

8-15-2024

Andrews Community Forest Wildlife Stewardship Plan

Notes:

- *Some content below could be integrated into the “Wildlife” section of the revised Management Plan, even replacing existing text. The formatting shown here may need to change to conform to MP2’s formatting. This can be worked out when a draft of MP2 is ready.*
- *Hotlinks (internal & external) and references to be added in future drafts.*

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Summary



A black bear studies the UVM research team studying wildlife habitats in the ACF.

This Plan describes stewardship goals and strategies for maintaining the biodiversity and functions of the Andrews Community Forest’s wildlife habitats. It derives from key conservation goals of the Richmond Town Plan and Vermont Conservation Design, the Purposes of the Conservation Easement, and best practices for conserving wildlife by safeguarding their natural communities and habitat types.¹

To achieve this, the ACF Committee carefully assessed the Forest’s ecological functions and vulnerabilities, its roles as a contiguous part of the Mount Mansfield Forest Block, and stewardship practices that both maintain and expand public enjoyment of the Forest’s wildlife. The Committee consulted with wildlife biologists at the Vermont Fish & Wildlife Department and reviewed numerous scientific papers, literature reviews and wildlife conservation guides.

[Note to ACFC: The following is based on something we haven’t yet discussed at length but is offered as a relatively simple way to achieve ecological/recreational balance. It needs discussion but it’s offered here to help get one started.]

The ACF’s Wildlife Stewardship Plan also takes guidance from the ACF Management Plan’s designation of two management zones within the Forest, using the former VAST trail (*or power lines*) as the divider. The southern, most accessible area is primarily managed for a variety of non-motorized recreation, including hiking, biking and skiing. The more remote and rugged northern area is managed to sustain its high-quality

¹ Supporting documentation can be found elsewhere in the ACF Management Plan as well as in the Appendix to this Plan.

wildlife habitats and connectivity, as well as for pedestrian use on existing, lightly maintained footpaths away from sensitive areas.

Finally, this Plan addresses wildlife stewardship at three ecological levels – landscape, community and species. While wildlife do not recognize property boundaries the activities on one property or part of the Forest can affect nearby areas and even those well beyond. For example, wide-ranging species such as black bears and bobcats need to be conserved across correspondingly large landscapes of suitable habitats. This also has the advantage of simultaneously protecting myriad other species and the natural communities they depend upon.

Introduction

The rich wildlife resources of the Andrews Community Forest and its surrounding forest block have been well-documented over recent years. Stewarding those resources maintains the Forest's state-significant biodiversity and ecological functions. It also helps sustain and enrich the ACF's wide variety of recreational and educational opportunities.

Key documents commit the Town to stewarding these resources:

- The ACF Conservation Easement describes the Town's legal responsibilities for managing the ACF. It lists as one of its four, co-equal "Purposes" the conservation of ACF's "productive forestland, wildlife habitats, biological diversity, natural communities, riparian buffers, wetlands, soil productivity, water quality, and native flora and fauna."
- The Richmond Town Plan further sets the stage for strong stewardship, urging citizens to "protect priority natural areas" by utilizing "the best available science" and, on Town-owned natural and recreation areas, "best management practices."

To develop this Plan, the ACFC used resources not known reviewed maps and assessments of the ACF's natural features and how they function for wildlife. It also gathered expert knowledge on practical ways to protect the ACF's wildlife populations and habitats while also supporting recreational access, educational programs and forestry activities to be conducted in the ACF. The Committee also devised a monitoring plan to detect and assess changes affecting ACF wildlife and habitats.

General goals

- Maintain the functional ecological integrity of the ACF and its contributions to the Chittenden Uplands and Mount Mansfield Forest Block
- Within the ACF, support high-quality, connected, biologically diverse and resilient natural communities, habitat features and linkages, and ecosystems
- Support public access to and appreciation for the ACF

Action Items

- Comply with the Conservation Easement and Town Plan
- Follow the provisions of the Forestry Management Plan for enhancing the ACF's biodiversity and wildlife habitats
- Base wildlife management decisions on scientific research and best practice recommendations of qualified professionals, including those from State agencies and the academic community
- Recognize 330 feet (100 meters) as a generalized, minimum distance for maintaining the functionality of sensitive natural communities and habitat linkages by buffering them from human interference
- North of the former VAST trail [*or power lines*], where sensitive areas are densest, use existing forest roads to maintain public access via lightly maintained footpaths on existing roads
- Focus recreational improvements south of the VAST trail [*or power lines*], where access is easiest and usage is highest, by building new hiking and biking trails, improving visitor amenities, and making connections to and from neighboring properties.
- Monitor the effects of this stewardship plan and other influences on the ACF's natural communities and habitat linkages.

A three-tiered approach to stewardship

Through consultations with wildlife biologists from the Vermont Fish and Wildlife Department, reviews of research studies and other wildlife management plans, the ACFC has organized this plan to serve a triad of functional levels – landscape, community and species.



Landscape-level stewardship

Stewardship of the ACF begins with “the big picture” – the ACF’s role within the 700,000-acre Mount Mansfield Forest Block, one of

Vermont's largest, most intact and highest priority areas of contiguous forest. Maintaining the ACF's landscape-level attributes, such as its high degrees of contiguity and connectivity with its block, will help sustain many plants and animals, including far-ranging, iconic wildlife such as bobcats, black bears, moose, fishers and others.

Landscape-level goals

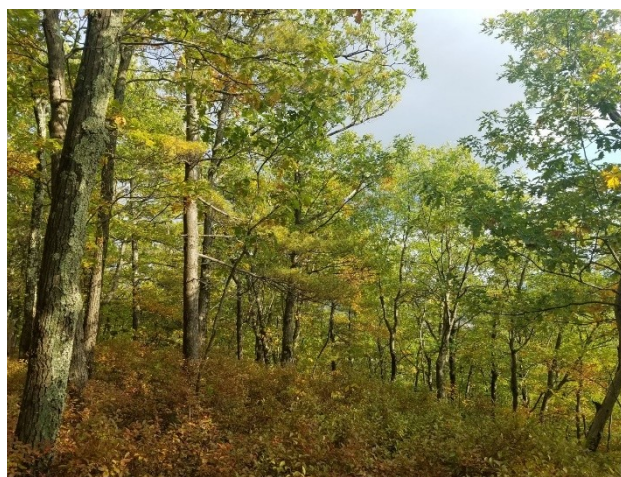
- Maintain and enhance ACF features and functions that are important for wildlife within the Mount Mansfield Forest Block, in particular wide-ranging species such as black bear, bobcat and fisher
- Coordinate activities with other towns and landowners within the block
-

Landscape-level action items

- In the ACF's most sensitive, northern zone, buffer sensitive habitats at least 330 feet from new trail construction, as referenced in recent, Vermont- and New Hampshire-focused literature reviews²
- Support the ACF Forestry Management Plan, which includes many provisions for protecting and enhancing ACF's landscape-level contributions
- Establish metrics for benchmarking and tracking the ACF's use by black bear and bobcat as far-ranging indicators of overall forest diversity and health
- Work with the County Forester and other professions to assess the health, distribution and security of the Forest's beech and oak stands – crucial food sources for wide-ranging black bears.
- Develop a monitoring program encompassing citizen volunteers, camera traps, remote audio recordings to monitor visits by these species and patterns in their use.
-

Community-level stewardship

Drilling down, the focus now shifts to the ACF itself and, first, its community-level elements. These include “natural communities,” defined as “interacting assemblage[s] of organisms, their physical environment, and the natural



² Naughton, 2021 and Oehler, 2017.

processes that affect them.³ Other communities include wetlands, riparian areas, aquatic features and vernal pools.

By conserving these assemblages, we can simultaneously conserve the thousands of species that live within them and enormously contribute to the ACF's biodiversity and health. The following table shows a sampling of just the mammals, birds and amphibians that depend on the Forest's natural communities, and each other as well.

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³ Thompson et al, 10

ACF natural communities and associated species⁴

Natural Community											Natural Community										
Northern Hardwood Forest											Northern Hardwood Forest ⁴										
Hemlock Forest											Hemlock Forest ⁵										
Hemlock-N. Hardwood Forest											Hemlock-N. Hardwood Forest ⁶										
Red Pine Forest											Red Pine Forest ⁷										
Dry Oak Forest											Dry Oak Forest ⁸										
Dry Red Oak White Pine Forest											Dry Red Oak White Pine Forest ⁹										
Shallow Emergent Marsh											Shallow Emergent Marsh ¹⁰										
N. Hardwd. Seepage Forest											N. Hardwd. Seepage Forest ¹¹										
Seep											Seep ¹²										
Vernal Pool											Vernal Pool										
Associated Species											Associated Species										
American woodcocks	*										N. two-lined salamanders									*	*
Barred owls		*			*						N. water thrushes									*	*
Black bears	*			*	*	*			*		N. leopard frogs								*		*
Blackburnian warblers		*	*								N. saw-whet owls		*								
Black-throated blue warblers	*										Pine warblers			*	*	*					
Blue-headed vireos		*									Porcupines	*	*	*					*	*	
Bobcats	*	*	*	*	*	*	*	*	*	*	Raccoons								*		*
Broad-winged hawks	*										Red squirrels								*		
Bullfrogs					*						Red-breasted nuthatches			*							
Canada warblers						*	*				Red-eyed vireos	*									
Chipmunks				*							Red-shouldered hawks										
Eastern red-backed salamanders	*										Red-winged blackbirds								*		
Eastern wood peewees				*	*						Scarlet tanagers	*									
Fishers		*		*							Spotted salamanders	*	*		*						
Gray foxes	*										Spring peepers					*	*				
Gray squirrels				*	*						Spring salamanders								*	*	
Great blue herons					*						Swamp sparrows								*		
Green frogs					*						Turkeys			*					*	*	
Hermit thrushes	*										Veerys								*	*	
Jefferson salamanders				*							White-tailed deer	*		*		*	*		*	*	
Minks				*	*						Winter wrens								*	*	
Muskrats					*						Wood frogs			*							
N. dusky salamanders					*	*					Wood thrushes			*							

Community-level goals

- Enable natural communities above the former VAST trails [or power lines] to continue preserving natural processes and biodiversity, including for sensitive keystone species such as bears and bobcats
- Maintain linkages among habitats within the ACF to facilitate the movement, dispersal and diversity of wildlife

Community-level action items

⁴ Ibid., pp. 102-109.

- Support the ACF Forestry Management Plan, which includes many provisions for protecting and enhancing the growth of the trees that define the ACF's communities
- Protect the functional integrity of community features for wildlife by buffering those in the northern zone from new trail traffic by at least 330 feet⁵. Elsewhere, strive to find alternatives to routing trail traffic within 330 feet of natural communities and other habitat features.
- Work with the County Forester and UVM resources to develop ways to measure and monitor the vegetative health of the ACF's communities in the face of challenges such as:
 - Invasive species
 - Tree and plant diseases
 - Human impacts
- Involve ACFC members and the public in monitoring programs, utilizing field visits, camera and audio traps, and consultations with experts to gauge the health of the ACFC's communities
 - Utilize black bear and bobcat [and ____?] as indicators of the overall health of the ACF's communities and landscape-level functions. Research ways to enhance the value of those communities to those species
 - Develop steps to enable the Town to maintain if not enhance conditions for wildlife in and among the ACF's natural communities:
 - Improve deer population management so the ACF's herd can contribute to its health and species diversity. Encourage rifle, muzzle-loader and bow hunting of both antlered and antlerless deer. Investigate exclosures to both track and demonstrate impacts of deer browsing the forest understory.
 - Protect mast-producing areas from disturbances during fruiting and wildlife foraging seasons
 - Avoid human disturbances of wildlife wintering and denning areas
 - Monitor forest health and quantitative/qualitative changes to its habitats (see Appendix IV)

Species-level stewardship



The third stewardship tier addresses species-level features. These are vital to certain kinds of wildlife with needs that may not be met at the landscape and community levels. Examples

include outcrops and cliffs that provide bobcats with secure places for raising their young; mast stands essential to nourishing bears, turkeys and other wildlife; and connectivity corridors that link isolated habitats, increase genetic diversity and promote resilience.

Species-level goals

- Maintain the integrity and functions of the ACF's species-level components
-

Species-level action items

- Support the ACF Forestry Management Plan, which includes many provisions for protecting and enhancing the growth of the trees that define the ACF's communities
- Protect the functional integrity of community features for wildlife by keeping new trail traffic and other disturbances at least 330 feet away from them.⁶
- Investigate and document locations of potential bobcat denning sites in ledgy, steep-sloped areas of the ACF
- Control invasive species
- Engage the public in learning about the ACF and the values its wildlife and habitats provide to provide to people in Richmond and beyond
- Look for opportunities for recreational users to assist in improving forest ecology
- Develop steps to enable the Town to maintain if not enhance conditions for wildlife in and among the ACF's natural communities, such as:
 - Improving deer population management so the ACF's herd can contribute to its health and species diversity. Encourage hunting of both antlered and antlerless deer. Investigate creating small, fenced-in areas to show how forest understories can respond when deer browsing is curtailed.]
 - Working with the VT Agency of Transportation and neighboring landowners on ways to reduce wildlife mortality where the ACF's connective corridors meet Rt. 2
 - Protecting mast-producing areas from disturbances during peak seasons
 - Establishing adequate undisturbed areas around sensitive habitats reflective of zones of influence
 - Avoiding human disturbances of wildlife wintering and denning areas
 - Creating and managing a program to monitor forest health and changes to its habitats

⁶ Naughton, 2021 and Oehler, 2017.

- Engage the public in learning about the ACF, its ecological diversity and dynamics, and the benefits its wildlife and habitats provide to the Forest and the community

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Appendix I

Foundations of This Plan

Overview

The ACF provides a precious ecological and wildlife resource, both connecting and contributing to the thousands of acres of high-value habitats and supporting features surrounding it. Future use of the Forest must maintain the integrity of these resources.

At the same time, the ACF Conservation Easement calls for providing recreational, educational and other opportunities in the Forest. Visiting and enjoying the Forest at all its levels can bring psychological and physiological benefits, and broaden appreciation of forests in general and their vast resources. The challenge with those resources is to avoid “loving them to death.” Accordingly, the challenge was to achieve a balance between maintaining forest integrity and accommodating public use.

To assist in this, the ACFC drew from a large body of scientific literature about the impacts that recreational uses can have on forests, even at significant distances, within areas known as zones of influence. This was invaluable in determining how trails could best be placed so traffic on them wouldn't disturb sensitive ecologic and wildlife features.

The process also involved mapping the ACF's landscape, natural communities and species features and qualities, both within its own boundaries and also in the context of its surrounding forest block. The ACFC examined the effects on recreation of buffering all sensitive areas according to a standard ZOI, leading to a core strategy of creating two wildlife stewardship zones.

The portion above the former VAST trail remains open to limited, non-mechanized recreation on several of the trails and woods roads existing at the time of the plan's adoption. Light mowing and other maintenance is designed to keep most traffic on those paths. Along and below the VAST trail a concentrated network of old and newer single- and multi-use trails serves hikers, bikers or other user groups. East-west connections extend onto neighboring properties where neighboring owners have given their permission.

The ACFC attains ongoing information about the conditions of the ACF's natural communities and habitat linkages through the monitoring program. The program provides a window into changing forest conditions to inform the protection the Forest's integrity in the context of human usage. The monitoring program itself serves to engage more members of the public with the Forest through active stewardship.

Ecological assessments

In preparing the Wildlife Stewardship Plan, the ACF Committee had the advantage of numerous reports on the ACF's natural resources. Most were conducted around the time of the Town's acquisition and conservation of the property. Two took place after the 2018 publication of the ACF's first Management Plan – an in-depth report and stewardship recommendations from the UVM Field Naturalist program, and a follow-up assessment of sensitive plant locations by Arrowwood Environmental.

More general research led to a wealth of scientific papers relating to wildlife stewardship. Many centered on the needs and methods for avoiding or mitigating the negative impacts recreation has been shown to have on wildlife. Others reviewed and synthesized recommendations from, at times, hundreds of individual papers⁷. Consultations with wildlife biologists from the Vermont Fish and Wildlife Department, along with reviews of Department literature⁸, led to this Plan's structure. Vermont Conservation Design, a conservation prioritization from the Vermont Agency of Natural Resources and Vermont Land Trust, was also helpful in ranking the entire ACF providing critical ecological functions from a statewide perspective.

After general action items applicable to all aspects of the ACFC's forest stewardship, the Plan describes actions designed to cover the Forest's triad of functional levels: landscape, community and species.⁹

- At the landscape level, the plan describes actions to support “big picture” functions and aspects of the ACF within the 70,000-acre Mount Mansfield Forest Block, one of Vermont's largest, most intact and highest priority areas of contiguous forest. These include physical landscape features such as elevation and slope along with the ACF stature as one of Vermont's “Highest Priority” or “Priority” forest blocks, connectivity blocks and wildlife habitats. Stewardship at this level supports the needs of many plants and animals, including far-ranging,

⁷ Larson et al., 2016; Hennings, 2017.

⁸ *Conserving Vermont's Natural Heritage*. 2004. Pp. 35-91.

⁹ Maps of many of the resources and functions supporting each level are available in Appendix ____.

iconic wildlife such as black bear and moose, and birds of the interior forest, such as ovenbirds and wood thrush¹⁰. [\(Hotlink\)](#).

- At the Community Level, “natural communities” refers to the ACF’s “interacting assemblage[s] of plants and animals, their physical environment, and the natural processes that affect them.” Communities also include the ACF’s wetlands, riparian areas, aquatic features and vernal pools. By conserving these assemblages, one maintains the habitat of the many species that require them, from insects, amphibians and smaller wildlife to apex species such as bobcat and black bear. All enormously contribute to forest biodiversity and health.¹¹ [\(Hotlink\)](#).
- The Species level consists of features vital to animals with specialized needs that may not be met at the landscape or individual community levels. Among these features are deer wintering areas, mast stands, cliffs and ledges, and brushy, early successional habitats. [\(Hotlink\)](#).

Maintaining the ACF’s functional integrity

The ACF and its interrelated components face a range of stewardship challenges within and across the preceding levels. The most sweeping for it and all Vermont forests relate to climate change, and how we can prepare for and mitigate the impacts of forecasted increases in temperatures and storm intensities. Working to ensure and track the Forest’s resilience to these changes, we can ensure its continued biodiversity and functional integrity – albeit, quite possibly, with an eventual mix of different plant and animal species.

Beyond the more systemic challenges are the more immediate and localized ones. These include maintaining the forest as high-quality wildlife habitat where recreation, education, forestry and other uses also have a home. This effort is aided by a substantial and growing body of literature about how wildlife respond to human disturbances and over what distances. This information has guided the Committee in locating recreational and other activities to minimize their impacts on sensitive areas.

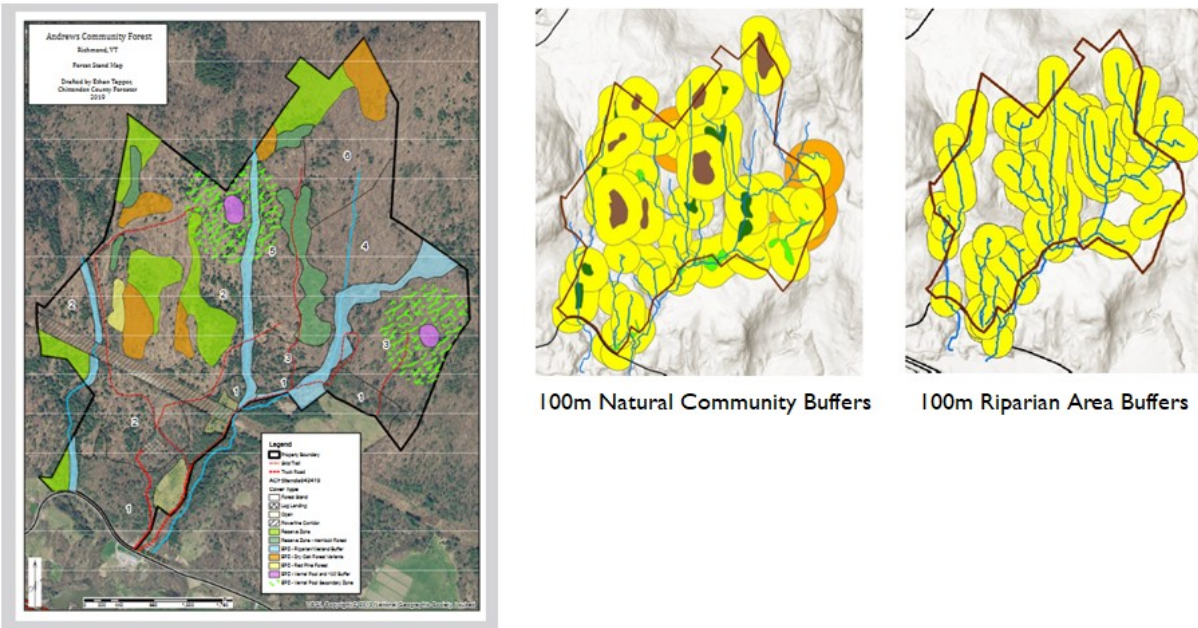
For example, research shows that wildlife characteristic of the ACF, such as bobcats, black bears and some raptors can detect and be frightened by people at distances of up to 1000 feet and more, areas known as “zones of influence, or ZOIs. The distances

¹⁰ Thompson et al. 2019.

¹¹ Ibid.

vary by species, feeding patterns, breeding seasons, terrain type and other factors. Researchers reviewing hundreds of peer-reviewed studies have arrived at a generalized ZOI distances of around 60 feet for birds and 330-400 feet for mammals in New England forests¹².

Protecting a habitat-dense landscape



The map on the left above shows how densely packed the ACF is with sensitive wildlife habitats and connective routes. The maps next to it show buffers of 100 meters (330 feet) around those features, sized at the minimum distance recommended to protect the integrity and functionality of these types of features for the myriad species that use them. (Vernal pools are buffered approximately twice as much, based on the provisions of the Conservation Easement.)

The conundrum is obvious. If the ACF Committee were to abide solely by ZOI distances, most, if not all, of the Forest would be off-limits for human access. That would conflict with the Conservation Easement as well as community desires. Yet ignoring ZOI impacts is likely to drive many animals from their requisite habitats, depriving the ACF and even surrounding lands of the many natural services they render year-round. These have earned the ACF high rankings even on statewide ecological scales, as shown in the slides [available here](#).

¹² Naughton, 2021; Ohler, 2017; and others.

Divide and compromise.

The solution clearly required finding a middle ground. Fortunately, the ACF Committee the Forest's geography, topography and existing manmade features provided a solution. In particular, the former VAST trail [*or power lines*] opened the opportunity for creating two distinct stewardship zones in the Forest. One, north of the VAST trail, is managed for wildlife diversity and sustainability, and the second, south of the trail, is managed to favor recreation, including new trail development. This approach aligns with page 17 of the ACF Forestry Management Plan, which also calls for concentrating trails in the south of the ACF and avoiding sensitive areas.

The northern zone now has about 5.5 miles of trails and woods roads. Those nearest sensitive areas or showing signs of traffic damage will be allowed to revert to their natural state. Others will be lightly maintained to remain open for hunting, hiking, skiing and other non-mechanized forms of recreation, as they've been since the Town acquired the Forest.

This approach aligns with meeting the primary desire expressed by the public in the ACF Visioning surveys – “hiking/running on rugged footpaths.” The northern zone's distances from parking areas and steepness of the terrain can be expected to keep human impacts light. The accompanying monitoring plan will help ensure that traffic is not affecting sensitive areas.

In the southern stewardship zone, the ZOI standard is relaxed to allow for the expansion of recreational opportunities and visitor amenities in the Forest's most accessible part. Some trails could be reserved for casual walkers; others designed for biking and other singular uses.¹³

Stewardship at Three Levels

Landscape-level stewardship

Vermont's Agency of Natural Resources' Vermont Conservation Design, a conservation prioritization from Vermont's Agency of Natural Resources and the Vermont Land Trust, serves as a framework for protecting the ACF's contributions to its forest block and ecosystems beyond – the landscape in which it functions. Categorizing and ranking key physical and functional attributes, VCD uses the Vermont BioFinder web platform¹⁴ to

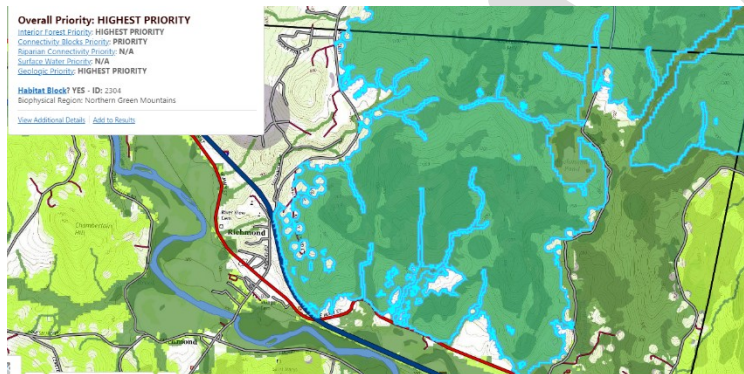
¹³ It should also be noted that this zonal approach allows resources to be spent on trails and amenities where they will be used by the most people – and where recreational management will be easiest.

¹⁴ <https://anr.vermont.gov/maps-and-mapping/biofinder>

display a connected landscape of “large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend.”¹⁵

The first foundational units of Vermont Conservation Design are “forest blocks” – large expanses of contiguous forest and other natural communities and habitats that are unfragmented by development¹⁶. These are essential to the survival of wide-ranging mammals like bobcat, black bears, fishers and moose, animals that need tens and even hundreds of square miles to live, feed and breed.

As noted earlier, the ACF’s 428 acres are part of the 70,000-acre Mount Mansfield Forest Block. Without its surrounding forests, the ACF would not have nearly the diversity of plants and animals found there now. And without the ACF, wildlife would have fewer options for accessing the rich, warmer, low-lying habitats south of the Forest, and adjusting to climate change by migrating through the ACF’s forest block to cooler landscapes to the north.



Accordingly, Vermont Conservation Design has designated much if not all of the ACF as “High Priority” or “Priority” parts of its larger ecological landscape, as illustrated by this map and in greater detail in Appendix I.

We should also note that, as of 2018, only about 10,000 of its 70,000 acres were conserved¹⁷. Those that are may differ from ACF in their biodiversity, lack robust wildlife protections in their easements, or be managed without wildlife stewardship plans. This gives the ACF plan an outsized opportunity to maintain and improve the ecological integrity and biodiversity of the block as a whole.

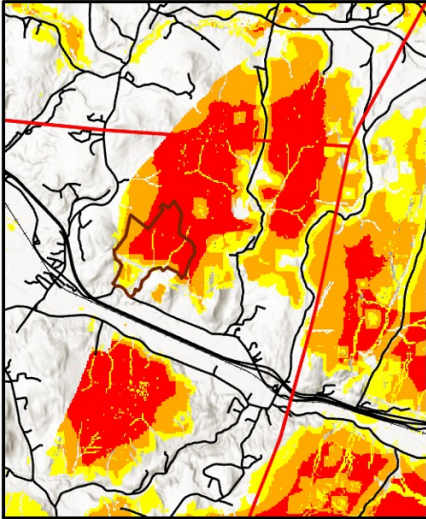
Community-level stewardship

¹⁵ Vermont Fish and Wildlife Department. <https://vtfishandwildlife.com/conservation/vermont-conservation-design>

¹⁶ Vermont Fish and Wildlife Department. <https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Conserve/VT%20Conservation%20Landscape-level%20Design/Interior-Forests.pdf>

¹⁷ Tapper, 2018

To date, ten natural and related communities have been identified in the ACF. The two dominant communities are Northern Hardwood Forest and Hemlock-Northern Hardwood Forest, which surround the other eight as well as ACF wetlands, riparian areas and vernal pools.



Wildlife habitat rankings of ACF and environs, with red showing the highest level. (VT BioFinder)

From a wildlife stewardship perspective, large and common natural communities in Vermont such as Northern Hardwood formations generally are more resilient to small-scale disturbance than smaller, less-common communities. However, the ACF's hardwood and hemlock stands, by harboring a relatively dense collection of those smaller communities, provide wildlife with the shelter and access that wildlife need to utilize those specialized habitats.

The individual and collective importance of these communities cannot be overlooked. The ACF's multiple hemlock communities shield white-tailed deer and dozens of other animals from wintertime snows and winds, enabling them to conserve energy.

The ACF's Dry Oak Forests – themselves encompassing Dry Oak-White Pine Forests – provide crucial summer and fall sustenance for black bears, and winter sustenance for wildlife sheltering in nearby hemlock groves. Year-round, they feed squirrels, mice, voles and other small wildlife, as well as the bobcats and fishers who hunt them there. Vernal Pools are nurseries for much of the Forest's frog and salamander populations and food sources for raccoons, barred owls and other species for whom amphibians are important sources of food.

The natural communities identified to date in the ACF include:

- Northern Hardwood Forests
- Northern Hardwood Seepage Forests
- Hemlock Forests
- Hemlock-Northern Hardwood Forests
- Dry Oak Forests
- Dry Oak-White Pine Forests
- Red Pine Forests
- Vernal Pools
- Shallow Emergent Marshes

Detailed descriptions of these communities and the role they play in the ACF can be found in Appendix ___.

Species-level stewardship

Not all elements important to the ACF's wildlife are covered at the landscape and community levels. The Forest also contains discrete and significant habitats that support a few species or critical activities that warrant special attention¹⁸. These include:

- Cliffs and ledges
- Mast stands
- Early successional forest and shrubland
- Rare, threatened and endangered species
- Wildlife connectivity corridors

Detailed descriptions of these assets can be found in Appendix ___.

¹⁸ *Conserving Vermont's Natural Heritage* lists other species-level elements that are important to wildlife, including winter wildlife habitats frequented by white-tailed deer. In the ACF these equate to the Forest's hemlock stands, which are covered in the community-level discussion above.

Appendix II

ACF Natural Communities

Map

Northern Hardwood Forests

- Large expanses of intact forest serve many species sensitive to human disturbance, including wide-ranging mammals and interior-nesting birds
- Variabilities in composition increase their habitat values. A beech grove in one area will feed bears, turkeys and blue jays, while younger, more open areas are favored by bobcat, ruffed grouse, and American woodcock. Barred owls, flying squirrels, scarlet tanagers and pileated woodpeckers gravitate to older sections with large trees and more complex structures. Leaf litter and downed trees provide homes for spotted salamanders and wood frogs.
- Related ACF natural community: Hemlock-Northern Hardwood Forest

Northern Hardwood Seepage Forests

- Uncommon in Vermont, these communities are among the first in the forest to sport fresh springtime growth, making them important to wildlife such as black bear, wild turkey and white-tailed deer.
- Several salamander species survive summer's heat in their cool waters, and lay their eggs there as well.
- Winter wrens nest in the roots of fallen trees, and northern waterthrushes forage on the edges of seeps and streams.

Hemlock Forests

- Typically found in patches within Northern Hardwood Forests, as in ACF
- Favored for nesting by several bird species, including northern saw-whet owls, red-breasted nuthatches, Blackburnian warblers and black-throated green warblers.
- Dense canopies trap snow, providing winter shelter for white-tailed deer and other wildlife, in turn attracting predators such as bobcat. Porcupines feed on hemlock inner cambium, buds and needles. Fox, fisher, coyotes, crows, ravens and red- and white-winged crossbills use these dense softwood stands to fulfill critical winter food requirements.

Hemlock-Northern Hardwood Forests

- Provide some of the most widespread mixed-forest habitat in Vermont

- Preferred by fishers, whose home ranges can comprise 10 or more miles, hunt in these forests for the porcupine, red squirrels and northern flying squirrels that often live there. Bobcat come looking for these and other prey as well.
- These communities also serve as breeding habitats for blue-headed vireos, Blackburnian warblers and black-throated green warblers. Barred owls, broad-winged hawks and other species found in interior forests may be found.

Dry Oak Forests

- Black bear, coyotes, foxes, cedar waxwings and other species feast on the blueberries and huckleberries found in this natural community type.
- During the fall of good hard mast years, black bear build up vital winter reserves for themselves and gestating young by gorging on calorie-rich acorns.
- Acorns also provide important nourishment to squirrels, chipmunks and turkeys – and, indirectly, to the bobcats and fishers hunting in these forests.
- More than 171 Vermont species use mast stands in natural communities such as Dry Oak, including 44 mammals, 16 amphibians and 102 birds¹⁹.
- Acorns are becoming an even more critical food source for wildlife as diseases kill of beech and butternut trees, their other traditional sources of hard mast.

Dry Oak-White Pine Forests

- Another important acorn source for gray and red squirrels, turkeys, black bears, blue jays and other species
- Dry Oak-White Pine Forests provide seasonal homes to breeding birds associated with forest interiors, such as black-throated blue warblers and ovenbirds, and those favoring more open canopies, among them Nashville warblers and Blackburnian warblers. The uncommon saw-whet owl prefers nesting in open pine woods.

Red Pine Forests

- Varied canopy cover allow blueberries and huckleberries to thrive, serving as a summertime food source for black bear, coyotes, red foxes and red squirrels.
- Pine warblers, hermit thrushes and Blackburnian warblers can be found, especially when these forests include a few hardwoods.

Vernal Pools

- Small, fragile and ephemeral bodies of water that serve a variety of amphibians and invertebrates as vital breeding sites

¹⁹ DeGraaf et al., 1992.

- Amphibians dependent on vernal pools include wood frogs, spotted salamanders, Jefferson salamanders and blue-spotted salamanders.
- Minks, raccoons, barred owls, and great blue heron feed on the amphibians and their eggs in the pools, and other birds and mammals feed on the amphibians after they've moved to surrounding habitats.

Shallow Emergent Marshes

- Aquatic habitats that can be seasonal or permanent, and typically shelter spring peepers and northern leopard frogs
- Permanent marshes can support muskrats, beaver, bullfrogs and green frogs
- Mink will hunt along the edges for voles and other small mammals, as well as small birds, frogs and aquatic species
- Common birds include red-winged blackbirds and swamp sparrows, and mallard and blue-winged teal may nest in these areas.

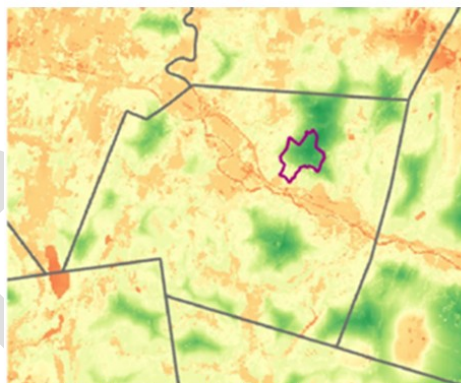
Appendix III

ACF Species-Level Components

Map

Outcrops and cliffs

In stark contrast to their forested surroundings, outcrops and cliffs can support a variety of natural communities and associated wildlife, depending on their geological composition and aspect. Their crevices can shelter porcupine, winter wren, bats and snakes. Bobcats, listed as a Vermont Species of Greatest Conservation Need, favor ledges and small caves for courting, breeding and keeping their young safe from less-nimble predators. Hikers



The ACF hosts a significant amount of Richmond's prime bobcat habitat.

have noted bobcat tracks in ledgy terrain below a Dry Oak natural community. Outside the ACF's boundaries and well within bobcat territorial range are excellent cliffside denning sites – among the westernmost of the ACF forest block. All told, the ACF in general hosts a significant portion of Richmond's prime bobcat habitat.

Mast stands

“Mast” refers to the seeds of shrubs and trees that provide food for many wildlife species, among them black bear, turkey, fisher and others. “Hard mast” comprises nuts such as acorns and beech nuts; “soft mast” is defined as berries from a variety of species.

The VT ANR book *Conserving Vermont's Natural Heritage* states, in bold italics, “**Simply put, these stands of beech and oak used by black bear are absolutely essential for the survival and reproduction of this species in Vermont!**²⁰” It cites research by Elowe and Rogers that found a direct correlation between the availability of hard mast in the fall and the minimum reproductive age of bears, productivity rates and cub survival.

²⁰ Austin et. al. P. 89

Black bears play important ecological roles, in part by being one of the wide-ranging omnivores that spread seeds for dozens of square miles across forests. (Fishers are another.)²¹ Unfortunately, the ACF's beech stands, like so many others around Vermont, suffer from beech bark disease. It cuts their nut production and eventually kills them – a fate likely for at least one of the ACF's bear-scared beech stands, in the northeast corner. Fortunately, bears may be able to fall back on acorns from the ACF's abundant oak populations, even though acorns aren't as rich in protein and calories as beech nuts²². Blueberries and other soft mast species proliferating among the oaks and along trails and idle forest roads will gain in importance for bears, too.

Early successional forest and shrubland

Ruffed grouse, American woodcock and New England Cottontail rabbits require early successional habitats to find the plants and insects they feed upon, as do a number of songbirds such as the golden winged warbler. For decades, though, Vermont and other Northeastern states have lost much of this habitat to both development and natural forest succession. This has led to a widespread general decline in the plants, mammals, birds and other species that depend on those habitats.²³

The ACF's Forestry Management Plan notes the presence of early successional habitat in the Forest's western areas, recognizing it as "an important habitat type which is relatively underrepresented across Vermont's landscape." In the Forest's eastern areas, careful harvesting and patch cuts are designed to restore the wildlife benefits of early successional habitats and bushy growth. The utilities' regular maintenance of the east-west swath beneath their powerline is probably the Forest's most significant area of similar vegetation, though the mowing and herbicide treatments it receives may diminish some wildlife potential.

Rare, threatened and endangered species

To date only one such species has been found in the ACF, the broad-beech fern during a fine-scale assessment of the route proposed for a new trail. In several parts of the forest tracks have been found of bobcats, designated by the State of Vermont as a Species of Greatest Conservation Need. On a broader scale, they are on the list of Regional Species of Greatest Conservation Concern in the Northeastern U.S.²⁴

²¹ Morse, 2023.

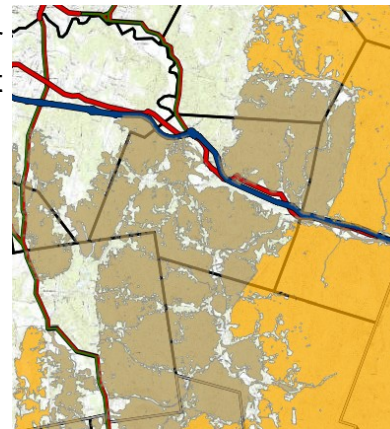
²² Morse, 2021.

²³ Litviatis, 1999.

²⁴ Terwilliger, 2013

Wildlife connectivity corridors

At landscape scale, the ACF is ranked a “Priority” landscape for enabling wildlife to move and disperse freely between important habitats, including adjacent conserved lands, undeveloped private lands, and land features such as the Winooski River lowlands and contiguous forest areas to the north, south and west. These places also allow for genetic exchange across populations of far-ranging animal species such as bear, bobcat and fisher. As climate change advances, landscape-level connectivity blocks such as the ACF will take on added importance, providing species with the ability to keep track with their native climate as it shifts to the north²⁵.



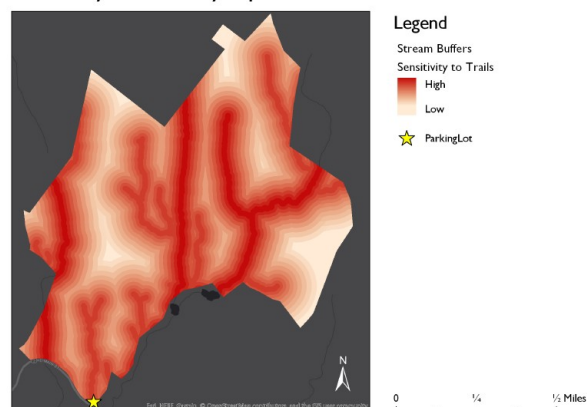
“High” and “highest” priority rankings of forest block connectivity in Richmond. Green is “high.”



Within the ACF, permanent and intermittent stream courses offer wildlife safe, substantially sheltered linear access to life requisites across a 500-foot elevation span. Mink, salamanders, invertebrates and other species find permanent homes in these riparian networks as well. In winter, they also serve wildlife as important sources of flowing water in an otherwise frozen landscape.

Elsewhere, however, studies show that the connective habitat bobcats and other wildlife need is expected to decline, with corresponding decreases in the ability of these animals to move among their subpopulations. This underscores the need for working to maintain the ACF’s habitat viability and connectivity²⁶.

Sensitivity to Trails by Riparian Buffer



Shadings of red show riparian areas of highest vulnerability to trail traffic. (Glynn et al, 2019, p. 29)

²⁵ Beier, 2012.

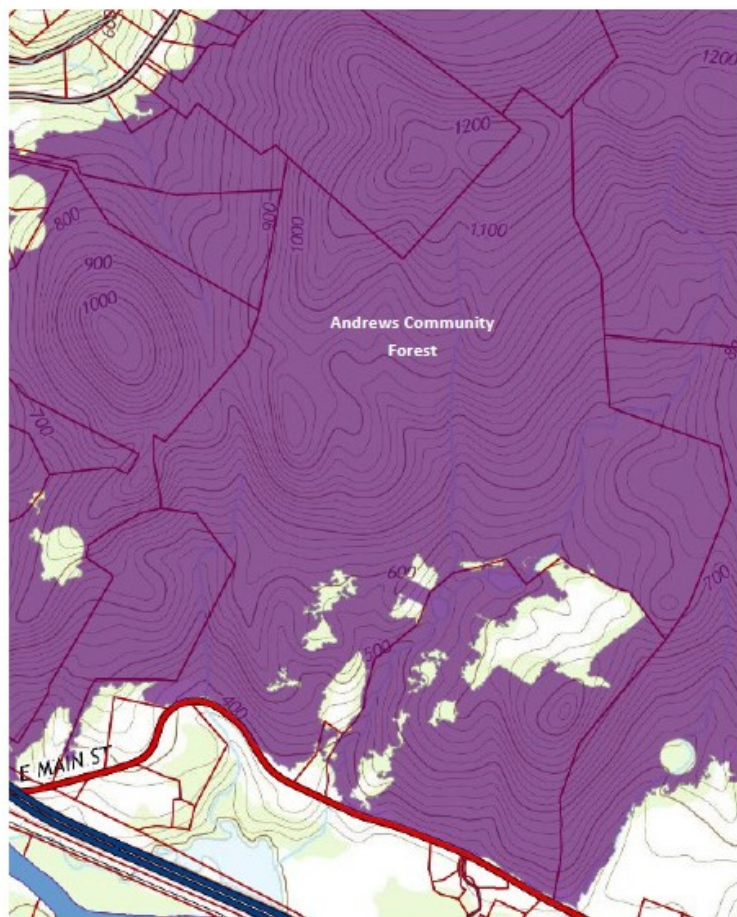
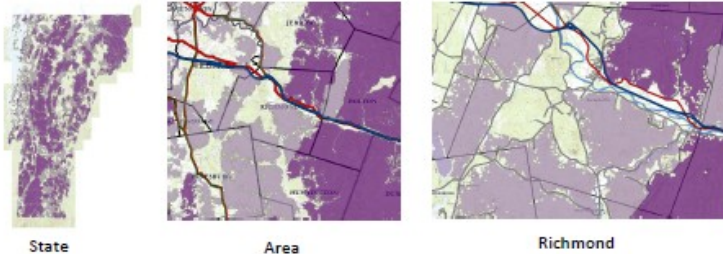
²⁶ Farrel et al. 2018

Appendix iv

Vermont Conservation Design

Interior Forest Blocks Landscape to Local Level

- Landscape Scale Components
- Interior Forest Blocks
- Highest Priority
- Priority



VT BioFinder

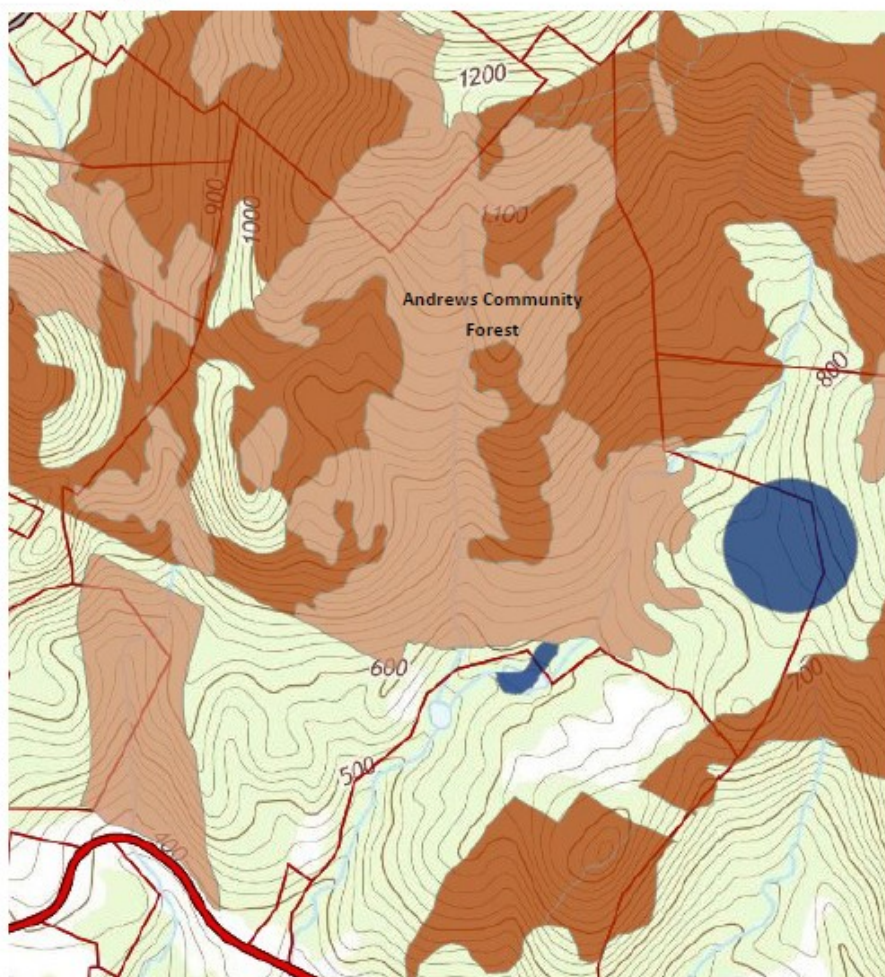
Connectivity Blocks

Landscape to Local Level



VT BioFinder

Species and Community Components Landscape to Local Level



VT BioFinder

Appendix VI Monitoring Program

Objectives

- Collect data over time to inform the ACF Committee and the public of changes in the ACF and its usage by wildlife and visitors
- Gain insights into wildlife and human activities in the Forest, particularly those of black bear, bobcat and other charismatic species indicative of forest health and functional integrity
- Expand community connections to and understanding of the Forest, its inhabitants and processes

Structure

- n-the-ground, volunteer monitors
- Bi-annual or more frequent visits to designated monitoring zones
- Reports submitted on a common template

Methodologies

- Development of monitoring materials
- Direct observations of monitoring zones
- Installation of remote camera and acoustic traps, including at locations suggested by the UVM Field Naturalist program and near new trails as they are built
- Collection and analysis of remote data
- Reports and management recommendations to the ACFC, Conservation Commission and Trails Committee

Support

- ACFC members
- Richmond Conservation Commission
- Richmond Trails Committee
- Vermont Fish and Wildlife Department
- UVM Field Naturalist Program²⁷
- Citizen science web apps (iNaturalist, eBird, Merlin)
- [*UVM Forest Ecosystem Monitoring Program*](#) – Investigate its ability to assist beyond the information contained in its *Regional Forest Health Monitoring Field Guide*²⁸.

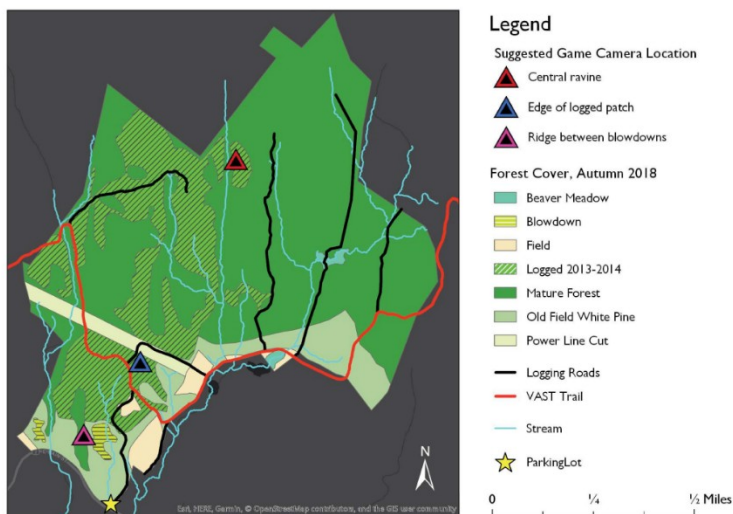
²⁷ [Glynn et. al. 2019](#), pp. 40-49

²⁸ https://www.uvm.edu/femc/attachments/project/1734/20230601_Master_FHM_FieldMethodsManual_updates.pdf

Implementation

- Name an ACFC member or local resident to serve as Volunteer Monitor Coordinator for a one-year, renewable term. Responsibilities:
 - Ensure a consistent legacy of monitoring protocols
 - Serve as a reliable contact for volunteers interested in ACF monitoring
 - Develop monitor reports based on samples provided in the UVM Field Naturalist Report²⁹
 - Maintain monitoring materials, distribution of remote equipment and instructions
 - Serve as point person in answering questions about the program
 - Maintain contact information for monitors and records of their visits
 - Report to the ACFC on each year's observations, changes noted and recommendations made for further stewardship and management needs

Suggested monitoring zones³⁰



Research from the UVM Field Naturalist study suggests starting with three monitoring zones, indicated here by triangles. These were chosen for their potentially valuable wildlife habitat and evidence of wildlife usage.

- "Central ravine": Identified by the Field Naturalists and Arrowwood as the major, north-south wildlife travel corridor in the ACF's central area. Parts of it are close to early successional habitat, and food and shelter that attract a variety of wildlife.

²⁹ [Glynn, ibid.](#)

³⁰ [Glynn et. al.](#)

(The Field Naturalist research team spotted two bears in this corridor during the fall of 2018.)

- "Edge of logged patch": A remote camera captured images of mammals such as fisher, coyote, deer, and flying squirrel. Evidence of wild turkey was also observed at this location.
- "Ridge between blowdowns": Field naturalists observed animal tracks and scat here through the fall of 2018.

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Appendix V

Further Reading

ACF Ecological and Wildlife Assessments

- [Vermont Land Trust \(2017\)](#)
- [Audubon Vermont \(2017\)](#)
- [UVM Field Naturalist Program \(2019\)](#)
- [Field Naturalist ACF Wildlife and Trails Story Map](#)
- Arrowwood Environmental Reports ([2021](#)) ([2022](#))
- [ACF page on iNaturalist](#)
- [From Farm to Forest](#), an overview of the Forest and its human history, by Angus Bisgard Cummings

UVM Masters thesis

- [Landscape Analysis and Wildlife in the Andrews Community Forest, Richmond, Vermont.](#) Grace Glynn, Eric Hagen, and Meredith Naughton. 2019. *Graduate students in the University of Vermont Field Naturalist MS Program assessed how wildlife utilize the ACF, with the goal of minimizing impacts of trail placements on sensitive area. Includes an outline for designing and implementing a monitoring program.*
- [An Ecological Assessment of Gladed Ski Trails at Bolton Backcountry in Bolton, Vermont.](#) 2015. Kathryn Wrigley, UVM Ecological Planning Program.

Effects of human presence on wildlife

Research studies

- [Understanding and Managing the Effects of Trail Use on Wildlife.](#) 2021. Meredith Naughton. University Of Vermont Field Naturalist Program, for the Vermont Fish & Wildlife Department and Department of Forests, Parks, and Recreation. *Naughton's literature analyses focused on those about species native to Vermont. As a graduate student at the University of Vermont, Naughton studied Richmond's Andrews Community Forest in depth (see "Landscape Analysis..." above).*
- [Recreation effects on wildlife: a review of potential quantitative thresholds.](#) Dertien JS, Larson CL, Reed SE (2021) *Nature Conservation* 44: 51-68. *Provides evidence about what we are calling 'Zones of Influence'*

- [An assessment of non-consumptive recreation effects on wildlife: current and future research, management implications, and next steps.](#) John Baas, Kari Dupler, Audrey Smith, And Rachael Carnes, *California Fish and Wildlife*, Recreation Special Issue; 62-73; 2020.
- [“Recreation-related disturbance to wildlife in California.”](#) Elizabeth Lucas, California Department of Fish and Wildlife.
- [Partial COVID-19 closure of a national park reveals negative influence of low-impact recreation on wildlife spatiotemporal ecology.](#) A.K. Anderson, J.S. Waller and D.H. Thornton. *Sci Rep* 13, 687. 2023.
- [A Landscape of Fear of Humans.](#) Asia Murphy, *American Scientist*, Volume 110, Number 5, Page 282. September-October 2022 DOI: 10.1511/2022.110.5.282 *Animals, even apex predators, take great pains to avoid people – a pervasive problem when these changes disrupt what they eat and where they go.*
- [Riparian Buffers and Corridors: Technical Papers.](#) Vermont Agency of Natural Resources 2005

Guidebooks and webinars

- [Trails for People and Wildlife.](#) New Hampshire Department of Fish & Game. *Guidebook to the science and techniques for locating trails to reduce their impacts on healthy wildlife populations. Also note NH’s program web page at www.wildlife.nh.gov/get-outside/trails-people-and-wildlife.*
- [Trails for People and Wildlife.](#) New Hampshire Department of Fish & Game. *The video version, on YouTube.*
- [The Impact of Trails on Wildlife: What We Know and What We Can Do.](#) Meredith Naughton. 2022. *Webinar for the Stowe (VT) Land Trust. As a graduate student at the University of Vermont, Naughton studied Richmond’s Andrews Community Forest in depth.*
- [Colorado’s Guide to Planning Trails with Wildlife in Mind.](#) *Comprehensive guide to the topic, though geared to Colorado’s terrain and species of greater conservation need. Includes a table of references for building “green” trails.*

Magazine articles

- [We Outdoor Recreationists—All Of Us—Are Displacing Wildlife”](#) April Craighead. *Mountain Journal*, January 31st 2022. *This article lists 10 related articles in Mountain Journal addressing the increasing impacts of humans (and dogs) on wildlife habitats.*
- [Trail Based Recreation and its Impacts on Wildlife.](#) Brittany Parker. *Backcountry Hunters & Anglers*. January 31, 2022. *Describes the need to maintain healthy forest block ecosystems and allow connectivity with minimal impact on them.*

- [Human noises make animals in the woods nervous.](#) Christine Peterson. *Popular Science/High Country News*. Jul 6, 2023. First published [here](#). *Using trail cameras and speakers to isolate what human sounds do to animals.*
- [Humans causing increased nocturnal behavior in mammals.](#) Anna Flagg. *National Geographic*, September 5, 2018, By Anna Flagg.
- [Effects of Non-consumptive Recreation on Wildlife in California.](#) California Fish and Wildlife Journal Special Issue May 2020.
- [“Don’t Hike So Close to Me.”](#) Salon magazine. *Describes trail traffic impacts on wildlife and how to minimize them.*
- [Juggernaut: Industrial Recreation Deepens Its Tear Across America’s Wildlands.](#) Todd Wilkinson. *Mountain Journal*. *The rush for recreation and impacts on the natural world.*
- [A Natural and Human History of Vermont.](#) Lillie Howell, Matt Lacey, Sarah Lindsay. Storymap. 2020.
- [Wish you weren’t here.](#) Rebecca Lin. *The Guardian*. 20 Aug 2022. *Photos showing an hour in the life of natural “hot spots” for tourists.*
- [Equilibrium – Hikers causing major disruptions for animals.](#) Saul Elbein and Sharon Udasin. *The Hill*. 2023.

