GUIDELINES FOR MINIMIZING RECREATIONAL IMPACTS TO ECOLOGICAL RESOURCES ON VT AGENCY OF NATURAL RESOURCES LANDS

Vermont ANR Lands Guidance Document

2024

VERMONT

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AGENCY OF NATURAL RESOURCES

Guidelines for
Minimizing Recreational Impacts on Ecological Resources On
Vermont Agency of Natural Resources Lands

Signed by:
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Vermont Agency of Natural Resources

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Date

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INTRODUCTION

Vermonters care about nature and wild places. Providing opportunities for people to enjoy and appreciate the outdoors while conserving a healthy environment are primary responsibilities of the Vermont Agency of Natural Resources (ANR). With great success, public lands in Vermont and across the country have been protected to provide recreation opportunities and to protect ecological function.

Outdoor recreation plays an essential role in the lives and livelihoods of Vermonters. Access to outdoor activities provides Vermonters with positive health outcomes, an improved quality of life, and generates economic activity in rural communities associated with natural and working landscapes (Reeder and Brown, 2005). Today, Vermont boasts an impressive range of recreational activities that reflect both cultural traditions as well as modern innovations. Outdoor recreation also generates economic activity within the state, catalyzes land conservation, leverages public and private funds, and attracts tourists to Vermont from all over the world.

Balancing the needs and interests of the outdoor recreation community with the responsibility to protect the health and ecological integrity of lands is an increasingly complex challenge. Significant research and work has been done in recreation management and recreation ecology to identify where recreation impacts natural resources, and to develop strategies for reducing that impact. Well-developed and comprehensive manuals describe the best practices for designing sustainable trails, water crossings, campsites and associated infrastructure like parking areas and bathroom facilities. These manuals generally focus on impacts to water quality, such as erosion and sedimentation, although they cover a wide variety of resource protection. Furthermore, much work has also been done to develop best practices for visitor use management in recreation areas. These manuals and guidance documents inform work on state lands (See Section IV for a full list of resources).

Recommendations for reducing impacts to wildlife are less established in recreation management. Wildlife require food, water, cover, and space to move around the landscape in order to survive, reproduce and behave as wild animals. The ability of our landscape to meet these needs is challenged by ongoing loss and fragmentation of habitat, expansion of invasive species, expansion of disease, and climate change. The rise in popularity of outdoor recreation places additional pressures on ecosystems that are already facing an increasingly perilous suite of challenges. ANR land managers have identified the need for guidance on how to reduce impacts to wildlife from recreation on state lands.

Scientific knowledge about the effects of recreation on wildlife is a rapidly growing field of academic study, and ANR land managers have decades of experience applying the best available science to management of state lands. ANR has protected important feeding and travel habitats used by black bears from human disturbance based on science that shows a disturbance and displacement effect (Hammond 2002). ANR has also adopted strategies to reduce disturbance from human activity on white-tailed deer based on studies that show a direct relationship between those activities and survival of deer during winter months (Eckstein et al. 1979, Beier and McCullough 1990, Stankowich 2008). Grounding management decisions in science allows ANR to direct recreational use to locations or times

of day or year where the impact to wildlife is minimal, supporting our dual goals of providing recreational opportunities and protecting ecological function on state lands.

Even so, understanding wildlife behavior and the intricacies of how wildlife behavior changes in response to human presence and activities is inherently complicated. In 2020, the Vermont Fish and Wildlife Department and the Vermont Department of Forests, Parks and Recreation hired a University of Vermont graduate student to review current and historical scientific studies on the ecological effects of recreation in ecosystems similar to Vermont's. Results from this project are provided in, "Wildlife & Recreation – Understanding and managing the effects of trail use on wildlife" (Naughton 2020). The report, along with national-level reports that have been published in the last few years, provide a compendium of useful information that ANR has consulted in developing these guidelines (See Section IV).

Despite the growth of scientific knowledge regarding recreation impacts on wildlife, there is a clear need for additional research, especially long-term population-level studies and research on the ecosystems, species, and recreation types found in Vermont. Staff within the departments of the Agency of Natural Resources keep abreast of new developments and will incorporate new information into the guidelines as appropriate.

These guidelines focus on natural communities, plants, and wildlife within the expertise of the Departments of Forests, Parks and Recreation and Fish and Wildlife. The Department of Environmental Conservation (DEC) manages and regulates ecological components of the landscape including surface and ground waters and air quality. These issues are critical to maintaining an ecologically functional landscape, and are considered by the ANR District Stewardship Teams (DST) in coordination with DEC.

How to Use These Guidelines

The purpose of this document is to provide guidance to DST during the planning and review of proposals for recreation infrastructure development on state lands and during the development of long-range management plans. DSTs are led by the Stewardship Forester and are responsible for the management of resources in the five FPR districts. The teams include state lands foresters, recreation specialists, fisheries and wildlife biologists, park staff, the state lands ecologist and watershed planners. The teams are also supported by the State Lands Manager and the State Lands Administration Program Manager. The teams utilize a multi-disciplinary approach to planning and managing state lands.

- **The guidelines are intended to help ANR state land managers navigate decision-making about trail and recreation projects.** This includes siting, design, new recreation infrastructure development, and management that balance the needs and interests of the three Departments, the public, and the overall integrity of Vermont's environment. The guidelines also provide additional transparency to the public about ANR's expectations for recreation project design on Agency-owned and managed lands. Although these guidelines were primarily designed to support evaluation of new recreational proposals, they can also be used to support assessment of current recreational activities on the landscape and relocate, close, or update features if aligned with Department resources and planning processes.

- **The guidelines are intended to be applied within the context of both regulatory requirements and other guiding management documents,** including statutory and regulatory directives, management plans, Agency or Department land management policies, guidelines and procedures, departmental missions and purposes of land ownership, and legal constraints associated with property, such as conservation easements and deed restrictions. DSTs are well versed in applying these guiding documents to their review of proposals for use of state lands.

- **The guidelines are intended to aid in the partnership-based design and management of recreation resources on state lands**. Although the guidelines primarily serve the DSTs, they should also be used as reference by Recreation Partners when they propose new projects through the pre-proposal/proposal process for recreation projects on state lands.

- **The guidelines are not intended to be prescriptive or to serve as "rules."** ANR DSTs and state lands managers maintain the authority to exercise professional judgement, to balance the multiple uses of public lands, and assess the myriad unique circumstances associated with individual project proposals on state land.

- **The guidelines are not intended to be static**. They serve as the basis for an adaptive management approach whereby ANR will update and adjust them as new information, science, tools, strategies, and experience emerges. Review of these guidelines will be ongoing. ANR staff can raise issues during regularly scheduled meetings or through contacting their Program Managers. Recreation partners can contact ANR staff or bring feedback to their regularly scheduled partnership meetings with FPR. If issues arise, they will be considered at the level of management that is appropriate to the issue (e.g. District Stewardship Team, ANR Lands Team or Departmental leadership).

- **The guidelines are not intended to replace any regulatory requirements** that might apply to a project proposal, nor were they created as a regulatory guide. As always, the goal in planning is to comply with all regulatory requirements and if possible, avoid the need for permits. During review, District Stewardship Team staff will identify areas where permits, including wetlands, stream alteration, surface water and other permits, cannot be avoided if the proposal were to go forward and will contact the associated DEC staff for review and comment as necessary.

These guidelines were developed and designed specifically for ANR lands for use in the ANR management planning process. We do not advocate for or take responsibility for their use in other contexts.

Vermont Conservation Design: Maintaining an Ecologically Functional Landscape

Acknowledging the Agency's interest in protecting an "ecologically functional landscape," the guidelines follow a similar structure to Vermont Conservation Design, a vision to maintain and enhance an ecologically functional landscape:

> *"An ecologically functional landscape contains all the native species found in Vermont, and the full range of native habitats and natural communities known to*

> *occur in the state. It also contributes to regional conservation, by maintaining species and habitat conditions that may be in regional decline (such as grassland birds and their habitat), or that may be well-represented in Vermont but regionally rare (such as habitats resulting from calcareous bedrock). It must be well-connected at multiple scales, allowing species movement and gene flow across the landscape. An ecologically functional landscape is also resilient, allowing species and natural communities to adapt and rearrange themselves in response to a changing climate and other stressors" (Zaino et al., 2018).*

The document below is organized at the three scales addressed by Vermont Conservation Design: the Landscape scale, the Natural Community and Habitat scale, and the Species scale. Ecological features discussed at the Landscape scale and the Natural Community and Habitat scale are drawn directly from Vermont Conservation Design and may include additional ecological features determined to be of importance to the Department of Fish and Wildlife (Deer Wintering Areas, for example). We did not generate a comprehensive Species scale set of guidelines, instead we evaluate species-level impacts and concerns through the recreation proposal review process and thorough literature reviews. Some ecological features identified in Vermont Conservation Design were eliminated or merged with other related sections, if they were deemed irrelevant to recreational planning or included guidance that was adequately addressed in other sections of the guidelines[1].

As noted above, the features identified herein are largely those within the purview of the Departments of Forests, Parks and Recreation and Fish and Wildlife, and especially focusing on natural communities, plants, and wildlife. Impacts on features such as, surface and ground waters and air quality are regulated by DEC and as such, anything beyond avoidance is considered by DEC staff as well as DST. Note also, that there are guidelines specific to some of these features such as the *Riparian Management Guidelines for Agency of Natural Resources Land*. Areas where permits and consultation with DEC staff may be needed are noted in the Guidance section of this document.

The Agency Lands Concept

Under a shared Agency of Natural Resources mission, the Department of Forests, Parks and Recreation; Fish and Wildlife Department; and the Department of Environmental Conservation each have distinct missions that, at times, diverge (see Appendix A). A 2012 Memorandum of Agreement (MOA) between these three departments establishes a framework to guide the three departments in the administration of ANR lands, including on matters of policy, planning, and decision making. This framework sets core tenets that are applied by ANR:

[1] Geological Diversity was not considered in the development of these guidelines, as the relevant aspects of geology to recreational planning are adequately addressed through other features considered herein (natural communities, cliffs, ledges, riparian lands, etc.).

- **Agency Lands Concept:** The MOA fosters inter-departmental coordination and communication and, where appropriate, improves consistency in state lands management and administration while recognizing the distinct missions of each department.

- **Role of District Stewardship Teams (DST):** DSTs are integral to ensuring collaborative and comprehensive decision-making in the management of ANR lands. DSTs are responsible for facilitating **multi-disciplinary input** into land management decisions within their districts, promoting an integrated approach to stewardship. While each department retains jurisdiction over its respective lands, DSTs ensure that management incorporates a **wide range of perspectives across natural resource disciplines**, rather than relying solely on the viewpoint of a single department. To support this work, DSTs are encouraged to seek input from the **ANR Lands Team**, which is composed of ANR Division Directors and other Agency staff as needed.

- **Decision-Making Authority:** Although the departments share a common ANR mission, the unique, specific missions of each department are recognized. Each department has its own funding sources and purposes for land acquisition. Final decisions regarding land management rest with the Commissioner of the landowning Department, ensuring decisions align with the department's priorities.

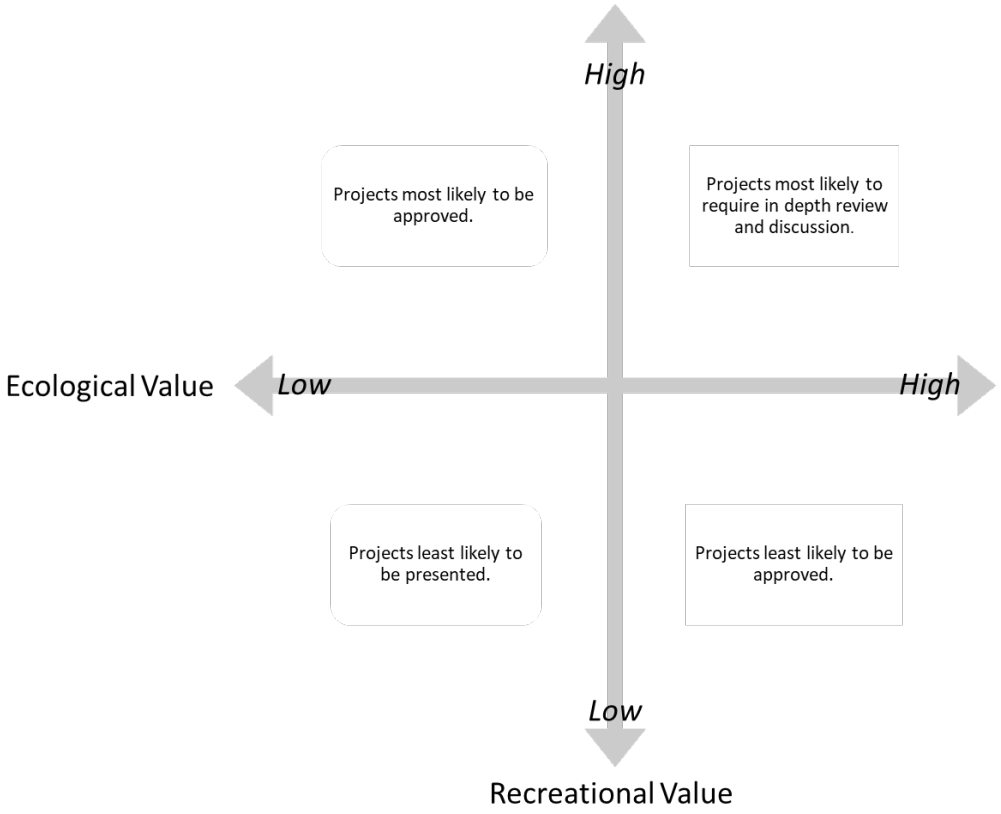
In recognition of the diverse values prioritized by each Department within the Agency, the following guidelines are structured to address both the **ecological** and the **recreational** values of features at the landscape, natural community, and species scale. These summaries are intended to underscore the ecological values that ANR seeks to protect, as well as the unique recreational values that these features provide.

Although the guidelines are organized around ecological features as the framework, emphasis is also placed on highlighting overlapping recreational values. Particular attention is given to recreational values that cannot be met elsewhere on the landscape, ensuring that the full spectrum of benefits is thoughtfully considered and integrated into management decisions. This approach reflects ANR's commitment to balancing conservation, sustainable recreation and a suite of other natural resources, fostering a holistic approach.

Overall, areas identified as having low recreational value and high ecological value are generally less likely to be approved for recreational infrastructure, while areas with high recreational value and low ecological value are more likely to receive approval. For areas with both high recreational and high ecological value, the decision-making process will involve the greatest review and discussion by the DST, as well as detailed planning and management to balance these overlapping priorities.

It is also important to recognize that the assumption that all recreation negatively impacts ecological features oversimplifies the complex interactions between recreational activities and natural resources (Miller et al., 2022). The DSTs are tasked with evaluating these interactions and weighing the many priorities on state lands to determine the most appropriate and sustainable outcome for each specific situation.

General Assessment Framework



Applying the Avoid>Minimize Framework

Each section of the guidelines includes situations to "Avoid When Practical" and "Strategies to Minimize Effect." In some cases, avoiding an ecological feature may not be possible, and minimization impacts might not sufficiently protect the resource. If a recreation proposal cannot be altered to accommodate the adverse impacts on the ecological feature, the project may be denied. In other situations, recreation proposals may proceed if the DST determines the recreational benefits of a project outweigh the ecological impacts. This approach—balancing ecological protection with recreation goals—ensures that decisions are carefully weighed and grounded in the broader goals of sustainable land management.

Avoid When Practical

When planning recreation projects, managers should first consider how to avoid adverse impacts to ecological and other resources. The guidelines in this report provide detailed recommendations for how to avoid impacts to each ecological resource. However, sometimes avoidance is not practical within the context of the project. When considering whether avoidance is 'practical,' DSTs should evaluate a range of factors related to the construction, management, and long-term sustainability of the recreation resource. Examples may include:

- **User Experience:** Changes that significantly shift the user experience or difficulty level of the recreation activity.
- **Cost:** Changes to the cost of constructing the recreation project and ongoing maintenance.
- **Physical Constraints:** Limitations due to ownership boundaries or topography, and siting constraints.
- **Public Interest:** Inability to meet a of significant recreational gap or need.

Importantly, this list is not exhaustive. Natural resource management is inherently contextual, and DSTs must consider unique circumstances. Ultimately, professional judgment of the multi-disciplinary team members is critical in determining the best course of action with consideration for the recreational merits and the ecological values of the specific proposal and location under consideration.

Strategies to Minimize Effect

If a proposal is determined to have enough merit to go forward and the strategies under "Avoid when Practical" are not deemed practical, then the DST will consider the strategies listed under "Strategies to Minimize Effect." Most of the time, these strategies should be used in order to minimize impacts as much as possible. However, DSTs are not required to implement them if they determine that the strategies do not fit the context of the proposal.

GUIDANCE

I. General Guidelines

These general principles apply at all spatial scales:

Strategies to Minimize Effect:

a. **Work with recreation partners to educate user groups** about Leave No Trace practices and other recreational practices that minimize the ecological effects of recreation**.** Visitor education is an essential component of helping recreationists understand, and comply with, management strategies to minimize impacts. A coordinated onsite and online communication campaign will help build common understanding of the new management strategies recommended herein.

b. **Utilize best management practices (BMPs) for trail design and building**. Recreation managers across all activity types have developed comprehensive trail design and build standards. These standards are listed in Section IV, but are also relevant for minimizing impacts for specific landscape and natural community-scale features. Specific strategies for reducing impact are listed under certain features to call attention to the strategy. However, BMPs should be universally utilized on state lands.

c. **Consolidate recreation infrastructure into distinct networks** linked by single connections, rather than establishing diffuse networks of trails across a large landscape.

d. **Co-locate trails and supporting infrastructure** to concentrate activities and reduce impacts, where appropriate.

e. **Consider the local, regional and statewide context** of a recreation proposal when evaluating its recreational merits.

f. **Evaluate and respond to "social trails"[2] early in their formation.** While social trails are an indication of user demand, these guidelines can be used to evaluate the suitability of an existing trail to determine appropriate actions (close, modify, or keep).

g. **Monitor and control for invasive plants** at all recreation sites.

II. Landscape-Scale Features

The landscape-scale features considered in these guidelines – Interior Forest Blocks, Connectivity Blocks, Surface Waters and Riparian Areas, and Wildlife Road Crossings – are drawn from Vermont Conservation Design (VCD; Sorenson and Zaino, 2018), a statewide roadmap for protecting and enhancing ecological function into the future. The VCD technical report provides clear statements about the ecological functions that these features provide, along with guidelines for maintaining ecological function. The recreational infrastructure guidelines below provide a pathway for maintaining ecological function into the future.

A. Interior Forest Blocks

Ecological Values:

"Interior Forest Blocks provide many ecological and biological functions critical for protecting native species and the integrity of natural systems (Austin et al. 2004). These include:

- supporting natural ecological processes such as predator-prey interactions and natural disturbance regimes;
- helping to maintain air and water quality and flood resilience;
- supporting the biological needs of many plant and animal species, particularly those that are wide-ranging or sensitive to human encroachment;
- supporting viable populations of wide-ranging animals by allowing access to important feeding habitat, reproduction, and genetic exchange;

[2] Recreational trails established unofficially, generally by members of the public, without land manager approval.

- and serving as habitat for source populations of dispersing animals for recolonization of nearby habitats that may have lost their original populations of those species.

- Large, topographically diverse forest blocks will allow many species of plants and animals to shift to suitable habitat within a forest block in response to climate change within the next century without having to cross developed areas to other forest blocks (Beier 2012)." (Sorenson and Zaino 2018).

Read more about the ecological functions of interior forest blocks, definition of highest priority features, and guidelines for maintaining ecological function here: Vermont Conservation Design: Interior Forest Blocks (Sorenson et al., 2015).

Recreational Values:

Interior Forest Blocks currently provide some of the most important and popular trail-based recreation opportunities across the state. Additionally, they provide natural space to establish trail connections between existing networks, expand existing trail networks, establish new trail networks, or designate trailless areas. They provide recreationists with the opportunity to immerse themselves in nature, and to go outside for long distance and overnight excursions.

Interior Forest Blocks without trails provide important hunting, foraging, and other remote recreation opportunities, with a low likelihood of encountering other human visitors. The associated feelings of solitude and remoteness are oft mentioned desired experiences.

Special Note:

The majority of state lands are within Interior Forest Blocks. The strategies below are general guidelines, but there are many contextual decisions that must come into play when assessing recreation proposals in these areas. DSTs will need to consider the quality and function of each specific Interior Forest Block under consideration, including how the state land parcel relates to the rest of the Interior Forest Block, how the proposal relates to both the entire forest block and the state land parcel, and how access to the state land may or may not affect where opportunities for recreation could exist on the landscape.

Avoid When Practical:

a. **New trail development into the interior forest**, especially in areas where trails do not currently exist.

b. **Establishing permanent infrastructure** in remote locations where it doesn't already exist (trail access and support structures, such as parking, campgrounds, etc.) and does not align with the designated Recreation Opportunity Spectrum (ROS)[3] for that area.

[3] The Recreation Opportunity Spectrum (ROS) is system originally created by the United State Forest Service that is used to designate the expected visitor experience of a managed area and is based on the physical setting, the social setting and the management constraints of the area. On state lands, the ROS is assigned through the long-range management planning process.

c. **Siting new access points near invasive plant infestation**. When establishing new access points, be mindful about trails as a pathway for invasive species into the forest interior. Avoid siting new access points near an invasive plant infestation, especially in areas where the forest interior does not host invasive plants. Where unavoidable, implement controls and monitoring at the site.

Strategies to Minimize Effect:

a. **Locate trails and infrastructure close to the edge or fringe** of an Interior Forest Block. Limited development on the margins of large forest blocks generally has less adverse effect than trails through the middle of the block, provided the development does not reduce connectivity between blocks (Sorenson and Zaino 2018).

b. **Co-locate trails and supporting infrastructure** whenever possible to consolidate effects and reduce negative impacts. When not possible, locate trails and supporting infrastructure near existing infrastructure.

c. **Identify areas with few or no trails and maintain that remote condition.** The size of the trailless area must be context dependent and should be consistent with the ROS designation assigned through the Long Range Management Plan process (Miller et a. 2022, p148).

B. Connectivity Blocks and Wildlife Road Crossings

Ecological Values:

"A network of Connectivity Blocks allows wide-ranging animals to move across their range, allows animals to find suitable habitat for their daily and annual life needs, allows young animals to disperse, allows plant and animal species to colonize new and appropriate habitat as climate and land uses change, and contributes to ecological processes, especially genetic exchange between populations (Austin et al. 2004, as cited in Sorenson and Zaino 2018). Enhancing landscape connectivity and establishing wildlife corridors can alleviate the negative impacts of habitat fragmentation on both wildlife populations and biological diversity (Beier and Noss 1998; Noss and Cooperrider 1994; Haddad et al. 2003; Damschen et al. 2006, as cited in Sorenson and Osborne, 2014).

Read more about the ecological functions of connectivity blocks, definition of highest priority features, and guidelines for maintaining ecological function here: Vermont Conservation Design: Connectivity Blocks .

Recreational Values:

Connectivity Blocks are similar to Interior Forest Blocks, in that they are large areas of the Vermont landscape that currently provide important trail networks and network connectivity, and non-trail recreation opportunities. Some of the highest value recreation access points near population centers, existing or potentially proposed, may overlap with high value connectivity corridors. Connectivity between trail networks may also intersect with connectivity pinch points, as they value many of the same attributes (e.g. forest cover, conserved natural areas, undeveloped space).

Special Note:

The majority of state lands are within Connectivity Blocks. The strategies below are general guidelines, but there are many contextual decisions that must come into play when assessing recreation proposals in these areas. DSTs will need to consider the quality and function of each specific Connectivity Block under consideration including how the state land parcel relates to the rest of Connectivity Block and other related forest blocks, how the proposal relates to both the entire block and the state land parcel, and how access to the state land may or may not affect where opportunities for recreation could exist on the landscape.

Avoid When Practical:

d. **Siting trails or supporting infrastructure in, along, or directly adjacent to wildlife road crossings** or critical linkages between Connectivity Blocks and/or between Connectivity Blocks and Interior Forest Blocks. Limiting development and preserving forest cover within and along the margins of bordering blocks is critical to maintaining and enhancing structural and functional connectivity (Sorenson et al., 2015).

e. **Building trails and trail infrastructure in natural or man-made pinch points or bottlenecks** within or between Connectivity Blocks and/or Interior Forest Blocks.

Strategies to Minimize Effect:

f. **Minimize disturbance** to the interface[4] between high value connectivity blocks and between high value connectivity blocks and interior forest blocks.

g. **Identify areas with few or no trails** and maintain that remote condition. The size of the trailless area must be context dependent and should be consistent with the ROS designation assigned through the Long Range Management Plan process (Miller et a. 2022, p148).

C. Surface Waters

Ecological Values:

"Vermont's rivers, streams, lakes, and ponds provide vital habitat for a rich assemblage of aquatic species, including fish, amphibians, reptiles, invertebrates (e.g., insects, mussels, snails, worms, freshwater sponges), and plants. This represents an enormous contribution to Vermont's biological diversity. The ecological integrity of an aquatic system is dependent on the condition of the watershed in which it occurs, but is also critically tied to the condition of the riparian area adjacent to the stream or pond. For stability, rivers and streams must have access to their floodplains and freedom to meander within their valley bottoms or river corridors." (Sorenson et al. 2015).

Read more about the ecological functions of surface waters, definition of highest priority features, and guidelines for maintaining ecological function here: Vermont Conservation Design: Surface Waters and Riparian Areas (p11, Sorenson et al., 2015).

[4] The border between a connectivity block and a neighboring connectivity block or interior forest block.

Recreational Values:

Recreation on and around surface waters includes a host of popular outdoor activities including boating, paddling, swimming, and fishing, as well as camping, picnicking, and hiking adjacent to water. Most water bodies feature public access points for either trailered or hand-carry boat access and many have either informal angler trails or developed paths that parallel or access the water's edge. Climate change is expected to increase the popularity and demand for access to water based recreation.

Special Note:

Surface waters are within the jurisdiction of the Department of Environmental Conservation's Lakes and Ponds and Rivers programs. Any proposed project that would impact these features will be identified by the DST and sent to staff from DEC for review.

Avoid When Practical:

a. **Reducing aquatic connectivity** by severing connections or introducing barriers to aquatic organism passage.

b. **Diverting and concentrating water flow** into perennial surface waters, lakes, ponds, and wetlands, or adding material that changes stream hydraulics

c. **Clearing or removing vegetation** to permit boating access (including wood and aquatic vegetation)

d. **Removing rocks or significant amounts of large wood from streams** for trail building or channel clearing without consulting fish biologists

Strategies to Minimize Effect:

e. None

D. Riparian Areas

Ecological Values:

"Naturally vegetated riparian areas provide many significant ecological functions, including stabilizing shorelines against erosion, storage of flood waters, filtration and assimilation of sediments and nutrients, shading of adjacent surface waters to help moderate water temperatures, and direct contribution of organic matter to the surface water as food and habitat structure. Riparian areas are also very essential habitat for many species of wildlife that are closely associated with the terrestrial and aquatic interface, including mink, otter, beaver, kingfisher, spotted sandpiper, and wood turtle. The shorelines and riparian areas of rivers and lakes support floodplain forests, several other rare and uncommon natural communities, and many species of rare plants and animals" (Sorenson et al., 2015).

"In addition to these ecological functions that are tied to aquatic systems, the linear network of riparian areas provides a crucial element of landscape connectivity for plant and animal movement in response to climate change (Beier 2012). Although many riparian areas and river corridors are highly altered by agriculture, roads, and urbanization, the risk of flooding serves as a natural deterrent for

future development. Riparian areas also respond rapidly to restoration efforts (Beier 2012)" (Sorenson et al., 2015).

Read more about the ecological functions of surface waters, definition of highest priority features, and guidelines for maintaining ecological function here: Vermont Conservation Design: Surface Waters and Riparian Areas (p11, Sorenson et al., 2015).

Recreational Values:

Riparian areas have long served as recreation and travel corridors- offering relatively suitable terrain for people to move up, down, or between watersheds. When sited properly and developed at an appropriate scale, recreation in riparian areas can offer important aesthetic, navigational, and access values. Riparian areas provide opportunities to experience the sights and sounds of moving water; observe specialized flora and fauna; and access water to rest or cool down. Riparian areas provide direct access to waters for recreation such as swimming, boating, and angling as well as access to drinking and wash water near overnight sites.

Special Note:

Many riparian areas are within the jurisdiction of the Department of Environmental Conservation's Rivers program. Any proposed project that would impact these features would be identified by the DST and sent to staff from DEC for review. Furthermore, the ANR Lands Riparian Management Guidelines set out guidelines for management with the riparian zone.

Avoid When Practical:

a. **Siting trail and infrastructure development** in riparian corridors, especially in narrowest portions of riparian corridor in natural cover or in frequently flooded soils.

b. **Developing trails within 300 feet** of the stream or river in areas where rare or uncommon plants or animals are associated with floodplain conditions (or greater distance depending on species requirements) (Semlitsch and Bodie, 2003; Spackman and Hughes, 1995; VTANR, 2005).

c. Siting trail or infrastructure development within **actively moving, dynamic areas along rivers** (e.g. seeps, deltas, cut banks, landslides, etc.).

d. **New trails that run parallel to long stretches** of streams and rivers.

e. **New trails that cross** the same streams and rivers multiple times.

Strategies to Minimize Effect:

f. **When necessary, locate trails in relatively wider areas** of riparian corridor with natural cover.

g. **If no crossing is necessary, maintain a no infrastructure buffer** to streams and rivers of between 50 and 300 feet depending on site specific features, such as areas of riparian vegetation, natural terraces, and natural sound barriers. (Fischer and Fischenich, 2000; Semlitsch and Bodie, 2003; Spackman and Hughes, 1995; VTANR, 2005)

h. **Use spur trails** to provide access to streams and rivers in stable areas with low slopes.

i. **Orient crossings perpendicular to streamflow** to minimize shoreline disturbance.

j. If practical, **utilize natural fords, or site bridges** on naturally occurring ledge, boulders, or rocky areas as crossings.

III. Natural Community and Habitat Scale Features

The natural community and habitat-scale features considered in these guidelines are identified within Vermont Conservation Design, and some additional specific habitats were identified for inclusion in the guidelines. The natural community and habitat scale guidelines complement the landscape-scale guidelines and taken together, provide a pathway for maintaining ecological function into the future.

A. Rare and Uncommon Natural Communities

Ecological Values

Natural communities are interacting assemblages of organisms and their environment, and they are classified into types, such as Northern Hardwood Forest, Hemlock Forest, Red Maple-Black Gum Swamp, and Cattail Marsh, that repeat across the landscape wherever similar conditions are found.

Natural communities are one of the most important “coarse filters” for conserving biological diversity (Hunter 1991, Thompson and Sorenson 2000). This is because there are relatively few natural community types—97 in Vermont—compared to the tens of thousands of plant and animal species. Collectively, these 97 types in Vermont encompass the full range of habitat conditions that native flora and fauna evolved with and are adapted to. Therefore, conserving high-quality examples of all the natural community types is an efficient way to conserve most species. Natural communities are relatively stable in a human timeframe, but their species assemblages have changed over thousands of years and will continue to shift in response to a changing climate. Sites with high-quality natural communities today represent places that are expected to continue to support important natural communities, and associated species, into the future” (Sorenson and Zaino 2018). By 2023, 82 percent of state lands were inventoried for natural communities. Approximately 43 percent of state lands are mapped as state significant. Rare (S1 & S2) and uncommon small-patch state-significant natural communities (S3) cover less than three percent of state land area.

Recreational Values:

Experiencing the variety of natural communities across the landscape – whether climbing in elevation from a Northern Hardwood Forest into Subalpine Krummholz or encountering an open wetland after traveling through dense forest -- is one of the reasons recreating in Vermont is enjoyable. Uncommon and rare natural communities can be attractive to people seeking nature-based recreation, like birdwatching and foraging. Some rare, state significant natural communities are found in valley bottoms (e.g. Mesic Clayplain and Sandplain Forests) near population centers and may be seen as community open space, ideal for recreation.

Special Note:

Some natural communities, like Lakeside Floodplain Forests (S3), are within the jurisdiction of the Department of Environmental Conservation's programs. Any proposed project that would impact these features would be identified by the DST and sent to staff from DEC for review.

Avoid When Practical:

a. **New recreation infrastructure in S1-S3 state significant small patch natural communities,** including Subalpine Krummholz (S1), Open Talus (S2), Rich Fen (S2), Temperate Calcareous Cliff (S3), Dry Red Oak-White Pine Forest (S3), etc.

b. **New recreation infrastructure in S1-S2 state significant large/matrix natural communities,** including Pine-Oak-Heath Sandplain Forest (S1), Mesic Clayplain Forest (S2), and Sand-Over-Clay Forest (S2).

c. **Altering physical processes and characteristics** that sustain or exemplify the natural community (ex., fires, blowdowns, cold air drainage, headwater seepage, thin, poorly drained, or easily erodible soils, etc.).

d. **Siting new access points near invasive plant infestation**. When establishing new access points, be mindful about trails as a pathway for invasive species into invasive-free natural communities. Avoid siting new access points near an invasive plant infestation. Where unavoidable implement controls and monitoring at the site.

Strategies to Minimize Effect:

e. **Minimize the presence of trails and recreation infrastructure within in S1-S2 and small patch S3 state-significant natural communities** (e.g., short sections by edges, rather than long and winding sections through the center; provide designated viewpoints with minimal impact of passage, with spur trails to access places of interest).

f. **Design trail corridors to keep people on the trails** within in S1-S2 and small patch S3 state-significant natural communities.

g. **Locate recreation infrastructure in areas with relatively common natural features if practical.**

h. **Identify the most important ecological functions of the natural community** and protect those functions through the design of the recreational feature.

i. **Site recreation infrastructure in areas with relatively more human disturbance**. Locate huts or trails along stable existing corridors (e.g., well-designed, but defunct landings and woods roads, well-designed, but old camp sites, existing trail systems).

j. **Use trail construction techniques that protect physical processes** (e.g., maintaining natural surface water flow through grade reversals and grade dips, constructing boardwalks in wet

areas (Hesselbarth et al. 2007), preventing soil erosion and compaction by minimizing trail width and length through sensitive soils, etc.

B. Hard Mast Stands

Ecological Values:

American beech (*Fagus grandifolia*) mast is widely recognized as providing significant resources for black bear, white-tailed deer, American marten (Jakubas et. al. 2005), fisher (Brown and Will 1979), wild turkey, ruffed grouse, and many small mammal and passerine species. The special importance of beech mast for black bear reproduction has been well documented (Jakubas et. al. 2005). This effect is most pronounced in areas where beechnuts constitute a large proportion of the fall diet, and alternate food sources are scarce. In the north half of Vermont, beech is the predominant mast species, and the only source of hard mast in the northeastern region of the state. Black bears exhibit fidelity to beech mast production areas, feeding in them year after year when mast is abundant. Clusters of mast bearing beech which are remote from human developments are particularly important feeding areas, so maintaining connectivity to such areas is a vital element of maintaining habitat for a viable black bear population.

Recreational Values:

A multitude of recreation activities- including both summer and winter uses- occur within mixed hardwood forests, where American beech and other hard mast species are present. It is not unusual for these stands to be classified as general management areas in long range management plans, which offers the greatest flexibility for public recreation and trail development. Hardwood mast species enjoy many of the same site characteristics that recreation trail enthusiasts seek- moderately or well-drained soils, abundant stone, flat or intermediate slopes, and partial shade.

Avoid When Practical:

a. **Permanent infrastructure that would lead to increased human presence during the mast season (Sept-Nov)** in areas with obvious use by bears. Bears serve as proxy for other animals that rely on these areas and are sensitive to human presence. (Ditmer et. al 2018, Baruch-Mordo et al. 2014, Hubbard et al. 2022)

Strategies to Minimize Effect:

b. **Impose seasonal restrictions on use of permanent infrastructure during the mast season (September to November)** in areas with obvious use by bears.

c. **Buffer mast stands by a quarter-mile natural buffer** (can be narrower if topography provides visual and auditory cover). (McLaughlin et. al 1994, Jakubas et. al 2005, Elowe and Dodge 1998)

d. **Identify replacement habitat elsewhere**; manage for beech elsewhere in the parcel, to provide viable replacement habitat at the site level.

C. Soft Mast Stands

Ecological Values:

Black cherry, apple, mountain ash, raspberries, blackberries, and blueberries, among others are considered soft mast fruit produced by trees and shrubs that provide a valuable source of food for a wide range of wildlife. Many types of fruit producing trees and shrubs occur throughout Vermont. Of particular importance for wildlife are areas of concentrated black cherry trees, apple trees and mountain ash trees that are in relatively remote environments. Like concentrated areas of hard mast producing trees, these areas tend to serve as important feeding habitats for black bears, moose, fisher, myriad birds and other wildlife. Often, soft mast trees are associated with concentrated areas of hard mast producing trees, resulting in a more rich and diverse assemblage of food for wildlife and raising the value of those habitats by increasing variety available food available. In some cases, concentrations of mountain ash in remote areas provide important seasonal food resources for wildlife.

Recreational Values:

Mountain ash and black cherry may occur at higher elevations in areas sought out by recreationists for mountain trails, vistas, and summits.

Avoid When Practical:

a. **Permanent infrastructure that would lead to increased human presence** in areas with concentrations of mountain ash, or concentrations of black cherry that are associated with other hard mast.

Strategies to Minimize Effect:

See strategies outlined in hard mast section.

D. Forested Wetlands

Ecological Values:

Remote forested wetlands are used as important feeding habitat by black bears, moose and other wildlife in the spring and early summer when food is scarce following winter months (Hammond 2002). Succulent herbaceous vegetation tends to emerge early in these areas and provides an important source of food for black bears and other wildlife. Like concentrated mast stands, these areas are used from year to year by local wildlife populations. They also provide important cooling habitat during the summer (aka, summer thermal refugia). Typically, these wetlands are scattered across the landscape, but where they are concentrated, often along headwater streams, they are particularly important for wildlife.

Recreational Values:

Forested wetlands are generally not well-suited for recreation use, primarily due to wet soils but also the unpredictability of variable seeps, shallow-rooted trees that are susceptible to windthrow, and the expense of installing trail infrastructure. On occasion, trails may be sited in forested wetlands as a means of connecting adjacent trail segments. In these instances, boardwalks, puncheon, step stones, or ditching are used to provide a stable tread and manage water flow. Winter trails (for snowmobiles

or skiing) may pass through forested wetlands but are also generally not practical for the reasons above and due to early thawing from ground water seepage.

Special Note:
Wetlands are within the jurisdiction of the Department of Environmental Conservation's Wetland Program. Any proposed project that would impact these features would be identified by the DST and sent to staff from DEC for review.

Avoid When Practical:

a. **Siting recreation infrastructure** in forested wetlands.

Strategies to Minimize Effect:

b. **Close trails until after Memorial Day** or allow trail use only with adequate snow cover.

c. **Provide a natural buffer of up to quarter-mile,** narrower if topography provides visual and auditory cover (McLaughlin et. al 1994, Jakubas et. al 2005, Elowe and Dodge 1998).

d. **Use spur trails** if these are desirable sites to view.

E. Grasslands

Ecological Values:
Grassland habitat contributes to the ecological health and diversity of wildlife in Vermont by providing breeding and foraging habitat for certain species of grassland-obligate birds, as well as habitat for plants and numerous other species of wildlife. Four species of birds that rely on grasslands for nesting are listed as Threatened or Endangered under Vermont's Endangered Species Act and another seven are listed as Species of Greatest Conservation Need (SGCN) due to population declines (VFWD 2022, VFWD 2021). Proactive protection of functional grassland bird habitat now will reduce the need to upgrade listed species (e.g. SGCN to Threatened or Endangered) and list additional grassland bird species as Threatened, Endangered, or SGCN over time.

Grassland obligate species rely on grassland habitat for nesting between May 1 and August 31. With most species having fledged young by August 1st in most years. Generally, fields must be 12 acres or larger in size with little to no woody vegetation, sufficiently open, and vegetated primarily with grasses (where forbs may also be present) to attract and retain nesting grassland birds.

Today, as in the past, grassland habitat is not uniformly distributed within Vermont. Much of the grassland habitat is found in the Lake Champlain valley, Lake Memphremagog basin, Connecticut River valley and the valley bottom lands along major rivers such as the White, Lamoille, and Missisquoi. The Champlain valley and the Connecticut River valley have particularly high concentrations of grasslands due to their agricultural nature. These regions represent the areas of Vermont with the highest concentrations of both grassland bird habitat and grassland bird populations.

Recreational Values:
Because grasslands are often the only open areas (non-wooded) in a region they can be popular destinations for gathering, walking, skiing and snowshoeing. Their habitat values also make them important areas for wildlife watching and birding. They are popular areas for hunting turkeys and deer.

Avoid When Practical:

a. **Disturbance to the interior of grassland habitats** by off-leash dogs, people, etc.

Strategies to Minimize Effect:

b. **Mowed trails only around grassland edges** with established viewpoints to accommodate birdwatching, if that is a desired activity during the nesting season.

c. Require dogs be kept on leash during the nesting season.

F. Wetlands

Ecological Values:
Many wetlands are used by nesting birds between March 15-August 1. Wetlands play a crucial role in supporting wildlife by providing essential habitat for a diverse range of species. These ecosystems serve as breeding grounds, nurseries, and feeding areas for various aquatic and terrestrial animals, including birds, amphibians, reptiles, fish, and mammals. Wetlands are highly productive environments, offering abundant food sources and shelter. They also contribute to biodiversity by hosting numerous species adapted to the unique conditions found in wetland habitats.

Wetlands provide wildlife critical resources such as food, water, and shelter throughout different stages of their life cycles. For example, marshes, a type of wetland, provide habitat for emergent vegetation, which serves as nesting sites and refuge for waterfowl and other bird species. Additionally, wetlands contribute to the overall health of ecosystems by filtering water, controlling erosion, and maintaining water quality, which indirectly benefits wildlife populations by ensuring the availability of clean water and a stable environment.

Recreational Values:
Wetlands may serve as a primary destination for recreation (interpretation, birding, wildlife photography) or as trailside features for longer paths that traverse the landscape.

Special Note:
Wetlands are within the jurisdiction of the Department of Environmental Conservation's Wetland Program. Any proposed project that would impact these features would be identified by the DST and sent to staff from DEC for review.

Avoid When Practical:

a. **Trails circumnavigating** a wetland.

b. **Developing trails within 300 feet** of state-significant wetland edges (or greater distance depending on species requirements) (Semlitsch and Bodie, 2003; Spackman and Hughes, 1995; VTANR, 2005).

c. **Siting recreational infrastructure** in state-significant wetland ecosystems.

Strategies to Minimize Effect:

a. Establish viewpoints as "out and back" **spur trails.**

b. Use trail structures such as step stones, puncheon, or boardwalks in the approach to cross wetlands to reduce impact to hydrologic processes.

c. Build boardwalks with helical piles to raise the surface of the trail above the wetland. Use naturally rot-resistant wood (not pressure-treated) where the material touches water.

d. Employ the recommendations in DEC's "Best Management Practices for Duck Blinds, Fences, Catwalks and Docks."

e. **Maintain buffers on state-significant wetlands of 50 to 300-ft** depending on the context and specific habitat of the wetland (Fischer and Fischenich, 2000; Semlitsch and Bodie, 2003; Spackman and Hughes, 1995; VTANR, 2005).

f. When establishing campsites in proximity to a wetland (i.e. along river trails where no other options exist), maintain a **vegetative screen**.

g. If trails must cross a wetland, **cross at the narrowest point** and utilize all strategies for reducing impacts to water movement.

Species-Specific Guidance:

h. Heron rookeries may need up to a 600-foot buffer or more (VTANR 2002).

G. Deer Wintering Areas

Ecological Values:

White-tailed deer in Vermont are at the northern edge of their natural range and have adapted to survive the harsh winter conditions by relying on unique winter habitat. Deer winter habitat is comprised of mature softwood cover, usually consisting of concentrated areas of eastern hemlock, red spruce, balsam fir, white pine, and white cedar. The softwood cover captures snow, resulting in reduced snow accumulation on the ground, making it easier for deer to move, find food and avoid predators. The softwood cover also buffers deer from exposure to wind and cold temperatures. Deer survive winter conditions by conserving energy rather than consuming it. Limited food available during the winter is far less important for deer survival than being able to conserve the energy reserves developed during summer and fall months when nutritious food is available (cite). Deer are vulnerable to stress and disturbance during winter months when they are concentrated in deer wintering areas.

Avoiding or minimizing unnecessary disturbance to wintering deer is important for their survival. This critical period is weather dependent, but generally extends from December 15th to April 15th.

Recreational Values:

Generally, deer wintering areas are not ideal for trail construction as they are often wet in the summer and have lower snow cover in the winter. However, deer wintering areas exist across the landscape, and it may be desirable to establish connecting trails or develop recreation infrastructure for opportunities like fat biking that are growing in popularity. As climate change affects winters in Vermont, areas that become more attractive for winter recreation, such as south facing slopes, may conflict with winter deer habitat.

Avoid When Practical:

a. **New winter trail use** through a deer wintering area

Strategies to Minimize Effect:

b. **Restrict winter trail use** in deer wintering areas.

c. **Trails should be less than 12-15' in width** to prohibit snow build up, which hinders deer movement.

d. **Leash dogs on trails** in or adjacent to deer wintering areas.

H. Old Forest

Ecological Values:

"Historically, the vast majority of Vermont's landscape was old forest, and it is the original habitat condition for many species. The state's native flora and fauna that have been here prior to European settlement are adapted to this landscape of old, structurally complex forest punctuated by natural disturbance gaps and occasional natural openings such as wetlands or rock outcrops. The complex physical structure of old forests creates diverse habitats, many of which are absent or much less abundant in younger forests.

As a result of the persistent structural and vegetative complexity above ground and the diverse biome belowground and associated complex biotic and abiotic relationships that develop over time, old forests also protect water quality, and sequester and store carbon, provide opportunities for adaptation of species and community relationships to climate and other environmental changes, and an ecological benchmark against which to measure active management of Vermont's forests" (Zaino et al. 2018).

"Old Forest" is defined in Vermont Conservation Design as "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." Additional Old Forest characteristics are outlined in the VCD Natural Community and Habitat Technical Report (p15, Zaino et al. 2018).

Recreational Values

People appreciate visiting old forest for the unique experience of experiencing this rare landscape condition.

Avoid When Practical:

a. **Establishing new trails and recreational infrastructure** in areas of exemplary old forest.

b. **Disruption to soil, snags, and large fallen logs.** Soils, snags, and decomposing logs in old forest host a complex network of mycorrhizal fungi, invertebrate decomposers, nesting wildlife. Soils hold and transport water in ways that are prone to disruption when soils are disturbed, such as by compaction, which can reduce the growth of seedlings and trees, while also increasing surface erosion (Ballantyne and Pickering, 2015; Leonard et al., 1985).

c. **Siting new access points near invasive plant infestation**. When establishing new access points, be mindful about trails as a pathway for invasive species into invasive-free natural communities. Avoid siting new access points near an invasive plant infestation. Where unavoidable implement controls and monitoring at the site.

Strategies to Minimize Effect:

d. **Contain trails, interpretive or otherwise, to a small section of forest**, along the edge of the forest.

I. Ledges

Ecological Values:

Vermont has many areas of exposed bedrock or ledge, which can vary in size from a small outcrop to a significant series of complex ledges. Ledges provide diverse microhabitats, offering nesting sites, shelter, and foraging opportunities for various wildlife species and many plant species. Exposed bedrock with sharp vertical relief creating overhangs, or broken jumbles of rock with a multitude of nooks and crannies can provide important denning habitat for bobcats and other animals.

Recreational Values:

Depending on the size of the ledges, these areas can provide viewpoints across the landscape or interesting features to look at, hike around, or hike, ski or bike over. In some areas they are ubiquitous across the landscape, while in others they are valued destinations.

Avoid When Practical:

e. **Installation of recreational infrastructure within quarter mile of ledges** with evidence of denning.

f. **Concentrated winter use in areas with high level of confidence in a site's denning potential**.

Strategies to Minimize Effect:

g. **Build trails as far from ledges with high denning potential as possible**, cross ledge systems at a perpendicular when necessary.

h. **Avoid parallel travel along top or bottom of long ledge systems;** consider spur trails to access ledge systems for views.

J. Cliffs

Ecological Values:

Although challenging to access, cliffs provide significant ecological function for a number of species, supporting both traditional plant communities on stable ledges and open patchy dispersion of small herbs, sedges, grasses and bryophytes on open rock. These geologic features also provide nesting habitat for peregrine falcons, common ravens, and turkey vultures (see Raptor Nesting Sites).

Recreational Values:

Vermont's cliffs provide recreational opportunities for rock and ice climbing and are scenic destinations for many trails. Trail access to cliffs typically include cliff top vistas, although trails may also traverse the base of cliffs or, in rare circumstances, scale portions of the cliffs themselves. Hikers and land managers may expand naturally occurring vistas by removing vegetation- below and at the margins of the vista- to create more expansive views.

Avoid When Practical:

a. **Establishing new recreational infrastructure** within 2,000 feet of cliffs with evidence of nesting peregrine falcons (Ontario MNR, 1987, Holthuijzen et al 1990, Craig et al. 2002).

b. Locating new recreational uses at cliffs with known RTE species.

c. Developing vistas or cliff access points directly above nesting areas.

Strategies to Minimize Effect:

a. **Seasonally restrict recreational use of cliffs and nearby trails with known active populations of RTE and nesting species,** such as between March 15 and August 1 at cliffs actively occupied by peregrine falcons. This is particularly important for access on and above the cliff. The recommended buffer for peregrine falcons is 3,000 feet from the nesting site for climbing and 2,000 feet for other recreation activities off the cliff (Ontario MNR, 1987, Holthuijzen et al. 1990, Craig et al. 2002).

b. **Provide information regarding nesting areas and cliff closures** on site and online (in collaboration with Audubon Vermont and CRAG-VT).

c. **Provide signage in areas where RTEs are in proximity** and could be impacted if climbing routes are expanded.

d. **Manage cliff access** (trails, staging areas, etc.) to minimize environmental impacts.

e. **Avoid trails that parallel top or bottom of cliff systems;** use spur trails to access cliff systems for views.

K. Talus

Ecological Values:

Talus is a slope formed by an accumulation of rock debris, often at the base of a cliff. Talus is found at the base of cliffs and many of the ecological values are connected to both the cliff system and the adjoining forest, which is often a wooded talus community. The open air talus, specifically, is a rare feature across the landscape and can provide important microclimate, either warmer or colder than surrounding communities depending on the situation. Depending on the type of rock forming the talus, some rare plants can be found in these areas. Reptiles, including eastern timber rattlesnakes use talus to warm themselves.

Recreational Values:

Talus itself is unlikely to be a recreation destination as it is inherently dangerous for travel. However, crossing talus can be necessary to reach more valuable recreation destinations, particularly cliffs for rock climbing. Bouldering, as an activity, may also occur within or near talus areas.

Avoid When Practical:

a. **Building trails over loose talus.**

b. **Talus areas with RTE element occurrences or sensitive ecological features created by microclimates** (such as cold air talus communities found outside of their normal ranges).

Strategies to Minimize Effect:

c. **Establish formal route** that is well marked and stable if crossing a talus slope is necessary.

d. **Consolidate use** by clearly marking the established entrance and exit to the talus slope as well as the route.

L. Amphibian Breeding Pools

Ecological Values:

Necessary wildlife habitat for pool-breeding amphibians includes well-functioning breeding pools connected to intact upland forest. The animals are active between March 15 and October 15 with primary breeding activity in April and early May and fall migration of juveniles away from pools from late September through the end of November. Adults breed exclusively in the vernal pool depression (“pool”) in early spring. A pool may be water filled in spring then dry for much of the summer and fall. A 100-foot radius (“pool envelop”) surrounding the pool supports pool hydrology and emigration from the pool by juveniles and adults. Juveniles and adults may migrate through a 650-foot radius upland from the pool (“life zone”) to forage and shelter, then to hibernate under cover.

The local and meta-populations become susceptible to loss of individual amphibians and/or reproductive failure from disturbance within the breeding pool, pool envelop, or life zone, and when migration is obstructed by any development including forest clearing. Connectivity among breeding pools is critical for maintaining viable local population and sustaining genetic diversity. Individuals are most vulnerable when migrating during spring and fall between the breeding pool and terrestrial habitats. Migration routes must remain free of physical barriers and offer sufficient forest canopy to preserve a shaded cool moist forest floor with ample leaf litter. Dry, compact, and exposed soils with temperature extremes due to canopy openings are not favorable although the species may cross small open areas.

Recreational Values:
Amphibian breeding pools have little recreational value for humans but can be attractive for dogs and they can be abundant in certain areas. Trails traversing the landscape will likely pass within the 650-foot 'amphibian life zone.'

Avoid When Practical:

a. **Disturbance within the pool** and pool envelope (100-ft).

b. **Trails circumnavigating** the pool.

c. **Trails passing between** pools that are within 650-feet of each other.

Strategies to Minimize Effect:

d. **Restrict new trail construction to one side of the pool**.

e. Contain any unavoidable disturbance to the outer portions of the life zone (650-ft).

f. **Leash dogs** during amphibian breeding season (March 15 – June 1) and prevent pool access by dogs from May 15 – October 15.

g. **Use trail construction techniques** that allow amphibian migration such as avoiding building vertical barriers to movement across trails that could entrap or slow migrating amphibians.

h. **Retain natural forest structure** within amphibian life zone (650-ft); maintain natural forest floor cover including all woody material, do not leaf blow trails.

i. **Educate users** about potential impacts/collisions on trails (especially during migration season).

M. Moose Winter Habitat

Ecological Values:
Moose at the southern edge of their range in Vermont encounter numerous challenges, including habitat loss, heavy parasite loads (e.g., winter ticks, brainworm), and the impacts of changing weather patterns. Like Deer, moose are vulnerable to stress and disturbance, particularly during winter months when their health is often more compromised as winter browse is neither very nutritional nor easily

digestible. Consequently, moose will usually lose weight and must rely on fat reserves to survive harsh winters. Upland hardwood or mixed forests are frequented by moose during the fall and winter months—particularly, moose may seek softwood canopy cover at mid to high elevations when snow depths reach approximately 35 inches or during extreme cold windy conditions. Such preferred habitats often provide refuge from deep snow, security from predators including humans, and lateral protection from wind, preventing additional energy loss (Timmermann and McNicol 1988).

Recreational Values:

Higher elevation trails and recreation uses may approach or pass through important winter moose habitats. Many recreation trails climb into higher elevation forest to access summits, vistas, and ridges. Backcountry skiers seek mid to high elevation forests where moose are known to congregate in winter.

Avoid When Practical:

a. **Siting new trails (e.g., skiing, hiking, snowmobile) and backcountry ski zones** in areas of known winter moose concentrations or important winter habitat.

Strategies to Minimize Effect:

b. **Design backcountry and cross-country ski trails** to be outside of (ideally greater than 500m from; Ferguson & Keith, 1982) known winter moose concentrations or highly suitable winter habitat.

c. **Establish seasonal restrictions** in areas with known moose concentrations or important habitats to avoid increased energy expenditure during the winter months (e.g., December 15th – April 15th).

d. **Educate** users about the potential impacts different recreation types can have on moose stress levels and how to prevent disturbances.

N. Montane Nesting Habitat

Ecological Values:

Nesting habitat for Bicknell's Thrush and other high elevation songbirds that specialize in using this type of habitat.

"More than half of the 10 bird species (Yellow-bellied Flycatcher, Winter Wren, Bicknell's Thrush, Swainson's Thrush, Hermit Thrush, Blackpoll Warbler, and White-throated Sparrow) monitored by Mountain Birdwatch have experienced average declines of greater than -39% since 2010." "All bird species and population segments that nest within the high elevation spruce-fir zone are highly susceptible to the effects of global climate change." (Hill, 2022)

Therefore, continued focus on limiting human disturbance to these birds in their natural habitat is an important factor in the protection of these species.

Recreational Values:

Montane habitats are a primary destination for mountain recreation- specifically hiking, but also snowshoeing and skiing in the winter. Trail access in montane habitats provide access to summits, ridges, and vistas and generally occurs in Vermont at elevations over 2000 feet. Developed recreation in montane habitats occurs at higher elevations in the Green Mountain and Worcester Ranges, on isolated peaks in northeastern Vermont, and other select sites. Many developed ski resorts have trails within montane habitats, as well.

Avoid When Practical:

a. **New trails/disturbance** through montane habitat.

b. **Tree and vegetation trimming and removal** in high elevation forests except along existing trails (above 2,500 feet).

Strategies to Minimize Effect:

a. Adhere to Bicknell's Thrush Habitat Protection Guidelines

b. **Co-locate new uses** on existing ski trails or other existing trails.

c. **Restrict dogs** or require they be leashed (May 1 through July 15).

d. **Educate trail users** about the importance of this habitat for nesting songbirds.

e. **Ensure educational signage is clear at high elevation campsites** to educate users that fires are not allowed and to reduce foraging for campfire wood.

O. Raptor Nesting Sites - (Non-cliff areas)

Ecological Values:

Bald Eagles

In 2000, no bald eagles nested in Vermont. Bald Eagle numbers have increased substantially during the past two decades, and Vermont is now host to at least 45 territorial pairs. In the U.S., eagles are federally protected by the Bald and Golden Eagle Protection Act, though they were removed from the federal Endangered Species Act listing in 2007 and removed from Vermont's Endangered Listing in 2022.

During the breeding season, bald eagles are sensitive to a variety of human activities. However, not all bald eagle pairs react to human activities in the same way. Some pairs nest successfully just dozens of yards from human activity, while others abandon nest sites in response to activities much farther away. This variability may be related to several factors, including visibility, duration, noise levels, extent of the area affected by the activity, prior experiences with humans, and tolerance of the individual nesting pair. Bald eagle breeding, incubation, rearing, and fledging season is January to August (USFWS 2007.

Ospreys

Ospreys breed near large bodies of water with an abundant supply of fish. In Vermont they nest near lakes and rivers, occasionally in loose colonies. The nest is a large, bulky pile of sticks, put together on the top of a tall dead tree, a rocky ledge, telephone pole cross arms, or an artificial platform. The Osprey was one of the first species removed from the state's endangered species list. State and federal wildlife agencies, non-governmental organizations, electric utilities, and private landowners facilitated the recovery of osprey and collaborated to address the problems that had decimated the birds' populations: habitat loss, pollutants such as lead and mercury, and pesticides that weaken eggs. Osprey nesting, incubation, rearing and fledging season is April to June.

Other Raptors

Other raptors, such as Goshawks and other *Accipiters*, as well as owls, nest in trees across the forested landscape. They may nest in the same tree, in the same area or in different areas year after year. Goshawks, in particular, can be aggressive to people who come near their nests.

Recreational Values:

Raptors use a wide variety of habitats, many of which are valuable for recreation including cliffs, water edges and interior forest.

Avoid When Practical:

a. **Siting new trails** within 660 feet of known, routinely used eagle and peregrine nest sites (Richardson and Miller 1997).

Strategies to Minimize Effect:

1. Avoid **activities within a quarter mile of nest sites** and especially activities above nests during the breeding season (March/April- August). Post warning signs so recreationists are aware of the closures.

2. **Design temporary relocations of trails** around goshawk nests in order to reduce conflict and protect recreationists. Check for nesting at known locations in the spring.

3. Where trails are close to known raptor nest sites, consider **restricting trail use during the breeding season**, April 1 through August 1

III. Site-Specific Guidance

Once it is decided where a trail will be located on the ground, trails and associated recreational infrastructure can be installed and maintained in a manner that minimizes ecological impacts. FPR and ANR strive to use well-established and science-based BMPs for various trail types by consulting federal agency resources, creating Vermont-specific resources where needed, and utilizing user specific organization resources, many of which are documents co-created by non-profits and agencies.

BMPs reduce impacts on resources at the landscape and natural community/habitat scale and should be used whenever recreation infrastructure is designed and built on state lands. Sustainable design should be taken into consideration and balanced when assessing strategies for avoidance and minimization of impacts. In most situations, BMPs for sustainable trails and recreation infrastructure will align well with the Landscape and Habitat scale guidance, but in some situations, design at the site scale may reveal strategies that will reduce overall ecological impact that do not precisely match the BMPs. For example, in areas with ledges, it may at times reduce erosion and water quality impacts, which also reduce impact to wildlife, to cross the ledge at a not quite perpendicular angle even if perpendicular may generally cause the least impact to wildlife. As such, ANR staff will apply BMPs as appropriate based on site specific factors, to provide the greatest level of protection for natural resources.

Below as a non-exhaustive list of BMPs that staff may choose to implement on state-owned and managed lands.

General Guidelines

- USFS Trail Construction and Maintenance Notebook
- USFS Trail Fundamentals and Trail Management Objectives
- Vermont Town Forest Trail Design Guide
- Guidance for Non-Native Invasive Plant Species Monitoring and Control in Connection with Section 248 Projects
- Interagency Visitor Use Management Framework

By Use Type

Accessible Recreation

- USFS Accessibility Guidebook
- Access Board Guidance for Boating Facilities
- Access Board Guidance for Fishing Piers
- Adaptive Mountain Bike Standards

Mountain Biking

- IMBA Guidelines for a High Quality Trail Experience

Rail Trails and Multi-Use Paths

- VTrans Pedestrian and Bicycle Facility Design Manual

Equestrian

- USFS Equestrian Design Guidebook for Trails Trailheads and Campgrounds

Backcountry Ski

- Vermont Backcountry Ski Handbook

Snowmobile

- VAST Best Practices for the Development of Snowmobile Trails

River Access

- NPS River Access Planning Guide

Rock Climbing

- Access Fund Climbing Management Guide

Trails Near Wetlands

- USFS Wetland Trail Design and Construction
- VT DEC Wetlands Program Recreation Trail Building and Wetlands

Trails Near Rivers

- VT DEC Rivers Program Recreation Trail Building and Riparian Areas – *coming soon*

Campsites, Viewpoints and other Recreation Sites

- USFS Sustainable Recreation Site Design Guide
- USGS Sustainable Camping Best Management Practices
- ATC-USFS-NPS-GMC Backcountry Sanitation Manual

APPENDICES

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Appendix A. Implementation Guidance

Scenarios Where These Guidelines Can Be Applied:

1. Conceptual inquiry from a recreation partner

An early conceptional project inquiry from a recreation partner is an ideal time to explore *avoidance* of likely ecological conflicts. The FPR Recreation Specialist (or other relevant position) can help the recreation partner understand the constraints and opportunities of a particular location based on a field visit and/or desktop review using geospatial data.

2. Recreation pre-proposal development

Once a proposed recreation project is developed into a written pre-proposal, the Recreation Specialist, on behalf of the District Stewardship Team, can communicate recommendations for avoidance and/or strategies to minimize impacts to ecological resources in writing, in response to review of the pre-proposal.

3. Recreation full proposal review

Once a proposed recreation project advances to a full proposal, *avoidance* measures will generally have been incorporated through earlier project review phases, and the DST can begin to shift their review focus towards *minimization* of impact. This may be best achieved through field visit.

4. New recreational proposal developed by a recreation specialist or other state lands staff

When a new recreation project idea is developed *internally* (versus being proposed by an external partner), these guidelines should be applied as the concept is being developed. The DST shall evaluate the project using this guidance as part of the Annual Stewardship Plan development process. The assumption and expectation is that ideas originating internally shall be held to the same standards as projects originating external to the Agency. Any recreation projects conceived of by ANR staff other than Recreation Specialist should be developed in concert with the Recreation Specialist to ensure that ANR's standard recreation project development process is followed.

5. Long-range management planning process

These guidelines may be used in the long-range management planning process to inform areas of high recreational value (in the Recreation Assessment), areas of high ecological value (in the Ecological Assessment), and to identify areas where avoidance is desirable and areas where recreation is encouraged (in the Management Strategies and Actions section). Decisions about how these guidelines will be applied in the LRMP should be captured in the assignment of the Recreation Opportunity Spectrum and associated Recreation Management Strategies and Actions.

6. Relocations or projects on existing recreational infrastructure

These guidelines may help the Recreation Specialist evaluate whether relocation of an existing recreational asset presents a desirable opportunity to avoid or minimize impacts that were not contemplated or addressed when the project was originally developed.

Existing Geospatial Data to Support Recreation Project Review

Biofinder > Landscape Components > Interior Forest Blocks

Biofinder > Landscape Components > Connectivity Blocks

Biofinder > Community & Species Components > Terrestrial Wildlife Road Crossings

Biofinder > Community & Species Components > Riparian Wildlife Road Crossings

Biofinder > Landscape Components > Riparian Wildlife Connectivity

Biofinder > Landscape Components > Surface Waters & Riparian Areas

Biofinder > Community and Species Components > Natural Communities

State land invasive plant mapping (anticipated data source; not yet finalized)

ANR Atlas > ANR Basemap Data > Waterbody/Stream/River Area

ANR Atlas > Atlas Layers > Rivers > River Corridors

ANR Atlas > Atlas Layers > Geology > Soils – Floodable Soils

RTE Element Occurrences (access limited to ANR staff)

ANR Atlas > Soils

ANR Atlas > Hydric Soils

ANR Atlas > State Significant Natural Communities

ANR Atlas > Recreation Sites

ANR Atlas > E911 Trails

ANR Atlas > ANR Travel Routes

ANR Atlas > Atlas Layers > Watershed Management > Wetland – VSWI

ANR Atlas > Atlas Layers > Fish and Wildlife > Deer Wintering Areas - This layer is predictive only and will need to be assessed by a wildlife biologist

State land invasive plant mapping (future source)

LRMP, LUC 2.2 – Critical Plant and Wildlife Habitat

Grasslands – Eagle Point WMA, Windsor Grasslands WMA, Dead Creek WMA, Lemon Fair WMA.

ANR Atlas > Bedrock outcrops

ANR Atlas > LiDAR data

ANR Atlas > Slope layer

ANR Atlas> Bedrock outcrops

ANR Atlas> Rare Threatened and Endangered Species

ANR Atlas> Vernal pool layer

VFWD/VCE vernal pool atlas

Uncommon EO layer (peregrine falcon nesting sites and eagles; access limited to ANR staff)

USFWS – Do I Need an Eagle Take Permit?

USFWS - National Bald Eagle Management Guidelines

Vermont Peregrine Recovery Plan

Appendix B. Agency and Department Mission Statements

Agency of Natural Resources mission statement:

The Vermont Agency of Natural Resources is charged with oversight and management of Vermont's natural environment on behalf of the people of Vermont. We endeavor to draw from and build upon Vermonters' shared ethic of responsibility for our natural environment, an ethic that encompasses a sense of place, community and quality of life, and an understanding that we are an integral part of the environment, and that we must all be responsible stewards for this and future generations.

Department of Forests, Parks and Recreation mission statement:

The Vermont Department of Forests, Parks, and Recreation's (FPR's) mission 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, including providing and promoting opportunities for compatible outdoor recreation
- Providing related information, education and service

Department of Fish and Wildlife mission:

The conservation of fish, wildlife and plants and their habitats for the people of Vermont.

Department of Environmental Conservation mission:

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

Appendix C. Process to Create the Guidelines

In October 2022, the Agency Lands Stewardship Team supported the formation of an interdisciplinary work group of ANR land managers to develop guidelines for recreational trail siting and development on ANR lands. Specifically, the work group was responsible for developing "written guidelines for recreational trail development on ANR lands, providing BMPs for recreational trail development and siting at the species, natural community, landscape and temporal scales."

The work group was comprised of an eight member interdisciplinary team of ANR land managers representing the FW and FPR, with broad experience in state lands management: John Austin (Fish and Wildlife Lands and Habitat Program Manager), Noel Dodge (Wildlife Biologist), Jim Duncan (Forestry State Lands Manager), Tim Morton (Stewardship Forester), Luke O'Brien (Forest Recreation Specialist), Danielle Owczarski (State Lands Ecologist), Hannah Phillips (State Lands Administration Program Manager), and Claire Polfus (Recreation Program Manager). [5]

The work group convened eight times in winter and spring of 2023 to draft these guidelines, circulated the guidelines for District Stewardship Team (DST) feedback in May 2023, brought the guidelines to the ANR Lands Team for review and feedback in June 2023.

Following the meetings with ANR staff, a core project team of Hannah Phillips, Claire Polfus and Becca Washburn incorporated feedback, added clarification to the introduction and added call outs for where DEC staff would be contacted for review. Fish and Wildlife staff, including Danielle Owczarski, Noel Dodge and Josh Blouin added citations.

Recreation staff then presented the draft to a nominated subset of the Vermont Trails and Greenways Council for partner feedback on the presentation and clarity of the information. Feedback from partners was largely positive and included recommendations for how to successfully implement the guidance.

The final draft was reviewed and approved by the ANR Lands Team and by ANR leadership in 2024.

[5] Because BMPs for recreational trail siting and development related to water quality protection are already well-developed, we decided in consultation with staff from the Department of Environmental Conservation (DEC) that the watershed planners, who sit on the District Stewardship Teams (DSTs), would provide a review of the document once drafted, but their participation on the working group was not necessary. We will seek a similar review from the Fisheries Division (FW), the Wetlands Program (DEC), and the Rivers Program (DEC).