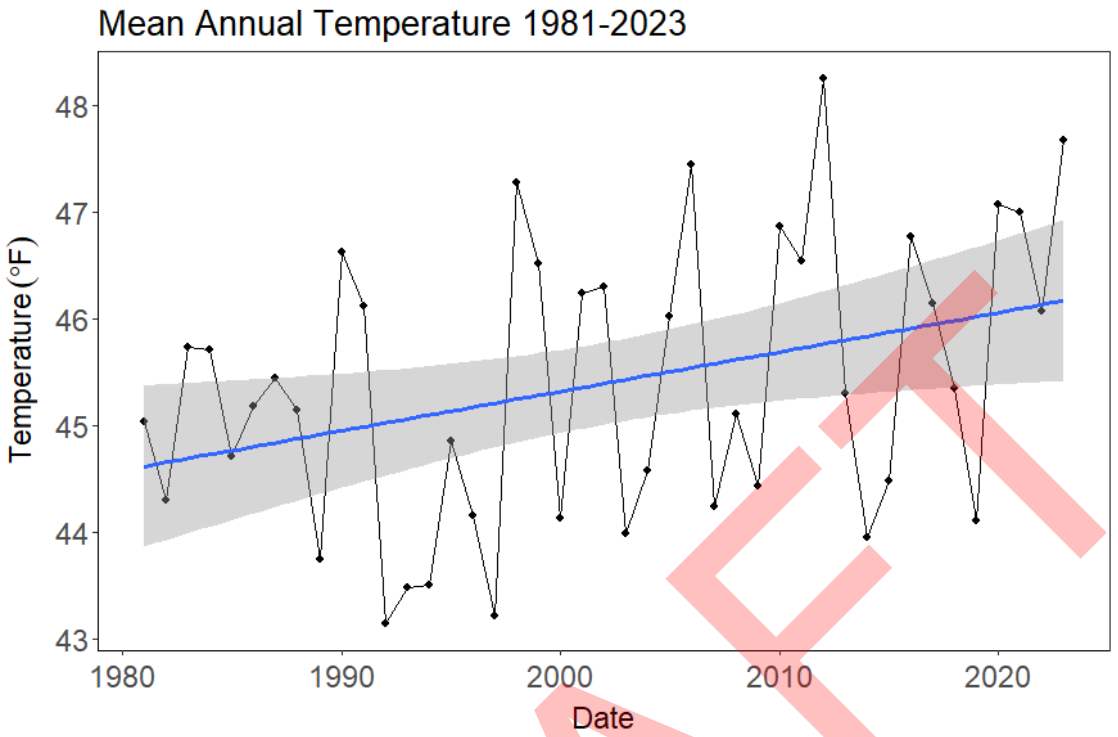
[20] PRISM Climate Group, Oregon State University, https://prism.oregonstate.edu, data accessed May 2024.

Figure 2: Mean annual temperature (degrees Fahrenheit) and total annual precipitation (inches) at CMU for year 1981-2023 (4 Km resolution, source: PRISM Climate).



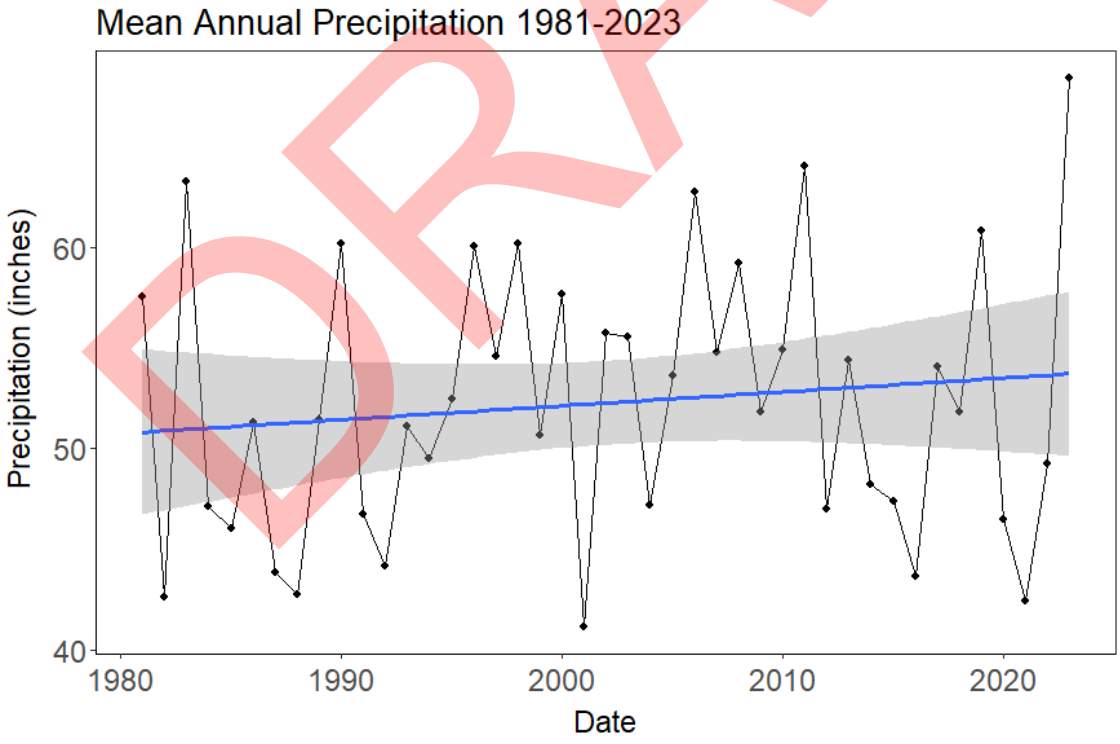


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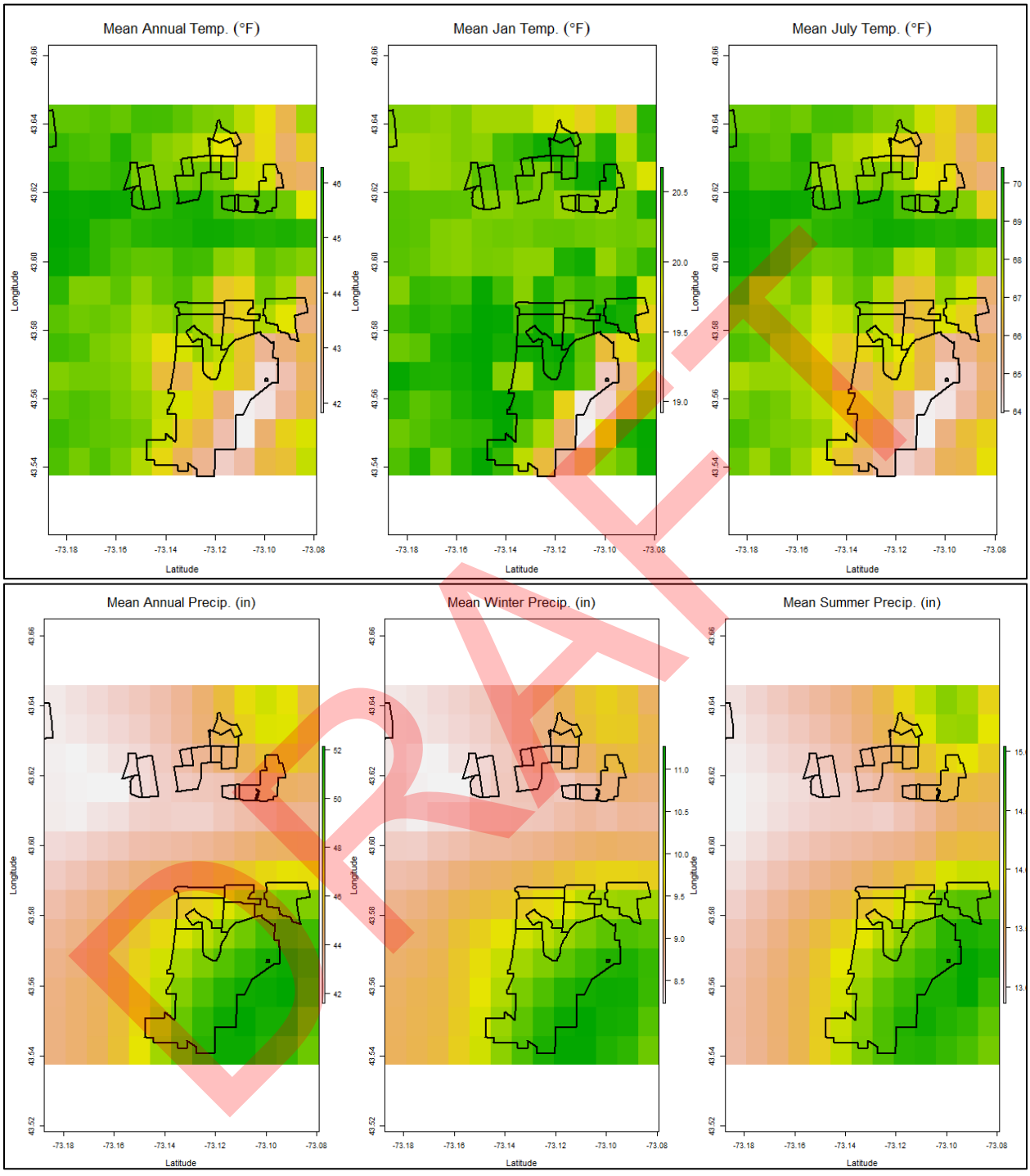
Figure 3: Mean temperature (degrees Fahrenheit) and precipitation (inches) for the CMU (30-year normals [1994-2024], 800 m resolution).



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Anticipated Impacts of Climate Change on Forest Ecosystems

Climate change is already altering the growing conditions for forests in Vermont, with greater changes expected to come. While it is not known for certain how climate change will affect all forest ecosystem processes, the *New England and Northern New York Forest Ecosystem Vulnerability Assessment and Synthesis* compared projections from multiple models and lines of evidence to provide a confidence assessment for each projected change (Table 14).

Table 15: Projected Changes to the Climate in New England and Northern New York[21]

Projected Change	Confidence[22]	Description
Temperatures will increase	Robust evidence, high agreement	All global climate models agree that temperatures will increase with continued increases in atmospheric greenhouse gas concentrations.
Growing seasons will lengthen	Robust evidence, high agreement	There is strong agreement that projected temperature increases will lead to longer growing seasons in the assessment area.
Winter processes will change	Robust evidence, high agreement	There is strong evidence that temperatures will increase more in winter than in other seasons across the assessment area, leading to changes in snowfall, soil frost, and other winter processes.
The amount and timing of precipitation will change	Robust evidence, high agreement	There is strong agreement that precipitation patterns will change across the assessment area. Total precipitation is generally expected to increase during winter and spring, but summer and fall projections are more uncertain.
Intense precipitation events will continue to become more frequent	Robust evidence, high agreement	Climate models generally project that the number of heavy precipitation events will continue to increase in the assessment area. If they do increase, damage from flooding and soil erosion may also become more severe.
Soil moisture patterns will change in response to temperature and precipitation	Medium evidence, high agreement	Warmer temperatures and altered precipitation will interact to change in soil moisture patterns throughout the year, but there is uncertainty about the direction and magnitude of the changes.
Forest vegetation may face increased risk of moisture deficit and drought during the growing season	Medium evidence, medium agreement	Studies show that climate change will affect soil moisture, but there is some disagreement among climate and impact models on how soil moisture and drought will change during the growing season

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[21] Janowiak, et al. 2018. New England and Northern New York forest ecosystem vulnerability assessment and synthesis; a report from the New England Climate Change Response Framework project. Gen. Tech. Rep. NRS-173. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 234 p.

[22] "Confidence" was determined by Janowiak et al. 2018 by gauging the level of evidence and the level of agreement among information where "evidence" refers to the body of information available based on theory, data, models, expert judgement, and other sources. Evidence was considered robust when multiple observations or models, as well as an established theoretical understanding to support a statement, were available. "Agreement" refers to the agreement among the multiple lines of evidence. If theories, observations, and models tended to suggest similar outcomes, then agreement was high.

Projected Change	Confidence[22]	Description
Certain insect pests and pathogens will increase in occurrence or become more damaging	Medium evidence, high agreement	Evidence indicates that increases in temperatures will lead to increased threats from insect pests and pathogens, but research to date has examined relatively few species.
Many invasive plants will increase in extent or abundance	Medium evidence, high agreement	Evidence indicates that increases in temperature, longer growing seasons, and more frequent disturbances will lead to increases in many invasive plant species.

These projected changes (Table 14) may have varied impacts to Vermont's forests; some impacts may be positive and others negative. By understanding how the climate has changed and how it is projected to change in the future, forest managers can anticipate the possible impacts and manage accordingly. Adaptation management can be used to promote ecosystem resilience to climate change by minimizing stressors and allowing forests to respond and adapt to change. The following factors are anticipated to affect the capacity of forests to adapt to a changing climate.[23]

- Forests with low species diversity may be more vulnerable to negative impacts from climate change. Studies have consistently shown that high-diversity forests are more resilient to disturbance.
- Tree species in isolated or fragmented landscapes will have reduced ability to migrate to new areas in response to climate change.
- Ecosystems that have greater tolerance to disturbance may have less risk of declining on the landscape due to climate change.
- Species or systems that are limited to particular environments will have less opportunity to migrate in response to climate change. The current ecological understanding indicates that migration to new areas will be particularly difficult for tree species and forest communities with narrow habitat requirements.

Table 16: Potential Impacts of Climate Change on Forests in New England and Northern New York[24]

Potential Impact	Confidence	Description
Many northern and boreal tree species will face increasing stress from climate change	Medium evidence, high agreement	Ecosystem models agree that northern and boreal tree species will have reduced suitable habitat and biomass across the assessment area, and that they may be less able to take advantage of longer growing seasons and warmer temperatures than warm-adapted, temperate forest species.
Habitat will become more suitable for southern species	Medium evidence, high agreement	Ecosystem models agree that longer growing seasons and water temperatures will increase suitable habitat and biomass for many temperate species across the assessment area

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[23] Janowiak, et al. *New England and northern New York forest ecosystem vulnerability assessment and synthesis: a report from the New England Climate Change Response Framework project*. Department of Agriculture, Forest Service, Northern Research Station. 234p. Newtown Square, PA: Gen. Tech. Rep. NRS-173, 2018.
[24] Janowiak, et al. *New England and northern New York forest ecosystem vulnerability assessment and synthesis: a report from the New England Climate Change Response Framework project*. Department of Agriculture, Forest Service, Northern Research Station. 234p. Newtown Square, PA: Gen. Tech. Rep. NRS-173, 2018.

Potential Impact	Confidence	Description
Forest composition will change across the landscape	Medium evidence, high agreement	Although few models have specifically examined how forest communities may change, model results from individual species and ecological principles suggest that recognized forest community assemblages will change.
Shifts in forest composition will take at least several decades to occur in the absence of major disturbance	Medium evidence, medium agreement	Although some models indicate major changes in habitat suitability, results from spatially dynamic forest landscape models indicate that a major shift in forest composition across the landscape may take 100 years or more in the absence of major disturbances.
Conditions affecting tree regeneration and recruitment will change	Medium evidence, high agreement	Seedlings are more vulnerable than mature trees to changes in temperature, moisture, and other seedbed and early growth requirements.

As climate change impacts forest ecosystem function, there is a need for management to increase forest adaptive capacity. Current methods to achieve increased adaptive capacity at the ecosystem level (retaining ecosystem function despite threats to individual tree species or forest types) include increasing forest structural complexity and enhancing compositional and functional diversity and redundancy. Climate adaptation strategies as they related to CMU are implemented as part management actions and are included in the Land Management Classification section of the LRMP (page 93).

Forest Carbon

Carbon resilience is an important aspect of managing the forests in the CMU. Carbon stocks and rates are measured through permanent FIA plots that occur on state lands. [25]

Vermont forests accumulate carbon from the atmosphere and store it in aboveground biomass and soil and confer landscape and community resilience, even while being vulnerable to climate change impacts themselves. The ability of a forest to store carbon and the rate at which forests accumulate carbon peak at different stages of forest development. Young forests accumulate carbon at a higher rate but have less storage, while old forests have a lower rate of accumulation but can store greater amounts carbon, Figure 4.[26]

Both the rate of accumulation and storage of carbon are critical pieces of the equation for carbon mitigation and resiliency, emphasizing the importance of having a range of forest structural and compositional diversity across the landscape. It's important to note that forests are more than their carbon content or the timber products they provide; they are complex systems that provide an array of ecosystem services and should be managed tactfully to achieve a balanced-approach and not through the narrow lens of a single-objective approach to maximize one service over the other (e.g., carbon, timber, etc.). The CMU LRMP utilizes sustainable forest management to enhance or maintain forest and carbon resilience through diversifying both species and structural

[25] USDA Forest Inventory and Analysis (FIA) program: The Forest Inventory and Analysis (FIA) program of the USDA Forest Service Research and Development Branch collects, processes, analyzes, and reports on data necessary for assessing the extent and condition of forest resources in the United States.
[26] Hoover, C.M., Smith, J.E. "Aboveground Live Tree Carbon Stock and Change in Forests of Conterminous United States: Influence of Stand Age." *Carbon Balance Manage* 18, 7: 2023.

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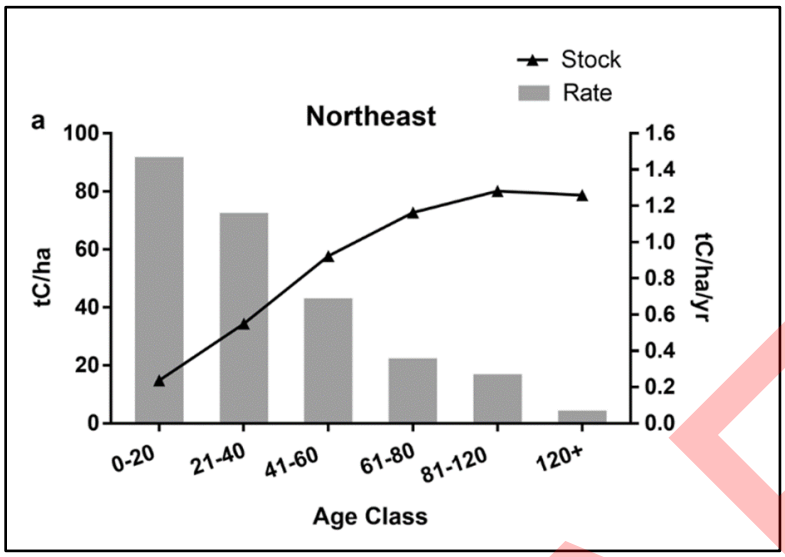
composition while addressing social and ecological needs (e.g., wildlife habitat, forest products, carbon storage and accumulation, recreation, etc.). More information can be found on page 83.

Figure 4: Average stocks (tC/ha, line, e.g., carbon storage) and annual net change (tC/ha/yr, bars, e.g., rate of accumulation) in live aboveground tree carbon stocks by age class in the Northeast.[27]



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[27] Hoover, C.M., Smith, J.E. "Aboveground Live Tree Carbon Stock and Change in Forests of Conterminous United States: Influence of Stand Age." *Carbon Balance Manage* 18, 7: 2023.

F. Forest and Timber Resource Assessment

Overview

CMU is nearly entirely forested and is managed to meet a variety of goals and objectives. Forest management strategies are designed to produce high-quality forest products while providing for habitat, biodiversity, healthy and vigorous forests, protection of water resources, opportunities for research, and the demonstration of forest management techniques to the public. Managed forests contribute to the sustainable production of forest products, improvement of forest health conditions, management of quality wildlife habitat, control of invasive species, contributions to forest resiliency and climate adaptation.

The Forest and Timber Resource Assessment provides a detailed look at the forest vegetation and associated forest stand conditions on the CMU to identify needs and opportunities for specific management interventions and inform how forest management should be applied to meet the overall unit goals.

Soils and Site Condition

Soils and site condition play a role in determining the mix and growth rates of tree species, and together with other information and silvicultural guides inform the timing and frequency of management actions. Across the CMU there are soils from approximately 13 different soil series (groups of similar soil types) as shown on Map 12. Refer to Table 17 for a summary of those soil types with the widest distribution across the Management Unit. The soil information found here is based on the Rutland County Soils Survey conducted by the US Department of Agriculture (USDA).

Site class is expressed in terms of capacity to produce additional biomass in the form of tree volume, with site class I representing the most productive and site class IV the least productive sites. Site index is defined as the height that dominant trees in even-aged stands will reach at a certain age, in this case 50 years, broken out by species. Table 16 shows the productivity definitions of each site class and the corresponding site index for different species.

Table 17: Site Class and Productivity

Site Class	**Potential Productivity** (cubic feet of wood /acre/year)	**Site Index** (height at age 50)
Site Class I	> 85 cubic feet	White Pine 70’ N. Hardwoods 60’
Site Class II	50 to 84 cubic feet	White Pine 60-69’ N. Hardwoods 53-59’
Site Class III	20 to 49 cubic feet	White Pine 50-59’ N. Hardwoods 45-52’
Site Class IV	< 20 cubic feet	White Pine 50’ N. Hardwoods 45’

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Map 12: Mapped Soil Series on Castleton Management Unit

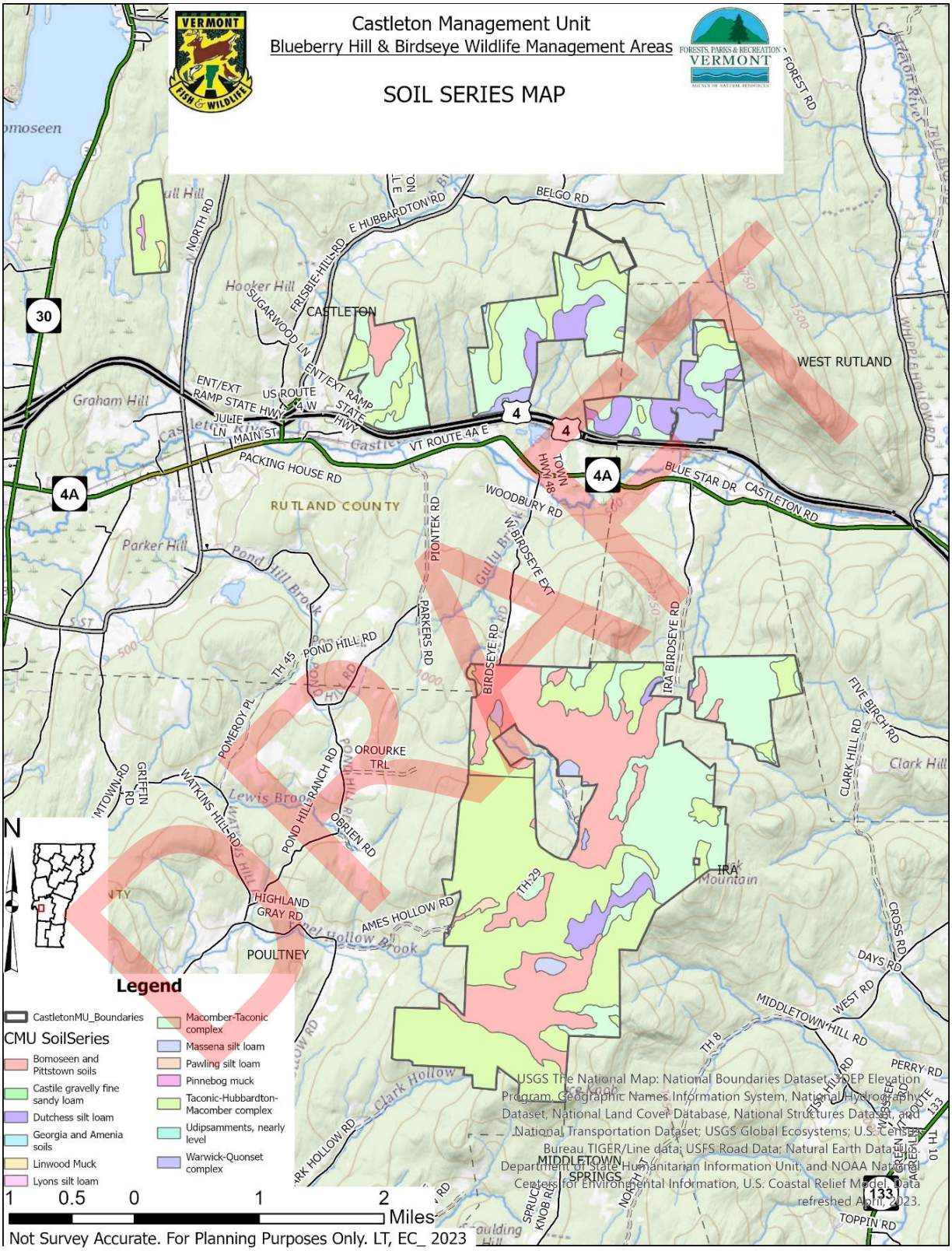

Table 18: Summary of Major Mapped Soil Series within Castleton Management Unit

NRCS Soil Series	Soil Characteristics	Site Class	Acres
Bomoseen and Pittstown soils	Moderately well drained soils shallow or moderately deep to dense basal till and very deep to bedrock. Loamy	I	1074.51
Castile gravelly fine sandy loam	Very deep, moderately well drained soils. Sandy Loam	I	0.02
Dutchess silt loam	Very deep, well drained soils. Silt Loam	I	278.94
Georgia and Amenia soils	Very deep, moderately well drained soils. Loamy	I	0.93
Linwood Muck	Very deep, Very poorly drained soils	IV	6.12
Lyons silt loam	Very deep, Very poorly drained soils. Silt loam	IV	1.66
Macomber-Taconic complex	Moderately deep, well drained soils. Silt loam	II	1485.66
Massena silt loam	Very deep, poorly drained. Loamy	I	37.14
Pawling silt loam	Very deep, moderately well drained soils. Silt loam	I	10.02
Pinnebog muck	Very deep, very poorly drained soils.	IV	5.56
Taconic-Hubbardton-Macomber complex	Shallow, somewhat excessively drained soils. Loamy	II	1969.59
Udipsamments, nearly level	Very deep, moderately well drained to excessively drained soils. Sandy	IV	1.59
Warwick-Quonset complex	Very deep, somewhat excessively drained soils. Sandy Loam	III	79.55

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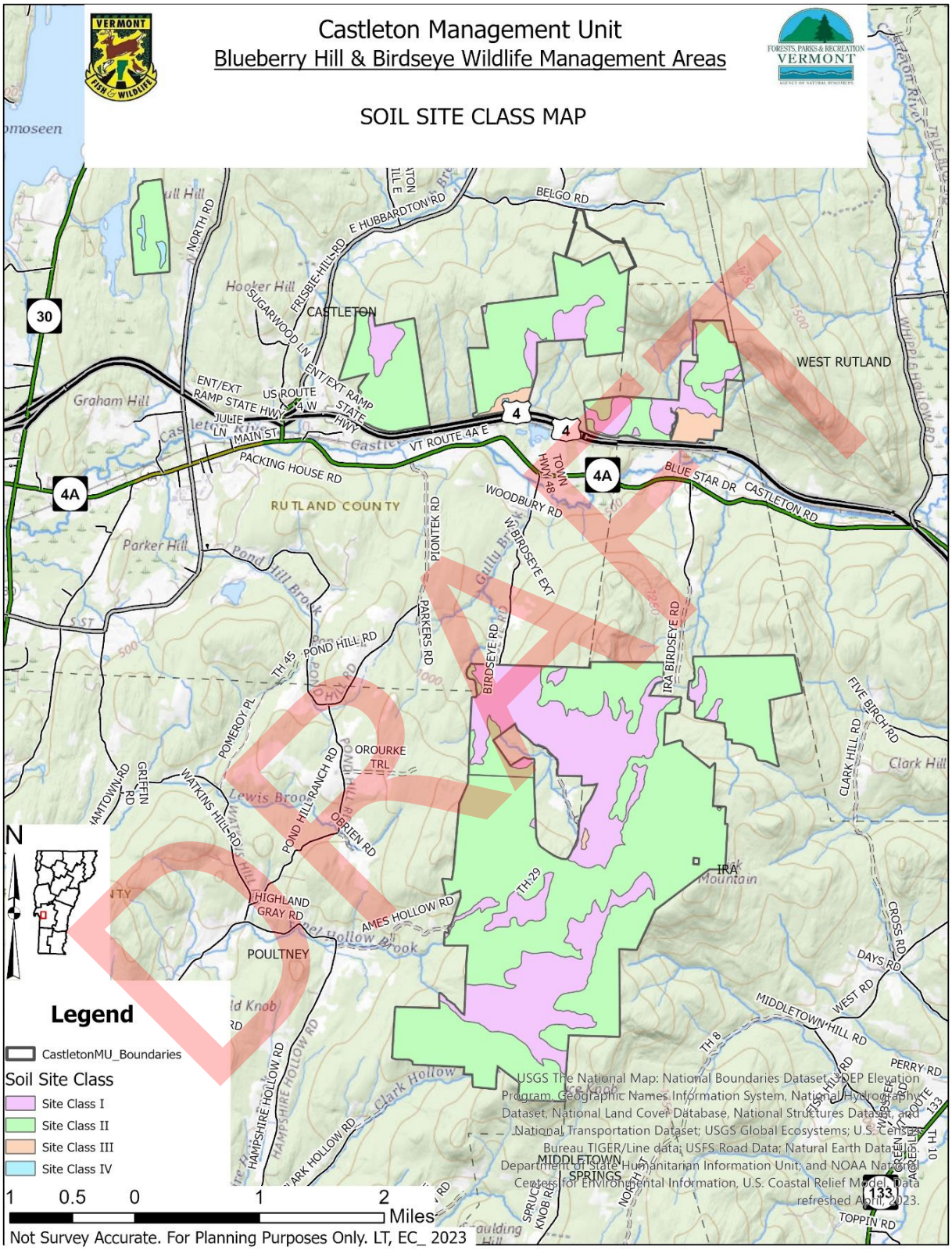
Map 13: Soils and Site Classification of Castleton Management Unit



Forest Composition

Forest resource assessments are conducted periodically using the FOREX inventory method developed by the Vermont Department of Forests, Parks, and Recreation, to inventory and evaluate state lands for long range management planning. Data are systematically collected at a series of plots distributed throughout the CMU. The forest resource assessment or forest inventory for this plan was completed in multiple stages between 2011 and 2022. During this time, plot data was collected on approximately every 5 acres. Approximately 990 plots were measured. Data collected using FOREX provides detailed information on the forest stand conditions and provides ANR land managers with the necessary data to make informed and science-based decisions to best manage the natural resources. A complete summary of forest inventory is found in the Appendix 3.

Table 19 summarizes the dominant forest cover types found on the CMU and their associated characteristics.

Table 19: Dominant Forest Types of Castleton Management Unit

Type	Major Species	Condition	Quality	Regeneration	Acres	% of CMU
Blueberry Hill WMA						
Mixedwood	White pine Sugar maple White ash Black cherry White cedar	Pole to sawtimber-sized stems, fully to overstocked; vigor is fair to good, live crown ratios in pole-sized softwood is poor	Overall stem quality is fair to good	Generally poor to nonexistent due to heavy deer browse pressure	122	2%
White pine	White pine	Mostly sawtimber-sized stems that are fully to overstocked; general vigor is fair to good	Overall stem quality is poor due to weevil damage. Two stands have good quality sawtimber.	Very little due to high stocking (dense overstory). Most is hardwood species.	159	3%
Hardwood	Sugar maple White ash Black cherry	Sapling to sawtimber-sized stems, fully stocked, vigor is good	Overall stem quality is fair to good	Low diversity & density of native tree species regeneration due to heavy deer browse pressure	997	20%
Aspen	Aspen White birch	Pole to sawtimber sized stems	Fair	Very little due to stem exclusion phase of stand development	12	0.3%
Birdseye WMA						
Northern hardwoods	Sugar maple White ash Yellow Birch	Sapling to Sawtimber-sized stems, fully stocked, vigor is good. White ash vigor expected to decline.	Overall Stem quality is fair to good	Good in areas regenerated in last management cycle. Otherwise, low diversity & density of native tree species regeneration due to	2346	47%

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Type	Major Species	Condition	Quality	Regeneration	Acres	% of CMU
				deer browse pressure & beech competition.		
Mixed wood	Red Maple Red Oak White pine Hemlock	Sapling to Sawtimber-sized stems, fully stocked, vigor is good. White ash and hemlock vigor expected to decline.	Overall Stem quality is fair to good	Good in areas regenerated in last management cycle. Otherwise, low diversity & density of native tree species regeneration due to deer browse pressure & beech competition.	486	10%
Mixed hardwoods	Red oak Sugar maple Red Maple	Sapling to Sawtimber-sized stems, fully stocked, vigor is good. White ash vigor expected to decline.	Overall Stem quality is fair to good	Good in areas regenerated in last management cycle. Otherwise, low quantity and diversity of native species due to stocking, deer, and beech competition.	349	7%
White Pine	White Pine	Mostly pole to sawtimber sized stems. Fully to overstocked. Vigor decreases as stocking increases	Quality is poor to good.	Mostly hardwood regeneration.	126	3%
Aspen	Aspen / White birch	Sapling to small sawtimber sized stems	Fair	Very little due to stem exclusion phase of stand development	95	2%

Map 14, **below, shows the forest stands and their associated cover types**.

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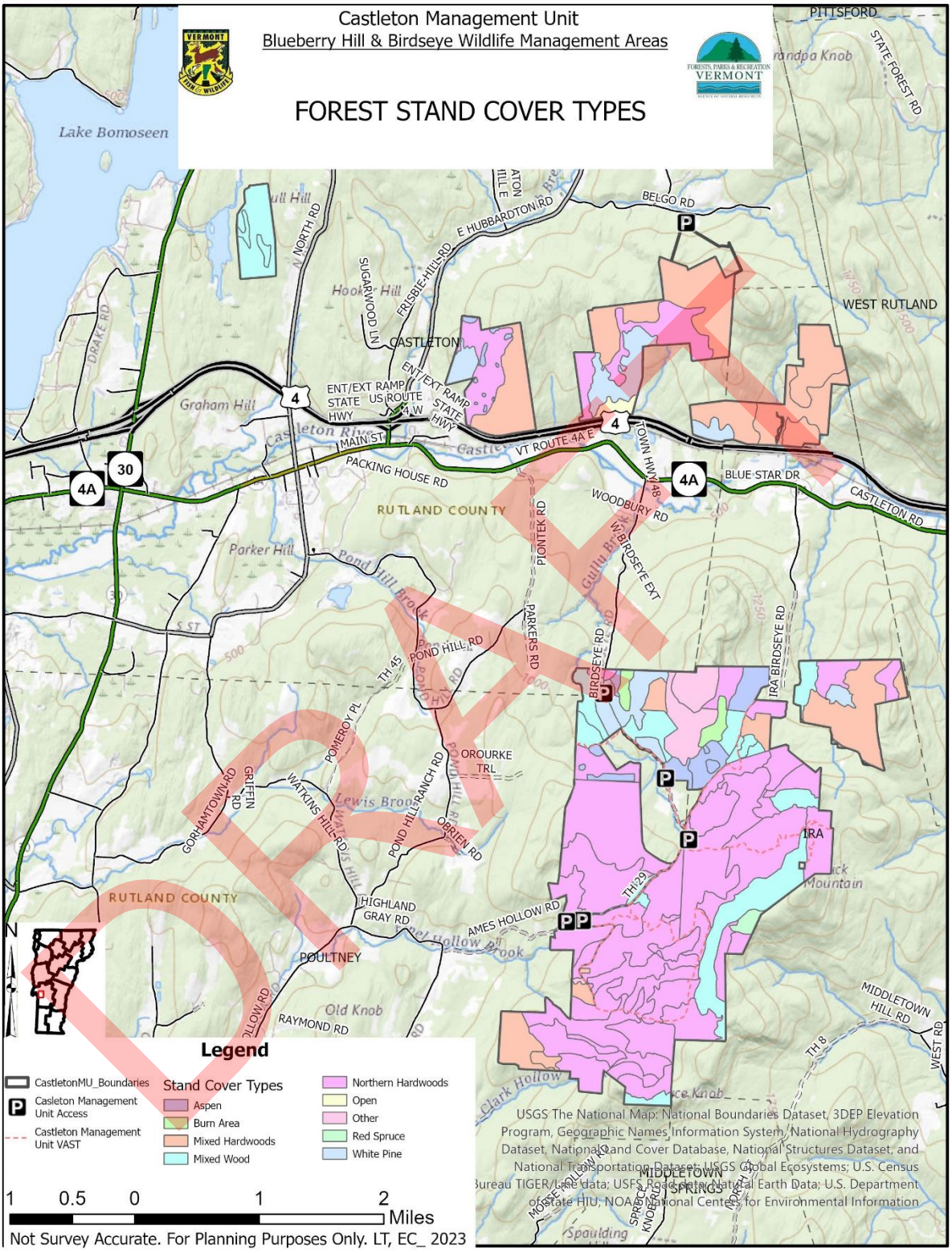
Map 14: Forest Stands and Cover Type



Young Forests

Functional young forest habitats are those that regenerate from natural or human disturbance and are dominated by seedlings and saplings. As described in the Wildlife and Habitat Assessment, the Vermont Conservation Design (VCD) defines them as areas with greater than 50 percent cover of woody seedlings, shrubs, or saplings, up to 4.9" diameter, and at least 450 stems/acre.[28] This includes early successional stands of shade intolerant pioneer species, as well as regenerating forests of mid and late successional species, such as sugar maple, hemlock, or red spruce. In general, young forests are comprised of trees less than 15-20 years old. Functional young forest habitat that meets the needs of obligate wildlife species are typically 5 acres or larger and have a minimum diameter of 575 feet. In addition to the wildlife habitat benefits, successfully regenerating young forests of native species are critical to keeping forests healthy and resilient and poised to provide the myriad benefits of a forested landscape. Prior to European settlement in Vermont nearly all young forests were created because of natural disturbance. Currently, forest management creates most young forests in the state.[29] This forest habitat type is important to maintaining forest health because it supports a diversity of age classes needed for the forest to be resilient in the face of climate, weather, insect, and disease threats. An example of this is found in recent research in forest stands in Connecticut affected by the non-native insect spongy moth (*Lymantria dispar dispar*) during a recent outbreak in 2015-2018. Large dominant red oaks in these stands experienced high rates of mortality despite surviving several multi- year defoliation events during previous decades. The study suggests that tree age was a large factor that contributed to the mortality. This helps to highlight the importance of managing forests for the diversity of many characteristics, including tree or stand age. [30] Additional young forest benefits are described in more detail in the Wildlife and Habitat Assessment. The VCD suggests a return to pre-European levels of young forest abundance as a target. This is estimated to be about 3-4% of the forests in the Taconic Mountains biophysical region. The current inventory of young forest on the CMU is summarized below in Table 20.

Table 20: Current Young Forest Habitat on CMU

Current CMU Young Forest as of 2024

Approximate Age	Acres	% of CMU
5	10	0.2%
10	10	0.2%
12	99	2.0%
16	51	1.0%
20	29	0.6%
Total	199	4.0%

[28] Zaino, R., Sorenson, E., Morin, D., Hilke, J., & Thompson, K. *Vermont Conservation Design Part 2: Natural Communities and Habitats Technical Report*. State of Vermont, Department of Fish and Wildlife; Department of Forests, Parks and Recreation, Montpelier, 2018.

[29] Zaino, R., Sorenson, E., Morin, D., Hilke, J., & Thompson, K. *Vermont Conservation Design Part 2: Natural Communities and Habitats Technical Report*. State of Vermont, Department of Fish and Wildlife; Department of Forests, Parks and Recreation, Montpelier, 2018.

[30] Ward, Jeffrey & Jones, Chad & Barsky, Joseph. Multiyear defoliations in southern New England increases oak mortality. *Canadian Journal of Forest Research*. 52, 2021.

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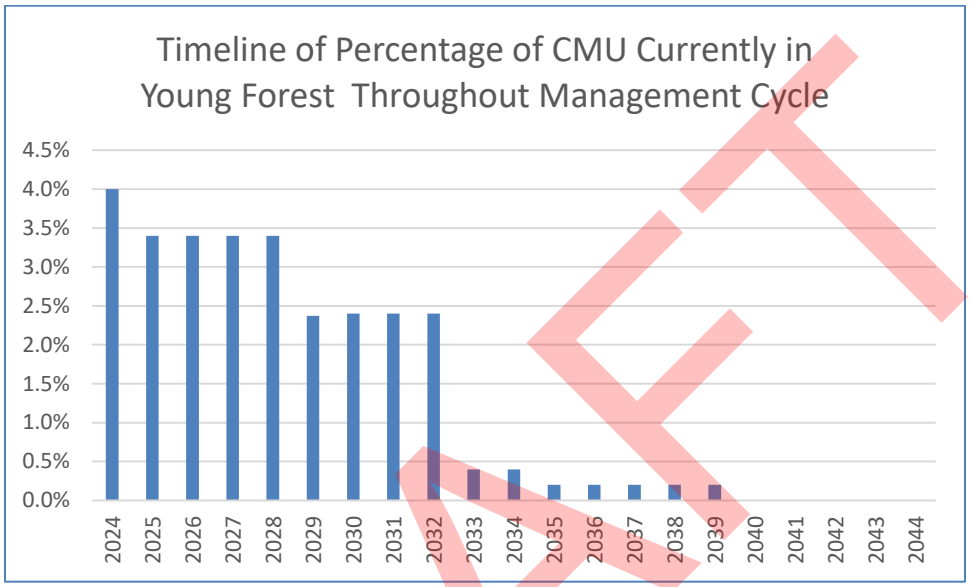
Table 19 shows that CMU is currently within the regional target described in the VCD. Currently all these young forest habitats are within Birdseye WMA; almost none are found on the Blueberry Hill WMA. Over time, these forests will continue to mature and lose the qualities of young forest habitat. The timeline below, in Figure 5, shows the decrease in young forest habitat over time without management.

Figure 5: Timeline of Young Forest Effectiveness on CMU



Before the end of this management cycle, the young forest currently found on CMU will no longer be functional as that habitat type. Maintaining young forests to avoid the trend shown above will require management strategies and interventions. Management is an important tool that will be needed to create this sustained supply of young forest. And while natural disturbance (e.g. wind, ice) can also create this forest age class, these events alone may be at a scale that does not create young forest at a functional scale, rather they can be considered in combination with active management. Most of the opportunity is on Birdseye WMA – North Block based on forest inventory data.

Old Forest

Just as the Vermont Conservation Design (VCD) highlights the importance of young forest habitats, it also recognizes the importance of old forests. According to the VCD: "Old forests are biologically mature forests, often having escaped stand-replacing disturbance for more than 100 years and exhibiting minimal evidence of human-caused disturbance as well as continuity of process, senescence of trees, and regeneration response." Post European settlement, about 80% of the forests of Vermont were cleared.[31] A large portion of the remaining forests were disturbed

[31] Zaino, R., Sorenson, E., Morin, D., Hilke, J., & Thompson, K. *Vermont Conservation Design Part 2: Natural Communities and Habitats Technical Report*. State of Vermont, Department of Fish and Wildlife; Department of Forests, Parks and Recreation, Montpelier, 2018.

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by human use. Throughout New York and New England, "there are few remaining examples of old-growth forests, which now occur on less than 0.1 percent of the region."[32] Regionally 99.9% of forests are second growth, meaning they have grown back since the initial European settlement and the intensive land conversion and logging of past centuries. Though these forests represent great resilience in demonstrating the ability of forests to recover after disturbance, many lack the complex structural characteristics associated with old forests. These characteristics include presence of old and dead trees, spatial variation in tree density and tree size, abundant downed deadwood, large diameter standing dead trees, multiple canopy layers, understory regeneration, and well-developed plant communities. These characteristics and their associated ecological functions, adaptation mechanisms, and management strategies are described in more detail from the publication *Restoring Old-Growth Characteristics to New England' s and New York's Forests* by Anthony D'Amato and Paul Catanzaro and in an excerpt found in Appendix 2.

Active management can play a role in restoring old forest characteristics. While many of these second growth forests may not meet the definition of old forest or passively develop to old forest over time, management can include strategies that mimic old forest characteristics and speed the development of more complex forest structure. The effectiveness of each strategy is largely determined by the landscape characteristics associated with each site. On the CMU, there are opportunities to implement both active and passive management to restore these characteristics and support the development of old forests (see Figure 6 below). Areas better suited for passive restoration include those locations that are steep, have inoperable slopes and shallow soils, have had a less intense disturbance history, and/or have sensitive or significant natural communities. These will make a significant contribution toward the target of old forest for the Taconic Mountains.

Much of CMU supports active management for a variety of goals that include supporting species and structural diversity, carbon sequestration, and wildlife habitat that can also include managing to enhance the development of old forest characteristics. Landscape conditions including dense forest plantations, deer herbivory, and forest health issues of invasive plants, emerald ash borer, beech bark disease, and potentially hemlock woolly adelgid all create an environment where passive management will likely result in the slower development of old forests.

Managing for old forest characteristics often occurs on a gradient, with higher emphasis placed in certain silvicultural treatments and lower in others. The diagram below from D'Amato and Catanzaro (2022) illustrates the gradient of old-growth restoration strategies.

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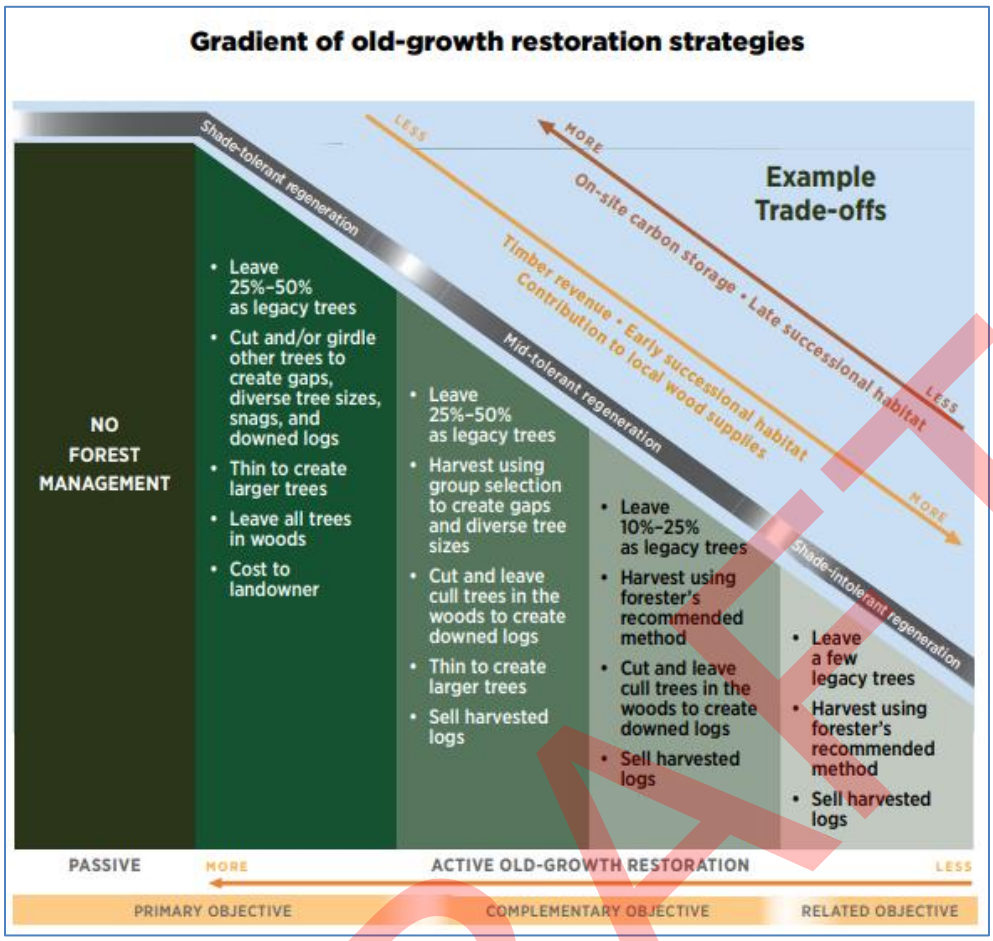
[32] Catanzaro, Paul & D'Amato, Anthony. *Restoring Old-Growth Characteristics to New England's and New York's Forests*, 2022.

Figure 6: Old Forest Restoration Strategies



In the face of numerous stressors on our forests, e.g., climate change, insects, disease, etc., it is important that forest managers utilize a wide range of tools to help ensure our forests remain healthy, diverse, and resilient. "Since old growth is the condition that our forest species evolved with for thousands of years, maintaining old-growth characteristics within our forests restores missing pieces that will help ensure that our forests continue to sustain themselves and the many benefits we depend on."[33]

Timber Quality

The suitability of timber to produce quality forest products varies widely across due to numerous factors including site and soil conditions, insects, and disease, impacts of deer browsing, invasive species, and past land-use and management history. Management can be implemented to reduce future timber quality impacts. More information can be found in the Forest Health and Resiliency Assessment.

[33] Catanzaro, Paul & D'Amato, Anthony. (2022). Restoring Old-Growth Characteristics to New England's and New York's Forests. 10.13140/RG.2.2.22226.84163.

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Timber Management History

While there are portions of ***Blueberry Hill WMA*** that are not suited to forest management timber harvests due to steep, inoperable slopes, shallow soils, and low economic value, there are areas that support productive forests and are operationally suitable for timber harvests. The management practices undertaken by previous owners are not known completely, but it is likely that accessible areas of these parcels had been harvested for timber. Timber harvest activities undertaken under State ownership have been limited in part due to lack of viable management access. There was a timber harvest conducted on the West Block, Compartment 1, in 1995. To conduct this harvest, the State obtained temporary rights-of-way and use agreements with adjoining landowners.

The larger, ***Birdseye WMA***, has more diverse topography and site conditions. While it has similar operational limitations to BBHWMA, it also has many more acres that are suitable for forest management timber harvests and wildlife habitat management. The North Block of the WMA has been under state ownership since the late 1970s and has been managed to support a diversity of wildlife habitats. There have been ten timber harvests that have occurred on this block under state ownership. Forest products are never the sole driver for management action. Multiple goals are achieved through this work. Forest and wildlife habitat management goals included creating young forests, regenerating aspen stands to create habitat for Ruffed Grouse and other species, and enhancing species, age, and structural complexity within the forest. Two of the harvests were operations that salvaged white pine plantations that were destroyed in windstorms. Goals for these operations included public safety, recreational (including hunting) access, and aesthetics. Table 20 below summarizes the 10 timber harvests that have occurred on the CMU under State ownership.

Table 21: Timber Harvest History on Castleton Management Unit Under State Ownership

Year	Parcel	Timber Harvest Name	Harvest Area (ac)	Sawtimber Volume (MBF)
1983	BE WMA	Bird Mountain 1983 Sale	7	13
1987	BE WMA	Bird Mountain 1987 Sale	48	72
1988	BE WMA	Bird Mountain Pine	13	12
1989	BE WMA	Gully Brook 89 Sale	53	128
1992	BE WMA	Bird Mountain Pine Blowdown Sale	10	6
1993	BE WMA	Rocks and Popple Sale	62	144
1995	BBH WMA	Pine and Popple Sale	150	143
2003	BE WMA	Bird Mountain Pine and Patch Sale	58	68
2013	BE WMA	Bird Mountain 2013 Sale	42	66
2018	BE WMA	White Pine Salvage Sale	10	50

No forest management has occurred on the South and Northeast Blocks since coming into state ownership in 2016 although these blocks were actively managed for many years by timber companies and as farm woodlots. The Ira Birdseye Block of BWMA was formerly owned by the International Paper Company. It was most recently owned and managed by Yankee Forest LLC

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before being sold to The Conservation Fund and later the State of Vermont. The Birdseye South Block was a compilation of approximately 12 parcels of old farm and timber company lands acquired under the ownership of the Mettowee Lumber Company. This block was also most recently owned and managed by Yankee Forest LLC prior to being sold to The Conservation Fund and later the State of Vermont. Prior to state ownership nearly the entire ownership has been actively managed between 1988 and 2009. Harvest history prior to that time is not available.

Access Infrastructure for Forest Management

The condition of road infrastructure into and throughout the forest plays a role in whether commercially viable forest management timber harvests are possible. The road infrastructure also helps make other forest management activities, such as mast tree release and treatment of invasive plants, affordable. Lack of legal access to BBHWMA has limited the past development of truck roads and skid trails. There are established truck roads and skid trails within BWMA that provide management access. A full assessment of this infrastructure can be found in the Infrastructure and Public Access Assessment section.

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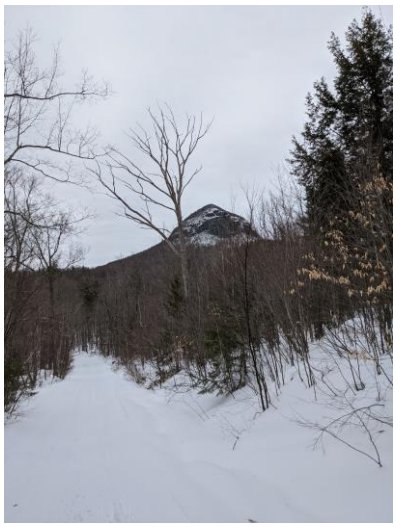
G. Historic and Cultural Assessment

An area's sensitivity to the potential for a Native American site, also known as a pre-contact site, is often heavily influenced by its proximity to water. Given this, the area of greatest potential are the lands along wetlands and rivers, including Gully Brook and in proximity to the Castleton River. People have been living along major rivers since the end of the last Ice Age, moving up and down the valleys fishing, hunting, and gathering. Although main settlements or base camps were typically located in association with major rivers, small bands maybe consisting of one or two extended families, likely moved up the tributary valleys on a seasonal basis.

There are no known archaeological sites within CMU from before 1600. However, for thousands of years smaller groups are thought to have splintered off from valley dwellings, moving up into places like CMU, possibly for hunting, but also to gather food and other materials that they were not able to find at lower elevations. Their use of the mountains was therefore more transient than what has been found in the valleys, with smaller and briefer occupations centered around more specialized tasks.

Blueberry Hill WMA is dominated by steep terrain, and shallow and droughty soil that likely discouraged historic use. Archeologically sensitive areas are highly localized at the toe of slope along the southern boundary just north of Route 4 that represent level terrain associated with the alluvial terraces of the Castleton River. Archaeology Consulting Team, Inc. conducted a site inspection of the WMA in 2002 and did not identify any archeologically sensitive areas. There are no sites listed on the Vermont Archeological Inventory or National Register of Historic Places.

East of the beaver pond in Ames Hollow within ***Birdseye WMA***, patches of white pine, old apple trees, and hawthorns indicate a history of clearing, also likely for pasture. This clearing is readily apparent in 1942 aerial imagery. Clearing is also evident at that time on the broad slopes of Birdseye Mountain, surrounding the present-day clearings. An old cellar hole with large, open-grown trees can be found on the northeast parcel of the BWMA. Beyond these areas, however, much of the remainder of the CMU appears to have been forested as of 1942 and may never have been cleared for agriculture. The land that now makes up Birdseye WMA has been owned and harvested by timber companies for much of the past century, first by Mettowee Lumber Company, then International Paper Timber Land Operating Company and, most recently, by Yankee Forest LLC.



View of Bird Mountain
Photo by: Travis Hart, VFWD

Other areas of significant importance to Native Americans included mountain tops such as Bird Mountain. The Indigenous name for what is now commonly referred to as Bird Mountain or Birdseye, is Wee-ko-wam-aden-sees, which roughly translates to "*mountain shaped like a little wigwam*."

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The name Bird Mountain is in reference to Colonel Amos Bird, a settler to the area, who by some accounts spent the night on the mountain after becoming lost.

Vegetation patterns can be indicators of historic activity. The pine stands on the lower slopes of CMU likely indicate a history of clearing, probably for pasture. Some oak forests have a history of grazing by sheep or cattle, often having the lasting effect of simplifying forest structure. Past grazing may also have increased soil erosion and exposed rock outcrops.

As part of ongoing management at CMU, all ground disturbing activities are reviewed for potential impact to historic resources. When indications of historic use are found including stone walls, foundations, historic plantings found they will be documented, assessed, and protected during management activities.

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H. Recreation Resource Assessment

Regional Recreation Availability

Just 6 miles from Rutland, CMU offers recreation opportunities that add to the portfolio of opportunities in the region. With the focus on fish and wildlife-based activities and its location in remote areas of the Taconic Mountains, CMU supports those recreational pursuits that rely on and benefit from remote areas (i.e., hunting, wildlife observation). Having those qualities in such an accessible location close to Rutland is increasingly unique. Other locations in the region including state forests, state and city parks, and private businesses offer a variety of other activities including hiking, biking, camping, etc. The designated snowmobile trails that cross CMU provide connectivity to a larger statewide VAST trail network.

Recreation Opportunities on CMU

Like WMAs across Vermont, the two WMAs within the Castleton Management Unit are managed to support opportunities for a variety of fish- and wildlife-based recreation including hunting, trapping, fishing, wildlife viewing and other wildlife-related outdoor activities. The diverse terrain and road access offer varied recreation opportunities, in those areas that are easily accessed and those that are more remote and rugged.

The Southern Block of the ***Birdseye WMA***, acquired in 2016, is subject to a public access easement co-held by the Vermont Land Trust and Vermont Housing and Conservation Board. In addition to conservation goals, this acquisition has stated goals promoting non-commercial recreational opportunities that include non-motorized, low impact, low density, dispersed, wildlife-based activities including hunting, fishing, trapping, bird watching, cross-country skiing, snowshoeing, walking and wildlife observation. Snowmobile use is along existing, designated VAST trails. This type of recreational use is consistent with what has been allowed on the remainder of the CMU and referenced in the Conservation Easement and is consistent with management objectives of Vermont Fish and Wildlife owned properties. The full document can be found in the appendix. Recreational opportunities within ***Blueberry Hill WMA*** are similarly focused on fish- and wildlife-based activities.

Management of recreation balances responsibility to protecting natural resources with interests of the recreation community. Using the Agency's "Guidelines for Minimizing the Ecological Effects of Recreation on ANR Lands" as guide, management decisions will consider placement of trails and infrastructure relative to habitat using an "avoid, minimize, mitigate" framework. Projects will be evaluated for their short and long-term effects on wildlife and wildlife habitat.

Recreation Assets

Public Access

Blueberry Hill WMA has limited deeded public access with just one point of developed public access to the separate parcels that make up the WMA. Access to the Middle Block is across land owned by the Vermont Federation of Sportsmen's Clubs that allows the pedestrian access to park and cross their land from the Belgo Road (Town Highway 29, Class 3) through a Memorandum

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of Understanding with VFWD. The Powder Lot, west of North Road, is accessed by a Pent Road.[34] US Route 4 is a limited access highway with no access to the WMA.

Birdseye WMA, on the other hand, is a larger, physically connected property that is accessed from the north via the Castleton-Birdseye Road (Class 3 & 4) and from the south via Ames Hollow Road (Class 4 & Legal Trail). The northeast parcel of the WMA is accessed via the Ira-Birdseye Road Birdseye (Class 4). While the Castleton-Birdseye and Ames Hollow roads traverse the WMA north to south it is not a functional through access for vehicles.

Parking

Parking for access to Blueberry Hill WMA is available off Belgo Road on lands of the Vermont Federation of Sportsmen's Club. Parking areas for Birdseye WMA are available on Castleton-Birdseye Road and Ames Hollow Road as shown on Map 5 and are described in Table 22. Parking availability meets current needs and will be monitored to ensure continued, safe, effective, and sustainable public access.

Table 22: Parking Access within Castleton Management Unit

Parcel	Location	Capacity	Description
Blueberry Hill WMA	Belgo Road	4-5 cars	Private land - available through agreement with VT Federation of Sportsmen's Clubs; not plowed in winter
Birdseye WMA	Castleton-Birdseye Road	2-3 cars	At northern end of property, access from the north
Birdseye WMA	Castleton-Birdseye Road	4-5 cars	At gated landing; access from the north, not accessible in winter
Birdseye WMA	Castleton-Birdseye Road	10 cars	Landing at base of Herrick Mtn
Birdseye WMA	Ames Hollow Road	1-2 cars	4x4 vehicles, road not maintained for cars
Birdseye WMA	Ames Hollow Road	3-4	At Ames Hollow landing, accessible from the south; not accessible in winter, 4x4 vehicles, not maintained for cars

Trails

There are approximately 8.5 miles of designated snowmobile trails on CMU that are managed in partnership with the Vermont Association of Snow Travelers (VAST) and its local clubs. On CMU that includes the Poultney Snow Devils and the Birdseye Snow Travelers. The trail that crosses the Powder Lot of BBHWMA along its eastern boundary is maintained by the Castleton Club (S.A.F.E.). Trails within CMU are part of a larger, statewide network of trails that provide trail linkage to the north and south.

[34] A pent road is any town highway which, by written allowance of the selectboard, is enclosed and occupied by the adjoining landowners with unlocked stiles, gates and bars in such places as the selectboard designate.

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Trail maintenance activities include:

- Installation of proper erosion control structures such as grade dips and waterbars and ditches.
- Maintenance of erosion control including waterbars, ditches and culverts.
- Building and maintaining bridges over streams.
- Maintaining parking areas and kiosks.

Dispersed Opportunities

Not all recreational use of CMU is trail-based. While there is a network of snowmobile trails and hiking occurs on some woods roads within the CMU, many activities (e.g., hunting, trapping, fishing, wildlife observation) occur off-trail as well. Remote areas, particularly those in the southern areas of Birdseye WMA, offer opportunities to explore broad expanses of forest for remote and self-reliant recreational experiences.

Uses of Wildlife Management Areas

Activities on Wildlife Management Areas are guided by rules governing public use of Vermont Fish and Wildlife Department Lands. Details can be found in appendix 6.[35]

Table 23: Summary of Authorized Activities on Wildlife Management Areas

Activity	Description	Location
Hunting, fishing, trapping	Permitted on all state land unless otherwise designated. Governed by state-wide rules and regulations established by the Vermont Fish and Wildlife Board.	throughout CMU
Wildlife observation and photography	Includes birdwatching, wildlife viewing, collecting shed antlers,	Throughout CMU
Dispersed, pedestrian activities	Includes hiking, walking, snowshoeing, cross-country skiing	Throughout CMU, including along gated roads and trails
Collecting edibles for personal use	non-commercial picking of berries, nuts, fungi, & other edibles (except ginseng)	Throughout the CMU
Snowmobiling	Permitted on designated VAST trails only	Trails on Birdseye WMA & Powder Lot Block of Blueberry Hill
Guiding	For purposes of hunting, fishing, trapping	Throughout CMU
Camping	For purposes of hunting, fishing, trapping – following VFWD guidance	In locations that meet camping guidelines

Prohibited activities under the Rule include:

- operation of motorized vehicles including ATVs,
- horseback riding,
- dog sledding,

[35]Vermont Fish & Wildlife Department, *WMAs Management and Funding*: https://vtfishandwildlife.com/conserve/lands-and-habitats/state-lands-and-state-managed-lands/wmas-management-and-funding.

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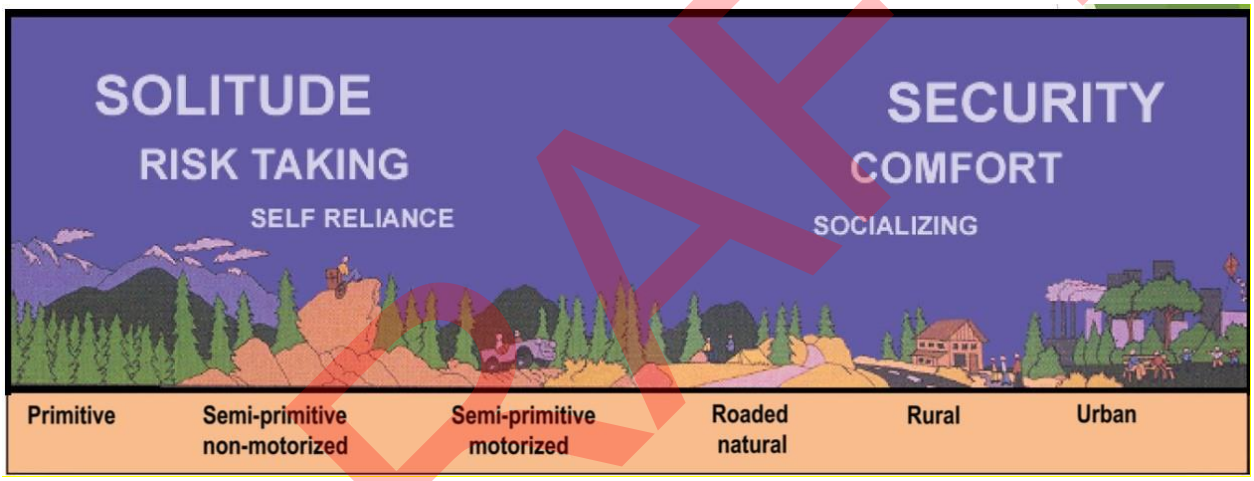
- non-motorized cycle riding, or
- use of motorized vehicles except on designated corridors
- and all other activities not specifically authorized including
    - hang-gliding,
    - recreational rock climbing
    - geocaching

Recreation Opportunity Spectrum

Recreation Opportunity Spectrum (ROS) is an experience-based inventory and assessment process designed to allow land managers to understand existing settings and identify the desired character of experience that a recreational user can expect to find on a parcel of land. Developed by the US Forest Service for application in the western United States, this system has been adapted for use in the eastern U.S. and more finely tuned for use in Vermont and New England.[36] Use of the system will result in the public being given consistent messaging on the types of recreation experiences to expect in various areas, regardless of being on state or federal lands.

Figure 7: Recreation Opportunity Spectrum



There are six ROS categories. These categories lie on a spectrum from urban (highly developed) to primitive (undeveloped). The characteristics used to map these ROS categories are based on:

1. Physical setting – type of access, remoteness, size of the area, and evidence of human use.
2. Social setting – user density, the amount and type of contact between individuals and groups.
3. Managerial setting – the amounts and kinds of restrictions on people's actions, facilities and site management, and evidence of visitor impacts and/or other land management activities.

Seasonal Classification

[36] More, T, S. Bulmer, L. Henzel & A. Mates. *Extending the Recreational Opportunity Spectrum to Nonfederal Lands in the Northeast: An Implementation Guide.* USDA Forest Service. Newtown Square, PA, 2003.

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Recreational use of the CMU varies from summer season to winter season as some trails are designated as for snowmobile use in winter or road segments go unplowed. Conversely, as winter season transitions to summer season, roads re-open and motorized use ceases on snowmobile trails, or in some instances, passenger vehicles can travel on maintained segments of road. These seasonal changes can lead to a shifting in the classification of a given area depending on recreational use. For the purposes of this management plan, "winter" will be defined as mid-November to mid-April and "summer" will be defined as mid-April to mid-November.

The remoteness and size of ***Birdseye WMA*** and the Herrick Mountain ridgeline area makes this a good example of semi-primitive nonmotorized in summer. Semi-primitive non-motorized areas are characterized by predominantly natural or natural-appearing landscapes of relatively medium to large size of at least 1,000 acres. Areas may be smaller if they are contiguous to other private or public lands that are protected and managed in a complementary manner. Interactions between users is low, but there is often evidence of other users. There is high probability of experiencing independence, closeness to nature, and self-reliance by applying outdoor skills in an environment that offers challenge and risk. Here, opportunities for more remote wildlife-based recreation consistent with VFWD mission and the Conservation Easement can be experienced.

Portal sub-class describes a heavily used, but minimally modified setting that acts as a gateway to more popular remote areas. Areas along the access roads to the WMA including Ames Hollow and Castleton Birdseye Roads are portals, or transitions to these semi-primitive non-motorized areas. While within the semi-primitive non-motorized ROS class, the setting is more typical of semi-developed natural areas.

Recreation experiences differ in winter with snowmobile use on designated trails. This shifts the classification to semi-primitive motorized. Semi-primitive motorized areas are characterized by being or being contiguous to a predominantly medium to large size (at least 1,000 acres) natural or natural appearing environment. Interactions between users is low, but there is often evidence of other users and there may be a higher number of parties at designated concentration points. The area is managed so that on-site controls are subtle. Motorized uses are restricted to designated corridors. Timber harvesting and vegetation management are compatible activities for this class. The areas provide an opportunity for a high degree of interaction with the natural environment and structures are rare and isolated. The areas are at least ½ mile from maintained roads. There is low road and trail density.

The distribution of ROS classes on Blueberry Hill WMA is influenced by its proximity to US Route 4 and significant town roads. Here ROS classes include Semi-Primitive Non-motorized in areas furthest from the roads semi-developed (roaded, natural) and developed natural (rural) in areas closer to town roads and US Route 4. In these areas the sights and sounds of people are more apparent and while interactions between users may be low to moderate, evidence of other users is prevalent. Developed natural areas are characterized by a substantially modified environment. Sights and sounds of people are readily evident. Interactions between users are often moderate to high because site/activity access is convenient. Road and trail density is moderate. Many timber harvesting and vegetation management practices are compatible.
The CMU does not currently contain any lands that would be categorized as "Primitive" or "Urban/Highly Developed."

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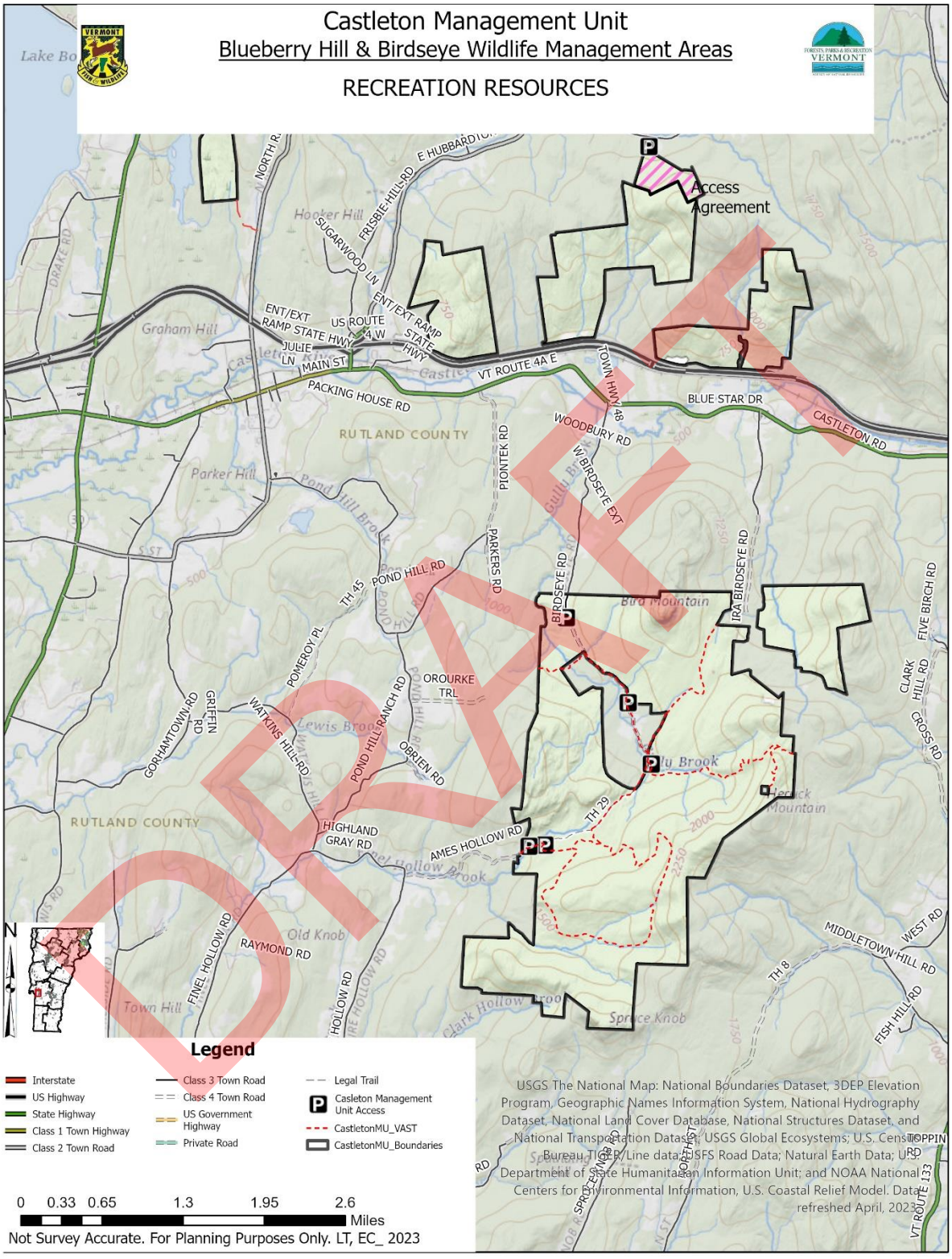
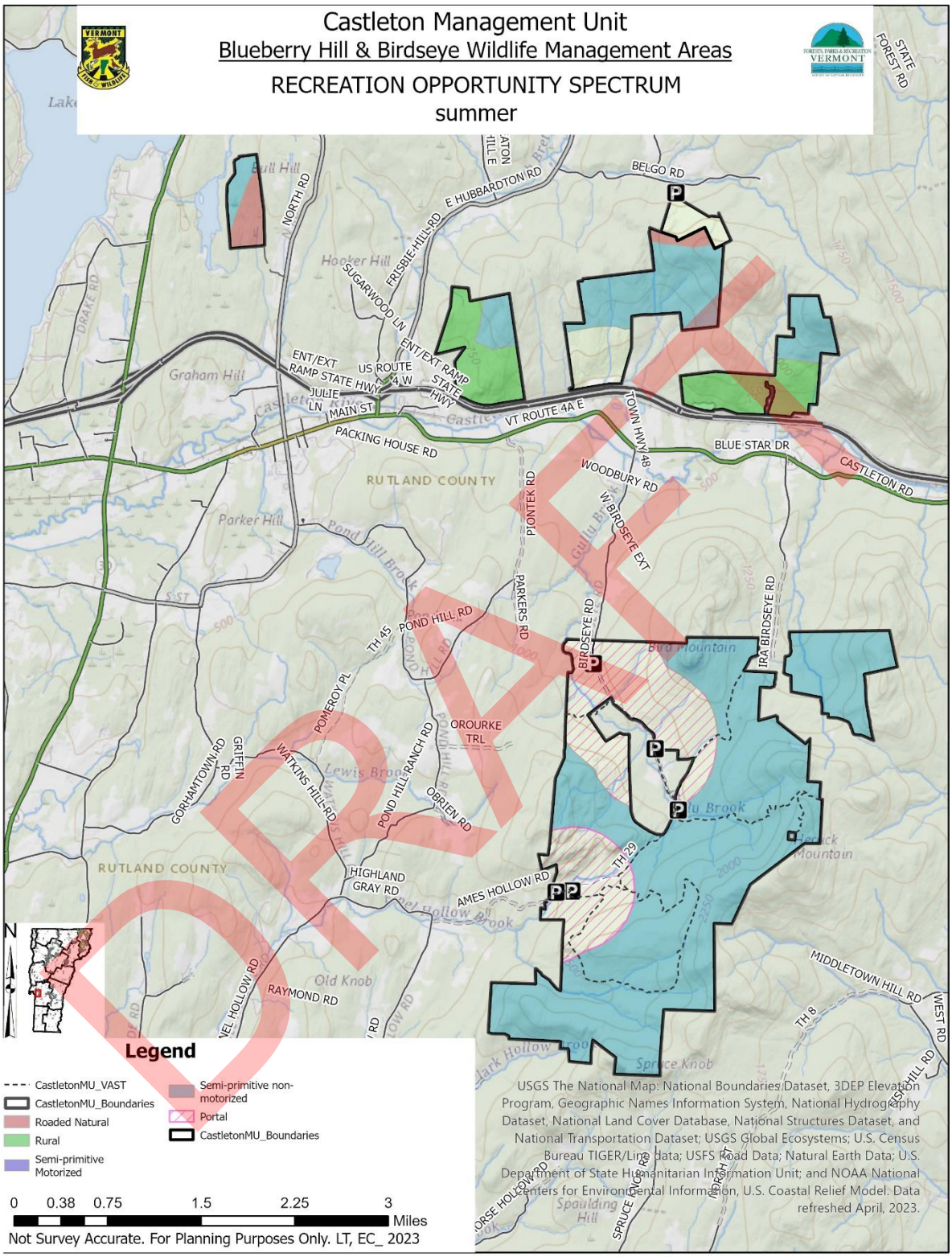
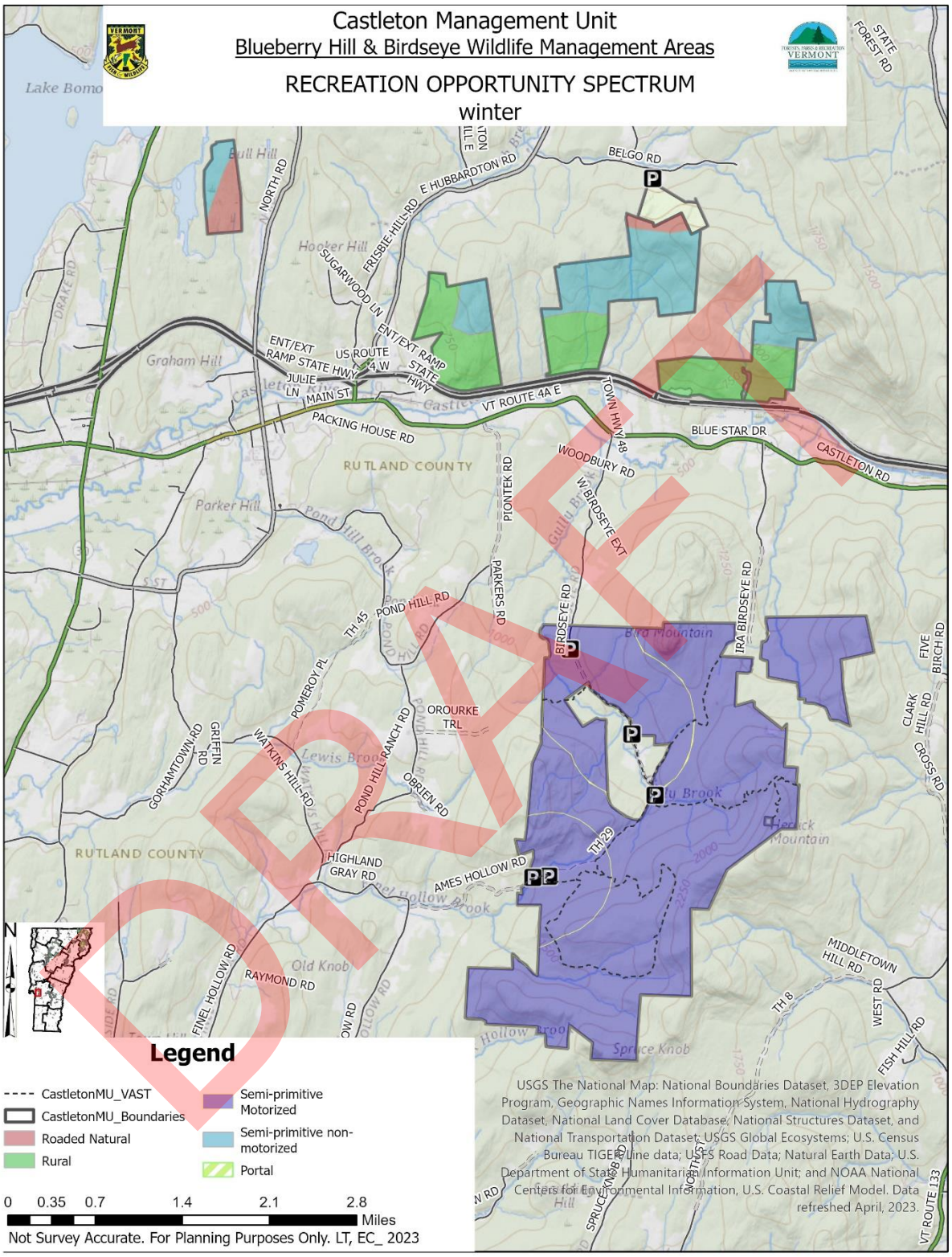
Map 15: Recreation Resource Map – Castleton Management Unit



Map 16: Recreational Opportunity Spectrum (Summer) for Castleton Management Unit



Map 17: Recreational Opportunity Spectrum (Winter) for Castleton Management Unit



I. Infrastructure and Public Access Assessment

Town Highways

Access to the CMU is via town roads (Map 2 and Map 5). Public access to BBHWMA is from Belgo Road in the Town of Castleton. Main access to Birdseye WMA from the north is via Castleton-Birdseye Road. The Ira-Birdseye Road provides access to the northeast parcel of BWMA. And Ames Hollow Road in Poultney provides access from the south. The section of town highway 5 (Ira) and town highway 29 (Poultney) running through Bird Mountain, is a designated trail (corridor No. 4) on the VAST trail system. The Powder Lot Block of BBHWMA is accessed via a Pent Road.[37]

Management Access Roads

Access within the CMU is via forest management access roads. The type and quality of interior access roads vary from skid trails that are utilized for logging and then stabilized until needed again for forest management and are often ditched and with culverts. These roads are maintained as regular forest management access. At the time of acquisition many steep skid roads had substantial washouts and needed to have appropriate erosion control structures installed or maintained. Since the VFWD assumed ownership, nearly 7 miles of these legacy roads on Birdseye WMA have been stabilized. The project included the installation or maintenance of 313 water bars and restoration or improvement of four stream crossings. The goal of this work was to stabilize roads, prevent soil loss through erosion, improve water quality and enhance flood resiliency.

Many of the access roads are not constructed for year-round use. Some are steep or wet, are only used under frozen conditions and are not suited for general vehicle use. Most roads are gated or barricaded against damaging unauthorized traffic.

Infrastructure and Public Use Adaptation Strategies

In addition to the far-reaching effects on ecological systems, climate change may also affect the infrastructure and public uses on CMU.

Potential effects could include:

- Floods damaging roads, trails, and infrastructure.
- Fires endangering users, camp properties, and neighboring properties.
- Increased precipitation leading to more temporary/seasonal road closures and increased road and trail maintenance.
- Shorter winters reducing snowmobile and winter use seasons.
- Windstorms are increasing maintenance needs to keep roads clear of trees.

Such effects will be dealt with on a case-by-case basis. It is anticipated that the systems in place to manage many of these uses will readily handle these issues. Others, for example increased

[37] Pent Road (selectboard proceedings 2/2/1915 and recorded in the Town of Castleton Land Records Large Book 3, page 353-454. http://www.legislature.vermont.gov – "Pent road is any town highway which, by written allowance of the selectboard, is enclosed and occupied by the adjoining landowner with unlocked stiles, gates, and bars in such places as the selectboard designate".

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precipitation and flooding, will require more comprehensive considerations. Maintaining the CMU as extensively forested, with significant riparian areas and intact wetlands is a key strategy to reduce and mitigate flooding in the CMU and downstream to the Castleton River. In addition, however, ANR has and will continue to replace undersized culverts (which can fail in flood events) with larger and better positioned structures and may need to consider relocating some roads away from streams.

Future assessments of landscape and species vulnerability to climate change effects may be conducted to help management decision-making by identifying locations vulnerable to weather extremes and species vulnerable based on factors such as temperature extremes and habitat conditions.

J. Scenic Values

Given its prominence on the landscape and position along US Route 4, the importance of the scenic values of the Castleton Management Unit to the public has long been recognized. The forests and mountains of the CMU are viewed daily by commuters traveling along Route 4 and other roads, from neighboring properties, and by visitors to the WMAs. Whether the distance is far, medium, or close, scenic values are important to visitors to the CMU as well as those who view from afar.

The Conservation Easement on the recently acquired parcels of Birdseye WMA has among its statements of purpose the goal to "conserve and protect the property's undeveloped character and scenic and open space resources for present and future generations." The scenic views of and from this property add to its recreational and public value and is one of the primary purposes of conservation. Located just west of Rutland and just south of the Route 4 interstate, the rugged, forested mountainous terrain of the property provides a scenic backdrop.[38] Further, the Baseline Documentation Report developed at the time of acquisition recognized that this property was identified for conservation by host towns. Both the Ira Town Plan (Highland Protection Zone) and Poultney Town Plan (Wildlife Habitat Area) state the importance of protecting scenic value and high elevation soils as part of their stated objectives.

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[38] Agency of Natural Resources, Vermont Fish & Wildlife Department. *Interim Stewardship Plan, Bird's Eye Mountain Property, Bird Mountain Wildlife Management Area*, 2016.

IV. MANAGEMENT STRATEGIES AND ACTIONS

A. Land Management Classification

Vermont ANR lands are managed using four categories of use or types of management to be emphasized on the land. In this section of the plan, the recommended levels of use or types of management will be shown for all the land area in this parcel. This section also describes generally how the land will be managed so that the activities occurring on the land are compatible with the category assigned. The four categories are: (1) *Highly Sensitive Management*; (2) *Special Management*; (3) *General Management*; and (4) *Intensive Management*.

As part of the planning process, the lands, resources, and facilities held by the ANR are evaluated and assigned to the appropriate land management category. Assignment of management categories for the Castleton Management Unit is based on a thorough understanding of the resources identified and the application of over-arching lands management standards. The resources include natural communities, plants, and wildlife as well as recreation, historic, timber, and water resources.

1.0) Highly Sensitive Management – Areas designated as Highly Sensitive Management are described as ***"areas with uncommon or outstanding biological, ecological, geological, scenic, cultural, or historical significance…"*** Acres managed under this category will have no timber management, salvage harvest, or active wildlife habitat management. However, trees and other vegetation may be cut to restore natural community species composition and structure in limited locations; manage specific habitat conditions for rare, threatened, and endangered species; and to maintain safe and enjoyable recreational conditions.

2.0) Special Management – Areas designated as Special Management include areas ***"…where protection and/or enhancement of those resources is an important consideration for management."*** Timber harvesting and wildlife habitat management as well as recreation are considered to be complementary uses within this classification to the extent that they do not impact special features.

3.0) General Management – The General Management category includes areas where ***"dominant uses include vegetation management for timber and wildlife habitat, concentrated trail networks, and dispersed recreation…"*** A primary consideration for management is minimizing conflict between activities. Sensitive resources that occur within these areas may require special attention.

4.0) Intensive Management – The Intensive Management category is characterized by a ***"high level of human activity and high intensity development on/or adjacent to State land."*** Aesthetics and safety are the primary management considerations in these areas. However, more sensitive resources that occur within these areas may require special attention.

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B. Management Goals and Objectives for Castleton Management Unit

Priorities of management for the CMU are to protect and conserve natural, cultural, and scenic resources, to provide wildlife-based recreation including hunting, fishing, trapping and wildlife observation, to maintain and enhance diverse wildlife habitats, and to continue to harvest forest products sustainably. Management priorities will also vary depending on the Land Management Classification (LMC) described below.

Unit wide goals

The following describes broad management strategies and actions that will help achieve each management goal. These are overarching and relevant across the entire management unit. The Land Management Classification that follows will have more site-specific priorities and management actions. The unit wide goals are:

- Protect the ecologically functional landscape and natural and cultural resources of the Castleton Management Unit.
- Promote carbon resilience and climate adaptation to address climate change impacts.
- Support Vermont Conservation Design Targets for Old and Young Forests.
- Provide high quality wildlife habitat for a diversity of species.
- Provide opportunities for dispersed, sustainable fish- and wildlife-based recreation.
- Sustainably manage forests to achieve wildlife habitat goals, support a healthy and resilient forest, and support the production of quality wood products.

Protect the ecologically functional landscape and natural and cultural resources of the Castleton Management Unit. Resource protection is incorporated with practically every management action conducted on the CMU. Management goals for the CMU are developed at multiple scales (including both landscape and fine scale) allowing for the protection of its natural resources while meeting Vermont Conservation Design's vision to sustain the state's ecologically functional landscape. The natural qualities found here must be maintained and enhanced to protect and conserve rare, threatened, and endangered species, natural communities, aesthetic values, watershed values, wildlife-based recreational opportunities, wildlife, and timber for present and future generations. Consideration must also be given to protecting important cultural and historic resources.

- Maintain and enhance quality rank of significant natural communities and protect habitat of rare, threatened, and endangered species.
    - Control or limit invasive species populations to the extent feasible.
    - Monitor impacts from other uses, including recreation and forest management.
    - When appropriate, allow natural processes and disturbance regimes to prevail.
- Conserve biological diversity by supporting an ecologically functional landscape on the parcel and contribute to the diversity of the larger landscape.
    - Support Vermont Conservation Design targets for young and old forest.

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        - Manage at least 24% of the 4,725-acre CMU as future old forest through both passive and active management strategies within all patch sizes of state-significant natural communities, increasing the regional old forest target by 3%.
        - Increase connectivity of old forest characteristics by implementing active old forest management along 100-ft buffers of and in between passively managed Highly Sensitive Management areas. These areas provide approximately 4% additional connectivity.
        - Manage 3-4% of the 4,275-acre CMU as young forest focused in General Management Areas to enhance structural diversity of stands, support wildlife functions, and help meet regional VCD targets.

- Enhance water quality, fisheries habitat, flood resilience, and wetland function.
    - Improve existing road and trail infrastructure to minimize soil erosion and improve water quality.
    - Adhere to *Riparian Management Guidelines for Agency of Natural Resources Lands.*[39]
    - Follow *Acceptable Management Practices on Logging Operations*[40] to protect water quality and control soil erosion.
    - Follow state and federal permit requirements and conditions related to wetlands, in-stream work, storm runoff, etc.
    - Plan water crossings on roads and trails to withstand increasing frequency and intensity of storm events, thereby enhancing flood resilience and mitigating downstream impacts.
- Maintain and enhance forest ecosystem health.
    - Conduct annual forest health surveys (VFPR).
    - Consider invasive plant, insect, and disease conditions when determining the timing of management activities. Strategies for invasive species control will include the use of herbicides and manual/mechanical methods such as mowing and pulling.
- Promote an ethic of respect for the land, sustainable use, and exemplary management.
    - Conform to all deed restrictions, conservation easements, and legal agreements.
    - Continue to improve public outreach and education efforts aimed at educating users about appropriate uses of state land.
- Document, interpret, and protect historic resources.

[39] Vermont Agency of Natural Resources. *Riparian Management Guidelines for Agency of Natural Resources Lands*, 2015.
[40] Vermont Forest, Parks, and Recreation. *Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont*, 2018.

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- Identify and buffer known and discovered cultural and historic sites.

Promote climate adaptability and carbon resilience on the landscape to address climate change impacts. One of the primary goals of the CMU is to assess the potential impacts of climate change on forested areas and subsequently devise strategies to mitigate risks and enhance resilience to future climatic conditions. Through both active and passive forest management, strategies will aim to encourage multi-aged/size structure, increase tree species and functional diversity, maintain hydrological cycle and erosion control, increase biological legacies and dead wood, and create stable carbon pools while balancing carbon storage and accumulation for carbon resilience. Many of these strategies are already an integral part of sustainable forest management on state lands in Vermont. Goals, actions, and strategies to achieve climate adaptation are listed below.

Climate Adaptation strategies

→ Keep forests forested and connected
→ Minimize forest stress
→ Reduce Vulnerability
→ Provide Refugia

Framework for addressing climate change through identifying goals and developing forest management actions and strategies to address these goals.[41]

- Keep forest forested and connected.
  - Protect resilient forests and the connections between them.
    - Minimize trails in areas identified for protection.
- Minimize forest stress.
  - Minimize levels of invasive plants.
    - Identify areas that are at risk.
    - Clean operational equipment before entering.
  - Prevent the introduction of invasive insects and diseases and limit the impact of existing ones.
    - Increase representation of non-host species.
  - Ensure water resources have forested buffers.
  - Reduce deer browse to protect tree regeneration.
    - Leave treetops whole to shelter regeneration from deer.
    - Continue hunting access on state land.
  - Maintain or restore soil and water health.
    - Minimize impacts by planning skid roads and trails, operating only during stable conditions, following Acceptable Management Practices, and leaving treetops and limbs for stabilization.
  - Ensure soil is abundant in organic matter and not compacted and eroding.

[41] Swanston, Christopher W., et al. "Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd Edition." Gen. Tech. Rep. NRS-GTR-87-2. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 161 p.

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        - Use scarification techniques where appropriate.
        - Operate only during stable conditions.
- Reduce vulnerability.
    - Promote diverse species, sizes, ages, and spatial arrangement.
        - Establish or maintain a minimum of two age classes.
        - Diversify aggregation of species arrangements
        - Utilize treatments that account for species silvics (e.g. gaps for shade-intolerant species, single-tree selection for shade-tolerant species).
    - Promote the establishment of well-adapted species.
        - Identify species that are expected to be resilient to future conditions and implement appropriate strategies for their establishment.
    - Reduce the proportion of trees that host invasive insects and diseases.
        - Reduce the number of trees that serve as host species for invasive insects and diseases in a manner that considers the overall health and function of the forest (considering regeneration and understory plant communities).
    - Reduce stem crowding to increase forest vigor.
        - Thin forest to decrease resource competition and increase tree vigor.
        - Vary thinning across the forest to create a range of spatial and environmental conditions.
    - Increase the amount of large snags and logs to reach appropriate levels of deadwood.
        - Implement a passive approach for natural accumulation.
        - Implement active management to create standing deadwood and down woody material by felling low-quality, unhealthy trees.
        - Protect deadwood during timber harvests.
    - Restore and protect riparian areas.
        - Protect riparian areas by establishing buffers.
        - Incorporate plantings where appropriate.
- Provide refugia.
    - Protect threatened, endangered, and at-risk species.
        - Identify areas and place protections for these species.
    - Harbor species that are at risk of being lost from the landscape.
        - Identify microclimates and diverse topography that may be potential refugia for species and other natural communities at risk of being lost from the landscape.
        - Reserve or promote through appropriate management strategy, active or passive.

Provide high quality wildlife habitat for a diversity of species. High priorities of management on CMU are special wildlife habitat projects and the incorporation of wildlife related management into other activities. Important wildlife habitats found within CMU include open talus, vernal pools, small wetlands, deer wintering habitat, mast stands, cliffs, and maintained fields. Specific management strategies aimed at maintaining and enhancing these resources are

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listed in Section IV C Land Management Classification – Site Specific Management Strategies. There are, however, many other important habitat features within CMU. Examples include seeps, aspen stands, young forest, bobcat denning habitat, raptor nesting trees, snag, and cavity trees and late successional (old) forest. Many of these features are found at a scale that is too small to be useful in the LMC or are ephemeral in nature. Management activities will be designed to maintain and improve wildlife habitat wherever possible, using a combination of active and passive management. Along with habitat management actions listed in the LMC section, specific wildlife habitat management strategies will be implemented.

- Protect and enhance unique wildlife habitats and features for both general and target wildlife species.
    - Adhere to current management guidelines for protecting and managing for bats. Review all timber harvests that are proposed with the CMU for potential effects on these species and adjust prescriptions and timing of operations accordingly.
    - Manage deer wintering areas including both softwood and south-facing hardwood areas to provide habitat that is critical to deer and other wildlife.
    - Release from competition and maintain where possible important mast producing trees and shrubs such as beech, apple, cherry, serviceberry, oak, hickory, and alders.
    - During management activities monitor for the presence of important wildlife habitat, such as bobcat denning sites, raptor nest trees and cliffs, etc., and provide a buffer adequate to prevent disturbance to these features.
    - Management strategies should promote adequate numbers of snags, cavity trees, and dead and downed wood, in accordance with the best available science. In the long-term a site would contain four to six each of snags and cavity trees >12" diameter per acre, with one to two each of snags and cavity trees >20" in diameter per acre. When the volume of downed woody material is inadequate, managers will attempt to recruit a total of 3-5 stems >18" in diameter, and 10 stems >14" in diameter per acre, all at least 16 feet long. Achieving these targets may not be possible on all managed sites after one entry.
- Protect and enhance wildlife habitat through all vegetated stages.
    - Use timber harvesting to increase the proportion of young forest found on CMU. ANR will attempt to achieve and maintain 3-4% in young forest (1-20 years). This will be achieved by creating patches from 2-5 acres in size for a target of 142-236 acres across the manageable lands of CMU over 20 years. This target is within the natural range for the Taconic Mountains biophysical region and in agreement with the target established by the Vermont Conservation Design (VCD).
    - Use a combination of passive and active forest management strategies to promote the development of old forest characteristics over time.
- Assess management activities for impacts to wildlife at the landscape level.
    - Document, maintain, and enhance known and suspected wildlife corridors to enable wildlife movement across the broader landscape.

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- Maintain connecting habitat on the CMU and within the region to aid in the movement of plant and animal populations adapting to changing climate and regional environmental conditions.
    - Maintain the unfragmented character of the CMU.
- Maintain high quality surface waters within the CMU to protect aquatic habitat.
    - Identify appropriate Riparian Management Zones in accordance with the *Riparian Management Guidelines for Agency of Natural Resources Lands* to protect riparian function around all wetlands, seeps, streams, and vernal pools. Activities that might result in disturbance or displacement of wildlife from these features will be avoided or minimized.
    - Design roads, trails, and other infrastructure to allow for aquatic organism passage and riparian connectivity.

Provide opportunities for dispersed, sustainable fish- and wildlife-based recreation. Manage opportunities within the capabilities of the resource following state policies, rules, and regulations and with regard to easement, funding, and other restrictions. Listed below are various strategies and tactics employed on a broad scale with CMU to support the stated recreation experiences. The CMU supports opportunities for remote, dispersed wildlife-based recreation.

- Protect and improve public access.
    - Evaluate the capacity of parking areas and identify and implement strategies to address parking challenges as needed.
    - Enhance opportunities for wildlife-based recreation, particularly hunting, fishing, trapping and wildlife viewing.
    - Pursue opportunities for public access to Blueberry Hill WMA.
    - Assess options to reduce the incidence of unauthorized and unsustainable trails.
- Maintain existing trails.
    - Continue ongoing maintenance of trails and associated facilities utilizing volunteers, contractors, available staff, and continuing work with established recreation partners.
    - Partner with organizations including Vermont Association of Snow Travelers (VAST), and its local clubs, to provide enjoyable and safe trail user experiences, and an ecologically sound trail system.
    - Continue to monitor trail systems, recreational activities, and associated infrastructure. Document status using trail registers, electronic counters, and other appropriate means.
    - Assess options for relocating trails out of sensitive habitat.
    - Management of road infrastructure addressed under forest management section.
- Consider opportunities and requests for expansion of recreation where appropriate and compatible with other goals.

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- Evaluate new recreational use requests in the context of recreational requirements of funding mandates, Agency and Department missions, and Conservation Easements. Consider total recreational use of the management unit (degree of use, number of trails), the Recreation Opportunity Spectrum, Rules Governing Use of Fish and Wildlife Lands, ANR's Guidelines for Minimizing the Ecological Effects of Recreation on ANR Lands, and other management goals for the management unit.
- Ensure proper planning for and implementation of new trails where appropriate. Planning should include expected changes because of climate change including decrease in snow, increased cost of maintenance, and the need for more robust infrastructure related to water crossings.
- Be proactive in recognizing emerging and growing recreational pursuits. Work with partner organizations to ensure sustainable and compatible accommodation of emerging activities.

- Engage in proactive education campaigns to inform users of opportunities available on Wildlife Management Areas and the value of remote lands and trailless areas to support dispersed wildlife-based recreation.

Sustainably manage forests to achieve wildlife habitat goals, support a healthy and resilient forest, and support the production of quality wood products. Produce a diverse array of wood products through sustainable management and harvest practices while achieving forest resilience, ecological function, and wildlife habitat goals.

ANR will employ a range of tools from passive to active forest management to meet management goals for forests, wildlife, water quality, natural community integrity and recreation. Passive management allows natural processes to dominate. Active forest management encompasses a number of activities that manipulate trees, shrubs, and other plants. These strategies can be implemented to maintain young forest on CMU including consideration of passive management within areas that have experienced natural disturbances (e.g. wind, ice) and even-aged silvicultural treatments designed to mimic larger forest disturbances. While there will be some opportunities to create young forest throughout the CMU, most will be with Birdseye North Block (Block 1) during this management cycle, reversing the declining trend described in the Forest and Timber Assessment. In addition to helping to meet the young forest goals, these treatments would also promote the restoration of natural community species composition in former agricultural fields currently dominated by white pine.

Active forest management includes:

- Invasive plant treatments to reduce or eliminate invasive plants that can compete with native vegetation and degrade ecological function and natural community integrity.
- Mast tree release that opens up light and space for certain trees such as oaks, hickories and beech that provide valuable food sources for a range of wildlife species, allowing more vigorous growth and mast production.
- Forest stand improvement that removes certain trees to give healthy trees more space to grow and supports a more resilient stand structure.

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- Prescribed fire that can stimulate growth of fire-adapted species and maintain or restore stand characteristics of fire-adapted systems.
- Forest management timber harvests that support the structure, diversity, resilience and/or health of forest stands. When justified by the conditions on the ground and the latest science, timber harvests are a tool that can be combined with other techniques to achieve many land management goals and maintain the benefits and services of healthy forests.

The CMU LRMP proposes a mix of active and passive management approaches tailored to conditions on the ground that will be used to achieve a range of goals. Active forest management of CMU contributes to the sustainable production of forest products, improvement of forest health conditions, management of quality wildlife habitat, control of invasive species, contributions to forest resiliency, and climate adaptation. Vermont is home to a vital forest products industry, of which ANR lands are a small yet important component. While revenue generation is never the primary reason to conduct forest harvesting activities on ANR land, it is still an important consideration as timber-derived revenues are reinvested in public land. Furthermore, commercial timber harvests are often the only affordable way to accomplish certain types of wildlife habitat management and to achieve management objectives related to landscape diversity and resilience at a scale needed to meaningfully address these goals.

- Develop and maintain a resilient forest that fosters natural communities with a range of tree densities, gap sizes, plant species, structure, and tree ages distributed over a variety of sites and conditions.
- Manage forests sustainably while bearing in mind the values of riparian zones, connected habitat, and inoperable terrain embedded within management zones.
- Utilize a range of established silvicultural techniques.
    - Consider a broad range of peer-reviewed silvicultural guides.
    - Utilize diverse types of forest management to create age and structural complexity.
    - Determine the most appropriate cutting regime on a site-specific basis. Such cutting regimes include but are not limited to single tree and group selection, irregular shelterwood, regular shelterwood, seed tree, patch cutting, and crown thinning.
    - Consider the timing of silvicultural treatments (winter v. summer) in regard to soil and water protection, and desired regeneration.
    - Match the harvest system and type of equipment used with location and site conditions of a given project.
- Design silvicultural prescriptions that consider likely climate change impacts and focus on resiliency and complexity.
    - Ensure that advanced regeneration is abundant prior to overstory removal when conducting even-age management.
    - Retain or improve the amount and distribution of coarse and fine woody material for maintaining nutrient cycling and soil protection.
    - Manage for tree age diversity and forest structural complexity.

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    - Follow Planting Guidelines for Agency of Natural Resources Lands for implementation of planting projects on ANR lands.
    - Monitor harvests and temporarily halt operations as needed to protect soil, water quality, and access infrastructure.
    - Match equipment to terrain and harvest objective to reduce soil and stand impacts.
    - Monitor for early detection and removal of invasive plants. Where invasive plant populations are already established, include aggressive management as a component of any silvicultural technique.
    - Plan silvicultural activities to help control invasive plant populations. Ensure all earth-moving equipment is free of soil and plant material prior to entering ANR land.
    - Undertake periodic forest inventories to assist with guiding future plans and developing proper silvicultural prescriptions.
- Maintain an adequate road access system.
    - Maintain roads and trails responsive to likely climate change impacts that suggest more frequent and intense storm events in the future.
    - Implement water quality improvement and flood resilience projects including upgrading culverts and stream crossing structures, installing stone lined ditches and ditch disconnection practices.
    - Minimize skid roads and trails.
    - Properly close out legacy skid roads as possible.
- Incorporate VFPR published Acceptable Management Practices and ANR Riparian Management Guidelines for Agency of Natural Resources Lands into all harvesting projects to ensure a continuing high level of protection of water quality and soils.
- Where appropriate implement silvicultural strategies to enhance natural community condition and support the enhancement of old forest characteristics. Strategies to include presence of large diameter trees, special variation in tree density, large diameter standing dead trees, large, downed logs, multiple canopy layers, and adequate regeneration.
- Place higher emphasis on implementation of active management for old forest characteristics in the transition to Highly Sensitive Management Areas that will be allowing passive management to advance forest maturity and where old forest characteristics are already present.

To achieve the various ecological, forest resource and wildlife resource goals of this plan, twelve timber harvest analysis areas have been identified for potential harvesting over the next 20 years across the CMU. Management actions will also include timber stand improvement, invasive plant management, mast tree release, and open land management.

Areas identified for further harvest analysis in this LRMP will receive additional review and inventory. A detailed review of special wildlife habitat (e.g., habitat for rare, threatened, or endangered species), significant natural communities, important historic or cultural sites, and sensitive natural features (e.g., streams, steep slopes, wetlands, etc.) will be conducted on each timber harvest analysis area. A more detailed pre-sale inventory will also be conducted on each

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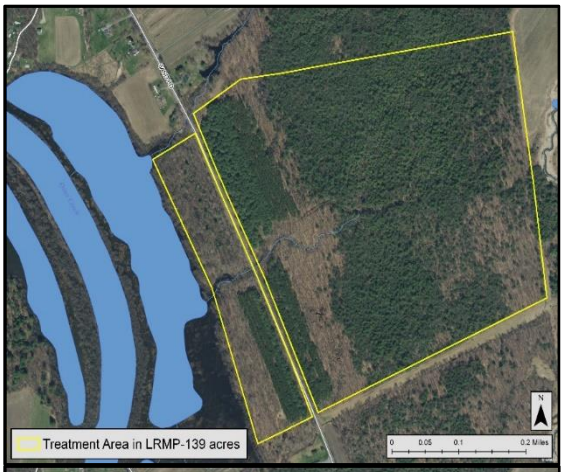
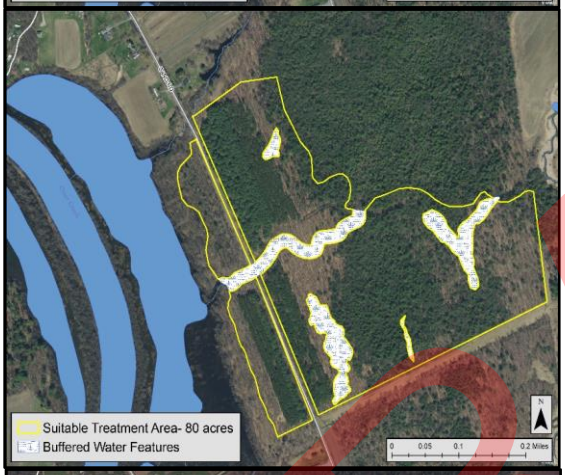
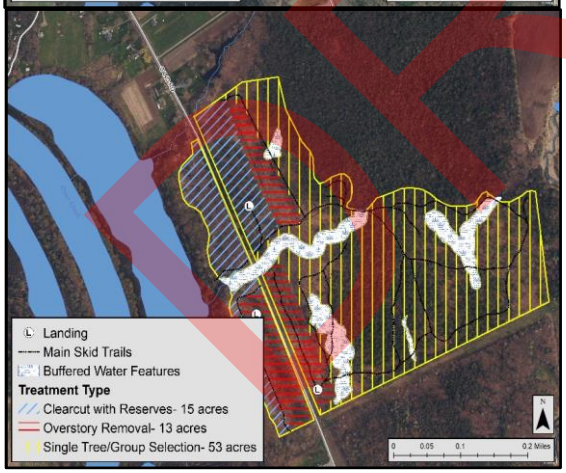
analysis area to gather data and information related to forest health, species composition, stand age, forest structure, soil characteristics, wildlife habitat, and information on forest product quality, value, and distribution.



This is the treatment area as depicted in a past Long-Range Management Plan. This area was selected based on the goals of the plan and the general inventory and assessments done during the planning process.



A more detailed site-level inventory and review excluded the northeast portion from cutting, identified water features that would be avoided, and developed more detailed boundaries for cutting based on the conditions of the forest stands. The imagery underneath shows the forest cover prior to



Treatment types were selected based on the site-level inventory and goals of the plan and then implemented. Most trees were cut in the blue hatched area, the overstory of mature trees was removed to release the understory in the red hatched area and select individual trees or small clusters were cut in the yellow hatched area. The areas between weren't cut at all, and no cutting occurred

Figure 8: The progression from a 'timber harvest analysis area' to a timber harvest showing the sharpening of boundaries, development of exclusion areas and selection of harvest intensity based on management goals and silviculture.

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These reviews and inventories will be used to develop silvicultural prescriptions for each harvest area that is consistent with the management goals for the CMU. Silvicultural prescriptions are written by State Lands Foresters with input and collaboration from other District Stewardship Team members, and then reviewed by Stewardship Foresters. Current silvicultural guides are referenced to formulate appropriate strategies for treatment. A variety of silvicultural treatments will be utilized depending on the results of the information gathered and an evaluation of opportunities for demonstration projects.

Harvest operations will primarily take place in winter months to reduce impact to sensitive natural resources and commercial tree regeneration, however summer logging is suitable in some instances when ground conditions allow and soil scarification benefits tree regeneration. Virtually all timber harvests are conducted by an independent contractor selected through a competitive public bid process. Generally, the high bidder is awarded the contract, with significant conditions and stipulations guided by the strategies above. Licensed foresters from VFPR are responsible for all aspects of harvest development, administration, and oversight.

The treatment schedule may at times need to be flexible due to unforeseen circumstances. Examples of this include disease or insect infestations, poor conditions for logging such as extended wet periods or lack of cold weather and/or inadequate snow cover. See Table 24 below for an implementation schedule of activities on CMU. The goal column represents a preliminary determination of the type of silvicultural treatment that will be utilized on a given project. The treatment type will be further refined after completing the pre-sale evaluation.

Control of invasive species will be a priority for staff. Strategies for control will include the use of herbicides and manual/mechanical methods such as mowing, pulling, and burning with a torch.

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C. Land Management Classification on Castleton Management Unit

Site Specific Management Strategies

Highly Sensitive Management Areas are those with uncommon or outstanding significance (biological, geological, scenic, cultural, or historic) where protection of those resources is the primary consideration for management. Human activities and uses should not compromise the exceptional feature(s) identified.

Primary considerations for management:

- Protection of significant and sensitive resources.
- Management activities should not compromise exceptional features.
- Focus on restoration of natural community species composition and structure.
- Management of habitat conditions for the conservation of rare, threatened, and endangered species.

Highly Sensitive Management areas represent approximately 1157 acres or 24% of the Castleton Management Unit.

1.1: *Exemplary natural communities or species* (605 acres)

Dry Oak Communities on Blueberry Hill WMA (1.1a, 1.1b. 1.1d) - 510 acres. The steep terrain and south-facing upper slopes within Blueberry Hill WMA support natural communities near the northern edge of their distributions and a habitat matrix that is unique for Vermont. This includes a significantly large occurrence of Dry Oak Forest and sensitive, state-significant natural communities and rare and uncommon plants.

- Dry Oak Forest
- Dry Oak Hickory Hophornbeam Forest
- Dry Red Oak White Pine Forest
- Dry Oak Woodland
- Red Pine Forest
- Temperate Hardwood Talus Woodland
- Cliff Communities

Management actions:

- Support passive management and natural processes that allow old forest conditions and characteristics to develop.
- Protect sensitive natural communities and rare and uncommon species.
- Monitor and maintain legal management access right-of-way through BBHWMA (West Block) and other routes of management access protecting soils and supporting water quality. Maintain management access roads monitoring and evaluating maintenance need and upgrading for enhanced resiliency.

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- Monitor and manage invasive species.

Dry Oak Communities on Birdseye WMA (1.1e) - 95 acres. The northeast block of Birdseye WMA supports oak-dominated natural communities. These steep, south and west facing slopes are relatively warmer and dryer and are characterized by natural communities and plant species near the northern edges of their distribution. This designation includes Mesic Red Oak Northern Hardwood Forest and several rare or uncommon communities:

  - Dry Oak Forest
  - Red Pine Woodland
  - Dry Oak Hickory Hophornbeam Forest
  - Erosional River Bluff

Management actions:

- Support passive management and natural processes that allow old forest conditions and characteristics to develop.
- Protect sensitive natural communities and rare and uncommon species.
- Evaluate legacy logging roads to determine needs and opportunities to mitigate erosion and enhance water quality.
- Monitor and manage invasive species.
- Maintain sustainable management access through this LMC to access LMC 2.1

1.5: ***Exceptional geologic features (70 acres)***

Bird Mountain Summit Area (1.5a) - 66 acres. Bird Mountain is a dominant landscape feature and WMA namesake. The summit has historic significance, supports wildlife habitat and habitat for rare, threatened, and endangered species and supports light to moderate dispersed recreational use. The summit and surrounding slopes support several natural communities including:

  - Dry Red Oak White Pine Forest
  - Temperate Calcareous Cliff
  - Northern Hardwood Talus Woodland
  - Open Talus

This complex of natural communities' support nesting Peregrine falcons with nesting attempts nearly every year since 1990. Small-footed bats were also noted roosting on the cliff face in 2009. Given the sunny openings these cliffs may provide bat roosts or valuable basking habitat for snakes.

Management actions:

- Limit access to cliffs during times of prime nesting and rearing to protect Peregrine falcons and bats.
- Allow natural processes to develop mature natural community expression.

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- Monitor levels and extent of use as well as impacts from hiking, climbing, and other uses. Implement mitigation measures to protect resources. Examples may include creating a cliff reserve or designating less impactful, sustainable hiking trails, etc.
- Monitor and manage invasive species especially the identified population of buckthorn.

Landslide Barren (1.5b) - 4 acres. A unique feature of open slopes composed of gravel, cobble, and small boulders with evidence of past debris flow at its base. This area supports a unique flora that hosts several rare species.

Management actions:

- Implement strategies to mitigate road runoff that contributes to gully erosion and slope stability.
- Consider options for road relocation especially if slope becomes unstable.
- Avoid gravel removal from this natural feature.
- Buffer from any future harvest operations or management activities that may lead to slope destabilization – consider avoiding slope altogether.

1.11 *Steep slopes and high elevations (482 acres)*

High Elevation Forest on Birdseye WMA (1.11) - 482 acres. The steep slopes and ridgeline from Herick Mountain south to Spruce Knob, much of which is above 2000 feet in elevation, supports remote, undeveloped, trailless high elevation forest and includes:

- Red Spruce Heath Rocky Ridge Forest
- Red Spruce Northern Hardwood Forest
- Upper elevation Northern Hardwood Forest
- Mesic Yellow Birch Red Spruce Forest

This area is part of a large, unfragmented intact forest that provides critical wildlife habitat connectivity. It also provides opportunities for remote recreation consistent with the purpose of ownership. This area will be managed to support the development of old forest.

Management actions:

- Support passive management to allow natural processes to develop mature natural community expression and old forest characteristics and conditions.
- Maintain as remote area for wildlife travel and remote dispersed fish- and wildlife-based recreation.
- Protect scenic values.
- Protect sensitive natural communities and rare and uncommon species.
- Evaluate legacy logging roads to determine maintenance needs and opportunities to mitigate erosion and enhance water quality.

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2) Special Management Category:

Special Management Areas are defined as those with unique or special resources where protection and/or enhancement of those resources is an important consideration for management. Timber harvesting and wildlife habitat management as well as recreation are considered to be complementary uses within this designation to the extent that they do not negatively impact special features.

Primary considerations for management:

- Protection and/or enhancement of unique or special resources
- Do not require the same level of protection given to highly sensitive areas.
- May be intensively managed for specific purposes, however timber harvesting, wildlife habitat management, roads, and recreational activities should not compromise the unique or special resources identified.

Special Management Areas represent approximately 1251 acres or 26% of the Castleton Management Unit.

2.1: *Important biologic, cultural, and geological resources* (405 acres)

Red Maple-Black Ash Seepage Swamp (2.1a) – 8 acres. State significant examples of this wetland community are found on the Powder Lot block of BBHWMA. Black ash is a component of this wetland, and its future is threatened by emerald ash borer (EAB). While not confirmed on site currently, the long-term viability of the community must be considered.

Management actions:

- Monitor black ash for EAB related decline and mortality.
- Be responsive to cultural management considerations of black ash.
- Consider and implement other measures to enhance natural community composition in light of EAB (i.e., planting, invasive control).
- Adhere to *Riparian Management Guidelines for Agency of Natural Resources Lands*
- Monitor and manage invasive species, especially as disturbance related to dying ash amplifies.

Ames Hollow West (2.1i) - 397 acres. A matrix forest of Northern Hardwood Forest and Mesic Red Oak Northern Hardwood Forest, this area is embedded with many inclusions of small, uncommon natural communities and rare, threatened, and endangered species. These small patch communities include:

- Northern Hardwood Talus Woodland
- Dry Oak-Hickory-Hophornbeam Forest
- Red Spruce-Heath Rocky Ridge Forest
- Seeps, Vernal Pools
- Dry Red Oak-White Pine Forest

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- Red Spruce-Cinnamon Fern Swamp
- Beaver Wetland

Management actions:

- Manage matrix forest toward an uneven-aged condition to enhance species, age and structural complexity. Opportunities for the establishment of young forest habitat at a functional scale may be limited and not possible in this area due to the presence of numerous embedded small patch natural communities.
- Implement multi-age silviculture with appropriate considerations for managing or protecting included natural communities.
- Buffer small patch natural communities and other inclusions where management may lead to adverse impacts.
- Maintain small patch natural communities through passive management unless management strategies can enhance community condition.

2.2: *Critical plant and wildlife habitat (846 acres)*

Softwood Deer Winter Areas (2.2d, 2.2e, 2.2h) - 183 acres. Lands within this designation are comprised of varying age classes of softwood species creating canopy conditions that effectively reduce snow depths and create higher mean daily temperatures during the winter months. These areas include hemlock dominated ravines and riparian areas and include Hemlock-Hardwood Forest and Hemlock Forest natural communities.

Management actions:

- Maintain hemlock dominated natural communities and deer winter habitat characteristics.
- Monitor hemlock stands for presence of the Hemlock Wooly Adelgid (HWA). If HWA becomes established, coordinate with forest health specialists to determine appropriate management to maintain hemlock for its wildlife habitat benefits.
- Within deer wintering areas that are scheduled for treatment, comply with Management Guide for Deer Wintering Areas in Vermont (VFPR and VFWD, 1990). Examples of key management strategies include a) perpetuate softwood cover, b) maintain deer mobility and access, and c) provide preferred, accessible browse.
- Adhere to *Riparian Management Guidelines for Agency of Natural Resources Lands* where hemlock is along streams.
- Discourage new trail development that would lead to increased use during the winter unless new trail reduces impact from existing or unregulated use.
- Monitor level of winter use (i.e. trail counters) and related impacts on habitat. Explore opportunities to relocate existing winter trails to avoid wintering areas, specifically on the Powder Lot block of Blueberry Hill WMA.

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Hardwood Mast Stands (2.2a, 2.2b, 2.2c, 2.2j) - 602 acres. These hardwood-dominated forests have a strong representation of mast species, an important food source for many species of wildlife. The large amounts of nut/fruit bearing tree species are typically dominated by oak, hickory and/or beech that provide essential fats and nutrients to many species. Additionally, they provide important winter habitat, and many are mapped by VFWD as Deer Wintering Areas. Situated on steeper south facing slopes these areas provide enough solar gain throughout the winter that they mimic similar protective conditions to the softwood wintering areas. There is a component of white pine within these areas that provide some winter habitat benefits in the near term, however, the natural progression is toward hardwood natural communities. These species and natural community types are expected to be more successful as the climate warms. These areas include:

- Mesic Red Oak Northern Hardwood Forest
- Mesic Maple Ash Oak Hickory Forest
- Dry Oak Forest

Management actions:

- Where treatments are scheduled implement silvicultural strategies including single tree, groups, patches and shelterwood techniques to maintain and regenerate mast species and promote overall species and structural complexity to support a healthy forest, wildlife habitat and climate adaptation.
- Where white pine is a significant component of stand composition manage for diversity and winter habitat value in the near term while transitioning to natural community composition over time.
- Manage to promote and recover oak and diversify age complexity in these stands especially on south-facing slopes that function as hardwood deer winter habitat.
- Maintain sustainability of main management access right-of-way through BBHWMA West Block following Acceptable Management Practices to support erosion control and water quality protection.
- Monitor and maintain boundaries of private land inholding within the East Block.
- Manage embedded patches of aspen as an important component of habitat complexity.
- Follow *Riparian Management Guidelines for Agency of Natural Resources Lands* (ANR 2015) within the steep hemlock ravine.
- Where treatments are scheduled include strategies to actively develop old forest characteristics especially as 2.2f transitions to 1.1e at the edge of this designation.

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Seepage Forest (2.2g) - 10 acres. There are several areas that support seepage forest, the largest is east of the Birdseye Road. This example has been compromised by past land use.

Management actions:

- Consider measures to improve hydrology as part of management that includes this area.
- Monitor and manage invasive species.

Bird Mountain West Slope (2.2h) - 34 acres. The steep western slope of Bird Mountain is an enriched site with a substrate of loose slate scree that supports Rich Northern Hardwood Forest and Dry Oak Hickory Hophornbeam Forest with an embedded Vernal Pool. The Rich Northern Hardwood Forest here shares many features with the Transition Hardwood Talus Woodlands found elsewhere on the WMA, though it is less rocky.

Management actions:

- Where treatment is scheduled, implement silvicultural strategies that enhance natural community composition and condition and protect enriched site conditions and advance the development of uneven-aged forest conditions.
- Adhere to *Riparian Management Guidelines for Agency of Natural Resources Lands* to protect values and function of the Vernal Pool.
- Discourage trail development that impacts the Vernal Pool and compromises enriched site conditions including the interruption of down slope movement of nutrients.

Dry Oak Demonstration Area (2.4) - 17 acres. This area is found lower on the slope and represents a less developed example of this natural community type. As such there are opportunities for demonstrating active management that supports the development of old forest conditions, natural community expression and climate adaptation and speeds the development of these characteristics through deliberate management strategies. This work will aid in natural community recovery and offer an accessible location that can be used to illustrate related forest management techniques with comparison to the adjacent passively managed natural community.

Management actions:

- Implement silvicultural strategies to enhance natural community condition and support the enhancement of old forest characteristics.
- Implement management as a demonstration project adjacent to 1.1 where passive management will occur with similar goals in the long term.

3) General Management Category:

General management areas are those where the dominant uses are sustainable timber harvesting, wildlife habitat management, trail networks, dispersed recreation, and other general land uses.

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Primary management considerations:

- Minimizing conflict between activities
- Minimizing conflict with lands categorized as more sensitive where they are adjacent to General Management areas.
- Identify sensitive resources within this area (i.e., vernal pools, seeps) that may require special consideration during management implementation.

Within CMU, there are approximately 2,548 acres or 50% within the General Management category.

Old Field Habitat (3.0b, 3.0k) - 49 acres. There are two fields that support early successional habitat on Birdseye WMA. These areas provide habitat for many species of wildlife, birds, and pollinators. These areas have been maintained in this successional stage through prescribed fire for many years. They contain inclusions of apple trees, aspen patches, and clusters of softwood within them to further diversify habitat. There are 14 acres of old field on BBHWMA that supports a stable mix of grasses and forbs. This may have been a borrow pit for construction of the adjacent highway. There is no management access to this field.

Management actions:

- Maintain fields in permanent early successional habitat using tools that include prescribed fire, brontosaurus, and mowing.
- Maintain inclusions of habitat elements such as apple trees, and patches of softwood and aspen.
- Continue the strategy of passive management in the field on BBHWMA. Manage invasive species if opportunities for access are found.

Hardwood Forest (3.0a, 3.0c, 3.0d, 3.0e, 3.0i) - 2499 acres. This designation is expansive particularly within Birdseye WMA and is largely found at lower elevations and includes natural communities with more common distribution across Vermont. Many of these communities are state significant but their condition varies widely. This includes:

- Mesic Maple Ash Hickory Oak Forest
- Mesic Red Oak Northern Hardwood Forest
- Northern Hardwood Forest
- Inclusions of seeps, vernal pools, wetlands

Management actions:

- Implement silvicultural strategies to meet goals of maintaining and enhancing natural community composition and condition.

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- Buffer small patch natural communities and other inclusions where management may lead to adverse impacts.
- Increase connectivity of old forest characteristics by implementing active old forest management along the buffers and in between passively managed Highly Sensitive Management areas.
- Focus management in areas with more history of human disturbance and manage in ways that enhance structural and age complexity of these stands.
- Implement silvicultural strategies including groups and patches to advance stands comprised of poor quality, post disturbance white pine toward natural community species composition.
- Maintain or encourage age diversity of oak species where present or where they can be recruited for forest structure, habitat, and climate adaptation.
- Create young forest with a target of 3-4% (142-189 acres in the 1–20-year age class).
- Implement pre-commercial vegetation management including forest stand improvement (FSI) and crop tree release in regenerating patches of white pine (3.0d) favoring mast and promoting species diversity.
- Coordinate with VAST to sustainably manage designated VAST trail.
- Maintain a sustainable forest management access network. implement water quality improvement and flood resilience projects and follow Acceptable Management Practices and ANR Riparian Management Guidelines to ensure continuing high level of protection of water quality and soils.
- Assess options to reduce unauthorized use of roads and trails.
- Monitor and manage invasive species, with focus on small areas of honeysuckle in Ames Hollow to keep them from spreading beyond the current infestation.
- Manage recreation to meet guidance of VFWD mission, funding, and conservation easement specifying dispersed fish and wildlife-based recreation. Maintain conditions for opportunities for remote dispersed recreation.
- Mitigate trail impact to Red Spruce-Cinnamon Fern Swamp in Ames Hollow including trail braiding, rutting, and sediment deposition by relocating section of main road/trail or adding additional appropriate drainage infrastructure and erosion control.

Long-term License (3.0f) - 2 acres. This area within Birdseye WMA is under a long-term license that allows for a life lease plus 20 years for intermittent use limited non-commercial purposes by the licensee. An annual fee is made to VFWD. This license was pre-existing at the time of state acquisition of the property. Once expired it will not be continued.

Management actions:

- Work with licensee to ensure that all terms of the agreement are followed.

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4) Intensive Management Areas

Intensive management areas are those where there are high levels of human activity and high intensity development on/or adjacent to state land.

Primary management considerations:

- Aesthetics and safety are primary management considerations.
- Sensitive resources that occur within these areas may require special attention.

There are no Intensive Management Areas within Castleton Management Unit.

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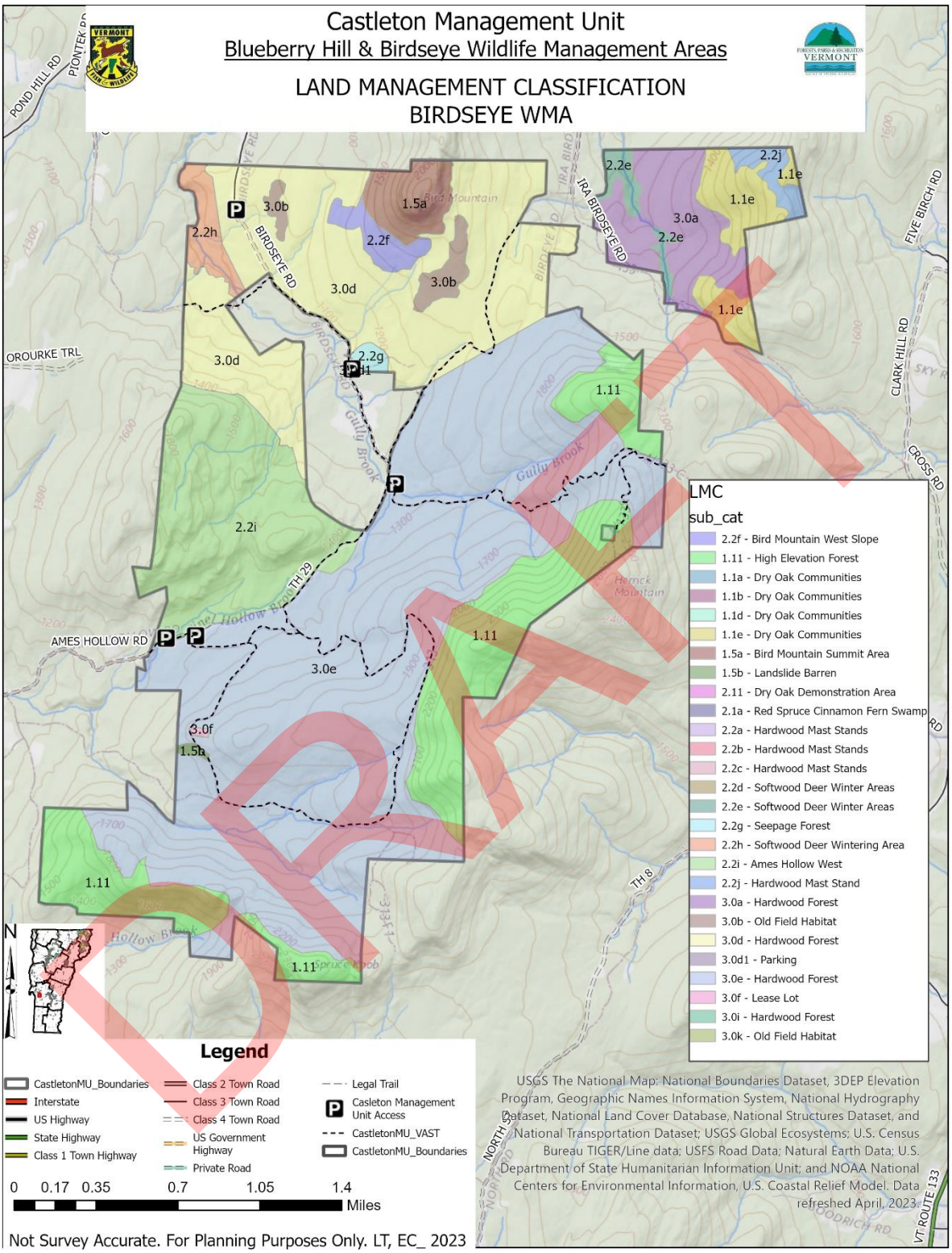
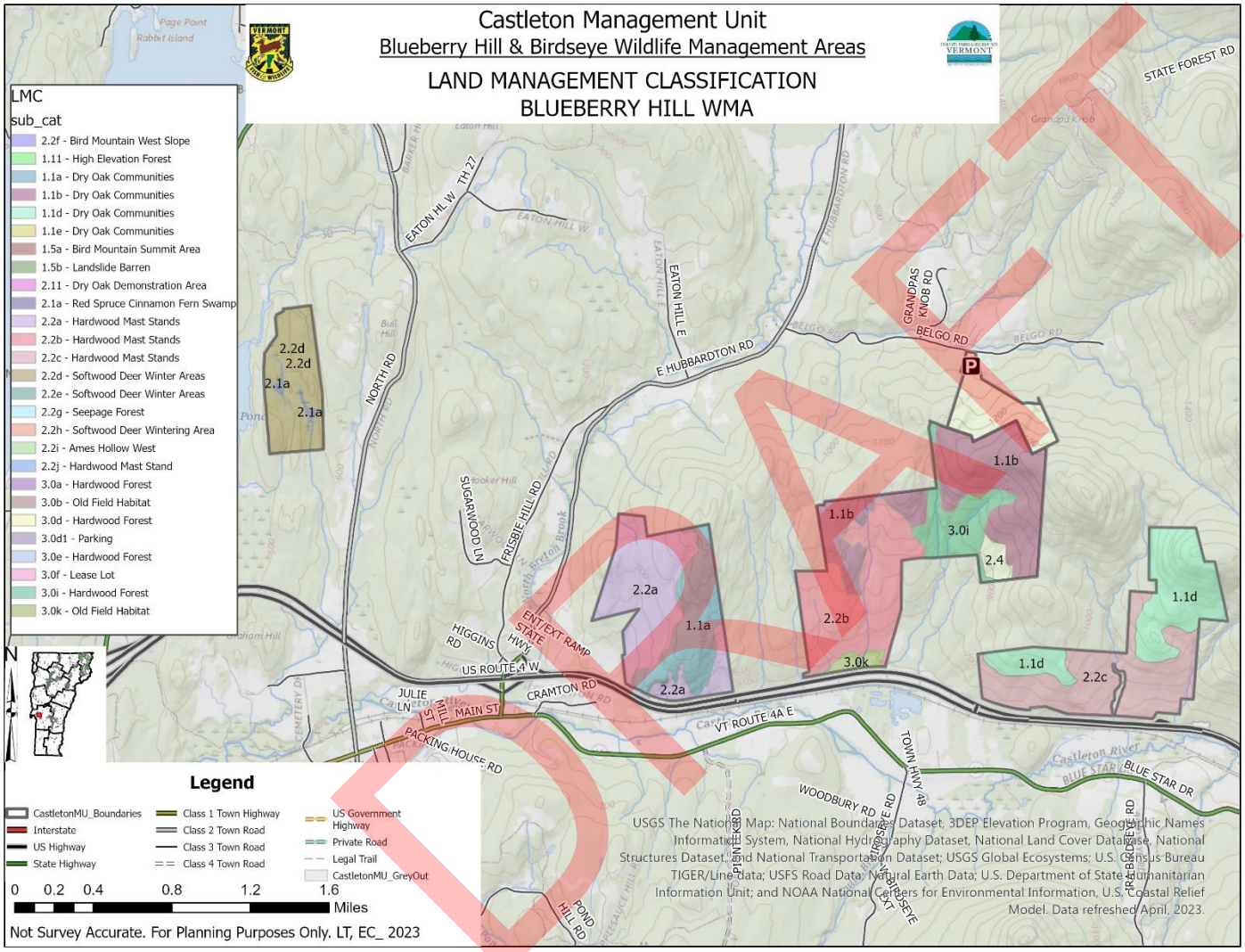
Map 18: Land Management Classification – Birdseye WMA



Map 19: Land Management Classification – Blueberry Hill WMA



D. Implementation Methods

Implementation of management actions identified in the section above is often carried out as opportunities arise and on an as-needed basis, or when particular financial or volunteer resources are available to ANR. The scheduling of these activities is flexible. Examples include forest management timber harvests, other active forest management, and road maintenance. On the following pages are maps and charts that describe proposed timber harvest analysis areas and other management activities for the coming 15-year period. The exact implementation schedule may need to be adjusted based on funding availability, extreme weather events, and other unforeseen factors.

The figures and tables below summarize timelines and locations of key management activities in this plan. This is just a subset of activities planned for the unit, as not all actions (e.g. routine maintenance activities) can be shown in this format. Table 24 provides an overview of the implementation actions and their scheduled years. Map 20 shows the distribution of forest management activities across Birdseye WMA over the planning period. Map 21 shows the distribution of management activities across Blueberry Hill WMA. Map 22 shows the distribution of active and passive old forest management across CMU. Table 25 shows the allocation of passive and active old forest management across CMU.

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Table 24: Implementation Schedule

Activity	Goal	Management	Parcel/ LMC	Target Year/ Schedule	Project Area (acres)
Parking Area Maintenance	Facilitate public use	Brushing, surfacing, signage, etc.	Both Parcels/ LMCs 2-3	As needed	-
Boundary Line Maintenance	Prevent encroachment	Repaint boundary lines	Both Parcels/ All LMCs	Every 15 years	-
Old Field Maintenance	Maintain and create early successional / young forest habitat	Prescribed burns, mastication, cutting, and/ or mowing	Birdseye WMA/ LMC 3.0b	Every 3 years	44
Landing Maintenance	Maintain for habitat and future forest management use.	Mowing	Both Parcels/ LMCs 2-3	As needed	-
Invasive species management	Maintain/ enhance native species composition to promote native ecosystems.	Treatment by chemical and mechanical methods.	Throughout	As needed	-
Apple Tree Management	Maintain Apple trees for wildlife habitat	Release Apples from competing vegetation and Pruning	Both Parcels/ LMCs 2-3	Throughout Management Cycle	-
Stand Improvement and Mast Tree Release	Wildlife habitat enhancement (food/ cover); improved diversification of species composition	Stand improvement (mostly mast tree release) with greatest focus on red spruce and red oak; potential wildlife openings for additional young forest by mastication, primarily in BEN Block (BE Block 1)	Both Parcels/ LMC 2.2a, 3.0d, 3.0e	Throughout Management Cycle	355

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Activity	Goal	Management	Parcel/ LMC	Target Year/ Schedule	Project Area (acres)
Harvest Analysis #1	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Birdseye WMA/ LMC 3.0e	2025	399
Harvest Analysis #2	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Birdseye WMA/ LMC 2.2i, 3.0e	2026	438
Harvest Analysis #3	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Birdseye WMA/ LMC 2.2h, 2.2i, 3.0d	2027	350
Harvest Analysis #4	Natural community restoration for increased biodiversity and resilience through young forest habitat creation. And Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	1st entry in even aged treatment of pasture/ plantation pine. Approximately ½ of stand area to be regenerated. Patch sizes to meet VCD guidance on young forest. And Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Birdseye WMA/ LMC 3.0a,3.0d	2028	233

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Activity	Goal	Management	Parcel/ LMC	Target Year/ Schedule	Project Area (acres)
Harvest Analysis #5	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Birdseye WMA/ LMC 3.0e, 3.0d	2029	215
Harvest Analysis #6	Natural community restoration for increased biodiversity and resilience through young forest habitat creation.	1st entry in even aged treatment of pasture/ plantation pine. Approximately ½ of stand area to be regenerated. Patch sizes to meet VCD guidance on young forest.	Birdseye WMA/ LMC 3.0d	2030	87
Harvest Analysis #7	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Blueberry Hill WMA/ LMC 2.2a	2031	151
Harvest Analysis #8	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Blueberry Hill WMA/ LMC 2.2b, 3.0i	2032	242

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Activity	Goal	Management	Parcel/ LMC	Target Year/ Schedule	Project Area (acres)
Harvest Analysis #9	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Blueberry Hill WMA/ LMC 2.2d	2033	105
Harvest Analysis #10	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Blueberry Hill WMA/ LMC 2.2c	2034	118
Harvest Analysis #11	Natural community restoration for increased biodiversity and resilience through young forest habitat creation.	2nd entry in even aged treatment of pasture/ plantation pine. Approximately ½ of stand area to be regenerated. Patch sizes to meet VCD guidance on young forest	Birdseye WMA/ LMC 3.0d	2040	112
Harvest Analysis #12	Natural community enhancement for maintaining/ increasing biodiversity (species, age, and structural complexity).	Multi-aged treatments. There may be opportunities, based on site conditions, to create young forest habitat.	Blueberry Hill WMA/ LMC 2.2d	2043	105

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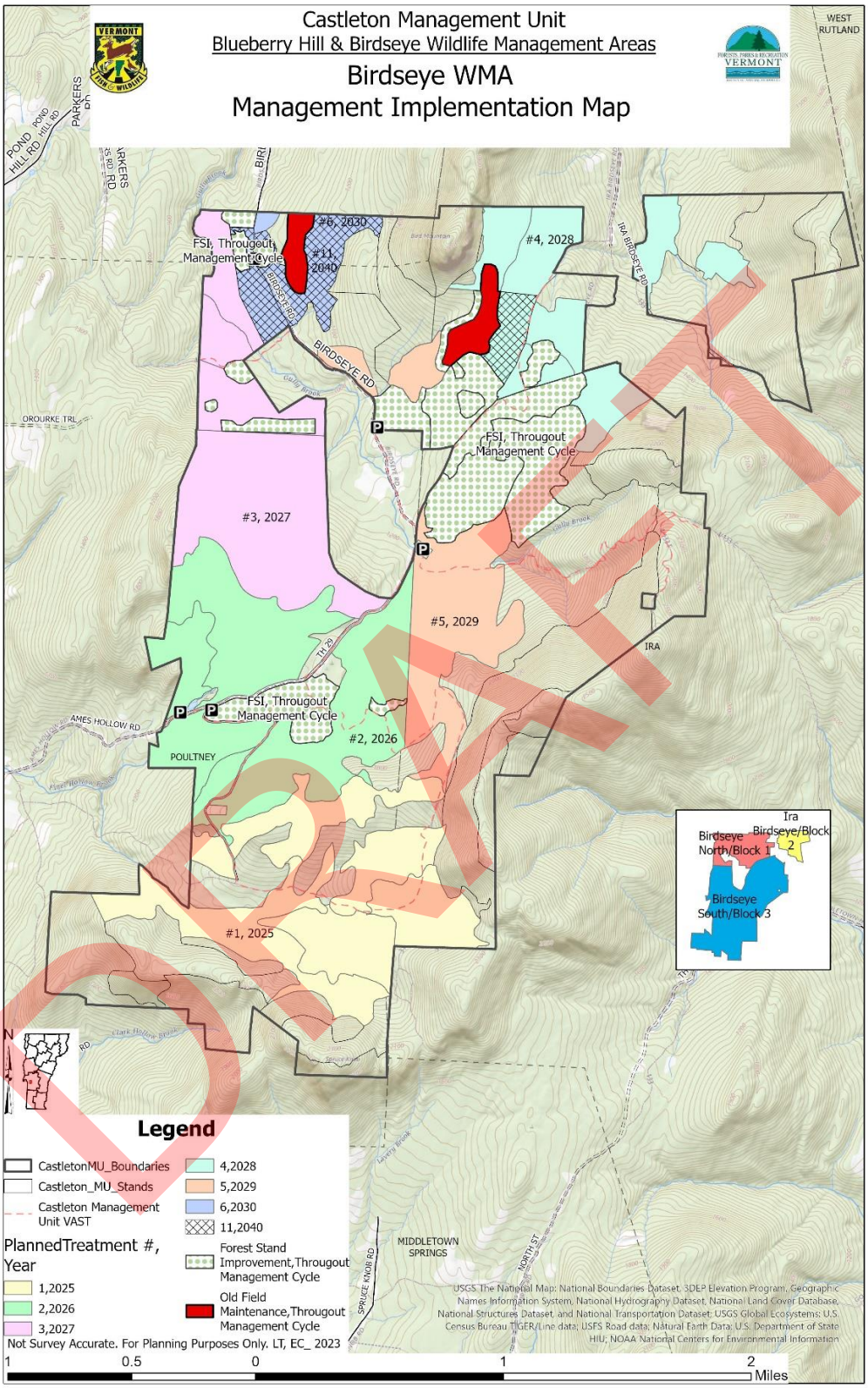
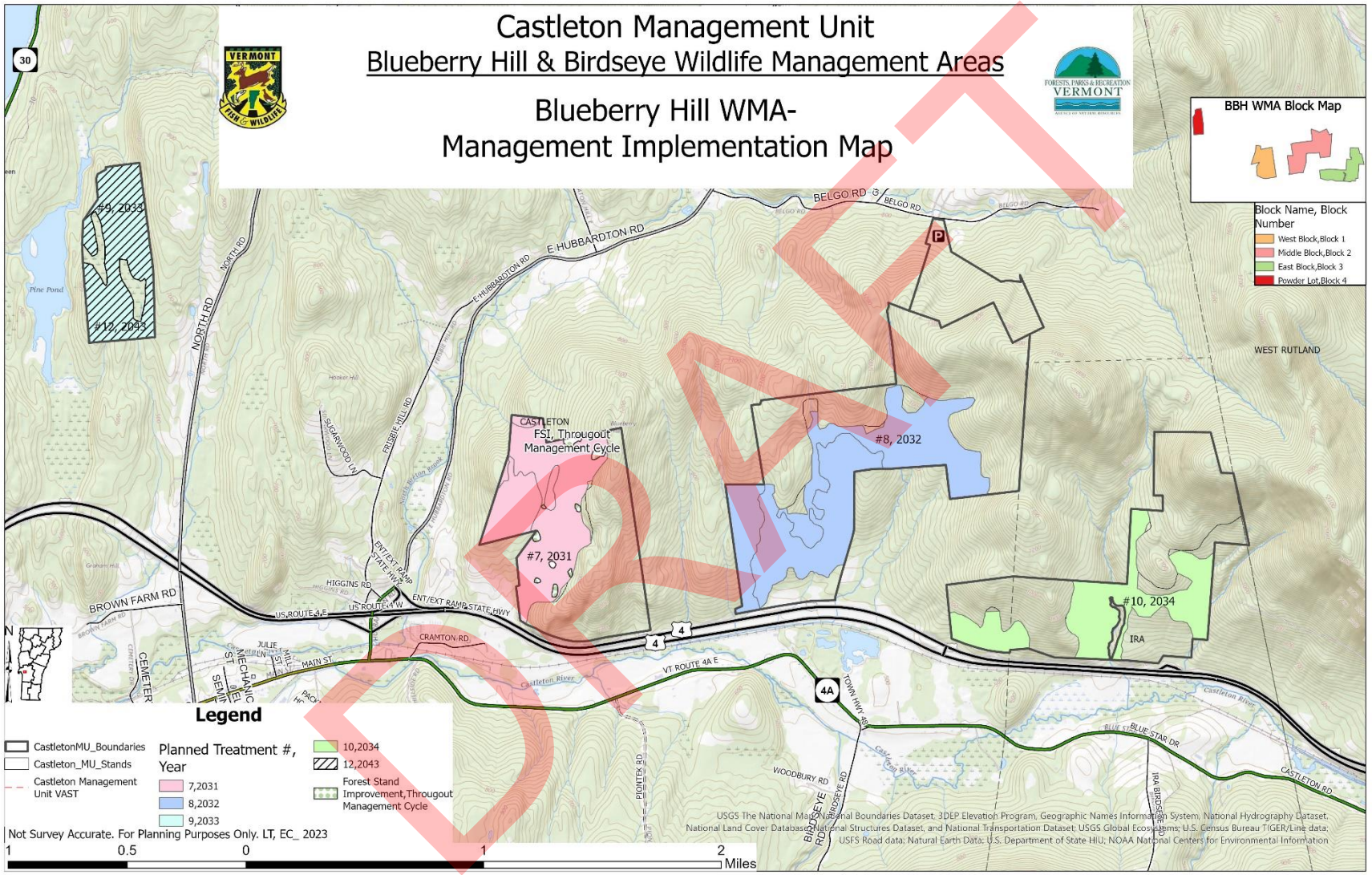
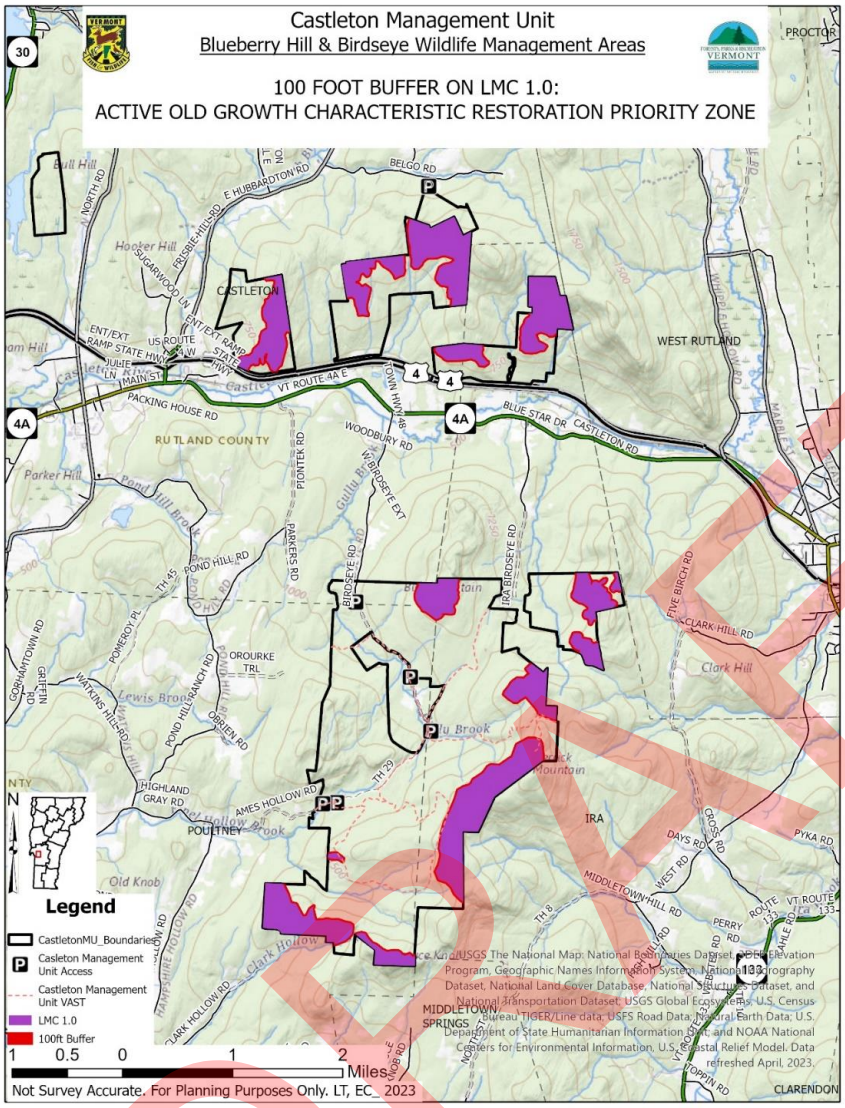
Map 20: Implementation Map- Birdseye WMA



Map 21: Implementation Map- Blueberry Hill WMA



Map 22: Implementation of Actively Managed Old Forest Buffers



Areas within LMC 1.0 (purple on map) will be left to develop old forest through natural processes. An approximate 100' adjacent buffer (red on map) will be actively managed to enhance old forest characteristics. Where management occurs outside those areas old forest characteristic enhancement will be implemented along the gradient in Figure 6.

Table 25: Passive and Active Old Forest Management across CMU

Location	% of CMU	Management
Land Management Class 1.0	24%	Passive old forest restoration
100' buffer or transition adjacent to LMC 1.0	4%	Active old forest restoration
Balance of CMU	72%	Where management occurs, active old forest characteristic restoration along the gradient (Figure 6)

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V. MONITORING AND EVALUATION

During the life of the LRMP for Castleton Management Unit, periodic monitoring and evaluation will be conducted to ensure that the resources are protected from fire, insects, and disease, encroachments, or unforeseen problems that may occur within the CMU. Management activities will be evaluated to determine how closely the results matched those projected within the plan. Minor adjustments in management may be made to reflect changed conditions or unanticipated results.

As long-term management for Castleton Management Unit continues, inventory, monitoring, assessment, and research are necessary to: evaluate the status of the resource; assess progress toward achieving stated goals; and determine the effectiveness of management actions and activities.

- Were proposed strategies and actions carried out?
- Did the strategies and actions have the intended effect?
- Were the results consistent with expectations and predictive models?
- Do we have the necessary information to understand and evaluate actions taken on CMU?

Obtaining quality information is critical to making informed decisions and conducting sound, thoughtful management actions. Research projects on CMU are directed by the District Stewardship Team to ensure that they do not conflict with the goals and objectives for CMU as set forth in the LRMP. It is important that individual research projects be assessed for their effects on the resource, potential conflicts with other uses or users, and consist of quality proposals from credible institutions and individuals. All data from private research will be shared with the Agency of Natural Resources.

Ecological/Wildlife

Maintaining the biological diversity of CMU requires long-term research and monitoring projects in a number of areas. Some of the efforts at meeting these goals include:

Strategies and Actions:

- Continue ongoing inventory and assessment projects promoting the collection and documentation of quality long-term information critical to the assessment and evaluation of management on CMU (including forest inventory, aerial insect and disease surveys, amphibian, and reptile surveys).
- Monitor rare, threatened, and endangered species and natural communities.
- Consider and support appropriate, credible research project proposals which further understanding of ecological elements and wildlife habitat on CMU and the impacts of management activities.

Timber and Wildlife Habitat

Timber management and harvest is an important tool used to achieve wildlife habitat and forest management objectives. An effective monitoring and assessment program is essential for ensuring the long-term sustainability of a quality timber management program. Careful analysis

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of the forest, its resource capabilities, potential impacts on other important management goals, protection of rare and/or threatened endangered species, water quality, management, or protection of rare and/or state significant natural communities, and the documentation of the occurrence of natural processes (i.e., insect and disease outbreaks, blowdown events) is important in the execution and understanding of the effects of timber management actions.

Timber harvests and wildlife management activities completed within the CMU will be periodically reviewed by the stewardship forester and the District Stewardship Team to determine how well management objectives are being met. If monitoring results indicate that there is a significant difference between the outcomes predicted by the plan and actual conditions, changes to the plan may be recommended.

Strategies and Actions:

- Continue to support ongoing assessment and mapping efforts (e.g., forest inventory, aerial insect, and disease surveys).
- Conduct periodic, standardized post-practice assessments to assess effectiveness of management activities.
- Support proposals for appropriate research addressing long-term evaluation of forest management activities. Gather baseline data as necessary and practical to support assessment of management effectiveness and impacts.

Recreation

Public recreation will be periodically monitored across the property by the District Stewardship Team to identify where recreational uses are in conflict with or may be damaging natural resources and to ensure that recreational uses remain consistent with the goals set forth in the long-range management plan. Changes in recreational uses may be implemented including new management strategies designed to minimize or eliminate conflicts. State game wardens will be utilized to assist with maintaining compliance with state laws where specific and/or ongoing problems are occurring.

Strategies and Actions:

- Document illegal use and damage of resources.
- Support appropriate research projects including the collection of baseline data to expand knowledge of recreational carrying capacity, resource impacts, and user conflicts.

Infrastructure

Infrastructure monitoring has been an ongoing process and largely informal. Advances in field data collection methods and data management should make this easier and more effective. There are many miles of roads, and numerous stream crossings (i.e., culverts and bridges) in variable conditions that need to be documented to effectively maintain, repair, and replace infrastructure to ensure adequate access by users and improve water quality. Proper documentation of infrastructure and its condition can help ANR make a stronger case for increased funding to address legacy issues.

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Strategies and Actions:

- Working with other districts and ANR IT, standardize data collection and long-term data storage in relation to roads, gates, culverts, bridges, etc.

Historic

There are both historic and suspected pre-contact resources within the CMU. Current understanding and documentation of these resources varies by site. Detailed documentation and study of field evidence is an important component to the understanding, protection, and interpretation of the individual sites and the greater historic context of CMU and surrounding areas.

Strategies and Actions:

- Continue to inventory, map, and document historic features.
- Monitor and document condition of known historic features using standardized forms and photo documentation.
- Support efforts to research the history of CMU.

Invasive Exotic Species

Invasive exotic species are known to be a problem in many areas of the state negatively impacting wildlife habitat, timber management, natural community composition, recreation, and economics. The District Stewardship Team will monitor the CMU for the presence of invasive exotic species and work to identify populations of invasive exotic species and implement control measures where feasible.

Strategies and Actions:

- Identify invasive species when populations are small. Develop control goals and implement.
- Assess and document levels of introduction of invasive exotic plants by species and location.
- Monitor timber harvest areas before and after timber sale activities. Control invasive species as necessary and practical.
- Evaluate invasive species control projects for effectiveness.

Climate Change

If the most conservative current models of climate change are accurate (Iverson, Prasad, Hale, & Sutherland), CMU, like the rest of the region, will experience strong impacts over the next 50-100 years. These changes may have important consequences for forest nutrient cycling, timber productivity, forest pest ecology, wildlife habitat, and our enjoyment of the forest.

Strategies and Actions:

- Monitor ground conditions, results of management, research, and adaptations of silvicultural guides to inform management decisions and adapt treatment prescriptions as appropriate.
- Support appropriate research project proposals which further understanding of climate change on CMU.

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VI. NEW USES AND PLAN AMENDMENT PROCESS

The long-range management plan provides guidance for the long-term management and development of a parcel of state land. However, the future cannot be fully determined at the time of plan development. The departments of Fish & Wildlife and Forests, Parks and Recreation undertake an amendment or plan update process when significant changes to the current long range management plan are proposed. These may include:

1) Substantial changes to any goals, management objectives, and implementation actions contained in the current plan;

2) Major change in land use, land classification, or species management direction;

3) Designation of non-developed camping sites (via statute regarding camping on state lands);

4) Permanent closure of existing trails and/or permanent creation of new recreation corridors not identified in the current plan;

5) Major rerouting, reclassification, permanent closing or creation of new roads (not including forest management access roads not meant for normal vehicle traffic) within state land boundaries not identified in current plan;

6) Major land acquisitions added to the existing parcel;

7) Major capital expenditures for new projects;

8) Facility closures;

9) Transfers in fee ownership;

10) Leasing of new acreage (e.g., ski resort); and

11) Renaming of natural features (prior to recommendation to Department of Libraries) or lands.

When the amendment process is triggered, a public involvement process begins. The type of process is determined at the time and is dependent upon the extent and type of amendment. If applicable, the easement holders are notified to discuss the proposed amendment.

There may be times when the public input and comments are sought regarding plan changes that are less significant than those triggering the plan amendment process. This is left to the discretion of the District Stewardship Team.

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VII. FUTURE ACQUISITION/DISPOSITION

Through its October 1999 *Vermont Agency of Natural Resources Lands Conservation Plan,* the Agency outlined priorities for acquiring new lands as well as for acquiring additions to existing ANR lands. It is the State's policy to acquire additions to ANR state lands parcels that are:

1) necessary for maintaining or enhancing the integrity of existing state holdings;

2) lands, such as inholdings and other parcels that serve to consolidate or connect existing state holdings and contain important public values and/or facilitate more efficient ANR land management;

3) parcels that enhance or facilitate public access to ANR lands; and

4) parcels that serve an identified facility, infrastructure, or program need.

All new acquisitions of land to CMU will be guided by this plan and must have a willing seller, as the Agency does not have the authority to exercise eminent domain. They will also be done in consultation with the regional planning commissions and the town(s) in which the parcel is located.

Any future disposition of land from CMU will be approved by the Agency of Natural Resources Land Acquisition Review Committee (LARC) and the Secretary of the ANR after consultation with the regional planning commission and the town(s) in which the parcel is located.

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VIII. APPENDICES

- APPENDIX 1: Natural Community Assessment
- APPENDIX 2: Characteristics of Old Forests
- APPENDIX 3: Forest Inventory Data and Stand Map(s)
- APPENDIX 4: Public Comment Summary
- APPENDIX 5: Works Cited
- APPENDIX 6: App. § 15 Rule Governing Public Use of Vermont Fish & Wildlife Department Lands *(optional – for WMAs only)*
- APPENDIX 7: Glossary
- APPENDIX 8: FPR Policy #21: State Lands Management Planning
- APPENDIX 9: ANR Policy on Public Involvement in ANR Lands Management

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APPENDIX 1: Natural Community Assessment

Ecological Assessment of Birdseye WMA

Draft: January 11, 2021

This ecological assessment of Birdseye WMA (BWMA) applies a "coarse filter/ fine filter" approach to inventory and assessment. A detailed description of this approach and of inventory and assessment methods is available upon request from the Vermont Department of Fish and Wildlife. This assessment is primarily based on fieldwork conducted between 2011-2017 by multiple staff from the Vermont Fish and Wildlife Department.

Coarse Filter Assessment

Biophysical Region and Climate

Birdseye WMA is located in the Taconic Mountains biophysical region. In Vermont, this region includes the northern end of the Taconic Mountains geological formation, which extends south into New York, western Massachusetts, and Connecticut. Despite a shared geological history, sites in the Taconic region are quite variable, and extremes in elevation, precipitation, and vegetation are found across the region. Aspect and elevation are particularly influential on climate and vegetation, and this is evident even within the relatively small area of the WMA. Elevations at BWMA range from 740 feet along Gully Brook at the northwest corner to 2,620 feet, along the east boundary just short of the summit of Herrick Mountain.

Bedrock, Surficial Geology and Soils

The bedrock of BWMA is metasedimentary rock dating to the Neoproterozoic era and Lower Cambrian period, roughly 1 billion to 500 million years ago. The WMA is primarily underlain by Bull Formation phyllites that contain local beds and pockets of limestone or dolostone; Biddie Knob Formation slate and quartzite and Bull Formation wacke and siltstone also underlie large swaths of the WMA. Within this matrix are localized areas of Bird Mountain Grit conglomerate and wacke and Bull Formation quartzite and conglomerate. For the most part, these rocks do not result in substantial nutrient enrichment in the soils and growing conditions, however, there are exceptions. Where limestone and slate are at the surface, there is increased evidence of nutrient enrichment. This enrichment can affect the distribution of some natural communities. Temperate Calcareous Cliffs, enriched Transition Hardwood Talus Woodlands, semi-rich and Rich Northern Hardwood Forests, and possibly Dry Oak-Hickory-Hophornbeam Forest on ridgetops, are driven by these enriched bedrock conditions, though some enriched sites may be driven primarily by colluvial enrichment processes.

The degree to which these bedrock types affect growing conditions in BWMA is mediated by the depth of the surficial materials deposited at the end of the last continental glaciation, some 15,000-12,000 years ago. As the glacier ice melted, rock fragments of all sizes, from boulders to clay, fell in an unsorted jumble known as glacial till. Almost the entire WMA features a layer of this till over the bedrock, although in places it can be just a few inches deep. Post-glacial accumulations of sediments are uncommon in BWMA and are limited to small areas of riparian sediment deposition; additionally, post-glacial accumulations of peat and muck can be found in the scattered wetlands.

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The soils of BWMA are primarily products of these surficial deposits. NRCS soil mapping indicates that till-derived soils are the most widely distributed. The Taconic, Macomber, and Hubbardton complexes are prevalent on slopes and ridges; these can be quite shallow, especially on the ridges and summits, mildy to extremely steep, and are typically described as rocky or very rocky. Bomoseen and Pittstown soils are prevalent mainly in lower slope positions in association with some of the larger valleys; these are often also described as very stony. The only wetland soil mapped by the NRCS is one small pocket of Lyons silt loam in Ames Hollow in an area with deep peat soils. However, there are numerous other small inclusions of wetland soils present in the WMA. More detailed soil descriptions can be found in the natural community summaries below.

Hydrology/Streams/Rivers/Ponds

BWMA receives around 41-46" of precipitation annually, which is intermediate for the state. In contrast, some portions of the Champlain Valley receive just 30" of precipitation annually, while to the east Killington and other high peaks of the Southern Green Mountains can receive more than 70" of precipitation annually. The entire WMA is within the Poultney River watershed; the northern parts of the WMA drain via Gully Brook and another unnamed tributary to the Castleton River, and thence to the lower Poultney River, while the southern parts drain via Finel Hollow Brook and Clark Hollow Brook directly to the upper Poultney River. The generally steep, dry landscape contains limited surface water; the streams are small and many go dry or nearly so by late summer. There are scattered small areas of groundwater seepage. A few vernal pools and several small, forested swamps are present, and may be important seasonal sources of water for a wide variety of wildlife species. A small beaver pond in Ames Hollow offers a more permanent water source.

Natural Disturbance

Natural disturbance processes, such as wind, fire, and flooding, continually shape landscapes and define their natural communities. In general, Vermont's forests are characterized by frequent small-scale disturbances, such as individual tree death and the resulting canopy gap dynamics. At larger scales, blowdown, ice damage, and insect outbreaks are normal disturbances, but these would be expected to occur infrequently.

The warm and dry landscape of BWMA may support naturally-occurring forest fires, particularly on the south-facing slopes and ridges. The natural communities on some of those slopes likely developed with fire as an important ecological factor. Broadly speaking, a frequent fire regime would favor certain fire-adapted species, such as chestnut oak (*Quercus montana*) and red pine (*Pinus resinosa*) over others; these two species are abundant on the upper slopes in the northeastern parcel of the WMA. Additionally, at other New England sites, fire is known to be important in preserving habitat for many rare and uncommon plants and animals, especially rare butterfly and moth species (Wagner et al., 2003). Because of forest fire suppression for most of the 20th century, reintroducing fire as a natural disturbance—either by using prescribed burns or allowing natural fires to burn—is sometimes a key objective for managing some dry oak and pine natural communities (e.g. Engstrom 1993; Engstrom and Mann 1991). Most Red Pine Forests in Vermont are thought to require periodic fire with a 20-100 year return interval for long term persistence of their characteristic red pine canopy composition and structure, which would be replaced by more shade tolerant species over time in the absence of fire. Natural fires may occur at BWMA, but, if they do not, it may become desirable, though challenging, to use prescribed fire or other management intended to mimic the results of wild fire to maintain this rare natural community type. While the close

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proximity of some patches of Dry Oak Forest and Dry Red Oak-White Pine Forest to Red Pine Forest at BWMA strongly suggests a role for fire, the specific role of fire in maintaining these dry oak types, and Dry Oak-Hickory-Hophornbeam Forest natural communities in Vermont is still not well understood. Thus, at present these sites are poor candidates for applying prescribed fire as an ecological management strategy unless as part of a systematic investigation of the topic. In addition to the dry oak and pine communities, some patches of Red Spruce-Heath Rocky Ridge Forest may have a fire history at BWMA. No direct evidence of this was found (i.e. no fire scars or soil charcoal); however, many of these areas have thin, dry soils on south-facing slopes and currently are cloaked in dense, small diameter red spruce, indicating some form of stand replacing disturbance occurred within the past 100 years. Without further research, it is unclear if fire is responsible for the current composition and structure of these forests, but it is possible. The role of fire in maintaining this natural community type in Vermont is not well understood, and, thus, at present these sites are also poor candidates for applying prescribed fire as an ecological management strategy.

Several areas at BWMA also show evidence of relatively recent landslide disturbance that has strong, if highly localized, effects on site conditions. All cliff and talus complexes indicate a history of rockfall disturbances, but the large north-facing cliff at BWMA is particularly unstable, shedding a nearly continuous stream of small debris and showing strong evidence of a geologically recent major collapse. This was noted on the ground as an abrupt topographic edge to the debris plume, complete with relict trees tilted at erratic angles or evidently pushed over by the landslide. This debris plume is clearly visible in LIDaR data and is mapped as both Open Talus and Northern Hardwood Talus Woodland. Elsewhere, south of Ames Hollow, there is an unusual landslide scar, evident as an open area of steep, gravel, and cobble strewn slopes, with jumbled debris flow topography below, now cloaked in young forest. This slide appears to have occurred before 1942 based on old aerial photos, and its mark on the landscape persists, creating a unique habitat setting that has been colonized by several rare plant species. At BWMA the steep slopes with thin soil veneers over bedrock may be especially prone to future landslide disturbances.

Human Disturbance

Human uses of the land can also greatly influence the present-day distribution of natural communities. Few areas of the Vermont landscape have escaped the effects of agriculture and timber harvesting, and BWMA is no exception. East of the beaver pond in Ames Hollow, patches of white pine, old apple trees and hawthorns indicate a history of clearing, probably for pasture; this clearing is readily apparent in 1942 aerial imagery which shows the Ames Hollow valley bottom and lower slopes as entirely cleared. Clearing is also evident at that time on the broad slopes south of Bird Mountain, surrounding the present-day clearings. An old cellar hole with large, open-grown trees was noted near the stream in the northeast parcel and probably had larger clearings around it. Beyond these areas, however, the remainder of the WMA appears to have been forested as of 1942 and may never have been cleared. Some oak forests may have a history of grazing by cattle or sheep, and often grazing can have a lasting effect of simplifying forest structure by removing sapling and shrub layers. Past grazing may also have increased soil erosion and caused some of the exposed rock outcrops found on the WMA. Many of the steeper slopes and more remote areas appear to have avoided clearing, but most show at least some evidence of past timber harvesting, including old stumps and logging trails cut into the slopes. The lower, more accessible slopes show more recent evidence of logging, including a large regenerating clear-cut (cut about 2011), stands of pole-timber, and extensive areas of selective harvesting. All of these, however, are past disturbances.

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Except for the relatively recent timber harvesting and some road maintenance activities, present human disturbance is minimal and largely confined to the network of trails used by VASA and communications tower servicers. Additionally, there are several open areas on the lower slopes around Bird Mountain, which receive periodic treatments to maintain early successional conditions.

Natural Communities

A natural community is an assemblage of biological organisms, their physical environment (e.g., geology, hydrology, climate, natural disturbance regime, etc.), and the interactions between them (Thompson and Sorenson 2005). The 97 natural community types currently described in Vermont repeat across the landscape in patches (or "polygons") of various sizes. These patches (or groups of patches in close proximity to each other) are referred to as natural community occurrences, and are to be distinguished from broad descriptions of community types.

Natural communities at BWMA were identified through aerial photograph interpretation and field surveys. Because some natural communities occur at very small scales (e.g., less than ¼ acre), this mapping effort is probably incomplete. Natural community mapping is an iterative process, and our knowledge improves with each mapping effort. Thus, the map presented here should not be viewed as a final statement on community distribution; instead, it should be treated as a first attempt at describing natural communities in this area. Land managers and members of the public should be aware that additional examples of small patch natural communities (e.g., vernal pools and seeps) probably occur on the management unit. As subsequent inventories and site visits are conducted, this map will be improved.

During this effort 114 occurrences of 24 natural community types and 3 additional landcover types were identified and mapped within Birdseye WMA. A total of 251 polygons were mapped.

Some broad patterns emerged from this mapping effort. The landscape of Birdseye WMA shows striking contrasts based largely on the aspect of its slopes. South and west facing slopes are especially warm and dry and are characterized in large part by natural communities and plant species near the northern edges of their distributions. Northern Red Oak (*Quercus rubra*) is abundant or dominant in most of these forests, and Chestnut Oak (*Quercus montana*) and Shagbark Hickory (*Carya ovata*) make sporadic appearances, creating a habitat matrix that is unusual for Vermont. Dry Oak Forest, Dry Red Oak-White Pine Forest, Dry Oak-Hickory-Hophornbeam Forest, and Red Pine Forest are found on these slopes embedded in a matrix of Mesic Red Oak-Northern Hardwood Forest. By contrast, north-facing slopes are relatively cool and moist, supporting the typical matrix of Northern Hardwood Forest. Although the higher ridgetops are only about 2,000 to 2,600 feet in elevation, they support distinctive Red Spruce-Heath Rocky Ridge Forests and the sugar maple variant of Montane Yellow Birch-Red Spruce Forest, which are strongly shaped by the heightened exposure of these ridgetop settings. Much of the WMA is on very steep and rocky ground with small cliff and talus patches found throughout the area, in addition to the larger cliffs on Bird Mountain and the north end of Herrick Mountain. Wetlands are notably sparse – on a total of over 3,600 acres, just 41 acres (1.1%) are mapped as wetlands. These wetlands are important features that contribute disproportionately to habitat and species diversity on the WMA.

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Natural Communities of Birdseye WMA				
Natural Community		Acres	Vermont Distribution	Example of Statewide Significance?
Wetlands	Red Spruce-Cinnamon Fern Swamp	7	Uncommon	Yes
	Seepage Forest	15	Uncommon	
	Seep	12	Common	Yes
	Vernal Pool	<1	Uncommon	Maybe
	Wetlands Total	**34**		
Uplands	Dry Oak Forest	93	Uncommon	Yes
	Dry Oak-Hickory-Hophornbeam Forest	67	Uncommon	Yes
	Dry Red Oak-White Pine Forest	71	Uncommon	Yes
	Erosional River Bluff	<1	Rare	
	Hemlock Forest	54	Common	Yes
	Hemlock-Northern Hardwood Forest	18	Very Common	
	Mesic Maple-Ash-Hickory-Oak Forest	164	Uncommon	
	Mesic Red Oak-Northern Hardwood Forest	1,234	Common	Yes
	Montane Yellow Birch-Red Spruce Forest	34	Uncommon	Yes
	Northern Hardwood Forest	1,573	Very Common	Yes
	Northern Hardwood Talus Woodland	33	Uncommon	Yes
	Open Talus	3	Rare	Yes
	Red Pine Forest	3	Rare	Yes
	Red Spruce-Heath Rocky Ridge Forest	110	Uncommon	Yes
	Red Spruce-Northern Hardwood Forest	27	Very Common	
	Rich Northern Hardwood Forest	66	Common	Yes
	Temperate Acidic Cliff	4	Common	Yes
	Temperate Calcareous Cliff	6	Uncommon	Yes
	Temperate Hemlock-Hardwood Forest	1	Uncommon	Yes
	Transition Hardwood Talus Woodland	8	Uncommon	Yes
	Uplands Total	**3,571**		
Other*	Landslide Barren (variant of Open Talus)	1	Rare	Yes
	Open Land	33		
	Beaver Wetland	7		

*These land cover type descriptions are not currently recognized natural community types.
For more information on these and other natural communities, see Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont, by Elizabeth Thompson and Eric Sorenson.
Information may also be found online at:
http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=109813#

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Natural Community Descriptions

Wetlands:

Red Spruce-Cinnamon Fern Swamp

Five Red Spruce-Cinnamon Fern Swamps spanning 7 acres and constituting 4 occurrences are present at BWMA. Except for the beaver wetland complex in Ames Hollow, these are the largest wetlands in the WMA, though each is just 1-2 acres in size. These swamps form in small perched or headwater basins that have moderate to no groundwater seepage influence. This results in relatively acidic conditions that promote formation of deep peat deposits and relatively acidic flora. Three of these swamps occur in the valley bottom of Ames Hollow and are drained by small outlet seepages or channels, these swamps show slightly more mineral enrichment in places, making them somewhat transitional to Hemlock-Balsam Fir-Black Ash Seepage Swamps. The other two swamps are in perched basins, one above Ames Hollow and the other high (~2180ft) in a saddle on the ridgeline of Herrick Mountain. All but the swamp north of Ames Hollow are state-significant.

All of these swamps have relatively open canopies ranging from 25-75% cover, often with more of the cover occurring in the subcanopy layer, which may be an indicator of past disturbance, natural or otherwise. Red spruce (*Picea rubens*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*) are prevalent in the canopy, often with a small component of emergent white pine (*Pinus strobus*), and sometimes with scattered small American elm (*Ulmus americana*) and a few black ash (*Fraxinus nigra*). American mountain ash (*Sorbus americana*) and striped maple (*Acer pensylvanicum*) can be present in the shrub layer, but it is dominated by winterberry (*Ilex verticillata*), which occurs in dense patches. Low heath shrubs including low sweet blueberry (*Vaccinium angustifolium*), velvet-leaved blueberry (*Vaccinium myrtilloides*), and even black huckleberry (*Gaylussacia baccata*) can be present, especially on the taller hummocks around large white pines. The herb layer is dense (75-95%) often dominated by cinnamon fern (*Osmundastrum cinnamomeum*), with abundant dwarf raspberry (*Rubus pubescens*), common jewelweed (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), foam flower (*Tiarella cordifolia*), fowl manna grass (*Glyceria striata*), brome-like sedge (*Carex bromoides*), and two-seeded sedge (*Carex disperma*). Other less abundant herbs include crested woodfern (*Dryopteris cristata*), turtlehead (*Chelone glabra*), northeastern manna grass (*Glyceria melicaria*), blue skullcap (*Scutellaria lateriflora*), stout wood reed (*Cinna arundinacea*), red-stemmed aster (*Symphyotrichum puniceum*), bristle-stalked sedge (*Carex leptalea*), common Joe Pye weed (*Eutrochium maculatum*), and many others. Boreal herbs such as starflower (*Lysimachia borealis*), bluebead lily (*Clintonia borealis*), goldthread (*Coptis trifolia*), and wood-sorrel (*Oxalis montana*) occur on the hummocks. Bryophyte cover is extensive (95%) including a mixture of *Sphagnum* species and many other types. The soils are peat, typically at least 2.5 feet thick, but often over 4 feet deep.

These swamps may offer early spring herbaceous growth that can be an important food resource for bears and other grazing species. Some swamps may have temporary pools that provide amphibian breeding habitat similar in function to a vernal pool – this is particularly true of the swamp perched north of Ames Hollow (Poly_ID 18), which is very open, shrubby, and transitional to a Basin Shrub Swamp.

Unfortunately, the main trail through Ames Hollow runs directly past and between the two parts of one swamp occurrence with no culvert or other crossing structure to facilitate the seepage that connects the two sections. This has resulted in extensive rutting and trail braiding in the edge of the lower swamp (Poly_ID 29) as vehicular users of this trail attempt to cross the area. Improved drainage structures and

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trail work may help mitigate the impacts to this swamp. Isolated occurrences of a few invasive shrubs also appeared in two of these swamps, with a single glossy buckthorn (*Frangula alnus*) in one (Poly_ID 67), and a multiflora rose (*Rosa multiflora*) in another (Poly_ID 97). The swamps in Ames Hollow may also have had historical impacts associated with the agriculture, since the surrounding valley bottom areas appear cleared in 1942 aerial imagery.

Seepage Forest

Six areas of Seepage Forest are mapped at BWMA encompassing about 15 acres. None of these are state-significant and all appear to be in recovery from some degree of past agricultural and logging disturbance. The largest polygon along Birdseye Road (Poly_ID 229), was not fully inventoried - it is recommended that this area be revisited and evaluated for its significance prior to any management activities in the patch. Some of this area has been managed for early successional habitat. Other nearby polygons display somewhat open canopies (75%) with a mixture of red maple (*Acer rubrum*), quaking aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), basswood (*Tilia americana*), yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*), and red spruce (*Picea rubens*). Hop-hornbeam (*Ostrya virginiana*), ironwood (*Carpinus caroliniana*), nannyberry (*Viburnum lentago*), and meadowsweet (*Spiraea alba*) are present in the shrub and subcanopy layers along with occasional hawthorns (*Crataegus spp.*). The relatively lush (90%) herb layer includes interrupted fern (*Osmunda claytoniana*), sensitive fern (*Onoclea sensibilis*), dwarf raspberry (*Rubus pubescens*), tall meadow-rue (*Thalictrum pubescens*), large goldenrod (*Solidago gigantea*), rough-leaved goldenrod (*Solidago rugosa*), and fowl manna grass (*Glyceria striata*). In an isolated higher elevation polygon, the open canopy of poorly formed sugar maple (*Acer saccharum*) and white ash (*Fraxinus americana*) shows extensive top breakage, along with thinning from past harvests. The herb layer includes a patch of the uncommon spreading sedge (*Carex laxiculmis*). The mineral soils in these occurrences are moist, mottled, silty, and generally have fewer rocks.

Wildlife that use Seeps may also use Seepage Forests, which are in many ways simply a mosaic of seeps and upland forest at a fine scale. Woodcock may find the moist mineral soil and open canopy of these areas suitable for feeding.

Seep

Though small, Seeps are important features in the otherwise quite dry landscape of BWMA. Seventy-three polygons constituting 49 occurrences, for a combined total of about 12 acres, were mapped. Of these, nine occurrences are state-significant, encompassing the larger Seeps and Seep complexes with little disturbance. Several of the state-significant Seeps north of Ames Hollow offer lush, enriched versions of this community and include calciphilic species, such as silvery glade fern (*Deparia acrostichoides*), wood nettle (*Laportea canadensis*), Goldie's fern (*Dryopteris goldiana*), and the uncommon glade fern (*Homalosorus pycnocarpos*), in addition to more typical Seep species such as sensitive fern (*Onoclea sensibilis*), water carpet (*Chrysosplenium americanum*), rough sedge (*Carex scabrata*), ostrich fern (*Matteuccia struthiopteris*), cinnamon fern (*Osmundastrum cinnamomeum*), common jewelweed (*Impatiens capensis*), and others. The Seeps typically have saturated, shallow, organic muck soils, though a few that appear to receive substantial surface runoff have organic-rich silty mineral soil, often studded with many rocks. Unfortunately, a substantial number of small Seeps have been impacted by past logging activities, either through rutting or clearcutting; many of these still retain wetland vegetation, but the species composition is altered by increased light availability and hydrologic disturbance. Some may recover with returning forest canopy, while recovery is less certain for those

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subjected to heavy rutting. Numerous areas mapped as Seeps are a result of previous mapping efforts by Arrowwood Environmental; these were all incorporated here, though many have not been field verified by VFWD staff. One larger Seep (Poly_ID 198) may provide Vernal Pool function and should be revisited along with the mapped Vernal Pools to better assessment its function and community type.

Seeps can be an important source of early-spring browse for deer and bear; however, in the south-facing, dry and warm landscape of the WMA, there may be other sources of food available. Some species of insects and amphibians may concentrate around seeps (as well as other wet areas) in dry landscapes. In general, seeps with natural canopy cover and hydrology will provide functional habitat and water for a wide variety of wildlife species.

Vernal Pool

Vernal pools form in small basins that are often dry, but fill with water in the spring (and occasionally in other seasons) due to heavy rain and snowmelt. Because they lack fish, these pools are excellent amphibian breeding habitat. Unlike other natural communities, which are typically defined and assessed based on vegetation, vernal pools are better characterized and assessed by the amphibian species present, such as wood frog, spotted salamander, and Jefferson salamander, and invertebrates such as fairy shrimp, fingernail clams, and various aquatic insect larvae.

Five Vernal Pools have been mapped within BWMA. These were all visited during the fall, so none could be fully evaluated for amphibian breeding at the time, thus their potential significance remains unknown. There has been a report of the rare Jefferson salamander (a single adult found in upland habitat) on the WMA, so evaluating the pools during the breeding season is a priority, both to fully assess their significance and to identify the breeding habitats for this rare species. All pools were dry when visited in the fall; some appear quite shallow at maximum depth and may not provide suitable amphibian breeding habitat due to a short hydroperiod. However, even short hydroperiod pools may still provide habitat for invertebrates such as fairy shrimp, and may have other important ecological functions such as nutrient cycling.

The pools vary in size and landscape setting. All occur within a forested matrix, but one small pool occurs high on a ridgetop next to a cliff (a migration barrier in that direction), while the others occur in various mid-slope settings on benches and small clefts in the terrain. They range from small pools about 30x45 feet to a larger, deeper pool about 50x225 feet. Pool vegetation is usually sparse (<5-50%) and often includes plants such as pale manna grass (*Torreyochloa pallida*), gynandrous sedge (*Carex gynandra*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmundastrum cinnamomeum*), foam flower (*Tiarella cordifolia*), blue skullcap (*Scutellaria lateriflora*), drooping sedge (*Carex prasina*), water carpet (*Chrysosplenium americanum*), and fowl manna grass (*Glyceria striata*), in addition to patches of *Sphagnum* and other mosses. The pool substrate is typically well-decomposed, dark, organic muck, derived from leaf litter, and varies in these pools from about 8” over bedrock to several feet deep. Some mapped pools were ambiguous in appearance during the dry season and may better be described as Seeps, depending on their water holding capacity (Poly_IDs 252 & 254). Additionally, one larger mapped Seep (Poly_ID 198) may provide Vernal Pool function and should be revisited along with the mapped Vernal Pools. Some Red Spruce-Cinnamon Fern Swamps on the WMA may also include small temporary pools that provide function breeding habitats for amphibians otherwise associated with Vernal Pools.

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Uplands:

Dry Oak Forest

About 93 acres of this uncommon natural community type occur in upper slope positions on many of the warmest, driest, south, southwest, and southeast-facing slopes. The scattered patches constitute two separate occurrences; an 80-acre complex of 4 patches on the upper slopes of the northeastern parcel and a smaller (12+ acres) pair of patches on the southern slopes west of Spruce Knob; both occurrences are considered state-significant.

At BWMA, Dry Oak Forest is found on shallow, till-derived soil series usually mapped by the NRCS as "very stony" or "very rocky." The occurrences have a closed canopy (75-90% cover) that averages around 40-50' tall. Northern Red Oak (*Quercus rubra*) is the dominant tree species overall, though Chestnut Oak (*Quercus montana*) is locally abundant, especially in the northeastern occurrence; White Oak (*Quercus alba*) makes rare appearances, and Black Oak (*Quercus velutina*) may also be present. White Pine (*Pinus strobus*) is present and abundant in places, especially in the northeastern occurrence where it is joined by substantial red spruce and hemlock, but in other areas these softwoods are virtually absent. Scattered red pines (*Pinus resinosa*) also occur in some of the drier microsites, especially those in close proximity to Red Pine Forests. The abundance of red spruce (*Picea rubens*) in places, along with pockets of large-toothed aspen (*Populus grandidentata*), may be related to past logging disturbances. These forests intergrade with Dry Red Oak-White Pine Forest at BWMA, especially on the southern edge, where chestnut oak (*Quercus montana*), and white oak (*Quercus alba*) have very low to rare abundance, becoming virtually absent in areas mapped as the Dry Red Oak-White Pine Forest type. The Dry Oak Forest understory layer has oaks *(Quercus* sp.), Sugar Maple (*Acer saccharum*), Striped Maple (*Acer pensylvanicum*), American Beech (*Fagus grandifolia*), Hop Hornbeam (*Ostrya virginiana*), and common shadbush (*Amelanchier laevis*). Shrub cover varies widely, but is generally 30-50%; it includes maple-leaved Viburnum (*Viburnum acerifolium*), Witch Hazel (*Hamamelis virginiana*), black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), hillside blueberry (*Vaccinium pallidum*), round-leaved shadbush (*Amelanchier sanguinea*), and wild azalea (*Rhododendron prinophyllum*). Herbs are also abundant, particularly the graminoids Woodland Sedge (*Carex pensylvanica/ lucorum*) and common hairgrass (*Deschampsia flexuosa*). Other herbs were scattered and largely senesced by the time of late season inventory occurred; they include Torrey's wild licorice (*Galium lanceolatum*), false lily-of-the-valley (*Maianthemum canadense*), Bracken Fern (*Pteridium aquilinum*), Marginal Wood Fern (*Dryopteris marginalis*), and Blue-stemmed Goldenrod (*Solidago caesia*). Pincushion moss (*Leucobryum glaucum*) makes prominent mounds in areas of sparse ground cover. The cryptic and uncommon species Back's sedge (*Carex backii*) is found in this community in slightly enriched microsites, and is likely more widespread than was mapped. It is likely that additional rare species are present in this community, but were not documented due to the late timing of inventory in a very dry season.

Among the patches of Dry Oak Forest one southeast-facing slope (Poly_ID 4) stands out as the most undisturbed example. This patch is extremely dry with more stunted red oak canopy of seemingly mature trees mostly 6-8" in diameter (dbh) and less than 40 feet tall. A dense (40-80%) heath shrub layer is present here along with scrubby chestnut oaks and occasional shagbark hickory and white oak. Little or no signs of past logging were evident here, likely due to the stunted nature of the forest. Th northeastern occurrence is atypical in having hemlock present toward the north edges of 2 patches (Poly_IDs 22 and 24); these areas appear a bit more mesic with a slight north aspect and are transitional to Temperate

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Hemlock-Hardwood Forest. While still in good condition overall, this occurrence shows somewhat more ground disturbance than other sites, as numerous logging trails were previously cut into the steep slopes.

Dry Oak Forest can provide habitat for many common species of wildlife, including white-tailed deer, black bear, turkey, and songbirds such as ovenbird and scarlet tanager. The extensive south-facing, oak-dominated slopes of BWMA, which include this community, appear to be frequented by white-tailed deer, and may function as deer winter habitat. It may also provide habitat for some rare and uncommon wildlife species, perhaps including eastern whip-poor-will, ring-necked snake, and some species of uncommon moths.

Based on the species composition, soils, and aspect, it can be speculated that fire is a normal part of the natural disturbance regime in this community. However, since very little is known about the fire history of this site, and there is uncertainty regarding the general role of fire in Vermont's oak-dominated forests, specific fire management strategies are not recommended at this time.

Dry Oak-Hickory-Hophornbeam Forest

Six occurrences of Dry Oak-Hickory-Hophornbeam Forest spanning 67 acres are found on BWMA; all except two occurrences are state-significant.

This community is typically found on very shallow, rocky soils of small knolls, ridges, and steeper slopes, especially in areas with somewhat more calcareous bedrock. At BWMA the community exists in the typical form and the Sugar Maple-Hophornbeam Forest variant, the latter of which is especially associated with more calcareous conditions which favor sugar maple over red oak. The canopy averages 40-50' tall and 80% closed, and is typically characterized by Northern Red Oak (*Quercus rubra*), Shagbark Hickory (*Carya ovata*), sugar maple (*Acer saccharum*), and White Ash (*Fraxinus americana*). White Oak (*Quercus alba*) is rarely present as well. In the sugar maple variant, sugar maple dominates the canopy, while oaks and hickory are sparse to absent. The trees often appear somewhat gnarled and slow growing. The secondary canopy is dominated by hop-hornbeam (*Ostrya virginiana*). Shrubs are sparse and include Striped Maple (*Acer pensylvanicum*), hop-hornbeam (*Ostrya virginiana*), choke cherry (*Prunus virginiana*), and common shadbush *(Amelanchier laevis)*. Unlike the Dry Oak Forest community, ericaceous shrubs are generally absent in this type. Herbs average around 70-80% cover, but much of that is a dense lawn of Woodland Sedges (*Carex pensylvanica*/*C. lucorum*). Other herbs include marginal wood Fern (*Dryopteris marginalis*), purple-oat (*Schizachne purpurascens*), fringed bindweed (*Fallopia cilinodis*), wild millet (*Milium effusum*), blue-stemmed goldenrod (*Solidago caesia*), broad-leaved sedge (*Carex platyphylla*), white wood aster (*Eurybia divaricata*), nodding fescue (*Festuca subverticillata*), peduncled sedge (*Carex pedunculata*), and Torrey's wild licorice (*Galium lanceolatum*).

The southern-most, and largest, occurrence is in a complex of dry oak communities that transition to Mesic Red Oak-Northern Hardwood Forest on cooler aspects and lower slope positions. Within the dry oak areas Dry Oak-Hickory-Hophornbeam Forests largely occur downslope of Dry Oak Forests and Dry Red Oak-White Pine Forests where they may receive some colluvial enrichment from above. The western patches (Poly_IDs 17&18) of Dry Oak-Hickory-Hophornbeam Forest separated by a patch of Dry Oak Forest (Poly_ID 3) on the same ridgeline demonstrate the correlation these communities can have with bedrock chemistry; the former in more calcareous settings and the latter in more acidic settings. Overall, this Dry Oak-Hickory-Hophornbeam Forest occurrence is more strongly enriched than other occurrences,

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supporting calciphiles such as early meadow-rue (*Thalictrum dioicum*), running ragwort (*Packera obovata*), kidney-leaved crowfoot (*Ranunculus abortivus*), early saxifrage (*Micranthes virginiensis*), and the state-endangered Drummond's rock cress (*Boechera stricta*) – many of these are associated with small limy outcrops.

This community likely provides similar wildlife habitat as the Dry Oak Forest community, providing excellent habitat for white-tailed deer, black bear, turkey, and songbirds, though this function may be reduced in examples that lack oaks and hickories.

Dry Red Oak-White Pine Forest

About 71 acres of this uncommon natural community type are mapped at BWMA. Like the closely related Dry Oak Forest type, it occurs in upper slope positions on many of the warmer, dry, south-facing slopes, often in association with small cliffs and outcrops. Three occurrences are present, all state-significant, consisting of a complex of patches on knolls north of Ames Hollow, the summit of Bird Mountain itself, and a strip across the upper slopes west of Spruce Knob adjacent to areas of Dry Oak Forest.

At BMWA this community is quite similar in setting and composition to Dry Oak Forest, being dominated by red oak (*Quercus rubra*), but differs mainly in lacking the warm climate oaks chestnut oak (*Quercus montana*) and white oak (*Quercus alba*). White pine (*Pinus strobus*) and red spruce (*Picea rubens*) are scattered throughout the forests, especially on dry ledges and outcrops along with occasional red pines (*Pinus resinosa*) in some of the driest microsites, especially those in close proximity to Red Pine Forests. Shrub cover varies widely but is generally 10-30%; it includes maple-leaved Viburnum (*Viburnum acerifolium*), witch hazel (*Hamamelis virginiana*), black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), hillside blueberry (*Vaccinium pallidum*), striped maple (*Acer pensylvanicum*), and wild azalea (*Rhododendron prinophyllum*). Common herbs include Eastern Spicy-Wintergreen (*Gaultheria procumbens*), Wavy Hair Grass (*Deschampsia flexuosa*), Woodland Sedge (*Carex pensylvanica/lucorum*), common sedge (*Carex communis*), silver rod (*Solidago bicolor*), blue-stemmed goldenrod (*Solidago caesia*), early goldenrod (*Solidago juncea*), white wood aster (*Eurybia divaricata*), poverty-oats (*Danthonia spicata*), marginal woodfern (*Dryopteris marginalis*), trailing arbutus (*Epigaea repens*), and Bracken Fern (*Pteridium aquilinum*). Pincushion moss (*Leucobryum glaucum*) occurs abundantly along with other bryophytes. Rare and uncommon species found here include silver-flowered sedge (*Carex argyrantha*), and stout goldenrod (*Solidago squarrosa*); large-leaved grove sandwort (*Moehringia macrophylla*) and tall cinquefoil (*Drymocallis arguta*) may also be present on Bird Mountain, but these have not been confirmed present for many years. The occurrence of large-leaved grove sandwort (*Moehringia macrophylla*) is intriguing since this species is otherwise only known to occur on serpentine bedrock in Vermont. Wildlife use of these forests is likely very similar to that described for Dry Oak Forest above.

The occurrence on the summit of Bird Mountain (PolyID_8) is somewhat atypical in that the southern half becomes quite open (as little as 25% canopy cover), with woodland structure and extremely stunted trees (<20ft tall) due to extremely dry, rocky conditions. This area is similar in structure to Dry Oak Woodland, but lacks the characteristic chestnut oak (*Quercus montana*) dominated canopy.

Erosional River Bluff

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One very small Erosional River Bluff occurs along the unnamed stream that flows through the northeastern parcel. This stream is deeply incised with the channel lying 15-30 feet below the surrounding landscape at the bottom of a steep-walled ravine. The Erosional River Bluff occurrence consists of a small (roughly 40x40ft) area of valley wall that collapsed into the channel. The upper part of this collapse is now a sparsely vegetated moist gravel exposure in a small canopy gap. The lower portion is a jumbled mass of downed wood and relict living trees now tilted at odd angles. The channel has eroded through the toe of the debris. The open area has sparse cover of common old field and disturbance species, including self-heal (*Prunella vulgaris*), fowl manna grass (*Glyceria striata*), rough-leaved goldenrod (*Solidago rugosa*), flat-stemmed oat-grass (*Danthonia compressa*), Indian tobacco (*Lobelia inflata*), grass-leaved goldenrod (*Euthamia graminifolia*), path rush (*Juncus tenuis*), common blue-eyed grass (*Sisyrinchium montanum*), common daisy (*Leucanthemum vulgare*), common St. John's-wort (*Hypericum perforatum*), sensitive fern (*Onoclea sensibilis*), Queen Anne's lace (*Daucus carota*), leafy muhly (*Muhlenbergia frondosa*), and heart-leaved aster (*Symphyotrichum cordifolium*). This mass failure may have been exacerbated or triggered by an old logging trace cut across the upper slope. It is not clear if this tiny feature provides any unique habitat attributes for wildlife, though it does add to the physical landscape diversity. It is not state-significant.

Hemlock Forest

Fifty-four acres of Hemlock Forest are found in two occurrences along Gully Brook and a parallel, unnamed drainage to the east. These areas have important local function as a riparian forest along the brooks, and the eastern occurrence is state-significant. The Hemlock Forests are on steep slopes above the brook, which has down-cut to bedrock in many places. Shale bedrock is occasionally exposed as short cliffs, and, overall, the soil is very loose and rocky. The canopy (50' tall, 80-90% cover) is predominantly Eastern Hemlock (*Tsuga canadensis*), with occasional Red Maple (*Acer rubrum*), Yellow Birch (*Betula alleghaniensis*), and Big-Toothed Poplar (*Populus grandidentata*). Red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), and black birch (*Betula lenta*) are also common in the eastern occurrence, which is transitional to Temperate Hemlock-Hardwood Forest. The shrub layer is sparse and primarily composed of beech, hemlock, and birch saplings, and the very sparse herb layer includes Long Beech Fern (*Phegopteris connectilis*), One-Flowered Indian-Pipe (*Monotropa uniflora*), Evergreen Wood Fern (*Dryopteris intermedia*), Marginal Wood Fern (*Dryopteris marginalis*), starflower (*Lysimachia borealis*), running clubmoss (*Lycopodium clavatum*), prickly tree clubmoss (*Dendrolycopodium dendroideum*), and Rock Polypody (*Polypodium virginianum*).

These forests are mostly not mapped by VFWD as deer wintering habitat, but are adjacent to mapped deer wintering areas and may function as suitable winter cover.

Hemlock-Northern Hardwood Forest

Hemlock-Northern Hardwood Forest is a minor forest type at BWMA occupying only about 18 acres among four scattered patches in varied landscape settings. Two patches occur along steep-sided stream gullies, while the other two occur in mid and upper slope positions. One of these latter patches (Poly_ID 40) occurs on an extremely steep, northwest facing, stair-step ledge complex where thin rocky soils probably promote hemlock. The other (Poly_ID 38) occurs toward the upper elevational limits of hemlock (1700-2000ft) and is a somewhat enigmatic occurrence amid the sea of surrounding Northern Hardwood Forest; there is no strong apparent driver of hemlock occurrence here, such as a major outcrop, and many of the hemlocks appear much older (with strong epicormic branching) and larger (up to

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~32”dbh) than the surrounding forest. It could be valuable to further evaluate the age of these trees through coring, though at less than 4 acres, this is at best a small island of older trees. Due to their small sizes none of these occurrences are state-significant.

Eastern hemlock (*Tsuga canadensis*) is the most abundant tree species in all of these patches, filling 50% or more of the canopy, but substantial hardwood components are also present, mainly yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*) and white ash (*Fraxinus americana*), though red oak (*Quercus rubra*) is quite abundant in two patches. Red spruce (*Picea rubens*) is also present in some patches. Shrub and herb layers are typically very sparse under the dense hemlock shade, though small patches of talus debris below cliff bands in polygon 40 promote pockets of mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), and hop-hornbeam (*Ostrya virginiana*). Some of these patches, particularly those along the streams, may transition toward Hemlock Forest over time in the absence of disturbance.

Mesic Maple-Ash-Hickory-Oak Forest

Mesic Maple-Ash-Hickory-Oak Forest is a matrix forest type spanning about 164 acres across warmer, lower elevations along Gully Brook. Because much of this land has regenerated from cleared fields (visible in 1942 aerial photos), or had a long history of timber harvest, this occurrence is fairly disturbed and is not state-significant. The area is currently dominated by old field Eastern White Pine (*Pinus strobus*), but may succeed toward more characteristic Mesic Maple-Ash-Hickory-Oak Forest composition over longer time scales. The stands of white pine may provide suitable deer wintering habitat in their current state, although over time they are not expected to persist without active management.

Mesic Red Oak-Northern Hardwood Forest

This natural community is one of the matrix forest types at BWMA, spanning over 1,200 acres, making it among the largest known occurrences for this forest type in Vermont. It is generally found on lower and middle slopes, as well as in small mesic draws on the ridge tops and is especially prevalent on gentle, south and west-facing slopes, ridges, and in valley bottoms where the warmer conditions favor oak to a moderate degree. However, it also occurs on select north-facing slopes and the drivers of oak presence in these areas are not entirely clear. Because this community is widespread on a variety of slopes, aspects, and soils, it can vary from resembling a typical Northern Hardwood Forest on cooler, moister sites, to resembling a dry oak forest on drier sites; thus, this occurrence displays a wide range of the variability within this community type and grades into adjacent community types in many spots. The single, very large occurrence at BWMA is state-significant, though, like its composition, its condition varies widely across the site. Some sections (e.g. Poly_IDs 46 and 71) include mature stands with large oaks and little recent logging, while others (e.g. Poly_ID 50) have been heavily impacted by recent logging prior to acquisition. Additionally, aerial imagery from 1942 shows the Ames Hollow valley bottom and the slopes south of Bird Mountain were cleared at the time, having since regenerated to post-agricultural forms of this community type. In Ames Hollow, especially, the degree of recovery in less than 80 years is remarkable, though it has the densest concentration of the invasive Morrow’s honeysuckle (*Lonicera morrowii*) in the WMA. Despite these impacted areas, most of the occurrence is in good condition.

Except where recently harvested, this community has a closed canopy (80-90% and 50’-80’ tall) that contains substantial amounts of red oak (*Quercus rubra*) and a variable mixture of northern hardwoods. Depending on the site, other species that may be abundant include American beech (*Fagus grandifolia*),

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sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and red maple (*Acer rubrum*), with lesser amounts of basswood (*Tilia americana*), red spruce (*Picea rubens*), yellow birch (*Betula alleghaniensis*), black birch (*Betula lenta*), and hemlock (*Tsuga canadensis*). The subcanopy often includes hop-hornbeam (*Ostrya virginiana*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and striped maple (*Acer pensylvanicum*). Tall shrubs are patchy, though American beech (*Fagus grandifolia*) and striped maple (*Acer pensylvanicum*) can form a dense layer in places, along with witch-hazel (*Hamamelis virginiana*) and beaked hazelnut (*Corylus cornuta*). Low shrubs include Maple-leaved Viburnum (*Viburnum acerifolium*), Lowbush Blueberry (*Vaccinium angustifolium*), and shadbush (*Amelanchier* sp.). Herb cover is generally low (less than 15%) and includes Starflower (*Lysimachia borealis*), Small Solomon's-seal (*Polygonatum pubescens*), Canada Mayflower (*Maianthemum canadense*), partridge-berry (*Mitchella repens*), prickly tree clubmoss (*Dendrolycopodium dendroideum*), beech-drops (*Epifagus virginiana*), white wood aster (*Eurybia divaricata*), Bracken Fern (*Pteridium aquilinum*), and sedges (*Carex* spp.). While red oak saplings and understory trees are relatively sparse in the closed canopy portions of this community, seedlings are very abundant throughout much of the area, reflecting strong recent acorn crops and favorable site conditions for the species. The uncommon species summer sedge (*Carex aestivalis*) and two-rayed Poa (*Poa saltuensis* var. *saltuensis*) were found to be sparsely but widely scattered throughout this community; additionally, the very rare liverwort *Metzgeria crassipilis* occurs on a large boulder/outcrop in this community, as well as on adjacent cliffs.

Like other oak communities Mesic Red Oak-Northern Hardwood Forest can be excellent habitat for black bear, white-tail deer, wild turkey, and many other animals that feed on acorns.

Montane Yellow Birch-Sugar Maple-Red Spruce Forest

This community type, occupying roughly 34 acres, is a variant of Montane Yellow Birch-Red Spruce Forest that occurs in shallow to bedrock areas along the summits and ridgelines of Herrick Mountain and Spruce Knob. As is common for this variant, it occurs at lower elevation, around 2,200 – 2,600 feet, than the typical form of the community type and grades into adjacent Northern Hardwood Forests and Red Spruce-Heath Rocky Ridge Forests. More extreme climatic exposure, shallow soils, and possibly somewhat enriched bedrock conditions appear to be the driving factors for this variant, which has a short, rather stunted, woodland-like structure with a 35’ to 50’ tall canopy of about 60-75% cover. This canopy is composed primarily of gnarled sugar maple (*Acer saccharum*), with lesser amounts of yellow birch (*Betula alleghaniensis*), red spruce (*Picea rubens*), black cherry (*Prunus serotina*), and American mountain ash (*Sorbus americana*). Shrubs are often abundant though patchy, and include choke cherry (*Prunus virginiana*), mountain maple (*Acer spicatum*), red raspberry (*Rubus idaeus*), and striped maple (*Acer pensylvanicum*). Herb cover can be as high as 70% and includes intermediate woodfern (*Dryopteris intermedia*), mountain woodfern (*Dryopteris campyloptera*), fringed bindweed (*Fallopia cilinodis*), swollen sedge (*Carex intumescens*), common hairgrass (*Deschampsia flexuosa*), rough-leaved goldenrod (*Solidago rugosa*), and drooping wood reed (*Cinna latifolia*). Small bedrock outcrops and exposed slabs are frequent.

The four patches of Montane Yellow Birch-Sugar Maple-Red Spruce Forest variant constitute three or possibly just two occurrences depending on the off-parcel extent of the community along the Herrick Mountain ridgeline. Despite some impacts from a regularly traveled communications tower access trail along the ridgeline, all of these occurrences are state-significant. The northern-most patch (Poly_ID 73) includes an open shrub glade on the steep northeast facing slope and summit; this area is a dense shrub

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thicket of choke cherry (*Prunus virginiana*) and red raspberry (*Rubus idaeus*) with scattered beaked hazelnut (*Corylus cornuta*) and stunted very stunted trees. A few old signs of view clearing enlarge this gap, which otherwise appears to be naturally occurring.

The presence of mountain ash and black cherry in this community may make these sites important sources of soft mast for bears and other fruit eating wildlife.

Northern Hardwood Forest

Along with the Mesic Red Oak-Northern Hardwood Forest, the Northern Hardwood Forest constitutes one of the most extensive community types at BWMA forming the matrix forest over nearly 1,600 acres. The relatively large size and good condition of this single, wide ranging occurrence make it state-significant. As with the Mesic Red Oak-Northern Hardwood Forest, the varying aspects, soils, landscape positions, and disturbance histories create variability across this occurrence, and it encompasses much of the variation in the community type. This includes extensive acreage of the semi-rich variant, Sugar Maple-White Ash-Jack-in-the-Pulpit Forest, and at least one patch of Yellow Birch-Northern Hardwood Forest variant on the north side of Spruce Knob (Poly_ID 84), in addition to the typical form. A few of these variants were mapped as discrete units, but most were not due to time constraints.

The semi-rich variant has a strongly sugar maple (*Acer saccharum*) dominated canopy, with scattered white ash (*Fraxinus americana*), occasional basswood (*Tilia americana*), and an open understory with a somewhat lush herb layer containing abundant Christmas fern (*Polystichum acrostichoides*), marginal woodfern (*Dryopteris marginalis*), intermediate woodfern (*Dryopteris intermedia*), and scattered enrichment indicators, such as wild leek (*Allium tricoccum*), blue cohosh (*Caulophyllum thalictroides*), Virginia waterleaf (*Hydrophyllum virginianum*), and foam flower (*Tiarella cordifolia*). This variant is quite widespread, especially in coves north of Ames Hollow (Poly_IDs 82 and 83), on the north slopes of Herrick Mountian (Poly_IDs 77 and 78) and on a small slope in the southwest corner of the WMA (Poly_ID 80). All of these sites include slopes and coves that allow for colluvial enrichment processes, which may be a driving factor for this variant at BWMA. Many of these stands appear fairly even-aged and some have fairly large diameter trees (24”+ dbh).

The more typic form of Northern Hardwood Forest is also widespread at BWMA and has a mixed hardwood canopy of sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and red maple (*Acer rubrum*); black birch (*Betula lenta*) and white pine (*Pinus strobus*) are also common in places with more recent disturbance history, and small amounts of red oak (*Quercus rubra*) are present in areas transitional to Mesic Red Oak-Northern Hardwood Forest. Striped maple (*Acer pensylvanicum*) and hop-hornbeam (*Ostrya virginiana*) are common understory and tall shrub species in addition to saplings of canopy species, and some areas have abundant red spruce (*Picea rubens*) regeneration in the shrub layer, possibly suggesting that spruce will become more common over time. The herb layer includes many common herbs such as false lily-of-the-valley (*Maianthemum canadense*), starflower (*Lysimachia borealis*), Christmas fern (*Polystichum acrostichoides*), intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris marginalis*), and hay-scented fern (*Dennstaedtia punctilobula*).

Northern Hardwood Talus Woodland

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Talus is a widespread feature at BWMA occurring below the cliffs of Bird Mountain, below the large north-facing cliff at the north end of Herrick Mountain, below Spruce Knob, and in scattered locales north of Ames Hollow. The majority of the talus areas are vegetated, comprising patches of both Northern Hardwood Talus Woodland and Transition Hardwood Talus Woodland. Four occurrences of state-significant Northern Hardwood Talus Woodland are present, collectively spanning about 33 acres. The largest of these (13.9 acres) is found below the cliff on Bird Mountain while another occurrence, consisting of 7 smaller patches, collectively totals over 9 acres. This community type is found on steep slopes often immediately below cliffs of various sizes, though some occurrences are simply on steep, extremely rocky ground and lack a cliff above. Some patches continue to actively receive new talus debris through rockfall events, while others, especially those without adjacent cliffs, have stabilized and no longer actively receive talus. The talus boulders vary greatly in size depending on the type and degree of fracturing of the source rock. In some areas, such as below Bird Mountain, talus blocks are large, often approaching the size of a car, with little intervening soil build up, while in other areas, such as the north end of Herrick Mountain, much of the rock debris is finely fractured producing patches of channery soils amid larger talus blocks. Canopy cover varies from 40-70%, and in some places the canopy can be stunted (only 20' tall). Canopy trees include yellow birch (*Betula alleghaniensis*), White Ash (*Fraxinus americana*), Sugar Maple (*Acer saccharum*), Paper Birch (*Betula papyrifera*), Northern Red Oak (*Quercus rubra*), and other hardwoods. The shrub layer is often dense thanks to the thin canopy, and is dominated by mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), choke cherry (*Prunus virginiana*), and American mountain ash (*Sorbus americana*), with lesser amounts of red elderberry (*Sambucus racemosa*), hop-hornbeam (*Ostrya virginiana*), round-leaved dogwood (*Cornus rugosa*), beaked hazelnut (*Corylus cornuta*), and red raspberry (*Rubus idaeus*). The invasive shrub European Buckthorn (*Rhamnus cathartica*) was noted as occasional in the occurrence below Bird Mountain. Herbs are typically sparse (20-30% cover) and include Marginal Wood Fern (*Dryopteris marginalis*), Rock Polypody (*Polypodium virginianum*), Pale Touch-Me-Not (*Impatiens pallida*), and White Snakeroot (*Ageratina altissima*), fringed bindweed (*Fallopia cilinodis*), and Axillary Goldenrod (*Solidago caesia*).

Portions of these occurrences may be late-successional, as many have large-diameter trees for the site conditions (24"+ dbh) and abundant downed woody material and snags. Some patches (e.g. Poly_IDs 89 & 92) display a significant degree of colluvial enrichment, as indicated by calciphilic species such as Goldie's fern (*Dryopteris goldiana*) and the uncommon glade fern (*Homalosorus pycnocarpos*). The rare to uncommon species stout goldenrod (*Solidago squarrosa*) and purple virgin's-bower (*Clematis occidentalis*) were also found in some patches. Northern Hardwood Talus Woodland can provide good habitat for many species of snakes, and may also be used by small mammals such as voles and shrews. Larger overhangs, crevices and caves in the talus may provide bobcat habitat and frequently provide denning sites for porcupines. One patch (Poly_ID 94) has substantial boulder caves, some extending 30 feet or more into the hillside, which may also provide bear denning sites or bat hibernacula.

Open Talus

While much of the talus at BWMA is vegetated and forested, comprising the talus woodlands, seven patches (totaling nearly 3.5 acres) are Open Talus. Six of these (~1.5acres) form an occurrence below Bird Mountain while a separate 2-acre patch below the cliff at the north end of Herrick Mountain forms another. Both occurrences are state-significant, though they differ physically due to differing rock characteristics. In both areas, the talus blocks are metasedimentary rock, mapped as a mix of Biddie Knob

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Formation slate and quartzite, Bull Formation phyllite and limestone, and Bird Mountain Grit conglomerate and wacke. Below Bird Mountain, blocks range in size from roughly several feet square to truck-sized boulders, whereas the Herrick Mountain site presents the Shale Talus variant of this community with much of the talus debris being finely fractured into small, loose, plate-like material that readily tumbles and slides downhill. This latter setting, combined with the high rate of continued rockfall from the cliff above makes this site highly dynamic and unstable; extra caution is warranted when visiting this site. While the imagery is not especially clear, comparison of 1942 and more recent aerial imagery may indicate an increase in the Open Talus area between 1942 and 1962, which would only occur through a major rockfall event. Confirmation of this would be interesting. Both occurrences are very sparsely vegetated. Vascular plant species observed include Red Raspberry (*Rubus idaeus*), Red Elderberry (*Sambucus racemosa*), Mountain Maple (*Acer spicatum*), yellow birch (*Betula alleghaniensis*) and paper birch (*Betula papyrifera*) saplings, Virginia-Creeper (*Parthenocissus quinquefolia*), Poison-Ivy (*Toxicodendron radicans*), Rock Polypody (*Polypodium virginianum*), fringed bindweed (*Fallopia cilinodis*), fireweed (*Chamaenerion angustifolium*), early goldenrod (*Solidago juncea*), heart-leaved aster (*Symphyotrichum cordifolium*), and Mountain Crane's-Bill (*Geranium robertianum*). Several uncommon plant species, Wheatgrass (*Elymus trachycaulus*), American Bittersweet (*Celastrus scandens*), and Purple Virgin's-Bower (*Clematis occidentalis*), were also observed in some talus patches. Lichens and mosses can be an important part of the biota in Open Talus; they were noted as abundantly present and included *Umbilicaria, Stereocaulon, Cladonia*, and *Cladina* species, but no detailed inventory was attempted. Open Talus can provide important habitat for many wildlife species, such as voles and shrews, and many snake species.

Red Pine Forest

Small patches of two previously mapped state-significant Red Pine Forest occurrences are found at BWMA, with both extending beyond state lands. One very small patch (Poly_ID 112) is located on a dry, south facing knoll above an acidic cliff north of Ames Hollow, along the west property line. This small occurrence includes an additional patch nearby on the adjacent parcel, which was not visited during this assessment. The other occurrence includes a string of five small patches near the top of the southwest facing slope in the northeastern parcel of the WMA. Only about 3 acres of this occurrence are on the WMA, with at least an additional 22 acres previously mapped on adjacent lands, making it, in aggregate, among the larger occurrences for this community type.

Both occurrences are on very dry aspects and topographic positions and occur in association with Dry Red Oak-White Pine Forests and Dry Oak Forests. The shrub and herb layers of the Red Pine Forests share much in common with these types. Low heath shrubs, including black huckleberry (*Gaylussacia baccata*), low sweet blueberry (*Vaccinium angustifolium*), and hillside blueberry (*Vaccinium pallidum*), dominate the shrub layer forming patchy thickets along with black chokeberry (*Aronia melanocarpa*), wild azalea (*Rhododendron prinophyllum*), and common juniper (*Juniperus communis*). Woodland sedges (*Carex pensylvanica/lucorum*) and shaven sedge (*Carex tonsa*) are present along with common hairgrass (*Deschampsia flexuosa*), wintergreen (*Gaultheria procumbens*), silver rod (*Solidago bicolor*), three-toothed cinquefoil (*Sibbaldia tridentata*), bracken (*Pteridium aquilinum*), trailing arbutus (*Epigaea repens*), and false lily-of-the-valley (*Maianthemum canadense*). Red Pine (*Pinus resinosa*) is abundant in the often short and open canopy (<50-80%), though trees are relatively large and tall in some patches, reaching approximately 14” dbh and 80ft tall. Eastern White Pine (*Pinus strobus*) and red spruce (*Picea rubens*) are codominant with the red pine in some patches, and small amounts of red oak (*Quercus rubra*)

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are also present, as is chestnut oak (*Quercus montana*) in the eastern occurrence. Data from 1985 reports red pines in the eastern occurrence to be up to 130 years old (at that time), though it is not clear where precisely these older trees are. The soils are extremely shallow to bedrock and are very droughty, especially in the western occurrence, which encompasses a couple dozen rather stunted red pines.

The species composition and landscape setting of this community is suggestive of past fire, and old fire scars on red pines have been reported from areas just off the WMA (Engstrom pers. comm.). Research suggests a 20-100 year return interval for fire in this community type in Vermont (e.g. Engstrom, 1993; Engstrom and Mann, 1991), but no site specific information is available here. In the absence of repeated fire, these areas may transition to white pine (*Pinus strobus*), red spruce (*Picea rubens*), and oak-dominated sites.

Turkey vultures were observed using the western occurrence for sunning, at the edge of the cliff. Black bears have a notable preference for using red pines as marking trees, and a little searching shows claw and bite marks on many pines in these stands; scattered bear hairs can also typically be found in the sap flowing from these wounds. Fresh bear scat containing a bear track was also present.

Red Spruce-Heath Rocky Ridge Forest

About 110 acres of this uncommon community type are mapped at BWMA with the main occurrence extending in 14 discontinuous patches along the Herrick Mountain ridgeline south to Spruce Knob and nearby knolls. This large, state-significant occurrence also continues off state land on adjacent ridgetop settings. An additional small, isolated patch of this community occurs on a dry, southeast facing knoll north of Ames Hollow.

As the name suggests, this community type is confined to ridgetop settings and very steep (often >40°), rocky upper slopes. At BWMA the community spans elevations from about 1,700 to 2,500 feet, becoming transitional to Montane Yellow Birch-Red Spruce Forest in the highest areas. Many of the patches occur on drier, south, southwest, and southeast aspects, though some also occur on north and northwest aspects. These latter sites also appear quite dry due to the extremely steep slopes and very thin soils, though in some places, where spruce is less dominant, the community becomes transitional to more mesic Red Spruce-Northern Hardwood Forest. The classic expression of Red Spruce-Heath Rocky Ridge Forest has abundant, bare, rocky outcrops scattered throughout a red spruce (*Picea rubens*) dominated forest or woodland with abundant patches of lowbush blueberry (*Vaccinium spp.*) in openings. This structure and composition is best displayed on the southeast flank of Spruce Knob, but is not the dominant expression of the community type at BWMA. Instead, most patches, have very shallow soils (<6”), often nothing but accumulated organic matter over bedrock, with abundant small outcrops and boulders at the surface, but these are not large enough to create canopy gaps or woodland structure. Consequently, the canopy cover is dense (90%) and continuous, with a near monoculture of red spruce 40-60 feet tall in many areas. The trees in these patches are typically small diameter (3-10”) and appear even-aged, suggesting some past stand replacing disturbance occurred. In historical aerial imagery from 1942 these areas have a dense, uniform texture that may suggest a very young stand was present around that time. However, a 2.5-inch diameter spruce snag on Spruce Knob was sectioned and proved to be only about 35 years old. No soil charcoal was observed, but it is possible that fires may have been involved; further investigation is needed to understand the disturbance history and ecological forces shaping this community at this site.

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In addition to dense red spruce, much lesser amounts of yellow birch (*Betula alleghaniensis*), paper birch (*Betula papyrifera*), red maple (*Acer rubrum*), and American beech (*Fagus grandifolia*) are present, with red oak (*Quercus rubra*) appearing in lower elevation areas and American mountain ash (*Sorbus americana*) in higher areas. The shrub layer is typically sparse (<5%) and patchy with low sweet blueberry (*Vaccinium angustifolium*), dwarf bush-honeysuckle (*Diervilla lonicera*), mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), hobble-bush (*Viburnum lantanoides*), skunk currant (*Ribes glandulosum*), and common shadbush (*Amelanchier laevis*), in addition to saplings of canopy species. Herbs are comparably sparse and include common hairgrass (*Deschampsia flexuosa*), shaven sedge (*Carex tonsa*), bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), intermediate woodfern (*Dryopteris intermedia*), mountain woodfern (*Dryopteris campyloptera*), shining firmoss (*Huperzia lucidula*), flat-branched tree clubmoss (*Dendrolycopodium obscurum*), wood-sorrel (*Oxalis montana*), bluebead lily (*Clintonia borealis*), starflower (*Lysimachia borealis*), wild sarsaparilla (*Aralia nudicaulis*), and false lily-of-the-valley (*Maianthemum canadense*). Bryophytes (mosses and liverworts) are more abundant, 25-40% cover in places, with pincushion moss (*Leucobryum glaucum*) being strongly dominant and three-lobed whipwort (*Bazzania trilobata*) common in places. Lichens, especially rock tripe (*Umbilicaria* sp.) and reindeer lichens (*Cladonia* spp.), are also abundant in dry, bare rock areas.

These moderately high-elevation spruce dominated forests at BWMA often defy easy classification; they appear transitional to Montane Yellow Birch-Red Spruce Forest at the highest sites, transitional to Red Spruce-Northern Hardwood Forest on cooler, more mesic aspects, and transitional to Dry Red Oak-White Pine Forest in warm, dry, low elevation settings with less complete spruce dominance. Nevertheless, they collectively are best described as Red Spruce-Heath Rocky Ridge Forest. Past disturbance has played a strong role in shaping these stands, but the full story is not yet clear.

Red Spruce-Northern Hardwood Forest

About 27 acres of Red Spruce-Northern Hardwood Forest occur at BWMA, scattered among 10 patches, mostly in mid and upper slope positions. These areas are not considered state-significant, primarily due to their limited size. Many of the patches occur on steep, rocky settings, often on cooler, north aspects, such as the north end of Herrick Mountain. Some patches of Red Spruce-Heath Rocky Ridge Forest may grade into this community type as they wrap around to cooler, more mesic settings. Conversely, some patches (Poly_IDs 142 &143) in drier, ridgetop, slightly south-facing settings are transitional to the Red Spruce-Heath Rocky Ridge Forest type, though less spruce dominance helps distinguish them.

In general, these areas have a closed canopy of red spruce (*Picea rubens*), yellow birch (*Betula alleghaniensis*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), and paper birch (*Betula papyrifera*). Small amounts of red oak (*Quercus rubra*) are present in the warmer, drier patches and American mountain ash (*Sorbus americana*) is present in higher, cooler sites. Shrubs include striped maple (*Acer pensylvanicum*), hobble-bush (*Viburnum lantanoides*), mountain maple (*Acer spicatum*), American mountain ash (*Sorbus americana*) and, occasionally, low sweet blueberry (*Vaccinium angustifolium*), and red spruce (*Picea rubens*), American beech (*Fagus grandifolia*), and yellow birch (*Betula alleghaniensis*) saplings. Herbs are moderately abundant and include intermediate woodfern (*Dryopteris intermedia*), wild sarsaparilla (*Aralia nudicaulis*), wood-sorrel (*Oxalis montana*), shining firmoss (*Huperzia lucidula*), rock polypody (*Polypodium virginianum*), starflower (*Lysimachia borealis*), whorled wood aster (*Oclemena acuminata*), and wild-oats (*Uvularia*

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sessilifolia). In some steeper, more exposed patches (e.g. Poly_ID 147) the canopy is shorter, with many top-damaged trees and abundant spruce regeneration, while other patches (Poly_ID 140) have taller, larger, mature red spruce.

Rich Northern Hardwood Forest

Three areas of Rich Northern Hardwood Forest are present at BWMA. The largest of these, occupying the very steep (30-50 degrees) west slope of Bird Mountain is an atypical, but nevertheless state-significant, 50-acre stand with a substrate of loose slate scree. This occurrence has a canopy (60' tall, 70% cover) with Sugar Maple (*Acer saccharum*), Northern Red Oak (*Quercus rubra*), Basswood (*Tilia americana*), Bitternut Hickory (*Carya cordiformis*), and Paper Birch (*Betula papyrifera*). There is also a high cover of tall shrubs (10-18' tall, 50% cover) including Striped Maple (*Acer pensylvanicum*), Sugar Maple (*Acer saccharum*), White Ash (*Fraxinus americana*). The short shrub layer (5% cover) includes Mountain Maple (*Acer spicatum*) and Striped Maple (*Acer pensylvanicum*). Herb cover is abundant, and some areas had nearly 100% cover of Pale Touch-Me-Not (*Impatiens pallida*). Other abundant herbs include White Snakeroot (*Ageratina altissima*), Fringed Bindweed (*Fallopia cilinodis*), Eastern Waterleaf (*Hydrophyllum virginianum*), Jack-In-The-Pulpit (*Arisaema triphyllum*), and Marginal Wood Fern (*Dryopteris marginalis*). Axillary Goldenrod (*Solidago caesia*), Blunt-Lobed Hepatica (*Anemone americana*), and Canada Wild Ginger (*Asarum canadense*) were also noted in places. Invasive European Buckthorn (*Rhamnus cathartica*) is occasionally present and may represent a threat to the native vegetation in this community if it is allowed to persist and spread. This Rich Northern Hardwood Forest appears to share many features with the Transition Hardwood Talus Woodlands elsewhere on the WMA, though it is less rocky.

A second state-significant Rich Northern Hardwood Forest is present in a north-facing cove setting just west of the major cliff and talus complex at the north end of Herrick Mountain. This occurrence, while still steep and somewhat rocky, is more typical, being strongly sugar maple (*Acer saccharum*) dominated with scattered white ash (*Fraxinus americana*) and basswood (*Tilia americana*). It has a sparse, patchy understory of hop-hornbeam (*Ostrya virginiana*), but is extremely open below with few shrubs and a relatively lush herbaceous layer. While not the most strongly enriched example of Rich Northern Hardwood Forest, numerous calciphiles are present, including silvery glade fern (*Deparia acrostichoides*), northern maidenhair (*Adiantum pedatum*), foam flower (*Tiarella cordifolia*), sweet cicely (*Osmorhiza claytonii*), Canada violet (*Viola canadensis*), nodding fescue (*Festuca subverticillata*), Virginia waterleaf (*Hydrophyllum virginianum*), wild ginger (*Asarum canadense*), blue cohosh (*Caulophyllum thalictroides*), and sharp-lobed hepatica (*Anemone acutiloba*), wood nettle (*Laportea canadensis*), and pale jewelweed (*Impatiens pallida*), along with generalist species such as Christmas fern (*Polystichum acrostichoides*), marginal woodfern (*Dryopteris marginalis*), and intermediate woodfern (*Dryopteris intermedia*). A third small strip of Rich Northern Hardwood Forest, not state-significant, is present in a moist gully below a band of Northern Hardwood Talus Woodland north of Ames Hollow.

These forests likely provide habitat for a wide variety of bird, mammal, and reptile and amphibian species, similar to a Northern Hardwood Forest or Mesic Maple-Ash-Hickory-Oak Forest.

Temperate Acidic Cliff

Five occurrences encompassing 9 separate patches of Temperate Acidic Cliff are mapped in BWMA. All are state-significant occurrences. The cliffs vary substantially in size, both height and length. The largest

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occurs at the north end of the Herrick Mountain ridgeline above the Open Talus; this north-facing cliff is estimated to be 100-200 feet tall by 670 feet wide. This large cliff is very unstable, actively shedding an almost continuous rain of small rock debris. At the southern end of the Herrick Mountain ridgeline three separate cliffs occur around Spruce Knob, two are west facing and interrupt the ridgeline, including a large, dramatic 80 x 700 foot cliff in a saddle (Poly_ID 236), while a third short, but elongate, east-facing cliff runs along one side of a very steep talus chute. Further west along this ridgeline, another short, but very elongate (1100ft long) west-facing cliff cuts across the ridge. Another cluster of three separate acidic cliffs occurs on south facing slopes north of Ames Hollow along with several Temperate Calcareous Cliffs, while a final occurrence is found midslope in the northeastern parcel of the WMA. In addition to these mapped features, many other small cliffs and outcrops are present and share similar characteristics.

Despite varying aspects, the cliffs share much in common, being mostly dry, sparsely vegetated, and composed of various metasedimentary slates, phyllites, quartzites, and conglomerate. Rock tripe lichens (*Umbilicaria* sp. and *Lasallia papulosa*) are common, often more abundant than vascular or nonvascular plants. Vegetation on the cliffs varies and in places is indicative of localized calcareous influences with the presence of hairy rock cress (*Arabis pycnocarpa*), maidenhair spleenwort (*Asplenium trichomanes*), and other calciphiles, but the overall character of these cliffs seems to best fit the temperate acidic type. Woody species noted on the rock faces and ledges include: eastern white pine (*Pinus strobus*), red oak (*Quercus rubra*), hop-hornbeam (*Ostrya virginiana*), paper birch (*Betula papyrifera*), eastern hemlock (*Tsuga canadensis*), red spruce (*Picea rubens*), occasional chestnut oak (*Quercus montana*) and red pine (*Pinus resinosa*), shadbush (*Amelanchier* sp.), mountain maple (*Acer spicatum*), blueberries (*Vaccinium* spp.), bush-honeysuckle (*Diervilla lonicera*), common juniper (*Juniperus communis*), and Carolina rose (*Rosa carolina*). The warm climate species in this list are restricted to the south-facing cliffs while north-facing and higher elevation cliffs include species such as American mountain ash (*Sorbus americana*), fire cherry (*Prunus pensylvanica*), and yellow birch (*Betula alleghaniensis*). Herbs include marginal wood fern (*Dryopteris marginalis*), rock polypody (*Polypodium virginianum*), rusty cliff fern (*Woodsia ilvensis*), Canada bluegrass (*Poa compressa*), wild columbine (*Aquilegia canadensis*), harebell (*Campanula rotundifolia*), poverty-oats (*Danthonia spicata*), silver rod (*Solidago bicolor*), pilewort (*Erechtites hieraciifolius*), brownish sedge (*Carex brunnescens*), ticklegrass (*Agrostis scabra*), and maple-leaved goosefoot (*Chenopodium simplex*). A more commonly high-elevation moss species, *Pogonatum urnigerum*, was found on the north-facing cliff of Herrick Mountain. Several rare and uncommon plants were found on these cliffs including the state-endangered bronze sedge (*Carex foenea*), rare green adder's-mouth (*Malaxis unifolia*), and uncommon purple virgin's-bower (*Clematis occidentalis*) and stout goldenrod (*Solidago squarrosa*). Additionally, an unusual hybrid clubmoss *Huperzia x protoporophila (H. lucidula x H. appressa)* occurs on the large cliff at the north end of Herrick Mountain; this hybrid is of interest since one of its parents, *H. appressa*, is a rare alpine species.

Peregrine falcons likely use the larger cliffs as hunting areas (one noted at the north Herrick Mountain cliff) and potential nesting sites, though, given the long-established nesting site on the Bird Mountain cliff, these may be too close for additional nesting sites. Ravens appear to use at least one of these (Poly_ID 236) for nesting and roosting, while turkey vultures were observed sunning on another (Poly_ID 234). These cliffs (particularly the larger ones) might be used by roosting bats and other small mammals such as voles and shrews. The warm aspect ledges and shelves may also provide good basking sites for snakes.

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Temperate Calcareous Cliff

Five patches constituting three occurrences of Temperate Calcareous Cliff are mapped at BWMA. The bedrock forming these cliffs is a mixture of metasedimentary rocks variously mapped as Biddie Knob Formation slate and quartzite, Bull Formation phyllite and limestone, and Bird Mountain Grit conglomerate and wacke. As can be inferred from most of these rock types, they are not strongly calcareous, and thus, similar to the Temperate Acidic Cliffs, contain varying enrichment signatures. There are pockets of more acidic cliff, but on balance these cliffs better match the Temperate Calcareous Cliff type. All mapped occurrences are state-significant.

The largest of these occurrences is Bird Mountain, the summit of which is almost entirely ringed by an extensive Temperate Calcareous Cliff band that runs a half-mile from the southwest aspect of the peak to the northeast aspect of the peak. In places, the cliff is several hundred feet tall. Although appropriately classified as a calcareous cliff, the matrix rock appears to be largely acidic with calcareous influence appearing in veins and/or water seepage. Plant species noted on the cliff include Flowering Raspberry (*Rubus odoratus*), Bush-Honeysuckle (*Diervilla lonicera*), Poison-Ivy (*Toxicodendron radicans*), Scotch Bellflower (*Campanula rotundifolia*), Giant-Seeded Goosefoot (*Chenopodium simplex*), Marginal Wood Fern (*Dryopteris marginalis*), Red Columbine (*Aquilegia canadensis*), Brownish Sedge (*Carex brunnescens*), Mountain Crane's-Bill (*Geranium robertianum*), Maidenhair Spleenwort (*Asplenium trichomanes*), and Fragile Fern (*Cystopteris fragilis*). One rare species, Rock Whitlow-Mustard (*Draba arabisans*), and two uncommon species, Wheatgrass (*Elymus trachycaulus*) and Purple Virgin's-Bower (*Clematis occidentalis*), were found growing on the cliff and at its base. Since most of the rock face was not inventoried, additional species may be present.

Three small patches of Temperate Calcareous Cliff are present on the south-facing slopes north of Ames Hollow where they intermingle with patches of Temperate Acidic Cliff. The largest of these is about 30 feet tall by 300 feet long. These warm, dry cliff bands support red oak (*Quercus rubra*), dwarf bush-honeysuckle (*Diervilla lonicera*), mountain maple (*Acer spicatum*), flowering raspberry (*Rubus odoratus*), staghorn sumac (*Rhus typhina*), round-leaved dogwood (*Cornus rugosa*), choke cherry (*Prunus virginiana*), early meadow-rue (*Thalictrum dioicum*), maidenhair spleenwort (*Asplenium trichomanes*), blue-stemmed goldenrod (*Solidago caesia*), white wood aster (*Eurybia divaricata*), wild columbine (*Aquilegia canadensis*), rock polypody (*Polypodium virginianum*), hairy rock cress (*Arabis pycnocarpa*), and spikenard (*Aralia racemosa*). Bryophytes include *Anomodon attenuatus, A. rostratus, Porella platyphylla,* and *Metzgeria* spp. Several rare and uncommon species are associated with these cliffs including, most significantly, a very rare thallose liverwort (*Metzgeria crassipilis*), only the second known occurrence of this species in the state. The uncommon species slender wheat-grass (*Elymus trachycaulus*) and summer sedge (*Carex aestivalis*) were also noted here.

A third small cliff occurrence is found at the top of the southern ridgeline west of Spruce Knob. This area is a series of short broken faces surrounded by dry oak forests. Stunted white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), and red oak (*Quercus rubra*) form a thin canopy (60%) in the area with a small cliff top ‘lawn’ area of common hairgrass (*Deschampsia flexuosa*), European woodland bluegrass (*Poa nemoralis*), fringed bindweed (*Fallopia cilinodis*), Pennsylvania sedge (*Carex pensylvanica/lucorum*), early goldenrod (*Solidago juncea*), marginal woodfern (*Dryopteris marginalis*), white snakeroot (*Ageratina altissima*), bracken (*Pteridium aquilinum*), wild columbine (*Aquilegia canadensis*), nodding fescue (*Festuca subverticillata*), kidney-leaved crowfoot (*Ranunculus*

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abortivus), blue-stemmed goldenrod (*Solidago caesia*), and tall enchanter's nightshade (*Circaea canadensis*). The state-endangered Drummond's rock cress (*Boechera stricta*) is present here, along with the rare silver-flowered sedge (*Carex argyrantha*).

The large cliff on Bird Mountain is known to provide habitat for two rare animal species. It is a nesting site for peregrine falcons, with nesting attempts almost every year since 1990. In 2009, an eastern small-footed bat (*Myotis leibii*) was radio-tracked to a roost on the cliff's south face. This species has rapidly declined in recent years due to white-nosed syndrome, and is now considered very rare and is state-threatened. The other Temperate Calcareous Cliffs are probably too small to be of interest to peregrines, but, given their sunny aspects, may provide bat roosts or valuable basking habitat for snakes.

Temperate Hemlock-Hardwood Forest

One small (1.23 acres) patch of this community is present in BWMA. It is considered state-significant because of its good condition and landscape context, despite its very small size. Occurring on a very dry, steep, rocky, south-slope, this area shares much in common with adjacent dry oak forest types, but has substantial hemlock. The closed canopy is co-dominated by eastern hemlock (*Tsuga canadensis*) and red oak (*Quercus rubra*) with minor amounts of white pine (*Pinus strobus*), red spruce (*Picea rubens*), hop-hornbeam (*Ostrya virginiana*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), and sugar maple (*Acer saccharum*). The shrub and herb layers is sparse and includes American beech (*Fagus grandifolia*), American witch-hazel (*Hamamelis virginiana*), and blueberries (*Vaccinium* sp.). No herbs species were visible during the dry, late fall inventory period. The diverse mix of canopy species likely provides suitable habitat for a wide variety of forest-dwelling birds and mammals.

Transition Hardwood Talus Woodland

Several additional areas of talus, spanning over 8 acres, have substantially enriched conditions and canopies with an abundance of southern affinity tree species in warm, dry, south aspect settings. These are the Transition Hardwood Talus Woodlands. One occurrence occupies three patches below small cliffs north of Ames Hollow, while a second occurrence spans the steep, rugged slopes below Spruce Knob continuing substantially off state property. Both of these are state-significant.

This community type is more diverse than most Northern Hardwood Talus Woodlands and can, in places, appear transitional to a very rocky version of Rich Northern Hardwood Forest. The vegetation suggests calcium influence either from bedrock or from colluvial accumulation of nutrients - indeed one of the patches occurs below a section of Temperate Calcareous Cliff. Among the lush herbs (>50% cover) noted are round-lobed hepatica (*Anemone americana*), sweet-scented bedstraw (*Galium triflorum*), wild ginger (*Asarum canadense*), northern maidenhair (*Adiantum pedatum*), plantain-leaved sedge (*Carex plantaginea*), blue-stemmed goldenrod (*Solidago caesia*), early meadow-rue (*Thalictrum dioicum*), broad-leaved sedge (*Carex platyphylla*), bottlebrush grass (*Elymus hystrix*), nodding fescue (*Festuca subverticillata*), tall enchanter's nightshade (*Circaea canadensis*), marginal woodfern (*Dryopteris marginalis*), pale jewelweed (*Impatiens pallida*), fringed bindweed (*Fallopia cilinodis*), and many others. The open canopy (40-85%) includes sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), white ash (*Fraxinus americana*), basswood (*Tilia americana*), hop-hornbeam (*Ostrya virginiana*), black birch (*Betula lenta*), and occasional bitternut hickory (*Carya cordiformis*), butternut (*Juglans cinerea*), and shagbark hickory (*Carya ovata*). Shrubs are abundant in the openings, including mountain maple (*Acer spicatum*), flowering raspberry (*Rubus odoratus*), striped maple (*Acer pensylvanicum*), alternate-leaved

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dogwood (*Cornus alternifolia*), gooseberry (*Ribes sp.*), maple-leaved viburnum (*Viburnum acerifolium*), and witch-hazel (*Hamamelis virginiana*). Several rare to uncommon species are also present including stout goldenrod (*Solidago squarrosa*), purple virgin's-bower (*Clematis occidentalis*), and summer sedge (*Carex aestivalis*). Scattered clumps of the invasive shrub Morrow's honeysuckle (*Lonicera morrowii*) are present in one patch (Poly_ID 250) of this community.

The substrate varies somewhat across patches, with larger, irregular metasedimentary talus blocks present in many areas, and some patches (especially Poly_ID 249) with abundant channery soils, where the ground surface is covered by fine, loose rock flakes. These latter areas in some regards appear transitional to Dry Oak-Hickory-Hophornbeam Forest. Slopes are typically steep, measured at about 38 degrees. The wildlife habitat offered by this community is probably similar to that of Northern Hardwood Talus Woodland though the warmer setting with more hard mast species may provide additional benefits.

Other Landcover Types:

Landslide Barren

This is not a recognized natural community type at present, but is a unique feature that has created habitat for several rare species, making it worthy of special consideration. Two small, sparsely vegetated (<50%) areas, collectively spanning about an acre, are found just off the access road south of Ames Hollow on steep (~36 degree) south and southwest facing slopes below the crest of a small ridge. Closer examination suggests these are natural landslide scars that are visible in aerial photos dating back at least to 1942. The open slopes are somewhat reminiscent of the walls of a gravel pit, being strewn with gravel, cobble, and small boulders, but, unlike a gravel pit, these sit on a moist clay-rich till surface that has apparently been exposed and slowly weathering since the surficial materials slid off. At the base of the slope the terrain is rather lumpy, as might be expected for the accumulation zone of a debris flow. Much of this area appears open in the 1942 imagery, but is contiguous with a larger down-valley clearing that may be pastureland. It is not clear from the imagery alone what was happening here, but today, streams through this area are deeply incised, as though recently downcut through much loose surficial material. The openings below the slide area have a somewhat weedy, early successional character, but the slides themselves have a very unique flora. Very sparse (<5%) stunted or young trees are present, including white ash (*Fraxinus americana*), white pine (*Pinus strobus*), quaking aspen (*Populus tremuloides*), and paper birch (*Betula papyrifera*). Shrubs are moderately abundant (~20-30%) and are almost exclusively shrubby cinquefoil (*Dasiphora fruticosa*) with a small amount of common juniper (*Juniperus communis*). Herb cover is about 20-30% as well; locally abundant species include poverty-oats (*Danthonia spicata*), churchmouse three-awn (*Aristida dichotoma*), smooth aster (*Symphyotrichum laeve*), short-toothed mountain mint (*Pycnanthemum muticum*), wild strawberry (*Fragaria virginiana*), heath aster (*Symphyotrichum ericoides*), and dwarf ragwort (*Packera paupercula*). Additional species include silver rod (*Solidago bicolor*), gray goldenrod (*Solidago nemoralis*), blue-stemmed goldenrod (*Solidago caesia*), common lousewort (*Pedicularis canadensis*), Canada bluegrass (*Poa compressa*), harebell (*Campanula rotundifolia*), field pussy-toes (*Antennaria neglecta*), sheathed dropseed (*Sporobolus vaginiflorus*), and others. Surficial rocks present on the slope have abundant coverings of lichen, suggesting they are relatively stable substrates that have been exposed for some time. Several rare and uncommon species are present, including the very rare short-toothed mountain mint (*Pycnanthemum muticum*) and long-headed thimbleweed (*Anemone cylindrica*), and the uncommon slender wheat-grass (*Elymus trachycaulus*), smooth aster (*Symphyotrichum laeve*), and fringed gentian (*Gentianopsis crinita*). It is unclear what

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wildlife may particularly benefit from this unique site, though some specialized insects may benefit from the bare soil habitat.

The smaller patch just below the road has been impacted directly by the roadcut across its upper slope and continues to be affected by drainage from a culvert causing enhanced erosion. More non-native weedy species are present here and fewer of the rare species are present. Altering road drainage may help mitigate this situation, but needs further evaluation. In the long term, these barrens may succeed to Mesic Red Oak-Northern Hardwood Forest like the surrounding forest, but given the lack of recovery to forest since their pre-1942 origin, this is clearly a slow process.

Beaver Wetland

A final wetland area is mapped in the Ames Hollow valley bottom, encompassing a small beaver impounded pond and associated mosaic of herbaceous, shrubby, and forested wetlands. At the time of inventory beavers were not present and the pond was a few feet lower than the top of the old beaver dam, exposing a strip of shoreline mudflats that grade up-valley into shrub swamps dominated by gray alder (*Alnus incana*) and meadowsweet (*Spiraea alba*). Further up-valley the wet ground has become reforested following agricultural clearing, but is dissected by a mosaic of braiding intermittent stream channels. Correspondingly this forest is a mosaic of wet and drier patches, somewhat akin to a Seepage Forest. This area was not mapped or inventoried with great detail given its substantial agricultural disturbance history; it appears cleared in 1942 aerial photos and no pond was present.

Despite the area's history of human disturbance, it provides a valuable wetland habitat that supports animal and plant species otherwise lacking from the WMA. Among these is a tiny, ephemeral, very rare, thallose liverwort, *Riccia huebeneriana* ssp. *sullivantii*, that was found growing in the exposed muds flats around the pond. Unfortunately, the combination of past agricultural clearing and beaver tree felling has created conditions for the invasive Morrow's honeysuckle (*Lonicera morrowii*) to thrive around the sunny margins of the pond, as well as in other edge habitats nearby.

Fine Filter Assessment

<u>Rare, Threatened, and Endangered (RTE) and Uncommon Plant Species</u>

Fourteen species of rare or very rare plants have been located within Birdseye WMA, as well as 11 uncommon plant species and one of uncertain rarity status. An additional rare species, pignut hickory (*Carya glabra*), may be present but needs further confirmation. Except for one sensitive species these are summarized in the table that follows; the sensitive species is not described in this report but land managers are aware of its location and management needs.

Several rare species are of particular note. Two species, bronze sedge (*Carex foenea*) and Drummond's rock cress (*Boechera stricta*), are listed as "Endangered" by the Vermont state endangered species statute (10 V.S.A. 123). For one species variety, small skullcap (*Scutellaria parvula var. missouriensis*), BWMA contains the only known site in the state. Additionally, a very rare thallose liverwort, *Metzgeria crassipilis*, found on several calcareous cliffs, is only the second known location for the species in Vermont. The presence of these plants in particular, is very important on a statewide basis.

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Many of these species, including both endangered species, are associated with distinctive habitat features of limited occurrence on the landscape; most commonly at BWMA these features are cliffs, talus, and outcrops, but also include enriched coves and seeps, the landslide barren area, the moist pondshore mudflats, and dry oak settings. In many cases the physical features involved (e.g. cliffs) provide a measure of inherent protection for the species since they are unlikely to receive extensive or intensive management. However, a few of the uncommon species, especially summer sedge (*Carex aestivalis*) and two-rayed Poa (*Poa saltuensis var. saltuensis*) are more broadly adapted, occurring sporadically in a relatively wide range of microsites and community types, including the matrix forests. These species are more likely to be exposed to management activities, but their broader tolerances suggest that maintaining the ecological integrity of these areas is probably the best strategy for protecting these species.

Several sites at BWMA are particular hotspots for rare species. These include the cliffs, talus, and summit area of Bird Mountain which are collectively known to support at least 6 rare and uncommon plant species as well as 2 rare and uncommon animal species, discussed below. The landslide barren area south of Ames Hollow is another concentrated site, supporting 5 rare and uncommon plant species. The scattered cliff and talus zones on the slope north of Ames Hollow also collectively support 5 rare and uncommon plant species.

Rare, Threatened, and Endangered (RTE) and Uncommon Animal Species

Two rare animals, including one state-threatened species, are known to occur at BWMA along with 3 uncommon animal species. These are summarized in the table below. The large cliff on Bird Mountain is known to provide habitat for two of these species. It is a nesting site for peregrine falcons, with nesting attempts almost every year since 1990. In 2009, an eastern small-footed bat (*Myotis leibii*) was radio-tracked to a roost on the cliff's south face. This species has rapidly declined in recent years due to white-nosed syndrome, and is now considered very rare and is state-threatened. The numerous other cliff areas within the WMA may provide additional important habitat for these species. During this inventory effort a peregrine was observed perching on the lip of the large cliff at the north end of Herrick Mountain; this area no doubt provides hunting and resting habitat for the peregrines, but may be too close to the Bird Mountain nest to support an additional nesting pair/site.

A single adult of the rare Jefferson Salamander (*Ambystoma jeffersonianum*) was found in 2017 in upland forest habitat south of Bird Mountain. The vernal pools and other potential breeding habitats, such as temporary pools in swamps, should be examined during spring breeding season for further evidence of this species and its critical breeding habitats in the WMA.

Other uncommon animals found on the WMA include Smooth green snakes (*Opheodrys vernalis*), which have been observed in two different open areas on the slopes around Bird Mountain. These openings are maintained by periodic burning and/or mowing helps create the green snake's preferred habitat of open areas with lush herbaceous vegetation. In these areas, they are well camouflaged and can readily hunt their prey, primarily insects. They may also use rocks and logs in open forests or nearby talus areas for basking and hiding. An uncommon Blue-gray Gnatcatcher (*Polioptila caerulea*) has also been reported from the area around Bird Mountain, but no further details on this siting are available. While not yet documented from the WMA, the hickory hairstreak (*Satyrium caryaevorus*), an uncommon butterfly, has been documented nearby and may be present, since its preferred larval foods, the leaves of hickory, butternut, and oak, are prevalent.

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Rare, Threatened, Endangered, and Uncommon Species of Birdseye WMA					
Species Name	**Common Name**	**Sites Where Found at BWMA**	**State Rarity Rank****	**Rarity****	**Legal Status**
Plants					
Anemone cylindrica	long-headed thimbleweed	landslide barren	S1S2	Very Rare to Rare	
Boechera stricta	Drummond's rock cress	calcareous cliffs and outcrops in dry forest	S1S2	Very Rare to Rare	Endangered
Carex aestivalis	summer sedge	widespread	S3	Uncommon	
Carex argyrantha	silver-flowered sedge	cliffs and outcrops	S2S3	Rare to Uncommon	
Carex backii	Back's Sedge	dry, semi-rich forest	S3	Uncommon	
Carex foenea	bronze sedge	cliffs and outcrops	S2	Rare	Endangered
Carex laxiculmis	loose-flowered sedge	Seepage Forest	S3	Uncommon	
Carya cf. glabra (needs confirmation)	pignut hickory	dry ridgetop	S2	Rare	
Celastrus scandens	American Bittersweet	Open Talus	S3	Uncommon	
Clematis occidentalis ssp. occidentalis	purple virgin's-bower	cliffs and talus	S3	Uncommon	
Draba arabisans	rock whitlow-mustard	cliffs and ledges on Bird Mountain	S2S3	Uncommon to Rare	
Drymocallis arguta	tall cinquefoil	near Bird Mtn summit	S3	Uncommon	
Elymus trachycaulus ssp. trachycaulus	slender wheatgrass	cliffs, talus, landslide barren	S3	Uncommon	
Gentianopsis crinita	fringed gentian	landslide barren, edges of moist openings	S3	Uncommon	
Homalosaurus pycnocarpos	glade fern	enriched seeps, coves, and talus woodlands	S3	Uncommon	
Huperzia x protoporophila	a hybrid clubmoss	ledges on acidic cliff	SNR*	Uncommon*	
Malaxis unifolia	green adder's-mouth	ledges on acidic cliff	S2	Rare	
Metzgeria crassipilis	a thallose liverwort	calcareous cliffs	S1	Very Rare	
Moehringia macrophylla	large-leaved grove-sandwort	near Bird Mtn summit	S2	Rare	
Poa saltuensis var. saltuensis	two-rayed Poa	slightly enriched forests, widespread	S3	Uncommon	
Pycnanthemum muticum	short-toothed mountain mint	landslide barren, gravel landing, openings, open road edges	S1	Very Rare	
Riccia cf. huebeneriana ssp. sullivantii	a thallose liverwort	moist mud flats around beaver pond	S1	Very Rare	
Scrophularia marilandica	figwort	moist forest gap	SU	Uncertain	
Scutellaria parvula var. missouriensis	shale barren skullcap	roadside	S1	Very Rare	
Sisyrinchium angustifolium	blue-eyed grass	gravel landing area	S2S3	Uncommon to Rare	
Solidago squarrosa	stout goldenrod	talus woodlands/dry forest/ cliffs	S2S3	Uncommon to Rare	
Symphyotrichum laeve var. laeve	smooth aster	landslide barren and adjacent forests	S2S3	Uncommon to Rare	
Animals					
Ambystoma jeffersonianum	Jefferson Salamander	moist forest, vernal pools	S2	Rare	
Falco peregrinus	Peregrine Falcon	Bird Mountain cliffs	S3B	Uncommon Breeder	
Myotis leibii	Eastern Small-footed Bat	cliffs and talus field	S1	Very Rare	Threatened
Opheodrys vernalis	Smooth Greensnake	open burned fields	S3	Uncommon	
Polioptila caerulea	Blue-gray Gnatcatcher	no details	S3B	Uncommon Breeder	

* an unranked hybrid form of interest. ** For a full explanation of these rarity ranks, visit the Vermont Natural Heritage Inventory website: http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=7927382

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Non-Native Species

Non-native species are, unfortunately, widespread across the landscape and, while many remain at low densities or occupy only highly disturbed sites, others become invasive, spreading rampantly and invading natural areas. These invasive non-native species represent a serious threat to the ecological integrity of our natural communities and to the persistence of native species. This discussion focuses only on those non-native species that are widely regarded as invasive or are suspected of having the potential to become so. Detailed efforts to track and map invasive species were not a part of this ecological assessment process, so the following summary provides only a general overview of species detected and areas of greatest concern.

Fortunately, only four invasive plant species were noted during field work at BWMA, and these are generally present at low to very low levels at present. These are summarized in the table below. This very low level of invasive plant infestation no doubt reflects the limited fragmentation of this large forest block and the limited history of agricultural land use, which can predispose sites to invasion following agricultural abandonment. This pattern is clearly displayed within the WMA itself. Historical aerial imagery from 1942 shows that much of the Ames Hollow valley bottom was cleared, as were the openings and lower slopes immediately south of Bird Mountain. These areas, along with the road corridors have the greatest (though still moderate) density of invasives today, while most of the areas that appear to have been continuously forested have very few or no invasives at all.

Morrow's honeysuckle (*Lonicera morrowii*) is by far the most abundant invasive species on the WMA, being especially abundant in Ames Hollow along the road edges and beaver pond margins. Common buckthorn (*Rhamnus cathartica*) appears with low abundance in the cleared and formerly cleared areas south of Bird Mountain, as well as in adjacent more intact communities including the Open Talus and Rich Northern Hardwood Forest. Multiflora rose (*Rosa multiflora*) occurs at low density along road edges and in the post-agricultural areas, but lone individuals were also noted in remote wetland openings (e.g. Poly_ID 97) displaying the species' ability to disperse widely, presumably via bird droppings. Finally, a single individual of glossy buckthorn (*Frangula alnus*) was noted in an otherwise pristine-looking Red Spruce-Cinnamon Fern Swamp in Ames Hollow. Other invasive species may also be present but remained undetected.

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Non-Native Invasive Species of Birdseye WMA				
Species Name	**Common Name**	**Sites Where Found at BWMA**	**Abundance**	**Present Threat to Native Plant Communities at BWMA?**
Frangula alnus*	glossy buckthorn	a forested swamp in Ames Hollow (Poly_ID 67)	extremely low	low
Lonicera morrowii*	Morrow's honeysuckle	road and pond edges, early successional forests and talus woodlands, especially in Ames Hollow	locally high, low overall	locally high, low overall
Rhamnus cathartica*	common buckthorn	Bird Mountain talus areas, rich forest, edges, early successional forests	low	low
Rosa multiflora	multiflora rose	edges, early successional forests, and a swamp (Poly_ID 97)	low	low
*Class B Noxious Weeds				

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Ecological Assessment of Blueberry Hill WMA

Draft: January 11, 2021

This ecological assessment of Blueberry Hill WMA (BHWMA) applies a "coarse filter/ fine filter" approach to inventory and assessment. A detailed description of this approach and of inventory and assessment methods is available upon request from the Vermont Department of Fish and Wildlife.

Coarse Filter Assessment

Biophysical Region and Climate

BHWMA is located in the Taconic Mountains biophysical region. In Vermont, this region includes the northern end of the Taconic Mountains geological formation, which extends south into New York, western Massachusetts, and Connecticut. Despite a shared geological history, sites in the Taconic region are quite variable, and extremes in elevation, precipitation, and vegetation are found across the region. Aspect and elevation are particularly influential on climate and vegetation, and this is evident even within the relatively small area of the WMA.

Bedrock, Surficial Geology and Soils

The bedrock of BHWMA is metasedimentary rock dating to the Neoproterozoic era and Cambrian period, roughly 1,000 million to 500 million years ago. The WMA is primarily underlain by the Bull Formation phyllite and limestone, but within this matrix are areas of Biddie Knob Formation slate and quartzite, and Bull Formation wacke and siltstone. While for the most part these rocks do result in substantial nutrient enrichment in soils and growing conditions, there are exceptions. Where limestone and slate are at the surface, there appears to be increased evidence of nutrient enrichment. This enrichment can affect the distribution of natural communities; in particular, nutrient richness may be a driving factor in determining the locations the Dry Oak Forest and Dry Oak-Hickory-Hophornbeam Forest on ridgetops.

The degree to which these bedrock types affect growing conditions in BHWMA is mediated by the depth of the surficial materials deposited at the end of the last continental glaciation, some 15,000-12,000 years ago. As the glacier ice melted, rock fragments of all sizes, from boulders to clay, fell in an unsorted jumble known as glacial till. Practically all of the WMA features a layer of this over the bedrock, although in places it can be just a few inches deep. Post-glacial accumulations of sediments are uncommon in BHWMA, but post-glacial accumulations of peat and muck can be found in the scattered wetlands.

The soils of BHWMA are primarily products of these surficial deposits. NRCS soil mapping indicates that till-derived soils are the most widely distributed. The Taconic, Macomber, and Hubbardton series are prevalent on slopes and ridges, and these series can be quite shallow, especially on the ridges and summits. The only wetland soil mapped by the NRCS is Linwood muck, found on the Powder Lot, but there are other small inclusions of wetland soil present in the WMA. More detailed soil descriptions can be found in the natural community summaries below.

Hydrology/Streams/Rivers/Ponds

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BHWMA receives around 37-40" of precipitation annually, which is intermediate for the state. In contrast, some portions of the Champlain Valley receive just 30" of precipitation annually, while to the east Killington and other high peaks of the Southern Green Mountains can receive more than 70" of precipitation annually. All of BHWMA is within the Castleton River watershed. The dry landscape contains very little surface water, with only small streams found on the WMA. There are few areas of groundwater seepage. Several vernal pools are present, and may be important sources of water for a wide variety of wildlife species.

Natural Disturbance

Natural disturbance processes, such as wind, fire, and flooding, continually shape landscapes and define their natural communities. In general, Vermont's forests are characterized by frequent small-scale disturbances, such as individual tree death and the resulting canopy gap dynamics. At larger scales, blowdown, ice damage, and insect outbreaks are normal disturbances, but these would be expected to occur infrequently. The warm and dry landscape of BHWMA may support naturally-occurring forest fires, particularly on the south-facing slopes. The natural communities on those slopes possibly developed with fire as an important ecological factor. Broadly speaking, a frequent fire regime would favor certain species (such as Chestnut Oak, *Quercus montana*) over others. Additionally, at other New England sites, fire is known to be important in preserving habitat for many rare and uncommon plants and animals, especially rare butterfly and moth species (Wagner et al. 2003). Because of forest fire suppression for most of the 20th century, reintroducing fire as a natural disturbance—either by using prescribed burns or allowing natural fires to burn—is sometimes a key objective for managing some dry oak and pine natural communities (e.g. Engstrom 1993). However, the specific role of fire in maintaining the Dry Oak Woodland, Dry Oak Forest, and Dry Oak-Hickory-Hophornbeam Forest natural communities in Vermont is still not well understood. Thus, at present these sites are poor candidates for applying prescribed fire as an ecological management strategy.

Human Disturbance

Human uses of the land can also greatly influence the present-day distribution of natural communities. Few areas of the Vermont landscape have escaped the effects of agriculture and timber harvesting, and BHWMA is no exception. Extensive pine stands on the lower slopes of the Middle Block indicate a history of clearing, probably for pasture. Some oak forests have a history of grazing by cattle or sheep, and often grazing can have a lasting effect of simplifying forest structure by removing sapling and shrub layers. Past grazing may also have increased soil erosion and caused some of the exposed rock outcrops found on the WMA. All of these, however, are past disturbances. With the exception of some relatively recent timber harvesting and habitat management activities, present human disturbance is minimal.

Natural Communities

A natural community is an assemblage of biological organisms, their physical environment (e.g., geology, hydrology, climate, natural disturbance regime, etc.), and the interactions between them (Thompson and Sorenson 2000). The 89 natural community types described in Vermont repeat across the landscape in patches (or "polygons") of various sizes. These patches (or groups of patches in close proximity to each other) are referred to as natural community occurrences, and are to be distinguished from broad descriptions of community types.

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Natural communities at BHWMA were identified through aerial photograph interpretation and field surveys. Because some natural communities occur at very small scales (e.g., less than ¼ acre), this mapping effort is probably incomplete. Natural community mapping is an iterative process, and our knowledge improves with each mapping effort. Thus, the map presented here should not be viewed as a final statement on community distribution; instead, it should be treated as a first attempt at describing natural communities in this area. Land managers and members of the public should be aware that additional examples of small patch natural communities (e.g., vernal pools and seeps) probably occur on the management unit. As subsequent inventories and site visits are conducted, this map will be improved.

37 occurrences of 16 natural community types were identified and mapped within Blueberry Hill WMA. A total of 67 natural community polygons were mapped.

Some broad patterns emerged from this mapping effort. The landscape of Blueberry Hill WMA is warm and dry, and characterized in large part by natural communities and plant species near the northern edges of their distributions. The extensive forests of Northern Red Oak (*Quercus rubra*), Chestnut Oak (*Quercus montana*), Eastern White Oak (*Quercus alba*), and Shagbark Hickory (*Carya ovata*) create a habitat matrix that is unusual for Vermont. Indeed, the 400+ acre occurrence of Dry Oak Forest may be the largest example of this natural community type in Vermont. Much of the management unit is on steep and rocky ground, and small cliff and talus patches are found throughout the unit. Wetlands are notably sparse – on a total of over 1300 acres, just 9 acres (<0.01%) are mapped as wetland natural communities. These wetlands are important features, and contribute disproportionate habitat diversity to the WMA.

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Natural Communities of Blueberry Hill WMA				
Natural Community		**Acres**	**Vermont Distribution**	**Example of Statewide Significance?**
Wetlands	Red Maple-Black Ash Seepage Swamp	8	Common	Yes
	Seep	0.2	Common	
	Vernal Pool	0.6	Uncommon	
Uplands	Dry Oak-Hickory-Hophornbeam Forest	54	Uncommon	Yes
	Dry Oak Forest	415	Uncommon	Yes
	Dry Oak Woodland	42	Rare	Yes
	Dry Red Oak-White Pine Forest	4	Uncommon	
	Mesic Maple-Ash-Hickory-Oak Forest	474	Uncommon	Yes
	Mesic Red Oak-Northern Hardwood Forest	170	Common	Yes
	Northern Hardwood Forest	11	Very Common	
	Red Pine Forest	1	Rare	Yes
	Temperate Acidic Cliff	0.5	Common	Yes
	Temperate Acidic Outcrop	0.5	Common	Yes
	Temperate Hemlock-Hardwood Forest	26	Uncommon	
	Temperate Hemlock Forest	91	Common	Yes
	Transition Hardwood Talus Woodland	0.7	Uncommon	
For more information on these and other natural communities, see Wetland, Woodland, Wildland: a Guide to the Natural Communities of Vermont, by Elizabeth Thompson and Eric Sorenson. Information may also be found online at: http://www.vtfishandwildlife.com/books.cfm?libbase_=Wetland,Woodland,Wildland				

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Dry Oak Forest

This uncommon natural community type is widespread on the south-facing slopes of BHWMA. The forest patches on the West, Middle, and East Blocks of the WMA all combine to form a single large occurrence. It is expected that these patches are essentially continuous on the intervening privately-owned land, though no inventory was conducted on these lands. On the WMA lands alone, this occurrence of Dry Oak Forest totals 415 acres, and is by far the largest known Dry Oak Forest occurrence in the state. As such it is of exceptional ecological value for Vermont, and is state-significant.

At BHWMA, Dry Oak Forest is found on shallow till-derived soil series usually mapped by the NRCS as "very stony" or "very rocky." The occurrences have a closed canopy (70-80% cover) which averages around 40-50' tall. Chestnut Oak (*Quercus montana*), White Oak (*Quercus alba*), Northern Red Oak (*Quercus rubra*), Black Oak (*Quercus velutina*) are the dominant tree species, though White Pine (*Pinus strobus*) is also frequent in places. An understory layer has oaks (Quercus sp.), Sugar Maple (*Acer saccharum*), Striped Maple (*Acer pensylvanicum*), American Beech (*Fagus grandifolia*), Hop Hornbeam (*Ostrya virginiana*), and an *Amelanchier* species. Shrub cover (30-50%) includes Maple-leaved Viburnum (*Viburnum acerifolium*), Downy Arrowwood (*Viburnum rafinesquianum*), Witch Hazel (*Hamamelis virginiana*), Lower Lowbush Blueberry (*Vaccinium angustifolium*), and Trailing Arbutus (*Epigaea repens*). Herbs are also abundant, and include Wild Licorice (*Galium circaezans*), Woodland Sedges (*Carex* cf. *lucorum/pensylvanica*), Indian Hemp (*Apocynum cannabinum*), Wild Sarsaparilla (*Aralia nudicaulis*), Bracken Fern (*Pteridium aquilinum*), Marginal Wood Fern (*Dryopteris marginalis*), and Blue-stemmed Goldenrod (*Solidago caesia*). Several rare and uncommon plant species are found in this community, including the only known extant population in Vermont of the very rare and state-listed threatened Flowering Dogwood (*Cornus florida*). Other rare and uncommon species found in these occurrences include Smooth False-foxglove (*Aureolaria flava*), Perfoliate Bellwort (*Uvularia perfoliata*), Rattlesnake Hawkweed (*Hieracium venosum*), Wood Lily (*Lilium philadelphicum*), and Four-leaved Milkweed (*Asclepias quadrifolia*).

Dry Oak Forest can provide habitat for many common species of wildlife, including white-tailed deer, black bear, turkey, and songbirds such as ovenbird and scarlet tanager. The extensive south-facing, oak-dominated slopes of BHWMA, which include this community, appear to be frequented by white-tailed deer, and may function as deer winter habitat. It may also provide habitat for some rare and uncommon wildlife species, perhaps including eastern whip-poor-will, ring-necked snake, and some species of uncommon moths.

Based on the species composition, soils, and aspect, it is possible to speculate that fire is a normal part of the natural disturbance regime in this community. Since very little is known about the fire history of this site, and there is uncertainty regarding the general role of fire in Vermont's oak-dominated forests, specific fire management strategies are not recommended at this time.

Dry Oak-Hickory-Hophornbeam Forest

Four occurrences of Dry Oak-Hickory-Hophornbeam Forest, all state-significant, are found on BHWMA.

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This community is typically found on very shallow soils. The canopy averages 40-50' tall and 80% closed, and is characterized by Northern Red Oak (*Quercus rubra*), Shagbark Hickory (*Carya ovata*), and White Ash (*Fraxinus americana*). White Oak (*Quercus alba*) is sometimes present as well. The secondary canopy is dominated by Hop Hornbeam (*Ostrya virginiana*). Tall shrubs are almost entirely absent, but low shrub cover (average 10-15%) includes Striped Maple (*Acer pensylvanicum*), Hop Hornbeam (*Ostrya virginiana*), *Amelanchier* spp., and Downy Arrowwood (*Viburnum rafinesquianum*). Unlike the Dry Oak Forest community, ericaceous shrubs are generally absent in this type. Herbs average around 70-80% cover, but much of that is a dense lawn of Woodland Sedges (*Carex pensylvanica*/*C. lucorum*). Other herbs include Wild Licorice (*Galium circaezans*), Common False Solomon's-seal (*Smilacina racemosa*), Sticky Tick-trefoil (*Desmodium glutinosum*), Blunt-Lobed Hepatica (*Anemone americana*), Marginal Wood Fern (*Dryopteris marginalis*), Hog Peanut (*Amphicarpaea bracteata*), and Rough-leaved Ricegrass (*Oryzopsis asperifolia*). The very rare Smooth False-foxglove (*Aureolaria flava*), and the rare Rattlesnake Hawkweed (*Hieracium venosum*) and Perfoliate Bellwort (*Uvularia perfoliata*) were all located in this community at BHWMA. This community likely provides similar wildlife habitat as the Dry Oak Forest community, providing excellent habitat for white-tailed deer, black bear, turkey, and songbirds. In particular, evidence of deer browse is abundant in this community type; the heavy browse may be impacting vegetation regeneration.

Dry Oak Woodland

Dry Oak Woodland is a distinctive community found on the driest ridge tops and slopes of BHWMA. These sites have very thin soils, consisting mostly of dry organic matter, 0-5" deep, over the bedrock. Warm and dry sites such as these are possibly prone to forest fires, and it is conceivable that fires may have helped shape the current vegetation composition by favoring the fire-resistant Chestnut Oak (*Quercus montana*). However, since the fire history of this site is unknown, and since there is uncertainty regarding the general role of fire in Vermont's oak-dominated forests, specific fire management strategies are not recommended at this time.

As noted, Chestnut Oak (*Quercus montana*) is dominant in the stunted (<30' tall) open canopy (60% cover or less) of this community. Other canopy species include White Oak (*Quercus alba*), Northern Red Oak (*Quercus rubra*), Black Oak (*Quercus velutina*), and White Pine (*Pinus strobus*). Shagbark Hickory (*Carya ovata*) is uncommon in this community. These woodlands have an open savannah character, with a sparse understory (15% cover or less) of oaks, shadbush (*Amelanchier* sp.), and the occasional Shagbark Hickory (*Carya ovata*). Tall shrub cover is typically absent or minimal (5% cover) and include Striped Maple (*Acer pensylvanicum*) and a shadbush (*Amelanchier* sp.). Low shrubs vary in cover from near 100% to almost absent, but the species are generally the same at all sites: Lower Lowbush Blueberry (*Vaccinium angustifolium*), Black Chokeberry (*Aronia melanocarpa*), and Black Huckleberry (*Gaylussacia baccata*), Wintergreen (*Gaultheria procumbens*), and *Rubus* species. Herb cover is high (as much as 70% cover) and the most abundant species include Cow-wheat (*Melampyrum lineare*), Bastard Toadflax (*Comandra umbellata*), Common Hairgrass (*Deschampsia flexuosa*), Woodland Sedge (*Carex* cf *lucorum*), Woodland Sunflower (*Helianthus divaricatus*), Blue-stemmed Goldenrod (*Solidago caesia*), and Sheep Sorrel (*Rumex acetosella*). Lichens and mosses are abundant in some places. Several rare and uncommon plant species are found in this community, including Rattlesnake Hawkweed (*Hieracium venosum*), Four-leaved Milkweed (*Asclepias quadrifolia*), and Slender Wheatgrass (*Elymus trachycaulus*). No rare or uncommon animals have been documented in this community type at BHWMA, but it could provide habitat for Eastern Whip-Poor-Will, which is a rare breeding bird in Vermont. In

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other New England states, chestnut oak communities provide habitat for rare Lepidoptera (butterfly and moth) species, such as the Red Winged Sallow, but these have not been studied in Vermont. The extensive south-facing, oak-dominated slopes of BHWMA, which include this community, appear to be frequented by white-tailed deer, and may function as deer winter habitat.

Four Dry Oak Woodland occurrences are found at BHWMA, and all except one are state-significant. The remaining occurrence was mapped based on aerial photos and not visited during inventory; therefore it is not yet assessed. It is likely that it too will meet the standard for significance.

Dry Red Oak-White Pine Forest

Slightly more than four acres of this provisional natural community type are mapped on the West Block of BHWMA. It was observed from the edges, but not thoroughly inventoried. It is found on a steep, west-facing slope that appeared to alternate between short ledges and small terraces. Species expected to be found in this community include Northern Red Oak (*Quercus rubra*), Eastern White Pine (*Pinus strobus*), blueberries (*Vaccinium* spp.), and low shrubs and herbs such as Eastern Spicy-Wintergreen (*Gaultheria procumbens*), Wavy Hair Grass (*Deschampsia flexuosa*), and Bracken Fern (*Pteridium aquilinum*). Since it is a provisional type and not fully inventoried, this occurrence was not assessed for state-significance.

Mesic Maple-Ash-Hickory-Oak Forest

Mesic Maple-Ash-Hickory-Oak Forest is a matrix forest type in the lower elevations and warmer sites of the BHWMA. Because much of this land has regenerated from cleared fields, or had a long history of timber harvest, this natural community is fairly disturbed. The occurrence at BHWMA (extending through the west, middle, and East Blocks) is in good ecological condition. It is characterized by a diverse canopy (40-50' tall, 85% cover) with Sugar Maple (*Acer saccharum*), Basswood (*Tilia americana*), Chestnut Oak (*Quercus montana*), White Ash (*Fraxinus americana*), Big-Toothed Poplar (*Populus grandidentata*), American Beech (*Fagus grandifolia*), Northern Red Oak (*Quercus rubra*), Shagbark Hickory (*Carya ovata*), Yellow Birch (*Betula alleghaniensis*). The understory included American Beech (*Fagus grandifolia*), Maple-Leaved Viburnum (*Viburnum acerifolium*), Striped Maple (*Acer pensylvanicum*), *Amelanchier* sp., and *Populus* spp. Herbs noted include Starflower (*Lysimachia borealis*), Fringed Milkwort (*Polygala paucifolia*), Sessile-Leaved Bellwort (*Uvularia sessilifolia*), Hairy Solomon's-Seal (*Polygonatum pubescens*), and the rare species Perfoliate Bellwort (*Uvularia perfoliata*). Shagbark Hickory (*Carya ovata*) is occasional throughout this occurrence. This occurrence is A-ranked and is state-significant.

Some area of old field Eastern White Pine (*Pinus strobus*), adjacent to this significant occurrence, are also likely to develop into Mesic Maple-Hickory-Ash-Oak Forest. The stands of white pine may provide suitable deer wintering habitat in their current state, although over time they are not expected to persist without active management. Sites with more typical Mesic Maple-Ash-Hickory-Oak Forest vegetation may provide roosting habitat for the northern long-eared bat, as well as a variety of more common bird and mammal species.

Mesic Red Oak-Northern Hardwood Forest

This natural community is one of the matrix forests of the BHWMA. It is found on most of the lower and middle slopes, as well as in small mesic draws on the ridge tops. Because it is widespread on a variety of slopes, aspects, and soils, this community can vary from resembling a typical Northern Hardwood Forest

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on cooler, moister sites, to resembling a dry oak forest on drier sites. There are two occurrences in BHWMA and both are state-significant.

This community has a canopy (80-90% closed and 40-50' tall) that contains Sugar Maple (*Acer saccharum*) and Northern Red Oak (*Quercus rubra*). Depending on the site, other species that may be present include Chestnut Oak (*Quercus montana*), White Oak (*Quercus alba*), Basswood (*Tilia americana*), White Ash (*Fraxinus americana*), American Beech (*Fagus grandifolia*), and Hemlock (*Tsuga canadensis*). A secondary canopy of Sugar Maple (*Acer saccharum*) and American Beech (*Fagus grandifolia*) is present at some sites. Tall shrubs are uncommon, though American Beech (*Fagus grandifolia*) can form a low dense understory in places. Low shrubs include Maple-leaved Viburnum (*Viburnum acerifolium*), Striped Maple (*Acer pensylvanicum*), Lower Lowbush Blueberry (*Vaccinium angustifolium*), and a shadbush (*Amelanchier* sp.). Herb cover is generally low (about 15%) and includes Starflower (*Lysimachia borealis*), Small Solomon's-seal (*Polygonatum pubescens*), Canada Mayflower (*Maianthemum canadense*), Bracken Fern (*Pteridium aquilinum*), and sedges (*Carex* spp.). Several rare and uncommon species were identified in this community, including Perfoliate Bellwort (*Uvularia perfoliata*) and Broad Beech Fern (*Phegopteris hexagonoptera*). Mesic Red Oak-Northern Hardwood Forest can be excellent habitat for black bear, white-tail deer, and wild turkey, all of which feed on acorns.

Northern Hardwood Forest

Two small occurrences of Northern Hardwood Forest are found in BHWMA. Together they total just 11 acres, and neither one is state-significant. Both found on north-facing slopes. These patches were observed but not inventoried. It is likely that in fact they are ecologically connected on intervening privately-owned land and function as a single occurrence that extends across the whole north slope of Blueberry Hill.

Red Maple-Black Ash Seepage Swamp

Two patches of Red Maple-Black Ash Seepage Swamp, totaling eight acres, are found on the Powder Lot of BHWMA. Together they form one occurrence that is state-significant. Scattered Eastern White Pine (*Pinus strobus*) emerge above the 50' tall canopy composed of Red Maple (*Acer rubrum*), Yellow Birch (*Betula alleghaniensis*), Black Ash (*Fraxinus nigra*), and Eastern Hemlock (*Tsuga canadensis*). Canopy cover averages 75%. Shrubs noted include Common Winterberry (*Ilex verticillata*) and Common Lowbush Blueberry (*Vaccinium angustifolium*). Cinnamon Fern (*Osmundastrum cinnamomeum*) is the dominant herb; other species noted include Royal Fern (*Osmunda regalis*), Marsh Fern (*Thelypteris palustris*), Dwarf Raspberry (*Rubus pubescens*), Sensitive Fern (*Onoclea sensibilis*), Three-Seeded Sedge (*Carex trisperma*), Indian Cucumber Root (*Medeola virginiana*), Starflower (*Lysimachia borealis*), Three-Leaved Goldthread (*Coptis trifolia*), and Canada-Mayflower (*Maianthemum canadense*). *Sphagnum* moss hummocks are intermixed with areas of exposed mineral soil. Soil sampling found poorly decomposed muck at least four feet deep. These swamps may be a source of early spring food for white-tail deer and black bear.

Red Pine Forest

A small but state-significant Red Pine Forest is found on the East Block of BHWMA. Located on a steep slope, it extends more-or-less linearly along the brow of a Temperate Acidic Cliff. Red Pine (*Pinus resinosa*) is abundant, and some trees are relatively large, reaching approximately 15"+ dbh. Eastern

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White Pine (*Pinus strobus*), Northern Red Oak (*Quercus rubra*), Chestnut Oak (*Quercus montana*), shadbushes (*Amelanchier* spp.), Black Huckleberry (*Gaylussacia baccata*), and Common Lowbush Blueberry (*Vaccinium angustifolium*) are also present. This community was inventoried prior to the growing season, so no herbs were noted other than Little Bluestem (*Schizachyrium scoparium*). The species composition of this community is suggestive of past fire – but says little about the expected natural return interval for fire at this site. In the absence of repeated fire, it may transition to an oak-dominated site.

Seep

In the dry landscape of BHWMA, only three seepage areas were encountered. None are state-significant. For the most part these are unlike the typical forest seeps commonly encountered in Vermont. One area mapped as a seep is regenerating from a past patch-cut harvest, which may have altered the hydrology and species composition of the site. Regeneration includes aspens (*Populus* spp.), White Pine (*Pinus strobus*), and Shagbark Hickory (*Carya ovata*). A soil sample found 12" of silt/clay over grey mottled silt and clay; during late spring inventory the soil was damp but not saturated. Other species present include Sensitive Fern (*Onoclea sensibilis*), Ostrich Fern (*Matteuccia struthiopteris*), Lady Fern (*Athyrium filix-femina*), Christmas Fern (*Polystichum acrostichoides*), Alternate-leaved Dogwood (*Cornus alternifolia*), and *Rubus* species. Cattail (*Typha* sp.) is also present, though it is unclear whether that indicates the wetland was open prior to cutting, or that the species seeded in after harvesting. Other small seepage areas are characterized by Red Maple (*Acer rubrum*), Striped Maple (*Acer pensylvanicum*), Black Birch (*Betula lenta*), Marsh Fern (*Thelypteris palustris*), and Sensitive Fern (*Onoclea sensibilis*). Seeps can be an important source of early-spring browse for deer and bear; however in the south-facing, dry and warm landscape of the WMA, there may be other sources of food available. Some species of insects and amphibians may concentrate around seeps (as well as any other wet areas) in dry landscapes. In general, seeps with natural canopy cover and hydrology will provide functional habitat for a wide variety of wildlife species.

Temperate Acidic Cliff

Two occurrences of Temperate Acidic Cliff are mapped in BHWMA. Both are state-significant occurrences. The first is within the West Block, and is a short (approx. 25' tall) cliff that is 100' long. It is mostly unvegetated except for rock tripe lichen (*Umbilicaria* sp.). The second Temperate Acidic Cliff is located on the East Block, and consists of a series of 10-30 foot tall cliff bands interspersed with ledges that altogether combine to form a tall cliff environment. This cliff is exposed enough that it was historically used by peregrine falcons, although there has been no use reported since 1913. Vegetation on the cliff varies and in places is indicative of calcareous influence, but the overall character of the cliff seems to best fit the temperate acidic type. Species noted on the rock faces and ledges include: Eastern White Pine (*Pinus strobus*), Chestnut Oak (*Quercus montana*), Northern Red Oak (*Quercus rubra*), Hop-Hornbeam (*Ostrya virginiana*), *Amelanchier* sp., Mountain Maple (*Acer spicatum*), Blueberries (*Vaccinium* spp.), Bush-Honeysuckle (*Diervilla lonicera*), and a *Rosa* sp. Herbs include Marginal Wood Fern (*Dryopteris marginalis*), Rock Polypody (*Polypodium virginianum*), Rusty Cliff Fern (*Woodsia ilvensis*), Maidenhair Spleenwort (*Asplenium trichomanes*), Early Small-Flowered-Saxifrage (*Micranthes virginiensis*), Scotch Bellflower (*Campanula rotundifolia*), Bulblet Fragile Fern (*Cystopteris bulbifera*), and Ziz-Zag Goldenrod (*Solidago flexicaulis*). Rock trip lichen (*Umbilicaria* sp.) is also abundant in places.

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Besides peregrine falcons, these cliffs (particularly the larger one) might be used by roosting bats, and other small mammals such as voles and shrews. The ledges and shelves may also provide good basking sites for snake species.

Temperate Acidic Outcrop

Two small Temperate Acidic Outcrops are found on the West Block, within areas of Dry Oak Woodland. Together these form a half-acre ecological occurrence that is considered state-significant. These outcrops are characterized by exposed bedrock, lichens, and herbs such as Bastard-Toadflax (*Comandra umbellata*), Rusty Cliff Fern (*Woodsia ilvensis*), and the uncommon species Rattlesnake Hawkweed (*Hieracium venosum*). A few stunted Chestnut Oak (*Quercus montana*) also grow in these outcrops. These outcrops could provide specialized habitat for invertebrates, and may be good basking habitat for snake species likely to be present on the WMA.

Temperate Hemlock Forest

Two occurrences of Temperate Hemlock Forest are found in BHWMA. One is a very small patch in the East Block that roughly corresponds with the boundaries of an inholding but also extends onto the WMA; this patch was observed but not inventoried. The second occurrence is comprised of three patches (two of which are small and along the boundary line) in the Powder Lot which together total 89 acres. Based on field observations, this occurrence is state-significant. However, detailed data on vegetation and soils was not recorded during inventory. Additional field work will be conducted to verify the determination of significance and to document the characteristics of this occurrence. This natural community type typical has a canopy of Eastern Hemlock (*Tsuga canadensis*), and occasional Northern Red Oak (*Quercus rubra*), Eastern White Oak (*Quercus alba*), Chestnut Oak (*Quercus montana*), and hickories (Carya sp.), and relatively sparse shrub and herb layers. This occurrence is not mapped as deer wintering area, but likely has areas of dense softwood canopy cover that function as suitable winter habitat. At the Powder Lot, this community surrounds several vernal pools, and provides important upland habitat for the wood frogs, spotted salamanders, and other pool-breeding amphibian species.

Temperate Hemlock-Hardwood Forest

Several small patches of this community are found in BHWMA. One small patch is on the East Block, and three patches (forming a single occurrence) are found on the Powder Lot. None of these are state-significant. The mostly closed canopy (approx. 80% cover) includes a mix of Eastern Hemlock (*Tsuga canadensis*), Black Birch (*Betula lenta*), Bitternut Hickory (*Carya cordiformis*), Shagbark Hickory (*Carya ovata*), American Beech (*Fagus grandifolia*), Chestnut Oak (*Quercus montana*), Gray Birch (*Betula populifolia*), and Red Maple (*Acer rubrum*). A shrub layer with 10-20% cover includes American Beech (*Fagus grandifolia*), American Witch-Hazel (*Hamamelis virginiana*), Eastern Spicy-Wintergreen (*Gaultheria procumbens*), an *Amelanchier* sp., and blueberries (*Vaccinium* sp.). During early spring inventory herb cover was sparse with only Flat-Branched Tree Clubmoss (*Dendrolycopodium obscurum*), and Christmas Fern (*Polystichum acrostichoides*). NRCS soil mapping indicates that both occurrences are found on rocky, till-derived soils. The diverse mix of canopy species likely provides suitable habitat for a wide variety of forest-dwelling birds and mammals.

Transition Hardwood Talus Woodland

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Below the Temperate Acidic Cliff on the East Block is a small (less than one acre) occurrence of Transition Hardwood Talus Woodland on the WMA. The WMA boundary traverses this natural community, but there does not appear to be substantial additional acreage beyond what is mapped on state-owned land. This occurrence is not state-significant. The talus is small baseball to soccer ball-sized rocks, with rocky soil in between. The slope is approximately 20 degrees. The vegetation suggests some calcium influence either from bedrock or from colluvial accumulation of nutrients. Over 30 species were noted in this community, including: Sugar Maple (*Acer saccharum*), Bitternut Hickory (*Carya cordiformis*), Northern Red Oak (*Quercus rubra*), Cherry Birch (*Betula lenta*), Basswood (*Tilia americana*), White Ash (*Fraxinus americana*), Hop-Hornbeam (*Ostrya virginiana*), Flowering Raspberry (*Rubus odoratus*), Sharp-Lobed Hepatica (*Anemone acutiloba*), Fragrant Bedstraw (*Galium triflorum*), Canada Wild Ginger (*Asarum canadense*), Plantain-Leaved Sedge (*Carex plantaginea*), and Northern Maidenhair Fern (*Adiantum pedatum*).

Vernal Pool

Vernal pools form in small basins that are often dry, but fill with water in the spring (and occasionally in other seasons) due to heavy rain and snowmelt. Because they lack fish, these pools are excellent amphibian breeding habitat. Unlike other natural communities, which are typically defined and assessed based on vegetation, vernal pools are better characterized and assessed by the amphibian and species present, such as wood frog, spotted salamander, and Jefferson salamander.

Nine Vernal Pools have been mapped within BHWMA. Four pools visited during amphibian breeding season had egg-mass counts indicative of high levels of amphibian use; these pools are state-significant. At least two of these pools had egg masses suggestive of the rare Jefferson salamander. Two pools, on the Middle Block and West Block respectively, appear to be semi-permanent. Three pools have not been fully assessed to determine amphibian use and significance. All pools may still provide habitat for invertebrates such as fairy shrimp, and may have other important ecological functions such as nutrient cycling.

While the vernal pools located on the Powder Lot are fairly typical pools with limited vegetation in the pool area, the examples on the Middle and West Blocks are somewhat atypical. These two pools, which are likely semi-permanent, have extensive cover of Highbush Blueberry (*Vaccinium corymbosum*) and Winterberry Holly (*Ilex verticillata*) growing in the water, although about 50% of each pool remains open. Some plant species noted around the edge of one pool include Witch Hazel (*Hamamelis virginiana*), Black Birch (*Betula lenta*), Red Maple (*Acer rubrum*), New York Fern (*Thelypteris noveboracensis*), Cinnamon Fern (*Osmunda cinnamomea*), and Royal Fern (*Osmunda regalis*). One pool has the rare Broad Beech Fern (*Phegopteris hexagonoptera*) growing around it on damp soils. Both these pools had populations of eastern newts. These pools may provide breeding habitat for wood frog, spotted salamander and Jefferson salamander, but are likely of lesser quality than seasonal vernal pools.

Fine Filter Assessment

<u>Rare, Threatened, and Endangered (RTE) Plant Species</u>

Six species of rare or very rare plants have been located within Blueberry Hill WMA, as well as four uncommon plant species. Several rare species are of particular note. Two species are listed as "threatened" by Vermont state endangered species statute (10 V.S.A. 123); one of these species may only

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persist in Vermont within the WMA. The presence of these plants is thus very important on a statewide basis.

The only known extant population of Flowering Dogwood (*Cornus florida*) is found on the West Block of Blueberry Hill WMA. This very rare species is listed as "threatened" by Vermont statute. There is evidence from USFS Forest Inventory and Assessment data that Flowering Dogwood is declining across its range in the eastern United States (Oswalt et al. 2012). These range-wide declines mirror what has been observed in Vermont, where populations have succumbed to dogwood anthracnose (*Discula destructiva*). Samples collected from the Blueberry Hill population and sent to the US Forest Service for analysis did not have evidence of the *Discula* fungus. It is likely the absence of anthracnose is a result of this population's relative isolation from other Flowering Dogwoods. At this time no active management is needed to perpetuate this species in the WMA; however, regular monitoring is needed to ensure that appropriate management could be taken if anthracnose or other threats are detected.

The remaining rare and uncommon plant species (including white adder's-mouth (*Malaxis monophyllos var. brachypoda*), which is state-listed as "threatened") are found in habitats that are unlikely to be disturbed by extensive management. Maintaining the ecological integrity of dry oak natural communities, cliffs, wetlands, and riparian zones is probably the best strategy for protecting these species.

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Rare, Threatened, and Endangered Plants of Blueberry Hill WMA

Species Name	Common Name	Sites Where Found	State Rarity Rank[1]	Rarity[1]	Legal Status
Cornus florida	Flowering Dogwood	Dry oak forest	S1	Very Rare	Threatened
Malaxis monophyllos var. brachypoda	White Adder's-Mouth	Red maple-black ash swamp	S2S3	Uncommon to Rare	Threatened
Aureolaria flava	Smooth False Foxglove	Dry oak forest	S2	Rare	
Uvularia perfoliata	Perfoliate Bellwort	Dry forests	S2	Rare	
Viola palmata	Wood Violet	Dry oak forest	S2	Rare	
Phegopteris hexagonoptera	Broad Beech Fern	Slightly enriched coves	S2S3	Uncommon to Rare	
Asclepias quadrifolia	Four-Leaved Milkweed	Dry forests	S3	Uncommon	
Hieracium venosum	Rattlesnake Hawkweed	Dry forests	S3	Uncommon	
Lilium philadelphicum	Wood Lily	Dry oak forest	S3	Uncommon	
Viburnum rafinesquianum	Downy Arrowwood	Dry forests	S3	Uncommon	

[1] For a full explanation of these rarity ranks, visit the Vermont Natural Heritage Inventory website: http://www.vtfishandwildlife.com/wildlife_nongame.cfm

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APPENDIX 2: Characteristics of Old Forests

TABLE 1 Common attributes associated with old-growth forests and linkages with key ecological functions and forest adaptation in the context of climate change and an increasing proliferation of non-native insects and diseases. General management strategies to restore and maintain these conditions in second-growth forests are also listed. Adapted from Keeton (2006); Bauhus, Puettmann, and Messier (2009); and D'Amato and Palik (2021).

Old-Growth Attribute	Ecological Function	Adaptation Mechanism	Management Strategies
Presence of large and old trees	• Food, shelter, and breeding habitat for wildlife • Well-developed bark providing substrate for dispersal-limited taxa, such as lichens, lignicolous fungi, and mosses • Perch sites for raptors • Carbon storage	• Conservation of regeneration options and genetic diversity (seed sources)	• Crown thinning to accelerate large-tree growth • Legacy tree designation of long-lived species to allow individual trees to live out natural life span • Potentially focusing old forest work on high-quality sites, which provide high growth potential
Spatial variation in tree density and tree size	• Diversity of habitats (gaps, closed canopy areas) and functional niches for wildlife species • Microhabitats (light, temperature, moisture) supporting understory plant and regeneration development	• Reduced vulnerability to disturbance (spatial variability in wind risk, fuels, drought stress) • Multiple recovery and developmental pathways (regeneration in gaps, propagules from surviving mature trees)	• Regeneration methods that combine removal of individual trees and groups of canopy trees with retention of a high proportion of mature trees in the stand (single-tree and group selection [0.1- to 0.5-acre openings], irregular shelterwoods, variable-density thinning) • Under burning in fire-dependent ecosystems[1]
Abundant downed deadwood in various sizes and stages of decay	• Habitat for deadwood-dependent species • Microsites for regeneration of small-seeded tree species • Soil stabilization, nutrient cycling, and moisture retention • Carbon storage • Water/moisture storage	• Regeneration safe site for tree species during drought • Water storage and reduction in run-off during extreme events • Microrefugia for moisture-sensitive taxa, such as amphibians, during drought	• Felling and leaving larger-diameter trees, particularly through culling • Legacy tree designation to provide future deadwood inputs • Limiting or refraining from salvaging trees after disturbance
Multiple canopy layers	• Foraging and nesting habitat for breeding birds • Habitat for epiphytic lichens • Interception and storage of precipitation • Habitat for arboreal mammal species • Stable microclimates: moderate temperature swings (thermal buffering), reduce wind speeds, maintain higher minimum temps, and provide greater efficiency in absorbing/dissipating incoming solar energy	• Reduced vulnerability to disturbance (heterogeneity in wind risk and host sizes for insect pests) • Resilience to canopy disturbance (presence of advance regeneration) • Water storage via interception to buffer extreme precipitation events	• Regeneration methods that promote and maintain multi-age conditions (selection and irregular shelterwood methods) • Protection of advance regeneration during harvesting

[1] Fire-dependent ecosystems are those in which fire is an important driver of forest conditions and processes, including the establishment and reproduction of certain plant species. Although fire is a comparatively rare disturbance in New England and New York forests relative to other parts of the globe, several of our ecosystems, namely pitch pine barrens and oak woodlands, were historically shaped by natural fires and Indigenous burning practices. As such, restoration of old-growth conditions in these areas may include the use of prescribed fire to restore barren and woodland conditions and encourage the recruitment of certain plant species, including oak and pine.

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Old-Growth Attribute	Ecological Function	Adaptation Mechanism	Management Strategies
Large-diameter standing dead trees (snags)	• Foraging and nesting habitat for breeding birds • Habitat for deadwood-dependent organisms • Roosting sites for bats • Carbon storage • Future source of downed logs	• Microrefugia for moisture-sensitive taxa during drought	• Legacy tree designation to allow for natural snag development, with priority given to existing cavity trees • Girdling of large-diameter trees • Prescribed fire in fire-dependent ecosystems
Regeneration	• Microhabitats (light, temperature, moisture) supporting understory plant and regeneration development • Hiding and nesting cover for bird species	• Reduced vulnerability to disturbance (spatial variability in wind risk, fuels, drought stress) • Multiple recovery and developmental pathways (regeneration in gaps, propagules from surviving mature trees)	• Regeneration methods that promote and maintain multi-age conditions (selection and irregular shelterwood methods) • Protection of advance regeneration during harvesting • Control of competing vegetation (e.g., invasive plants and beech thickets) • Control of deer and moose populations
Plant communities (understory plants, mosses, and lichens)	• Hiding and nesting cover for bird species • Food and energy sources for insects, including late-seral pollinators • Retention and cycling of nutrients	• Source populations for post-disturbance recovery	• Designation of reserve "patches" within stands where no harvesting occurs • Retention of canopy trees supporting an abundance of mosses and lichens

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APPENDIX 3: Forest Inventory Data

Castleton Management Unit – Forest Inventory Data and Treatment Summary v5.8.24

Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
BBHW 508	1	1	1	112	9.9	134	92	1.9	Northern Hardwood	SM 27 WA 13	Multi-aged Management Single tree and group selection, reduce stocking to 60-70 square feet, in 0-5 years
BBHW 508	1	1	2	33	10.0	166	98	10.8	White Pine	WP 55 HH 17	Even-aged Management Thin to maintain stand vigor and live-crown ratios, so that the stand continues to provide winter cover for deer, in 0-5 years.
BBHW 508	1	1	3	139	7.6	116	70	1.0	Dry site oak	BO 24 RO 17	No treatment
BBHW 508	1	1	4	6	4.1	33	33	0.0	Aspen	AS 60 BB 10	FSI: Crop Tree Release
BBHW 508	1	1	5	7	14.9	160	74	4.3	Aspen	AS 71 RO 8	Even-aged Management Clear-cut to regenerate aspen in 0-5 years.
BBHM 508	2	1	1	155	9.2	162	99	5.9	Mixed Hardwoods	RO 22 RM 19	Multi-aged Management Single tree and group selection, reduce stocking to 60-70 square feet, in 0-5 years.
BBHM 508	2	1	2	100	10.3	181	78	6.7	White Pine	WP 72 SM 6	Even-aged Management Thin to maintain stand vigor and live-crown ratios, so that the stand continues to provide winter cover for deer, in 0-5 years.
BBHM 508	2	1	3	260	10.6	155	57	1.2	Dry site oak	CO 25 RO 25	No treatment – much of this stand is inoperable or noncommercial
BBHM 508	2	1	open	22	-	-	-	-	-	-	Maintain open condition.
BBHE 508	3	1	1	33	10.7	115	53	0.8	Mixed Hardwoods	RO 19 RM 26	No treatment, old field, invasives present
BBHE 508	3	1	2	116	10.2	137	100	3.8	Mixed Hardwoods	RO 25 RM 19	Multi-aged Management Single tree and group selection, favor oak species, in 0-5 years
BBHE 508	3	1	3	25	13.8	196	120	8.4	White Pine	WP 87 Hick 8	Even-aged Management Thin to maintain stand vigor and live-crown ratios, so that the stand continues to provide winter cover for deer, in 0-5 years.

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Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
BBHE 508	3	1	4	186	8.4	114	66	1.6	Dry site oak	CO 35 BO 22	No treatment
BBHP 508	4	1	1	103	9.7	168	88	2.3	Mixedwood	HE 48 RO 18	Multi-aged Management Group selection to create browse and YF in 0-5 years
BBHP 508	4	1	2	16	9.5	153	40	0.0	Mixedwood	HE 56 RM 17	No treatment, forested wetland.
BEN 507	1	1	0	5	-	-	-	-	-	-	FSI: Crop Tree Release
BEN 507	1	1	1	37	14.0	158	71	3.6	Mixedwood	HE 52 RM 14	Multi-aged Management Single tree and group selection
BEN 507	1	1	2	34	11.4	212	68	2.3	White Pine	WP 100	Even-aged Management Regenerate stand in two entries using patch sizes of 5+ acres to create young forest conditions. 0-5 years. Treat honeysuckle established after the last harvest.
BEN 507	1	1	2a	6	-	-	-	-	-	-	Evaluate for FSI
BEN 507	1	1	3	24	11.4	236	180	2.5	Mixedwood	WP 54 SM 13	Multi-aged Management Single tree and group selection, reduce UGS in hardwoods, try to regenerate aspen where possible, in 0-5 years
BEN 507	1	1	4	62	11.8	124	86	4.2	N. Hardwoods	SM 36 BE 13	Multi-aged Management Single tree and group selection, reduce stocking to 60-70 square feet, in 0-5 years.
BEN 507	1	1	5	23	4.0	114	103	0.0	Aspen	AS 51 WB 46	Evaluate for FSI
BEN 507	1	2	1	4	9.5	130	100	2.7	N. Hardwoods	SM 69 RO 7	Multi-aged Management Single tree and group selection, reduce stocking to 60-70 square
BEN 507	1	2	2	64	10.3	186	65	1.1	White Pine	WP 76 AS 7	Even-aged Management Regenerate stand in two entries using patch sizes of 5+ acres to create young forest conditions, in 0-5 years.
BEN 507	1	2	2a	5	-	-	-	-	-	-	Evaluate for FSI
BEN 507	1	2	3	6	8.5	180	140	0.0	W. Birch	WB 50 WA 16	No treatment

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Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
BEN 507	1	2	4	62	9.7	149	83	1.7	Mixedwood	WA 37 WP 29	No treatment.
BEN 507	1	2	5	24	7.4	124	48	0.0	Dry site oak	HH 36 Hick 13	No treatment.
BEN 507	1	2	6	15	12.8	186	114	9.4	White Pine	WP 100	Even-aged Management Thin to maintain stand vigor and live-crown ratios, so that the stand continues to provide winter cover for deer, in 5-10 years.
BEN 507	1	2	7	21	5.2	145	67	2.6	Dry site hardwoods	HH 41 WA 20	Multi-aged Management Single tree and group selection, reduce UGS in hardwoods, try to provide vertical structure, in 5-10 years
			7a	7.6							FSI: Crop Tree Release on red oak
			7b	61.4							No Treatment
BEN 507	1	2	8	15	7.3	150	94	0.0	Mixed Hardwood	WA 33 AS 17	Evaluate for FSI
BEN 507	1	2	9	28	6.5	80	54	0.0	Aspen	AS 30 WA 17	Evaluate for FSI
BEN 507	1	2	10	28	11.7	172	76	1.6	Mixedwood Old field		Even-aged Management Regenerate stand in two entries using patch sizes of 5+ acres to create young forest conditions, in 0-5 years
BEN 507	1	2	11	24	2.4	53	100	0.0	Aspen	AS 62 WA 37	No treatment
BEN 507	1	2	NC	43	-	-	-	-	-	-	No treatment
BEN 507	1	2	open	43	-	-	-	-	-	-	Maintain in an open condition.
BEN 507	1	3	1	14.4	11.19	107	67	3.8	Mixedwood	RM 38 ASP 25	Multi-aged Management Single tree and group selection, reduce UGS in hardwoods, try to regenerate aspen and release spruce where possible, 0-5 yrs
BEN 507	1	3	1a	-	-	-	-	-	-	-	Evaluate for FSI
BEN 507	1	3	2	33	13.28	83	43	3.8	Mixed Hardwoods	RO 24 SM 24	Multi-aged Management Group selection, using smaller groups where adequate regen exists or large 2 ac groups in areas dominated by beech, 0-5 yrs
BEN 507	1	3	3	24	11.8	82	54	2.2	Mixed Hardwoods	RM 24 SM 14	No treatment.

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Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
BEN 507	1	3	4	42	8.0	122	73	3.5	Mixed Hardwoods	RM 27 RO 23	Multi-aged Management. Single tree and group selection, reduce stocking to 60-70 sf, favor mast trees treat in 0-5 years
BEN 507	1	3	5	29	11.6	117	85	7.0	N. Hardwoods	SM 46 RO 14	Multi-aged Management Single tree and group selection, reduce stocking to 60-70 square feet, favor mast trees treat in 0-5 years
BEN 507	1	3	open	4	-	-	-	-	-	-	No treatment, maintained by Justin Lindholm per agreement.
BEN 507	1	3	NC	18	-	-	-	-	-	-	No treatment.
IBE 507	2	1	1	30.8	10.7	105	57	4.9	Mixed wood	RM 40 RO14	Multi-aged Management. Expanding gap/ group selection with thinning. 10-15 years.
IBE 507	2	1	2	40.3	9.6	74	54	2.2	Northern Hardwoods	HE 30 BB 23	No treatment.
IBE 507	2	1	3	188	7.8	85	49	2.4	Mixed Hardwoods	RO 20 SM 16	No treatment.
IBE 507	2	1	4	17	13.9	120	77	11.7	White Pine	WP 64 SM 19	Multi-aged Management
IBE 507	2	1	5	24.7	9.8	84	57	1.1	Mixed Hardwoods	RO 24 SM 25	No treatment.
IBE 507	2	1	6	13.8	11.3	95	53	2.9	Mixed Hardwoods	RO 30 SM 25	No treatment.
BES 507	3	1	1	236	11.2	79	59.5	3	Northern Hardwoods	SM 50 WA 13	Multi-aged Management. Group Selection 0-5 years.
BES 507	3	1	3	8.8	11.6	87	61.2	2.5	Mixed wood	RO 50 RM 39	No Treatment.
BES 507	3	1	4	139.6	10.3	106	59	3	Northern Hardwoods	HM 27 RO 21	Multi-aged Management. Group Selection. Single tree selection between groups. 0-5 years.
BES 507	3	1	5	38.8	10.2	90	59	3	Northern Hardwoods	SM 48 WA 22	Multi-aged Management. Group Selection. Single tree selection between groups. 0-5 years.
BES	3	1	6	5.5	-	-	-	-	Wetland	-	N/A

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Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
507											
BES 507	3	2	1	37.3	11.5	104	71	6	Northern Hardwood	SM 69 WA13	Multi-aged Management. Group Selection with thinning between groups. 0-5 years.
BES 507	3	2	2	52	9.4	80	43	0.7	Northern Hardwoods	SM 26 RM 17	Evaluate for FSI
BES 507	3	2	3	41	10.3	63	44.5	2.4	Northern Hardwoods	SM 23 YB 23	No Treatment.
BES 507	3	2	4	15.4	12	120	67	4.9	Northern Hardwoods	HM 40 BE 40	No Treatment.
BES 507	3	2	5	34	8.6	130	82	3	R. Spruce-sugar Maple-BE	RS 80 WB 20	No Treatment.
BES 507	3	2	6	180	11.3	75	66	3	Northern Hardwoods	SM 35 RM 11 WA 9	Multi-aged Management. Group Selection. 0-5 years.
BES 507	3	2	6a	60.45	-	-	-	-	Northern Hardwoods	-	Evaluate for FSI Treatment
BES 507	3	2	6b	77	-	-	-	-	Northern Hardwoods	-	FSI. Crop tree release/ Liberation cutting for sapling/ pole red oak and red spruce
BES 507	3	2	7	178	10.3	80	50	1.7	Northern Hardwoods	HM 44 BE 12	No Treatment.
BES 507	3	2	8	59.7	8.8	82.2	18.2	0.6	Northern Hardwoods	SM 40 YB 18	No Treatment.
BES 507	3	2	9	190	10.2	90	64	3.7	Northern Hardwoods	SM 53 WA 33	No Treatment.
BES 507	3	2	10	25	7.6	127	89	0	Red Spruce	RS 120	No Treatment.
BES 507	3	2	11	32	9.7	88	18	0.4	Northern Hardwoods	BC 36 BE 20	No Treatment.
BES 507	3	2	12	25	12	87	38	1.3	Northern Hardwoods	YB 47 SM 27	No Treatment.
BES 507	3	2	13	9.1	9	120	83	8.6	White pine	WP 80 WB 30	No Treatment.

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Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
BES 507	3	2	14	53.8	9.8	77	64	1.2	Northern Hardwoods	SM 38 YB 15	Multi-aged Management. Group Selection with single tree selection. 5-10 years
BES 507	3	2	15	52.5	9.8	98	75	3.1	Northern Hardwoods	SM 56 WA 9 BE 9	Multi-aged Management. Group Selection. 5-10 years
BES 507	3	2	16	51.5	11.3	80	44	1	Northern Hardwoods	SM 35 BE 20	No Treatment
BES 507	3	2	17	75.5	9.7	51	51	1	Northern Hardwoods	SM 22 BE 9	Multi-aged Management. Group Selection. 0-5 years
BES 507	3	2	18	26.9	9.5	80	58	1.2	Northern Hardwoods	SM 33 WA 13 StM 13 YB 13	No Treatment.
BES 507	3	2	19	184.4	7.3	79	74	3.1	Northern Hardwoods	SM 59 WA 9	Multi-aged Management. Group Selection with single tree selection. 0-5 years
BES 507	3	2	19a	3.6	-	-	-	-	Northern Hardwoods	_	Evaluate for FSI Treatment
BES 507	3	2	20	48	10.2	43	51	0.75	Northern Hardwoods	SM 11 RM 8	FSI: red spruce and red oak release.
BES 507	3	2	21	51.6	9.6	84	74	1.9	Northern Hardwoods	SM 22 YB 20	Multi-aged Management. Group selection with thinning/ crop tree release between groups. 0-5 years
BES 507	3	2	22	16.6	12.8	73	72	2.9	Northern Hardwoods	SM 60 BE 13	Multi-aged Management. Group Selection with thinning. 0-5 years
BES 507	3	2	24	2	-	-	-	-	Land Slide	-	No Treatment
BES 507	3	2	25	14	11	150	56	~4	Mixed Hardwoods	RO 80 SM 30	Even or Multi-aged Management. Group Selection or shelterwood. 0-5 years
BES 507	3	2	26	47.1	10.1	58	52	1.8	Northern Hardwoods	SM 15 RO 11 WA 11	No Treatment
BES 507	3	2	27	11.2	-	-	-	-	Mixed hardwoods	-	No treatment.

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Block Parcel #	Block	Comp	Stand	Acres	QMD	BA/A Total	AGS BA/A	MBF/ Acre	Timber Type	Species %BA	Treatment Recommendations
									(high ridge line)		
BES 507	3	2	28	66.3	5.8	70	54.3	3.6	Northern Hardwoods	RM 18 RO 16 SM 16	No treatment.
BES 507	3	2	29	124	11.1	101	61	3.4	Northern Hardwood	SM 48 YB 11	Multi-aged Management. Single Tree and Group Selection. 0-5 years
BES 507	3	2	30	24.9	15.6	40	100	2.1	Northern Hardwoods	SM 100	No treatment
BES 507	3	2	32	43	9.6	87	46	1.8	Northern Hardwoods	YB 47 BE 20	No treatment
BES 507	3	2	33	70.7	12.3	78	72	3.6	Northern Hardwoods	SM 29 BE 20	Multi-aged Management. Group Selection. 5-10 years
BES 507	3	2	35	17.3	-	-	-	-	Red Spruce	-	No treatment
BES 507	3	2	36	53	10	120	83	2	Northern Hardwoods	SM 67 WA 40	No treatment
BES 507	3	2	37	72	9.6	104	84	2.2	Mixed Hardwoods	RO 47 SM 38	No treatment

[1] **Blueberry Hill WMA Parcel ID – 508**
BBHW – Blueberry Hill West Block (Block 1)
BBHE – Blueberry Hill East Block (Block 3)
BBHM – Blueberry Hill Middle Block (Block 2)
BBHP – Blueberry Hill Powder Block (Block 4)
Birdseye WMA Parcel ID – 507
BEN – Birdseye North Block (Block 1)
IBE- Ira-Birdseye Block (Block 2)
BES – Birdseye South Block (Block 3)
[1]

Code	Species	Code	Species
AS	aspen	RM	Red maple
BB	Black birch	RO	Red oak
BC	Black cherry	RS	Red spruce
BE	Beech	SM	Sugar maple

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BO	Black oak	StM	Striped maple
CO	Chestnut oak	WA	White ash
HH	Hardhack	WB	White birch
HE	Hemlock	WP	White pine
Hick	Hickory spp	YB	Yellow birch

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APPENDIX 4: Public Comment Summary

CASTLETON MANAGEMENT UNIT
Birdseye and Blueberry Hill Wildlife Management Areas
Public Comments and Responses

Comments are compiled from the public scoping process for the development of the Castleton Management Unit long-range management plan including an In-Person Meeting on 9/29/2021, distribution of a StoryMap, and in-person meeting on March 29, 2017 (BBHWMA only). Comments from the 2017 meeting are labeled BBH. Public comments are in bold. Like comments are grouped. ANR responses follow.

The purpose of this document is to provide readers with a summary of the public comments that were received during the Public Comment period for the Castleton Management Unit Long-range Management Plan including Blueberry Hill and Birdseye Wildlife Management Areas. The public input process was purposefully varied and included open-house style meetings, a widely shared digital StoryMap, public input surveys, and conversations with partner organizations, neighbors, and interested public to encourage meaningful dialogue of value and context.

Public comments were received, reviewed, and summarized by the Rutland District Stewardship Team (DST). The DST is an interdisciplinary group of Agency of Natural Resources professionals from the Departments of Fish and Wildlife, Forests, Parks and Recreation, and Environmental Conservation. The DST is responsible for planning and management of ANR lands within the Rutland district. When necessary, this group seeks input from other ANR professionals. This document organizes comments by theme and includes a response from the Agency of Natural Resources.

HUNTING, FISHING, TRAPPING

From the public:

- **Traditional uses should continue and hunting should not be restricted**
- **Hunting, fishing, and trapping are priority one, along with proper timber management to promote this.**
- **Thank you for making it a priority for hunters, fishers, and trappers to access this beautiful landscape**
- **Please focus more on leaving large areas remote, open to hunting/fishing/trapping. We do not need more trails or human "developments"**
- **Hound hunting and trapping are so cruel. These practices give Vermont the reputation of being "backwards" and out of touch. I believe Vermont is making a terrible mistake by allowing out of state visitors to kill our wildlife for their own entertainment. Vermont would be better served being known for wildlife protection, wildlife habitat protection, and tough laws penalizing anyone who is speeding through areas where wildlife cross roadways. I would like to see Vermont earn its money by keeping animals**

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alive in their natural habitat, rather than earing money by selling the lives of those animals to hunters.

- **I will be interested in hunting grouse and woodcock in the future.**
- **I learned to hunt in the area with family and harvested many deer there. Numerous different wildlife sightings like bobcats bear fishers raccoons turkeys and an interesting observation of finding on different occasions balloons or remnants of balloons with identification tags attached that I called the phone number attached and found they were launched from different schools from areas in New York**
- **I went hunting and didn't see anything because the forest isn't properly managed.**
- **The hunting success rate has declined average the past 10 years. Less grouse and deer at this property than in the past.**
- **Signage to educate folks about funding sources that conserve WMAs.**

ANR Response:

Recreational use on the Castleton Management Unit is guided by ANR and department missions, the Rule Governing Public Use of Vermont Fish and Wildlife Department Lands, legal constraints, Conservation Easement conditions and LRMP guidance. As a result, CMU supports dispersed fish and wildlife-based activities including hunting, fishing, trapping, wildlife observation, and other wildlife-related outdoor activities. The large parcel size, diverse terrain, and road access combine to provide recreation opportunities that are both easily accessible as well as areas that are trailless, more remote and rugged. Additionally, and consistent with these uses, the Conservation easement held on the southern block of Birdseye WMA has stated recreation goals promoting non-commercial opportunities that include hunting, fishing, trapping, birdwatching, cross-country skiing, snowshoeing, walking and wildlife observation. Snowmobile use is allowed along existing, designated VAST trails.

Hunting, fishing and trapping are permitted on state land unless otherwise designated. The actual pursuit of fish and wildlife is governed by rules and regulations established by the Vermont Fish and Wildlife Board.

Forest management projects are implemented to achieve a variety of goals including wildlife habitat management.

RECREATION

From the public:

- **Mountain bikes are everywhere. Please think about opening up more areas for horses**
- **More cycling**
- **More signage and parking for better accessibility**
- **Consider prohibition of snowmobiles and ATVs until they're electric**
- **Perhaps some trails included to attract hikers. Brook stocking of some brook trout. Historical markers.**
- **Designated hiking trails and no ATV use/increased signage.**
- **It's a great hike. Great views.**
- **It makes me happy**
- **Beautiful place**

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ANR Response:

CMU offers opportunities for a variety of dispersed recreation activities including a remote setting for wildlife-based activities.

Recreation on WMAs are guided by rules governing public use of Vermont Fish and Wildlife Lands (https://vtfishandwildlife.com/conserve/lands-and-habitats/state-lands-and-state-managed-lands/wmas-management-and-funding). Horseback riding, dog sledding, non-motorized cycle riding, and use of motorized vehicles (except on designated trails), are prohibited activities on WMAs based on this rule. Further, the recently acquired lands of Birdseye WMA are governed by the Conservation Easement that has stated goals promoting non-commercial recreational opportunities that include "non-motorized, low impact, low density, dispersed wildlife-based activities" including hunting, fishing, trapping, wildlife viewing and photography, dispersed wildlife-based pedestrian activities (i.e. walking, snowshoeing, cross-country skiing), non-commercial berry picking and primitive camping (following VFWD guidelines). Snowmobiles are allowed only on designated trail corridors.

FOREST & HABITAT MANAGEMENT

From the public:

- **Given that there are rocky outcrops on the property I would suggest this could be ideal bobcat habitat. Look for opportunities to create young forest habitat in the vicinity of these ledge complexes to support prey for bobcats and other wildlife.**
- **Any place you can create another clearing would be much appreciated. VT has too much forest that's too old to support a variety of wildlife**
- **I would like to see more early successional habitat created.**
- **The work being done at Birdseye is fantastic. I would like to see more patch cuts to increase habitat.**
- **Timber stand improvement, increase stem count to improve game animals habitat. Handicap ATC access to area.**
- **Preserve this land as much as possible. Severely limit clearcutting of trees, all terrain vehicles and development.**
- **Manage timber better**
- **I believe VTANR can do more to manage the habitats in the WMUs to support game populations**
- **I have seen progress in management over the years.**
- **Keep logging**
- **Actively manage the forest for timber and wildlife and have an active, visible plan as if you were in current use. Make sure the forestry industry is considered**
- **Do some timber harvesting to improve habitat (primarily game species) – BBH.**
- **Timber is becoming over mature and it would generate revenue that could be used to improve public access – BBH.**
- **Like views as they are and would like to not see timber harvesting – BBH.**
- **Oak stands are important for wildlife – BBH.**

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- **Value the area as deer wintering habitat and the importance of oaks for that habitat – BBH.**
- **Not enough deer browse – BBH.**
- **Wonder whether active management will occur on the WMA and how aggressive it would be – BBH.**
- **Leave portions of the forest unmanaged – BBH.**

ANR Response:

Actively managing wildlife habitat while conserving special features/habitats/species is central to WMA management. Management strategies are thoughtfully developed during the planning process based on mission, ownership goals, legal constraints, silviculture and habitat management guidance, and on an assessment of resources and natural features. The Land Management Classification for CMU represents a balance of actively managed forests and those that are passively transitioning toward old forest. Central to achieving those goals are science-based approaches to habitat management, climate adaptation, developing forest complexity, and silviculture.

Within this planning period 11 harvests are planned; designed to achieve a diverse set of goals including creation of both young and old forest conditions, enhanced wildlife habitat (i.e. mast, early successional habitat, enhanced species, age and structural complexity, deer winter habitat, climate adaptation). Following guidance from the Vermont Conservation design for the Taconic Mountains, management will strive to reverse the decline of young forest in the region with a goal of creating 3-4% in the 1-20 year age class and increasing the old forest target by 3%.

LONG RANGE MANAGEMENT PLAN DEVELOPMENT

From the public:

- **Out of state anti-hunting groups should not be allowed to comment**
- **This is a special area that must be maintained for future generations!!!**
- **Thank you for creating this survey. A good way to get input.**
- **One of the most remote areas in Western Rutland County. Please keep it that way… Thanks.**
- **Keep it wild**
- **No "forest preserves", "core areas", etc.**

ANR Response:

LRMP development is a robust process that includes resource inventories and assessments, and public input is a very important part of that process. Comments are taken as advice by the agency. The purpose is not to institute majority rule management of public land. However, in developing management plans, every effort will be made to include suggestions which are compatible with the ANR and its departments' missions; compatible with ANR lands management principles and goals; and which are fiscally realistic. Public input was sought in a purposely varied way and included in-person meetings, StoryMaps, and surveys. The ANR planning process includes a Land Management Classification that allocates land based on a

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thorough understanding of resources and application of over-arching lands management standards. This allows the public and land managers to have a common understanding of the overall level of use or type of management to occur on sections of ANR lands. These categories include Highly Sensitive, Special Management, General Management and Intensive Management areas. “Forest preserve” and “core area” are not categories of the Land Management Classification.

We agree, this is a remote area unique in this part of the county. That condition is recognized in the acquisition of the property, the conservation easement that governs its management, public comment, as well as within the LRMP.

WILDLIFE

From the public:

- **Peregrine falcons need their aerie protected.**
- **Some great bobcat tracks on Birdseye. Amazing place for furbearers**
- **I’ve been hunting grouse here for around 40 years. The bird numbers vary yearly, but they’re nowhere near what they were prior to about 15 years ago. The white pines along the Birdseye Rd. (mostly gone on the west side) and east of the clearing of the new parking area used to hold very high numbers of roosting birds. Tough to hit, but they were there. Not any more.**
- **Cerulean warbler observed on east block in spring 2016 and west block in spring 2015 – BBH.**
- **Need to do some cuts in order to have food for deer – BBH.**

ANR Response:

Peregrine Falcons populations have been recovering and as a result were removed from the endangered species list in 2005. They remain a Species of Special Concern. Due to the sensitivity of Peregrine falcons to disturbance people are cautioned to avoid nesting areas during the period from March-July.

CMU provides diverse habitat however, it is not static and continues to change over time through management and natural processes. Management prescribed with this LRMP includes actions to create young forest (1-20 years old) as well as that to advance old forest conditions. Grouse specifically are strongly associated with the young forest conditions that are part of the goals for this management unit over the next 15 years.

Deer utilize both young and mature forest as critical habitats within their range. Both of which are amongst the goals of the management for the CMU. The white pine stands along the Birdseye Road were blow down during a wind storm (a natural process event) and were harvested as part of a salvage operation in 2018

ACCESS & PARKING

From the public:

- **Access is limited to only one location on Blueberry Hill; access to the eastern side of Birdseye is limited too**

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- **Improve access to Blueberry Hill that is limited by US Route 4**
- **When dept was trying to raise money for access to blueberry hill the national wild turkey federation Vermont state chapter stepped up with funds**
- **The state continues to own parcels of public land that only serve the adjoining property owners…identify and create public access areas so that we can all enjoy our public lands.**
- **Just to say that I am an ardent support of any, and all WMAs in the state. I myself visit Wenlock, West Mountain quite a bit, and have been known to hike around Steam Mill Brook. I have seen these units getting more use every year. The more options that we have, the less crowded that they will be. The less crowded that they are, the less the chance of confrontation between users. There is never too much wild land!**
- **If the parcel owned by David Rogers heirs becomes available, it would be an opportunity to purchase it and join to large portions into one and improve access to the Blueberry Hill area.**
- **Signage to educate folks about funding sources that conserve WMAs – BBH**
- **Should have signs explaining what the public access is or isn't, for example on the Pent Road – BBH.**
- **Concern regarding public walking through privately owned parcel to access state land – BBH.**
- **Interested in easement from Route 4 rest area to private land – BBH.**
- **The state should sell the parcels if they are not going to get access onto them so the town of Castleton can get tax revenue – BBH.**
- **Poor access – department should explore options – BBH.**
- **Should arrange to use the rest are for public access – BBH.**
- **A big problem is the lack of public access to and into these parcels. The department in cooperation with legislative office holders and the public need to explore the possibilities – BBH.**
- **Interest in how the property can be accessed by the public and/or if there is any way public access can be improved. Suggestions include purchasing adjacent properties or at least rights-of-way, developing and access/ rest area off route 4 (likely the middle block) – BBH.**
- **Leave access as is, like the lack of people – BBH.**
- **Frustrated that the property is difficult to deer hunt because of the long distance to drag a deer out – BBH.**
- **Wonder about potential to build share access off Route 4 cooperating with landowner between the middle and east blocks – BBH.**
- **Need better public access to the WMA – BBH.**

ANR Response:

Access to and within Blueberry Hill WMA continues to be a challenge. These challenges are mitigated in part by access to the Middle Block through an agreement between VFWD and the

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Vermont Federation of Sportsmen. Through that agreement a parking area and public pedestrian access is provided.

The individual parcels that make up the WMA were acquired from VTrans following the construction of US Route 4 and included lands that were made inaccessible due to that construction. To complicate the public access, Route 4 is a limited access highway and access to the WMA is not allowed from the highway.

That said, ANR is always open to explore opportunities to enhance appropriate public access to public lands. The process must include a willing seller and the funding necessary to secure access.

ANR has been able to piece together some management access although full management access has also not been achieved to date.

Castleton Management Unit – LRMP Scoping Survey – Summary of Responses

This on-line survey was imbedded in the Story Map and made available to attendees of the in-person meeting held on 9/29/2021. Fifty-nine (59) people responded to the survey. The results are summarized below.

Of the 59 respondents:

- 70% said that they recreated on CMU
    - Of that nearly 80% hunted
    - And 70% hiked
- Most accessed the CMU from the north via the Castleton-Birdseye Road (66%)
- Very few from the south via Ames Hollow (5%)
- Visitation was fairly evenly distributed throughout the year and most visited in the 1-5 day frequency range
- Most respondents chose to recreate at CMU citing “quality of hunting” and “close to home” as reasons to visit.
- Evaluation of the importance of resources:
    - Fish and wildlife habitat followed by hunting, fishing and trapping were chosen as most important resources on CMU.
    - Resource protection and sustainable forestry were chosen as very important.
    - Pedestrian recreation (xc ski, snowshoe, hiking) and scenery were ranked as moderately important.
    - Economic benefits and climate change were ranked as somewhat important.
    - Snowmobiling was ranked as not important.
- Availability of resources:
    - Respondents said there is the right amount of:
        - Parking, recreation access, fishing access, hunting access, informational signage, and managed wildlife habitat

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        - And 70% said there is the right amount of remote areas/quiet forest areas
    - They stated that there are too little forest management areas
- How would you like to see the following managed?
    - 1. Fish and wildlife habitat (82%)
    - 2. Recreation (77%)
    - 3. Sustainable forestry (69%)
    - 4. Resource conservation (60%)
    - 5. Scenery/aesthetics (54%)
- Conflict
    - Moderate conflict between Fish and wildlife-based recreation and other types of recreation
    - Low conflict between recreation and wildlife
    - Low between recreation and natural resources
    - Low between timber and recreation
    - Low between timber and water quality
- Respondents stated overwhelming interest in CMU LRMP was as a recreational user (84%)
- 90% of those responding did not attend the in-person meeting
- Most (41%) heard about the survey through ANR social media
- Respondents were primarily from NY and Vermont (83%)
- And 23% of them were from the local area
- Age – 86% were over the ages of 45. Breakdown: 65+ (24%); 55-64 (27%); 35-44 (20%) and 45-54 (15%)

Individual responses were as follows:
Q10: *Do you have any additional comments for the Agency of Natural Resources on current or future management of the Castleton Management Unit?*

- Mountain bikes are everywhere. Please think about opening up more areas for horses
- Traditional uses should continue and hunting should not be restricted
- Not yet
- Hunting, fishing, and trapping are priority one, along with proper timber management to promote this.
- Thank you for making it a priority for hunters, fishers, and trappers to access this beautiful landscape
- Please focus more on leaving large areas remote, open to hunting/fishing/trapping. We do not need more trails or human "developments"
- Given that there are rocky outcrops on the property I would suggest this could be ideal bobcat habitat. Look for opportunities to create young forest habitat in the vicinity of these ledge complexes to support prey for bobcats and other wildlife.
- Out of state anti-hunting groups should not be allowed to comment
- Any place you can create another clearing would be much appreciated. VT has too much forest that's too old to support a variety of wildlife
- I would like to see more early successional habitat created.

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- Peregrine falcons need their aerie protected.
- Hound hunting and trapping are so cruel. These practices give Vermont the reputation of being "backwards" and out of touch. I believe Vermont is making a terrible mistake by allowing out of state visitors to kill our wildlife for their own entertainment. Vermont would be better served being known for wildlife protection, wildlife habitat protection, and tough laws penalizing anyone who is speeding through areas where wildlife cross roadways. I would like to see Vermont earn its money by keeping animals alive in their natural habitat, rather than earing money by selling the lives of those animals to hunters.
- More cycling
- This is a special area that must be maintained for future generations!!!
- Thank you for creating this survey. A good way to get input.
- More signage and parking for better accessibility
- Consider prohibition of snowmobiles and ATVs until they're electric
- Perhaps some trails included to attract hikers. Brook stocking of some brook trout. Historical markers.
- Designated hiking trails and no ATV use/increased signage.
- The work being done at Birdseye is fantastic. I would like to see more patch cuts to increase habitat.
- Timber stand improvement, increase stem count to improve game animals habitat. Handicap ATC access to area.
- Preserve this land as much as possible. Severely limit clearcutting of trees, all terrain vehicles and development.
- Manage timber better
- I believe VTANR can do more to manage the habitats in the WMUs to support game populations
- Access is limited to only one location on Blueberry Hill; access to the eastern side of birdseye is limited too
- Improve access to Blueberry Hill that is limited by US Route 4

Q17: *If you would like to receive more information about the Castleton Management Unit long-range management plan including future opportunities to provide feedback, please provide your email address.*

- Those who submitted email addresses were added to the stakeholder mailing list.

Q18: *Do you have any history, stories, or general observations you would like to share about the management unit?*

- Keep up the good work, Travis!
- The state continues to own parcels of public land that only serve the adjoining property owners…identify and create public access areas so that we can all enjoy our public lands.
- When dept was trying to raise money for access to blueberry hill the national wild turkey federation Vermont state chapter stepped up with funds
- Just to say that I am an ardent support of any, and all WMAs in the state. I myself visit Wenlock, West Mountain quite a bit, and have been known to hike around Steam Mill Brook. I have seen these units getting more use every year. The more options that we

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have, the less crowded that they will be. The less crowded that they are, the less the chance of confrontation between users. There is never too much wild land!

- Some great bobcat tracks on Birdseye. Amazing place for furbearers
- Note to survey people – you did not list the NEK towns of Victory or Granby – I live in Victory not Greensboro as indicated above. Thank you.
- I've been hunting grouse here for around 40 years. The bird numbers vary yearly, but they're nowhere near what they were prior to about 15 years ago. The white pines along the Birdseye Rd. (mostly gone on the west side) and east of the clearing of the new parking area used to hold very high numbers of roosting birds. Tough to hit, but they were there. Not any more.
- I will be interested in hunting grouse and woodcock in the future.
- I have seen progress in management over the years.
- One of the most remote areas in Western Rutland County. Please keep it that way… Thanks.
- I learned to hunt in the area with family and harvested many deer there. Numerous different wildlife sightings like bobcats bear fishers raccoons turkeys and an interesting observation of finding on different occasions balloons or remnants of balloons with identification tags attached that I called the phone number attached and found they were launched from different schools from areas in New York
- It's a great hike. Great views.
- It makes me happy
- I went hunting and didn't see anything because the forest isn't properly managed.
- Keep it wild
- The hunting success rate has declined average the past 10 years. Less grouse and deer at this property than in the past.
- Beautiful place
- If the parcel owned by David Rogers heirs becomes available, it would be an opportunity to purchase it and join to large portions into one and improve access to the Blueberry Hill area.

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APPENDIX 6: App. § 15 Rule Governing Public Use of Vermont Fish and Wildlife Department Lands

1.0 Authority

1.1 This rule is adopted pursuant to 10 V.S.A. §4145(a) which authorizes the Board to adopt rules to "regulate the use by the public of access areas, landing areas, parking areas or other lands or waters acquired or maintained pursuant to 10 V.S.A. § 4144."

2.0 Purpose

2.1 The purposes of this rule is to regulate public activities and use at Wildlife Management Areas, Riparian Lands, Conservation Camps, and Fish Culture Stations in order to protect, manage, and conserve the fish, wildlife, vegetation, and other natural and cultural resources of the state, to provide for the safe and efficient operation of the developed facilities of the Department and to protect the health, safety, and welfare of the public.

2.2 To foster quality hunting, fishing, trapping, and other fish-based and wildlife-based activities at these lands and facilities.

2.3 This rule does not apply to Fishing Access Areas governed by 10 V.S.A. § 4145.

2.4 This rule is not intended to interfere with deed restrictions, easements, rights-of-way or other applicable legal agreements.

3.0 Definitions

3.1 "Board" means the Vermont Fish and Wildlife Board as defined in 10 V.S.A. § 4041.

3.2 "Department" means Vermont Fish and Wildlife Department.

3.3 "Commissioner" means Commissioner of the Vermont Fish and Wildlife Department.

3.4 "Wildlife Management Area" or "WMA" means any lands or portions of lands of the Department so designated by the Department.

3.5 "Riparian Land" means any lands or portions of lands of the Department other than WMAs, Fish Culture Stations, Fishing Access Areas, and Conservation Camps so designated by the Department, such as but not limited to stream bank parcels, dams, and pond sites.

3.6 "Conservation Camp" means any facilities, lands or portions of lands of the Department so designated by the Department.

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3.7 “Fish Culture Station” means any facilities, lands or portions of lands of the Department so designated by the Department.

3.8 “Designated Site” means a delineated area at a WMA, Riparian Land, Conservation Camp or Fish Culture Station that the Department has designated for a particular activity or prohibition on an activity, and so identified and demarcated with signage or identified on a Department-issued map.

3.9 “Designated Corridor” means a road, trail, path or other linear travel route at a WMA, Riparian Land, Conservation Camp or Fish Culture Station that the Department has designated for travel by a particular means or vehicle, and so identified with signage or identified on a Department-issued map.

3.10 “Authorized Activity” means an activity for which a person does not need prior permission to engage in, and can engage in at a WMA, Riparian Land, Conservation Camp or Fish Culture Station, or at a Designated Site or on a Designated Corridor within a WMA, Riparian Land, Conservation Camp or Fish Culture Station.

3.11 “Prohibited Activity” means an activity that no person, group, business or entity shall be allowed to engage in under any circumstances, and for which no Permit, License or Lease shall be authorized, except as provided for in Sections 6.0 of this regulation.

3.12 “Commercial Activity” means any activity or service that produces income for any person, group, business or entity, including any activity or service by any non-profit entity where a fee is required or requested.

3.13 “Special Use Permit” means a written authorization issued by the Department or its designee issued to a person, group, business or entity to undertake an activity.

3.14 “Group” means ten (10) or more persons.

3.15 “Primitive Camping” means temporary overnight occupancy in a natural environment with no developed facilities leaving the site in its original condition so there is no or minimal evidence of human visitation.

3.16 “Self-contained Camping” means camping with a portable shelter equipped with a self-contained, portable, sanitary toilet.

3.17 “Artifact” means an object produced or shaped by human craft, especially a tool, weapon, or ornament or archaeological or historical interest.

3.18 “Emergency situation” means an unintended or unforeseen situation that poses a risk to the health or life of a person or animal.

3.19 “Field processing” means the gutting or dressing or other removal of non-consumptive parts of an animal for the preservation of the carcass to include the boning and quartering.

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3.20 "Tree stand" means a platform or structure (placed for any period of time) which is fastened to a tree by nails, bolts, wire, or other fasteners that intrude through the bark into the wood of the tree, or around the tree.

3.21 "Ground blind" means a structure or manufactured enclosure made of natural or man-made materials placed on the ground to assist in concealing or disguising the user or occupant. This does not apply to blinds constructed for purposes of hunting waterfowl which are governed by 10 V.S.A. App. § 23.

3.22 "Bait" means any animal, vegetable, fruit, or mineral matter placed with the intention of attracting wildlife.

3.23 "All-terrain vehicle" or "ATV" means any non-highway recreational vehicle, except snowmobiles, having no less than two low pressure tires (10 pounds per square inch, or less) or tracks, not wider than 60 inches with two-wheel ATVs having permanent, full-time power to both wheels, and having a dry weight of less than 1,700 pounds, when used for cross-country travel on trails or on any one of the following or a combination thereof: land, water, snow, ice, marsh, swampland, and natural terrain.

3.24 "Utility task vehicle" means a side-by-side four-wheel drive off-road vehicle that has four wheels, or tracks, and is propelled by an internal combustion engine with a piston displacement capacity of 1,200 cubic centimeters or less, and has a total dry weight of 1,200 to 2,600 pounds.

3.25 "Waterbody" means any lake, pond, river, or stream.

4.0 Authorized Activities

4.1 The following activities are authorized on all lands under this rule:

a) Hunting, fishing, trapping, and target shooting at designated shooting ranges, as well as all other activities authorized under 10 V.S.A. Part 4;

b) Fish and wildlife viewing and photography;

c) Boating, including launching and landing, for fish-based and wildlife-based activities where not otherwise prohibited by any other relevant regulations or statutes;

d) Dispersed, wildlife-based pedestrian activities including walking, snowshoeing, swimming, cross-country skiing, and collection of shed antlers;

e) Non-commercial picking of berries, nuts, fungi, and other wild edibles except ginseng;

f) Camping for purposes of hunting, fishing or trapping:

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i. Primitive camping on WMAs designated by the Department for no more than 3 consecutive nights. Camp sites must be at least 200 feet from any waterbody, property line, or road;

ii. Self-contained camping on sites designated by the Department for this purpose, for no more than 16 days during the periods of May 1-31, September 1 through December 15. No individual parcel will have more than three designated sites for self-contained camping unless that site's use has been demonstrated to have preceded January 1, 2007.

g) Fish-based and wildlife-based commercial activities limited to those specified in 4.a-4.c of this subsection when conducted by a person. This shall include guiding for purposes of fishing, hunting, and trapping.

5.0 Prohibited Activities

5.1 The following activities are strictly prohibited, unless otherwise authorized in accordance with Section 6:

a) The operation of any ATV, UTV, or any wheeled or tracked motorized vehicle not registered for public highway use, except as noted as provided for under this subsection and section 6.0 of this regulation:

i. Pursuant to 23 V.S.A. § 3506 (b) (4), ATV use is prohibited on, "any public land, body of public water…unless the secretary has designated the area for use by all-terrain vehicles pursuant to rules promulgated under provisions of 3 V.S.A., chapter 25."

ii. If the Secretary has previously designated an area of state land for use by ATVs pursuant to 23 V.S.A. § 3506 (b) (4), the Commissioner shall authorize a designated corridor on Department lands for under section 6.0 of this rule subject to the terms and conditions the Commissioner deems appropriate.

b) Use of motorized vehicles except on roads specifically designated for such use;

c) Snowmobiling except as approved by the Department and on designated corridors;

d) Horseback riding, dog sledding, non-motorized cycle riding, or use of motorized vehicles except on designated corridors;

e) Draft and pack animals except for retrieval of legally harvested moose, deer, and black bear during the respective hunting season(s);

f) Commercial Activities except those allowed under 4.1(a-c);

g) Artifact or fossil collection;

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h) Fires except in emergency situations, or for non-primitive and primitive camping in accordance with 4.1(f);

i) Abandoning, or disposing of any animal carcass, or their parts, except that portions of fish or game legally harvested on the property may be deposited on site during routine field processing for preservation and transport, or parts used in conjunction with legal trapping;

j) Construction or placement of temporary or permanent structures, except as provided under Section 7 of this rule or for primitive and non-primitive camping in accordance with Section 4.1(f);

k) Collection of plants, trees, evergreen brush or limbs, except wild edibles as allowed under Section 4.1(e) of this rule;

l) Use of any fireworks or pyrotechnic devices except signal flares in an emergency situation;

m) Feeding or baiting of wildlife except if otherwise authorized by law;

n) Taking of fish from a fish culture station except during special events established by the Department, including but not limited to fishing derbies, clinics, and educational events;

o) Entering within 500 feet of any building or other associated infrastructure that is associated with a Department Fish Culture Station or Conservation Camp during times of the day other than those times posted for public use;

p) Parking of vehicles except while engaged in an Authorized Activity;

q) All other activities not specifically authorized by this rule, or authorized in writing by the Commissioner including, but not limited to: para-sailing, hang-gliding, recreational rock climbing, and geocaching.

6.0 Special Use Activities and Designated Sites on Vermont Fish and Wildlife Department Lands

6.1 The Commissioner may grant a Special Use Permit, Lease or License for any activity under this rule, subject to Section 5.1(a), so long as the Commissioner has determined that there will be no adverse impact on Authorized Activities or other adverse impacts on Authorized Activities or other adverse impacts on the primary purposes of ownership.

6.2 The Commissioner may designate a site, by means of signage, or being identified on a Department-issued map, for any activity under this rule, subject to Section 5.1(a), so long

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as the Commissioner has determined that there will be no adverse impact on Authorized Activities or other adverse impacts on the primary purposes of ownership.

6.3 The Commissioner may permit accommodations to persons with a qualified disability pursuant to the Americans with Disabilities Act.

7.0 Use of Tree Stands and Ground Blinds on WMAs

7.1 Permanent tree stands and ground blinds are prohibited on state-owned WMAs.

7.2 Temporary tree stands and ground blinds are permitted on state-owned WMAs under the following conditions:

a) Tree stands and ground blinds may be erected and used without written permission from the Department during the time period from the third Sunday in August through the third Saturday in December annually, May 1 through May 31, all dates inclusive, or during any Youth Hunting Day or Weekend. This does not include blinds constructed for purposes of hunting waterfowl pursuant to 10 V.S.A. App. § 23.

b) Tree stands and ground blinds may be erected and used at other times of the year with advance notice to, and written permission from, the Department's District office staff responsible for managing and administering state land in the District in which the land is located.

c) Tree stands and ground blinds used on WMAs must be constructed and erected in such a way that:

i. No damage is done to any living tree in erecting, maintaining, using, or accessing the stand or blind except that:

a) Dead limbs, trees or shrubs may be removed as needed to erect and use the stand or blind, and;

b) No live limbs, trees or shrubs may be cut for any purpose except those one inch or less in diameter at either ground level or from the main stem or branch of the tree where the stand or blind is located as appropriate (for guidance, a United States quarter is .9 inch in diameter), and;

c) No nails, bolts, screws (including access steps), wire, chain or other material that penetrates through the bark and into the wood of live trees shall be used in erecting any stand or blind, and;

d) All tree stands or ground blinds used on WMAs must be clearly and legibly marked with the owner's name and address. Marking shall be

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legible and placed in a manner that enables a person to conveniently and easily read it.

7.3 Tree stands and ground blinds that do not conform to this regulation are prohibited and may be confiscated and/or destroyed by the Department. Building, erecting, maintaining, using or occupying a non-conforming tree stand or ground blind is prohibited. Construction of any tree stand or ground blind does not confer exclusive use of its location to the person who built it. Any person may use that location for purposes consistent with this rule.

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APPENDIX 7: Glossary

The following is a series of key words and their definitions used in the development of Long-Range Management Plans for Vermont Agency of Natural Resource lands.

Acceptable Management Practices (AMPs). In this plan, a series of erosion control measures for timber harvesting operations, as identified in state statutes. The AMPs are the proper method for the control and dispersal of water collecting on logging roads, skid trails, and log landings to minimize erosion and reduce sediment and temperature changes in streams.

Acceptable Growing Stock (AGS). AGS trees exhibit form and appearance that suggests they will maintain and/or improve their quality and can be expected to contribute significantly to future timber crops in the form of vigorous high-quality stems. They contain or may potentially produce high or medium quality sawlogs.

Age Class. One of the intervals, commonly 10 to 20 years, into which the age range of forest trees are divided for classification or use. Also pertains to the trees included in such an interval. For example, trees ranging in age from 21 to 40 years fall into a 30-year age class; 30 designates the midpoint of the 20-year interval from 21 to 40 years.

All-aged (Uneven-aged) system. Timber management which produces a stand or forest composed of a variety of ages and sizes. Regeneration cutting methods in this system include single tree selection and group selection.

Basal area. A measure of the density of trees on an area. It is determined by estimating the total cross-sectional area of all trees measured at breast height (4.5 feet) expressed in square feet per acre.

Best management practices. A practice or combination of practices determined to be the most effective and practicable means of preventing negative impacts of silvicultural activities.

Biodiversity. The variety of plants and animals, their genetic variability, their interrelationships, and the biological and physical systems, communities, and landscapes in which they exist.

Biophysical region. A region with shared characteristics of climate, geology, soils, and natural vegetation. There are currently eight biophysical regions recognized in Vermont.

Block. A land management planning unit.

Browse. The part of leaf and twig growth of shrubs, vines, and trees available for animal consumption.

Canopy. The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Capability. The potential of an area to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management

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intensity. Capability depends on current conditions and site conditions such as climate, slope, landform, soils, and geology as well as the application of management practices such as silvicultural protection from fire, insects, and disease.

Cleaning (Weeding). Regulating the composition of a young stand by eliminating some trees and encouraging others, and also freeing seedlings or saplings from competition with ground vegetation, vines, and shrubs.

Clearcutting. A cut which removes all trees from a designated area at one time, for the purpose of creating a new, even-aged stand.

Commercial forest land. Land declared suitable for producing timber crops and not withdrawn from timber production by statute or administrative regulation.

Conservation. The careful protection, planned management, and use of natural resources to prevent their depletion, destruction, or waste.

Conservation easement. Acquisition of some rights on a parcel of land designed to keep the property undeveloped in perpetuity.

Cover. Vegetation which provides concealment and protection to wild animals.

Cull Tree. Tree that does not meet regional merchantability standards because of excessive unsound cull. May include noncommercial tree species.

Cultural operation. The manipulation of vegetation to control stand composition or structure, such as site improvement, forest tree improvement, increased regeneration, increased growth, or measures to control insects or disease. Examples of methods used are forest stand improvement, cleaning or weeding, release, and site preparation.

DBH (diameter at breast height). The diameter of the stem of the tree measured at breast height (4.5 feet or 1.37 meters) from the ground.

Deer wintering area. Forest area with at least 70 percent conifer that provides suitable, stable habitat to meet deer needs during the winter.

Den tree. A live tree at least 15 inches DBH (diameter at breast height) containing a natural cavity used by wildlife for nesting, brood rearing, hibernating, daily or seasonal shelter, and escape from predators.

Developed (or intensive) recreation. Activities associated with man-made structures and facilities that result in concentrated use of an area. Examples are campgrounds and ski areas.

Diameter at breast height (DBH). The diameter of the stem of the tree measured at breast height (4.5 feet or 1.37 meters) from the ground.

Dispersed recreation. Outdoor recreation activities requiring few, if any, support facilities.

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Down woody material (DWM). DWM is also referred to as coarse woody debris, woody material, and down woody debris. DWM is comprised of woody material left in the woods from harvested trees as well as portions or whole trees that die and fall naturally.

Ecological processes. The relationships between living organisms and their environment. Among these processes are natural disturbances such as periodic fire, flooding, or beaver activity; natural stresses such as disease or insects; catastrophic weather-related events such as severe storms or lightning strikes; or more subtle ongoing processes such as succession, hydrology, and nutrient cycling.

Ecological reserve. An area of land managed primarily for long-term conservation of biodiversity.

Ecosystem. A complex array of organisms, their natural environment, the interactions between them, the home of all living things, including humans, and the ecological processes that sustain the system.

Ecosystem management. The careful and skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity, uses, products, and services over the long-term.

Endangered species. A species listed on the current state or Federal endangered species list (VSA Title 10, chapter 123). Endangered species are those which are in danger of becoming extinct within the foreseeable future throughout all or a significant portion of their range.

Even-aged system. Timber management that produces a forest or stand composed of trees having relatively small differences in age. Regeneration cutting methods in this system include clearcutting, seed tree (seed cut) method, and shelterwood method.

Forest health. Condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity.

Forest Stand Improvement. Activities conducted in young stands of timber to improve growth rate and form of the remaining trees.

Forest type. A natural group or association of different species of trees which commonly occur together over a large area. Forest types are defined and named after the one or more dominant species of trees, such as the spruce-fir and the birch-beech-maple types.

Forestry. The art and science of growing and managing forests and forest lands for the continuing use of their resources.

Fragmentation. Division of a large forested area into smaller patches separated by areas converted to a different land use.

Game species. Animals habitually hunted for food, particular products, sport, or trophies.

Gap. An opening in the forest canopy caused by the death or harvest of one or several overstory trees.

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Geographic Information Systems. A computer-based means of mapping lands and resources and communicating values associated with them (GIS).

Green certification. A process, sponsored by several international organizations, that promotes sustainable forest management practices, providing a marketplace identify for forest products certified to have been grown and manufactured in a sustainable manner.

Group Selection. The removal of small groups of trees to meet a predetermined goal of size, distribution, and species.

Habitat. A place that provides seasonal or year round food, water, shelter, or other environmental conditions for an organism, community, or population of plants or animals.

Hardwood. A broad leaved, flowering tree, as distinguished from a conifer. Trees belonging to the botanical group of angiospermae.

Healthy ecosystem. An ecosystem in which structure and functions allow the maintenance of the desired conditions of biological diversity, biotic integrity, and ecological processes over time.

Heritage Sites. Sites identified by the Vermont Nongame and Natural Heritage Program of the Department of Fish and Wildlife, which have rare, threatened, or endangered species of plants or animals. Heritage sites are identified using a common standards-based methodology, which provides a scientific and universally applicable set of procedures for identifying, inventorying, and mapping these species.

Intensive (or developed) recreation. Outdoor recreation activities requiring major structures and facilities.

Interior dependent species. Those wildlife species that depend on large unbroken tracts of forest land for breeding and long term survival. The term is also often used in conjunction with neotropical migratory bird species requiring large patches of fairly homogeneous habitat for population viability**.**

Intermediate treatment. Any treatment or tending designed to enhance growth, quality vigor, and composition of the stand after its establishment or regeneration and prior to the final harvest.

Invasive Exotic (Non-native). A species that is 1) non-native (or alien) to the ecoregion or watershed under consideration and 2) whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Land conservation. The acquisition or protection through easements of land for wildlife habitat, developed state parks, and working forests.

Landscape. A heterogeneous area of land containing groups of natural communities and clusters of interacting ecosystems. These can be of widely varying scales but normally include a range of elevations, bedrock, and soils.

Mast. The fruit (including nuts) of such plants as oaks, beech, hickories, dogwood, blueberry, and grape, used for food by certain wildlife species.

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Motorized use. Land uses requiring or largely dependent on motor vehicles and roads.

Multi-aged system. Timber management that produces a forest or stand composed of two or more age classes (two-aged and un-evenaged stands). Regeneration cutting methods in this system include single tree selection, group selection, regular and irregular shelterwoods.

Multiple-use forestry. Any practice of forestry fulfilling two or more objectives of management, more particularly in forest utilization (e.g. production of both wood products and deer browse).

Multiple-use management. An onsite management strategy that encourages a complementary mix of several uses on a parcel of land or water within a larger geographic area.

Native (species). A plant or animal indigenous to a particular locality.

Natural Area. Limited areas of land, designated by Vermont statute, which have retained their wilderness character, although not necessarily completely natural and undisturbed, or have rare or vanishing species of plant or animal life or similar features of interest which are worthy of preservation for the use of present and future residents of the state. They may include unique ecological, geological, scenic, and contemplative recreational areas on state lands.

Natural community. An assemblage of plants and animals that is found recurring across the landscape under similar environmental conditions, where natural processes, rather than human disturbances, prevail.

Nongame species. Animal species that are not hunted, fished, or trapped in this state. This classification is determined by the state legislature.

Northern hardwood. Primarily sugar maple, yellow birch, and beech. May include red maple, white ash, white birch, black cherry, red spruce, and hemlock.

Old growth forest. A forest stand in which natural processes and succession have occurred over a long period of time relatively undisturbed by human intervention.

Outdoor recreation. Leisure time activities that occur outdoors or utilize an outdoor area or facility.

Overstory. That portion of the trees, in a forest of more than one story, forming the upper or upper-most canopy layer.

Patch Clearcut (Patch-cut). Under an even-aged method, a modification of the clearcutting method where patches (groups) are clearcut in an individual stand boundary in two or more entries. Under a two-aged method, varying numbers of reserve trees are not harvested in the patches (groups), to attain goals other than regeneration.

Pole. A tree of a size between a sapling and a mature tree.

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Pole timber. As used in timber survey, a size class definition; trees 5.0 to 8.9 inches (varies by species) at DBH. As used in logging operations, trees from which pole products are produced, such as telephone poles, pilings, etc.

Regeneration. Seedlings or saplings existing in a stand. Regeneration may be artificial (direct seeding or planting) or natural (natural seeding, coppice, or root suckers).

Regeneration treatment (harvest cut). Trees are removed from the stand to create conditions that will allow the forest to renew or reproduce itself. This is accomplished under either an even-aged management system or an Multi-aged management system.

The four basic methods used to regenerate a forest are clearcutting, seed-tree, shelterwood, and selection (group selection or single tree selection).

Regeneration methods. Timber management practices employed to either regenerate a new stand (regeneration cutting) or to improve the composition and increase the growth of the existing forest (intermediate treatment).

Regulated Hunting/Fishing/Trapping. The harvest of wildlife under regulations stipulating setting of seasons, time frame of lawful harvest, open and closed zones, methods of take, bag limits, possession limits, and reporting or tagging of species.

Release (release operation). The freeing of well-established cover trees, usually large seedlings or saplings, from closely surrounding growth.

Removal cut. The final cut of the shelterwood system that removes the remaining mature trees, completely releasing the young stand. An even-aged stand results.

Riparian Area. "*The word "riparian" means of or pertaining to the bank of a river or lake. Riparian areas are ecosystems comprised of streams, rivers, lakes, wetlands, and floodplains that form a complex and interrelated hydrologic system. They extend up and down streams and along lakeshores from the bottom of the water table to the top of the vegetation canopy, and include all land that is directly affected by surface water. Riparian areas are unique in their high biological diversity. They are "characterized by frequent disturbances related to inundation, transport of sediments, and the abrasive and erosive forces of water and ice movement that, in turn, create habitat complexity and variability…resulting in ecologically diverse communities"* (Verry, E.S., J.W. Hornbeck, and C.A. Dolloff (eds). 2000. Riparian management in forests of the continental Eastern United States. Lewis Publishers, Boca Raton, FL. 402p.)

Riparian Management Zone (RMZ). The width of land adjacent to streams or lakes between the top of the bank or top of slope or mean water level and the edge of other land uses. Riparian management zones are typically areas of minimal disturbance, consisting of trees, shrubs, groundcover plants, duff layer, and a naturally vegetated uneven ground surface, that protect the water body and the adjacent riparian area from the impact of these land uses.

Salvage Cutting. The removal of dead, dying, and damaged trees after a natural disaster such as fire, insect or disease attack, or wind or ice storm to utilize the wood before it rots.

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Sanitation cutting. The removal of dead, damaged, or susceptible trees to improve stand health by stopping or reducing the spread of insects or disease.

Sapling. As used in timber surveys, a size class definition. A usually young tree larger than seedling but smaller than pole, often 1.0 to 4.9 inches at DBH.

Sawlog or Sawtimber. A log or tree that is large enough (usually > than 10 or12 inches DBH) to be sawn into lumber. Minimum log length is typically 8 feet.

Seedling. A very young plant that grew from a seed.

Seed-Tree (Seed Cut) method. The removal of most of the trees in one cut, leaving a few scattered trees of desired species to serve as a seed source to reforest the area.

Shelterwood method. A series of two or three cuttings which open the stand and stimulate natural reproduction. A two cutting series has a seed cut and a removal cut, while a three cutting series has a preparatory cut, a seed cut, and a removal cut.

Silvicultural systems. A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration and according to the type of forest thereby produced.

Single tree selection method. Individual trees of all size classes are removed more or less uniformly throughout the stand to promote growth of remaining trees and to provide space for regeneration.

Site Preparation. Hand or mechanical manipulation of a site, designed to enhance the success of regeneration.

Site Quality. A broad reference of the potential of forest lands to grow wood. Site class identifies the potential growth more specifically in merchantable cubic feet/acre/year.

Snag. Includes standing dead or partially dead trees that are at least 6 inches in diameter at breast height (DBH) and 20 feet tall.

Softwood. A coniferous tree. Softwood trees belong to the botanical group gymnospermae, including balsam fir, red spruce, and hemlock.

Stand improvement. An intermediate treatment made to improve the composition, structure, condition, health, and growth of even or Multi-aged stands.

Stewardship. Caring for land and associated resources with consideration to future generations.

Stocking. A description of the number of trees, basal area, or volume per acre in the forest stand compared with a desired level for balanced health and growth. Most often used in comparative expressions, such as well-stocked, poorly stocked, or overstocked.

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Sustainability. The production and use of resources to meet the needs of present generations without compromising the ability of future generations to meet their needs.

Sustained yield. The yield that a forest can produce continuously at a given intensity of management.

Thinning. Removing some of the trees in a dense immature stand primarily to improve the growth rate and form of the remaining trees and enhance forest health.

Threatened species. A species listed on the state or Federal threatened species list. Threatened species are those likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Timber lands. Properties that are managed primarily for the maximum production of forest products.

Traditional uses. Those uses of the forest that have characterized the general area in the recent past and present, including an integrated mix of timber and forest products harvesting, outdoor recreation, and recreation camps or residences.

Unacceptable Growing Stock (UGS). UGS trees are high risk and are expected to decline before harvest. UGS trees are of poor form and/or low quality and cannot reasonably be expected to improve. They have the potential to produce only low quality logs or pulp-type products.

Uneven-aged (All-aged) system. Timber management which produces a stand or forest composed of a variety of ages and sizes. Regeneration cutting methods in this system include single tree selection and group selection.

Watershed. The geographic area within which water drains into a particular river, stream, or body of water. A watershed includes both the land and the body of water into which the land drains.

Weeding (cleaning). Regulating the composition of a young stand by eliminating some trees and encouraging others, and also freeing seedlings or saplings from competition with ground vegetation, vines, and shrubs.

Wilderness. Areas having pristine and natural characteristics, typically roadless and often with some limits on uses. (This is not the federal definition of wilderness.)

Wildlife habitat. Lands supplying a critical habitat need for any species of wildlife, especially that which requires specific treatment and is of limited acreage.

Working forest. Land primarily used for forestry purposes but also available for recreation, usually where both managed land and land not presently being managed is present.

Working landscape. A landscape dominated by land used for agricultural and/or forestry purposes.

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APPENDIX 8: FPR Policy #21: State Lands Management Planning

FPR POLICY #21
STATE LANDS MANAGEMENT PLANNING

Philosophy:
The management of state lands for a variety of values in the public interest, both environmental and human, is mandated by Vermont statute.

The many tracts and blocks of lands under the Department

a. General Information: pertinent maps, general description of property, overall purpose for the parcel, relationship of parcel to the larger state forest or park within which it is location.

b. Existing Conditions: vegetation types, soils, forest productivity classification, wildlife, recreation, cultural resources (e.g., cellar holes, stone walls, etc.), special constraints (natural areas, endangered species sites, deed or other legal restrictions, etc.), and emphasis zones; pertinent maps.

c. Desired Future: ideally, what the land will look or be like at the end of the planning period, as determined by the goals, objectives, and public vision.
d. Implementation: a description of how the parcel will be managed, taking into consideration all Existing Conditions (b) and to achieve the Desired Future (c); includes activities such as vegetation management, road improvements, etc.

e. Appendices: includes supplementary data such as use value appraisal summaries, glossary of terms used, etc.

2) **LRMPs – *Preparation.*** LRMPs will be prepared in stages, as follows:

a. Data/Information Gathering: Prior to writing of an LRMP, the Department will provide information at public meetings and to interested persons, and will solicit comments on overall management goals, activities, and other considerations to go into the LRMP.

b. Draft LRMP. Weighing public comments, legal restraints, land capabilities, and other factors, a draft LRMP will be prepared and offered for public comment.

c. Final LRMP. Based on responses to the draft, a final LRMP will be prepared, including a responsiveness summary.

3) **Annual Work Plans (AWPs).** The Department will prepare AWPs for each parcel to carry out implementation of provisions of the LRMP. These will be reviewed by the Agency of Natural Resources and be available for public review; they may be amended based on comments received.

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4) **Public Involvement.** Interested persons will have ample opportunity to provide input at several stages in the process, both for LRMPs and AWPs as shown above. Reasonable accommodation of legitimate concerns or suggestions will be made, if they are broadly acceptable to the public, do not compromise the area's natural resources or long-term ecological integrity, and do not conflict with established public uses that have already been determined to be compatible with the lands in question. The specifics of conducting public involvement will be guided by FPR Policy #20 (Public Involvement in State Land Management).

Procedure for Implementation:
The Lands Administrator, in consultation with the District Forest Managers/Regional Park Managers, Director of Forests, Director of Parks and Recreation, and Commissioner, will establish (1) a standard LRMP format and statewide schedule for adoption or revision and (2) a standard AWP format and schedule for implementation.

The appropriate District Forest Manager/Regional Park Manager will be responsible for preparation of LRMPs, AWPs, and related public involvement for each parcel under his/her jurisdiction. Work may be delegated to staff.

Persons/offices within the Agency of Natural Resources to review the draft LRMPs, AWPs, and subsequent revisions or amendments to either include at least the following:

Region/District
Forest Resource Protection Specialist
District Fisheries Biologist
District Wildlife Biologist
District Regional Engineer
District Environmental Coordinator

Central Office
Director of Forests
Director of Parks and Recreation
Director of Lands Administration
Nongame & Natural Heritage Program
Commissioner of Forests, Parks & Recreation

The LRMPs and AWPs will take affect following review by all the above and upon signing by the Commissioner.

Copies of all LRMPs and AWPs will be on file in Waterbury. District/regional offices will also keep on file those that pertain to lands within their jurisdiction.

Conrad M. Motyka, Commissioner
Effective Date: January 30, 1995

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APPENDIX 9: ANR Policy on Public Involvement in ANR Lands Management

Vermont Agency of Natural Resources (ANR) POLICY: PUBLIC INVOLVEMENT IN ANR LANDS MANAGEMENT

Philosophy:
Public land under the jurisdiction of the three departments of the Vermont Agency of Natural Resources (ANR), consistent with legislative direction, is held to protect, conserve, and enhance its inherent qualities. It is also managed to provide recreational opportunities, timber products, varied plant and wildlife habitats, utilization of fish and wildlife resources, clean water, and natural beauty for compatible enjoyment of and use by people. The ANR's goal of providing exemplary stewardship for these resources will be promoted by the departments working together in managing the lands under their specific jurisdictions.

As the resource stewards for state parks, forests, and wildlife management areas, the departments of the ANR must make decisions about the "public good" which span this and future generations. Implicit in this function is an obligation to conduct public needs assessment. Without such assessment we cannot purport to manage for the enjoyment of and use by the people. Public involvement, or citizen participation, is a broad term for a variety of methods by which the people of Vermont have input to public land management decisions. Recognizing the value of the public's role, the ANR is committed to seeking and incorporating the public's ideas for the management of these lands. The ANR is also committed to explaining how its lands planning process works, how people can participate, how lands are managed on an ongoing basis, and how final management decisions are made.

One result of the ANR seeking that input may be that important changes are made in how ANR lands are managed. Other results intended are that the general public, stakeholders, and interest groups understand that a principled approach to public involvement is being taken and that the process is fair; appreciate the value of public ownership of ANR land; become empowered as stewards of state lands; and support the ANR's approach to long-range management planning.

Policy:
The Vermont Agency of Natural Resources (ANR) shall encourage and be responsive to expressions of citizen interest in its lands management activities, including development of long-range plans, implementation of programs, development of policies, and management of state lands. Citizen expressions include written and oral comments which may pertain to any ANR lands program or area of management at any time.

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Comments from the public shall be taken as advice by the ANR. Every effort shall be made to include in ANR lands management suggestions which are compatible with the ANR and its departments' missions, compatible with ANR lands management principles and goals, and which are fiscally realistic. The ANR shall explain the extent to which public comments influence ANR lands management activities.

ANR personnel shall actively solicit input from the public through more formal methods whenever (1) a long-range plan is written or (2) a long-range plan requires an amendment due to a significant change in existing use or status quo being considered. Examples of significant changes are major land acquisitions, major capital expenditures for new projects, facility closures, and major changes in land use.

ANR personnel shall offer the public opportunities to comment on less significant changes by making annual work plans available and/or by notifying the public when such changes are proposed.

Procedure for Implementation:
Due to the great variability of the situations, publics, and resources in question, implementation of this policy is through guidelines rather than strictly prescribed methods. Attachment 1 gives further guidelines for department personnel.

/s/ 11/4/02
Conrad M. Motyka, Date
Commissioner, FPR

/s/ 11/4/02
Ronald Regan Date
Commissioner, FW

/s/ 11/4/02
Christopher Recchia Date
Commissioner, DEC

/s/ 11/4/02
Scott Johnstone Date
Secretary, ANR

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Attachment 1
Procedure for Implementing
the ANR Policy: Public Involvement in ANR Lands Management

With the great diversity of ANR land holdings and the diverse interests of

constituents, there is no one prescribed method of gathering public input regarding the management of state lands. Therefore flexible guidelines are necessary for implementing the policy on public involvement for ANR lands.

Public Involvement in Long-Range Planning and Amendments to Plans

Ongoing review of lands management needs by the five district lands stewardship teams, with input from the ANR Lands Stewardship Team, determines when long-range management plans are needed. Six general considerations are to be used in determining how intensively the public should be involved, as follows:

1. Inventory and resource assessments have revealed ecological, wildlife, cultural, recreational, or timber resources of widespread significance;

2. There are complex legal constraints on the parcel;

3. Significant changes in the management goals and objectives are proposed;

4. Significant issues and concerns by the public are anticipated, such as user conflicts;

5. The acreage of the parcel is large relative to other ANR-owned properties in the region; and

6. Proposed management of the parcel results in a significant change in land use.

Generally speaking, the greater the number of these considerations pertain to a parcel, the more the public should be involved in the planning process.

Agency personnel will also follow the following guidelines during the LRMP process:

1. The public will be notified at the start of the planning process;

2. Information will be made available in an understandable format;

3. Meetings will be held at times and locations convenient to the public;

4. Sufficient time will be allowed for public input which may vary according to the size and complexity of the parcel;

5. The agency will seek resolution to conflicts in an open and respectful manner using a wide range of methods for involving the public; and

6. The agency will make clear the role of the public in the planning process.

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Additional Public Notification Efforts

Besides involving the public in long-range management plan development and amendments, ANR personnel will provide the public with an opportunity to review the following:

Annual work plans;

Development of lands management policies; and

Acquisitions to ANR lands of parcels that are small in acreage, do not propose a change in existing management, or have significant user conflicts.

In addition, agency personnel will receive public comments at any time regarding ANR lands management.

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