dcr
Massachusetts

Resource Management Plan
Leominster State Forest

Adopted by the DCR Stewardship Council Month, 2025

Massachusetts Department of Conservation and Recreation
Division of Conservation and Resource Stewardship
Office of Cultural Resources

Maura T. Healey, Governor
Kimberley Driscoll, Lieutenant Governor
Rebecca L. Tepper, Secretary
Brian Arrigo, Commissioner

Purpose

Resource Management Plans (RMPs) are foundational documents that identify a park, forest, or reservation's defining natural, cultural, and recreational resources and identify potential threats and opportunities to guide DCR's continued stewardship of the property and to inform future decisions about the property in a way that celebrates and preserves its identity.

RMPs are prepared for "all reservations, parks, and forests under the management of the department" (M.G.L. c. 21, § 2F). These plans "shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources and shall ensure consistency between recreation, resource protection, and sustainable forest management." DCR finalizes RMPs following a public process and adoption by the DCR Stewardship Council. The contents of this RMP represent the best available information at the time of adoption by the Stewardship Council.

Mission and Core Principles

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, dams, parkways, and over 100 National Register listed properties. The agency's mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources for the well-being of all.

DCR strives to be an exemplary leader in conservation and recreation. DCR's staff is passionate, dedicated, and continuously employs best practices, expertise, and a sense of place in carrying out the mission. The following core principles ground the agency in its work. For the benefit and well-being of all—people and the environment—DCR pledges to:

- Provide access to a diversity of outdoor recreational experiences and unique landscapes that is equitable, inclusive, and welcoming.
- Conserve lands, water, and forests by integrating science, research, and technical expertise into the management of our natural resources.
- Advance climate change mitigation and adaptation efforts by implementing sustainable practices and advancing resiliency across our infrastructure, assets, and resources.
- Support healthy communities by providing places for people to connect with nature and each other.
- Inspire generations of stewards by recognizing and honoring our legacy through partnerships, public engagement, and education.

Stewardship

DCR honors Indigenous people for their care, throughout many generations, of the land that DCR now stewards on behalf of the people of the Commonwealth. DCR embraces this legacy of stewardship, fostering a sense of shared responsibility by all people for protection of the waters, lands and living things for the enjoyment and appreciation of all.

To learn more about the DCR, its facilities, and programs please visit us at www.mass.gov/dcr. Contact us at mass.parks@mass.gov.

Leominster State Forest

https://www.mass.gov/locations/leominster-state-forest

1. Property Overview

Characteristic	Value
Date Established	1922
Location	Fitchburg, Leominster, Princeton, Sterling, Westminster
Ecoregion	Southern New England Coastal Plains and Hills, Worcester Plateau
Watershed	Nashua
DCR Region	Central
DCR District	Central Highlands
DCR Complex	Wachusett
Management Forestry District	Mid-State
Fire Control District	North Worcester
Size (acres)	4,566.3
Boundary Length (miles)	39.0
Elevation - Minimum (feet)	618.8
Elevation - Maximum (feet)	1,233.3
Environmental Justice (acres)	131.1
Estimated Annual Attendance (2023)	25,000
Interpretive Programs (# programs, 2023)	0
Interpretive Programs (# attendees, 2023)	0

2. Landscape Designations

Designation	Acres
Parkland	188.8
Reserve	0.0
Woodland	4,053.1
No Designation	324.6

3. Regulatory Designations

Designation	Acres
Outstanding Resource Waters - Goodfellow Pond - Haynes Reservoir - Notown Reservoir - Rocky Pond - Simonds Pond - Wachusett Lake - Wachusett Reservoir	3,169.7
Priority Habitat (MESA)	132.6
Surface Water Supply Protection Zone A	986.4
Watershed Protection Act	288.1

4. Long-Term Agreements

Agreement	Expiration Year
Waste Management	Unknown

5. Concessions

Concession Type
None

6. Partners & Friends

Group(s)
New England Mountain Bike Association (NEMBA)
Midstate Trail Association
Appalachian Mountain Club

7. Features of Interest

Feature
Crow Hills Ledges
Upper and Lower Crow Hill Ponds
Mid-State Trail
Notown
Paradise Pond
Rocky Pond
Wolfden Hill

8. Natural Resources

Resource	Value
Tree Canopy (acres)	4,418.1
Rivers and Streams (miles)	11.7
Open Water (acres)	93.2
Wetlands (acres)	309.5
Certified Vernal Pools (#)	0
Potential Vernal Pools (#)	8
State-Listed Species (# Regulatory)	2
State-Listed Species (# Non-Regulatory)	1
Federally Listed Species (#)	0
Aquatic Invasive Plants (# known species)	2
Terrestrial Invasive Plants (# known species)	5

9. Forest Management (Since 2012)

Management Objective	Acres
N/A	0.0

10. History of Wildfires and Conditions Influencing Future Wildfires

Wildfire Attribute	Value or Characteristic
Number of wildfires on property; 2019–2023	2
Acres burned by wildfires on property; 2019–2023	0.5
Number of wildfires in Fire Control District; 2019–2023	294
Acres burned by wildfires in Fire Control District; 2019–2023	1169.6
Type of Wildland-Urban Interface	Intermix
Predicted rate of spread, based on Fire Behavior Fuel Model 13	Rapidly Spreading

11. Natural Hazards

Hazard Type	Acres
Flood (1.0%-chance)	195.6
Flood (0.2%-chance)	226.5
Hurricane Inundation (Cat. 1)	N/A
Hurricane Inundation (Cat. 4)	N/A

12. Climate Change (By 2070)

Type of Change	Amount of Change
Increase in annual days over 90° F	>30
Change in annual maximum daily rainfall (inches)	>10
Massachusetts Coastal Flood Risk Model area of inundation (acres)	N/A

13. Cultural Resources

Resource Type	#
Archaeological	1
Historic - Total MACRIS Listed	7
Historic - National Register Listed	0
Historic - National Historic Landmark	0

14. Recreation Resources

Resource	#
Dock	1
Car-top boat launch	1
Trails System	1
Picnic Areas	2
Waterfront Area	1

15. Recreation Activities

Activity
Bicycling, mountain
Boating, motor
Boating, sail
Canoeing/kayaking
Cross-country skiing
Dog walking, on-leash
Educational programs
Fishing, fin fish
Geotourism
Hiking/walking
Horseback riding
Hunting
Nature study/photography
Orienteering
Picnicking
Rock climbing/bouldering
Running/jogging
Running/jogging, races (road or trail)
Scenic Vista viewing
Skiing, cross country
Snowmobiling
Snowshoeing
Swimming/Sunbathing
Wildlife Viewing

16. Roads and Trails

Metric	Value
Roads - Unpaved (miles)	0.2
Roads - Paved (miles)	0.3
Forest Roads - Unpaved (miles)	11.6
Forest Roads - Paved (miles)	0.0
Trails - Unpaved (miles)	28.3
Trails - Paved (miles)	0.1
Trails - Unauthorized (miles)	4.0
Trail Density (miles/acre)	0.010
Area of Impact (acres)	2,155.4

17. Parking

Parking Resources	#
Lots	5
Parking Spaces - Total	125
Parking Spaces - Accessible (HP)	8
Parking Spaces - Other	117

INTRODUCTION

Leominster State Forest (Leominster or the Forest) is located in northern Worcester County, spanning the towns of Leominster, Fitchburg, Sterling, Westminster, and Princeton. The Forest, which is located approximately 15-miles north of Worcester, is in close proximity to Route 2 and Interstate 190. Johnny Appleseed State Park, located 5 miles east of the Forest, is a satellite property of the Forest. The Forest is made up of four noncontiguous tracts. They are:

- **Fitchburg Road Tract.** Fitchburg Road/Route 31 divides this tract, providing access to numerous parking areas and entry points. This tract is mainly surrounded by residential development, rural residential property, and undeveloped land, including DCR Division of Water Supply Protection (DWSP) land. The Leominster Sportsman's Association, Waste Management Fitchburg City Landfill, Great Wolf Lodge Water Park, and NE Renewable Power also dot the perimeter of the tract.
- **Beamon Road Tract.** This tract, located south of the Fitchburg Road Tract, is surrounded by residential property and DWSP land.
- **Main Street Tract.** This tract, located south of the Fitchburg Road Tract, is surrounded by rural residential property, conservation easements, and DWSP land.**Oak Hill Road Tract**. This tract is located north of Route 2 and is primarily bordered by residential property and undeveloped Town of Fitchburg land.The Midstate Trail passes north-south through the Forest. This 92-mile-long regional hiking trail runs from Rhode Island to New Hampshire and links to regional trails in adjacent states. Along its course it passes across Mount Wachusett and 10 other DCR-owned or managed properties, the closest of which to the Forest are Westminster State Forest and Wachusett Mountain State Reservation. The Midstate Trail Committee of the Appalachian Mountain Club's (AMC) Worcester Chapter maintains the treadway and provides trail information (Midstate Trail Committee n.d.).

The Forest is on land shaped by generations of Indigenous peoples and non-Indigenous inhabitants. Past and present Indigenous residents embody fluid, relational connections to the places and spaces now known as Leominster State Forest. Groups and individuals, including peoples known as the Nipmuc and Agawam are recorded in available documentation (Native Land Digital 2023) as having relationships to this place over seasons and generations. The area now considered the towns of Princeton, Leominster, and Westminster started experiencing European settlement in in the early 1700s (Massachusetts Historical Commission (MHC) 1984a, 1984b, 1984c). Some of the first European settlement included an area known as Notown. Land grants to property in Notown were given by the General Court for various reasons, including a series of grants issued to soldiers or to heirs of soldiers killed in the French and Indian Wars and King Phillip's War (Siergiej 1983). Historical remnants of Notown, which includes cellar holes, stonewalls, and fruit trees, remain visible from some roads and trails in the Forest. Leominster State Forest was established in 1922 with an initial acquisition of 141 acres (Department of Conservation (DOC) 1923). By 1932, the Forest had grown to 1,890 acres and seen numerous state crews undertake forest cutting and reforestation projects, usually planting red and white pine (DOC 1933). The Civilian Conservation Corps (CCC) established Camp SP-13 (Company 197) at Leominster State Forest in 1933 and completed numerous forestry projects including cutting and thinning the forest and planting trees. CCC workers also assisted with fire suppression efforts, constructing eight water holes in 1935. That the same year, numerous CCC projects were completed for the benefit of public recreation, including construction of a parking area, roads, and 2.2 miles of trails. The CCC aided wildlife management by creating a 20-acre wildlife refuge with essential food plantings for wildlife. By the time the CCC camp

shut down on December 15, 1937, Leominster State Forest had grown to 3,293 acres. Following camp closure, CCC workers were brought over from West Townsend to complete unfinished projects and develop the Crow Hill Pond picnic area (DOC 1939). Many of the CCC's projects are still visible or in use today. The adjacent DWSP lands are managed under a variety of watershed-specific plans (i.e., DCR 2018, 2018, 2023a, 2023b) and regulations.

Leominster State Forest's landscape is characterized by an abundance of natural, cultural, and recreational resources, conserved and managed to protect water quality, maintain and enhance native biodiversity, and preserve examples of our cultural heritage. The Forest consists mainly of upland forest and forested wetlands with some open water areas, including several ponds, allowing visitors to explore and experience different landscapes. Crocker Pond and Crow Hill Pond, also known as Upper Crow Hill Pond and Lower Crow Hill Pond, provide opportunities for water-based recreational activities such as swimming, fishing, and boating. Hikers on the Mid-State Trail can take in views of the Forest from Crow Hill. With several miles of biking and hiking trails and ample space to relax at one of the large picnic areas, visitors to Leominster may engage in many different recreational activities.

PARK IDENTITY

Leominster State Forest is strongly identified with historic cultural uses, abundant and diverse recreational opportunities, and natural resource protection. The Forest contributes to Surface Water Protection, conserving lands with drainage to drinking water resources. All future management activities and improvements should maintain sustainable public recreation and education opportunities consistent with the property's Parkland and Woodland Landscape Designations, while protecting the highly important natural and cultural resources in the Forest.

DEFINING RESOURCES AND VALUES

Resources that define the Forest are related to its natural, cultural, and recreational resources. They include:

- Numerous ponds within and bordering Leominster enhance the Forest's aesthetics, increase its ecological diversity, and provide opportunities for water-based recreation. The western portion of the Forest contains Crocker Pond, Upper and Lower Crow Hill Ponds, and Paradise Pond, with Sawmill Pond bordering the Forest. The eastern portion of the Forest contains Rocky Pond, with Notown Reservoir bordering the Forest to the northeast.
- Historic homesteads from the Notown settlement, partially located within the Forest, provide today's visitors with a visible connection to the past. Notown Road, which once led to the Notown settlement, is now a forest road for visitors to enjoy.
- The Civilian Conservation Corps made significant contributions to recreational infrastructure, including the beach at Lower Crow Hill Pond, a Waterfront Area still in use by visitors today, and Upper Crow Hills Pond Dam. Some trails and roads infrastructure were also installed by the CCC, including the trail steps on the west side of Route 31.
- An extensive trail system allows visitors to spread out in the Forest and explore varied landscapes. Trails near South Crow Hill and North Crow Hill reward hikers with eastward views of the Forest. An approximately 3-mile segment of the 92-mile Midstate Trail passes through the Forest, connecting

visitors to other DCR properties and conservation lands in the area, including nearby Wachusett Mountain State Reservation.

- The Ledges on Crow Hill provide an opportunity for rock climbing, an activity not found at most DCR properties. Rock climbers can challenge themselves to different routes and take in the views once reaching the top of Crow Hill.
- Portions of the Forest abutting Route 2, in the City of Fitchburg, are within an Environmental Justice (EJ) community. The Forest provides recreational amenities to, and enhances environmental quality and equity for, this (EJ) community.
- Over 900 acres of the Forest contribute to Surface Water Protection, including some drainages for the Wachusett Reservoir and Notown Reservoir. The Forest also directly borders Water Supply Protection land.

STATEMENTS OF SIGNIFICANCE

Statements of Significance describe the importance or distinctiveness of a place and its resources (National Park Service 1998). These statements reflect current scholarly inquiry and interpretation and go beyond a simple listing of resources to include contextual information that makes the facts more meaningful. Significance statements cover the following categories of information:

- The property's significance at the time of its establishment.
- How the property, or society's understanding of the property, has changed since its acquisition that makes it significant or unique within the state park system today.
- The property's role in recreation and its importance to the community it supports, particularly regarding activities that are unique to that property.

For park planning, these statements focus management actions on the preservation and enjoyment of those attributes that most directly contribute to the importance of the place. For interpretive planning, they comprise the information upon which the interpretive themes and overall program are built.

The following Statements of Significance have been identified for Leominster State Forest. The sequence of these statements does not reflect their level of significance.

- Leominster State Forest contains the remains of the settlement of Notown. What remains is little more than cellar holes, but the diversity of the sites is a time capsule of common 18th- and 19th-century buildings. Beyond the foundations, stone walls and fruit trees can still be seen today. These resources illustrate a broader picture of landscape use in the 19th century throughout the state.
- Although not a motivation in establishing the state forests, foresters at the time recognized the importance of trees to a watershed. Leominster State Forest feeds into three public water supplies. About three-quarters of the property is part of a public supply watershed and is designated as Outstanding Resource Waters. The ponds and vernal pools in the site provide valuable aquatic habitat.
- Although foresters recognized that forest management could enhance recreational areas, when they created the state forests, recreation was a secondary motivation. State forests were viewed as opportunities to provide a "wilder" recreational experience in contrast to "planned," more

landscaped parks. Despite this, Leominster State Forest has grown into a site that sees significant recreational use due to its location between Leominster and Fitchburg.

- The Massachusetts State Forest system was founded on the principles of scientific forest management. These practices contrasted with ongoing un-managed destructive practices throughout the country. This effort focused on the long-term cultivation of forests to achieve a sustainable harvest. Leominster State Forest saw extensive forestry work. Foresters worked to maximize production and provide a sustained yield over time, aiming for long-term stewardship over short-term profits.

UNIFYING THEME

The Unifying Theme is a statement that ties a property's stories together and shapes the overall interpretive message that DCR wants to share with visitors in their experience at the property. The theme provides an overarching conclusion for visitors to contemplate (Ham 2013) and answers the question "so what?" The theme guides all interpretation for the park, both personal (i.e., formal and informal interactions with visitors) and non-personal (e.g., exhibits, signage, brochures).

The Unifying Theme for Leominster State Forest is:

> Forest management can achieve stewardship goals, from habitat protection and creation to recreational opportunities.

VISITOR EXPERIENCE

Leominster State Forest provides a variety of visitor experiences, including the following:

- **Virtual Experience.** Potential visitors will find detailed information about Leominster State Forest on DCR's web site. The Forest has its own web page that provides potential visitors information needed to plan a visit but lacks specific information about where visitors can park. (https://www.mass.gov/locations/leominster-state-forest)
- **Entering the Forest.** Most visitors arrive by vehicle, and park at one of the five formal parking lots along Fitchburg Road (Route 31). These lots, from north to south, are the Beach Lot, Princeton Lot, Ledges Lot, Rocky Pond Lot, and Paradise Pond Lot. (See Figure 1. Land stewardship Zoning Map, page 27, for the locations of these lots.) The first two lots (i.e., Beach and Princeton) provide parking for activities at Lower and Upper Crow Hills Ponds, are paved, and provide visitors with informational signage and directional trail signs to help them navigate the Forest. The entrance to the Beach Lot is Leominster's *de facto* main entrance. Where the lot entrance road meets Route 31, visitors are greeted with a large, chain-link fence. The Forest's Main Identification sign is set behind this fence, barely visible to passing motorists. Visitors seeking to rock climb or hike the Midstate Trail park at the Ledges Lot, on the west side of Route 31. Other visitors may access the Forest from informal roadside parking areas along Route 31 in Westminster and Princeton, Notown Road in Westminster, Hastings Road in Sterling, or via foot from adjoining conservation lands.
- **Day-Use Area.** During the summer, visitors pass through the main entrance on Route 31 and into the day-use area where they are soon greeted by a contact station, where staff collects an $8 daily parking fee, and ample parking at the Beach Lot. A waterfront area and adjacent picnic area allow families to spend the day swimming in Lower Crow Hill Pond, sunbathing along its shores, and

picnicking in the nearby woods, all in close proximity to a comfort station. Trailheads, for the Ball Hill and Wolfe Rock trails, allow visitors to set out on foot or bicycle to explore the rest of the Forest.

- **Picnicking.** Picknickers may enjoy two large picnic areas, one near the waterfront area on the north shore of Lower Crow Hill Pond (see Day-Use Area, above for additional information) and one near the Princeton Lot, on the northwest shore of Upper Crow Hill Pond. Both provide visitors ample access to picnic tables, grills for cooking, and scenic pond views. The Princeton Lot also provides visitors parking for the Crow Hill Trail.
- **Water-based Recreation.** Leominster's ponds offer visitors opportunities for a variety of water-based recreation activities. Swimming and sunbathing are seasonally available at the waterfront area on Lower Crow Hill Pond. (See Day-Use Area, above, for more information.) Visitors may enjoy non-motorized or electric powered watercraft in many of Leominster's ponds. One car-top boat launch along Rt. 31 provides boaters access to Paradise Pond. Anglers have fishing opportunities at all ponds, including Crow Hill Pond, which is annually stocked with 400-500 trout by the Massachusetts Division of Fisheries and Wildlife.
- **Trail-based Passive Recreation.** Visitors seeking other recreational opportunities may access an extensive trails network. Hikers, runners, bicyclists, and other recreationists can roam nearly 40 miles of official forest roads and trails along ponds and through woodlands, providing visitors the opportunity for a light hike or ride, or an entire day of park exploration. When there is snow cover, the Forest's trails are also enjoyed by cross-country skiers and snowshoers. The Midstate Trail, a 92-mile-long long-distance trail, passes through the Forest and connects to the local trail system. (See Introduction for additional information on the Midstate Trail.)
- **Hunting.** Leominster provides public lands for hunting during all legal hunting seasons, with highest levels of use during the fall deer hunt.
- **Winter Recreation.** During winter, as weather conditions allow, visitors may partake in ice fishing, snow shoeing, cross country skiing, and snowmobiling, though the Forest lacks dedicated trailer parking for the latter. Although the Beach Lot is closed during winter, the Princeton Lot, Ledges Lot, Rocky Pond Lot, and Paradise Pond Lot are open for winter recreation parking.
- **Rock Climbing.** Technical rock climbers flock to the Ledges near South Crow Hill, a gneiss crag with numerous climbing routes ranging in height and difficulty, challenging their abilities, often in the company of friends. Climbers typically park in the Ledges Lot and walk 0.2 miles to the base of Crow Hill Ledge. Several of the ledge's rock-climbing routes (i.e., Intertwine, Tarzan, and Diagonal) are considered "among the best in the Commonwealth" (Mountain Project n.d.). The view from atop the ledge is considered among the best in the Forest and is enjoyed by climbers and hikers.

THREATS AND OPPORTUNITIES

The following information identifies potential threats to the park's natural and cultural resources and identifies opportunities to enhance their protection and stewardship. Although recreation is not considered a resource under statute (M.G.L. c. 21, § 2F), it is included below because recreation is an important part of the park-going experience, helps define a park's values, and is a key part of assessing the consistency of activities taking place in the Commonwealth's forests, parks, and reservations.

Threats and opportunities identified below are used to inform the development of management recommendations. Potential recommendations must meet prioritization criteria to be included in the Priority Recommendations table (Table 19, page 31).

Natural Resources

Threats

- Existing trails may slope towards ponds, wetlands, and streams, including those near Paradise Pond, contributing to erosion, which may potentially lead to sedimentation.
- The Massachusetts Department of Environmental Protection (MassDEP) has identified water quality impairments in Paradise Pond (MA81097) and Lower Crow Hill Pond (MA81026) within Leominster State Forest (MassDEP 2023), resulting in these water bodies being classified as not suitable habitat for sustaining a native, naturally diverse community of aquatic flora and fauna (MassDEP 2021). Because MassDEP updates its Integrated List of Waters on a regular basis, readers are directed to refer to the most recent version of that document for current information.
- Paradise Pond is currently used for water based recreational activities, including boating and fishing, but is located within Zone A Surface Water Supply Protection Area, potentially threatening the drinking water quality of water resources downstream.
- Forest visitors have created multiple unauthorized trails. Construction of trails without authorization or applicable regulatory review may threaten MESA-protected species' habitat, natural communities, and ecosystem functions.
- There are at least forty unapproved geocaches in the Forest. Inappropriately located geocaches may threaten sensitive natural resources.
- Trail users at Leominster State Forest often hike off trail to locate geocaches, trampling vegetation as they move through the forest and creating new unauthorized trails.
- Leominster has seen increased trail use, which may exacerbate negative impacts to natural resources, such as trail widening leading to decreased vegetation. The Forest also has past instances of unauthorized trail building, leading to decreased vegetation.
- Roadside parking is negatively impacting vegetation, exposing soil vulnerable to erosion, including areas along pond shores.
- Mountain laurel dominates the understory throughout portions of the Forest. Although mountain laurel is native, its dominance may prevent other native species from growing in the understory, leading to lack of diversity.
- The Ledges provide a unique habitat for species in Massachusetts but may be threatened by heavy recreational use, including rock climbing.
- The following seven species of invasive plants have been identified in the Forest: tree of heaven, garlic mustard, Asiatic bittersweet, burning bush, glossy buckthorn, Eurasian water-milfoil, and purple loosestrife. These invasives have been identified in the Forest by field staff. The Forest was not field surveyed for the 2017 Invasive Plant Management Plan: Central Region (BSC Group 2017). Invasive species may negatively impact both the ecological integrity and biodiversity of the Forest.

Opportunities

- Some of the Forest's nine potential vernal pools may "support rich communities of vertebrates and invertebrates" (Massachusetts Division of Fisheries and Wildlife (MassWildlife) 2009) and serve as important habitat components for other wildlife, including one of the Forest's state-listed species. Surveying and certifying these pools (DCR (n.d.a) and MassWildlife (2009)), as appropriate, may help better protect these animals.
- Ensuring that activities and conditions within the Zone I Wellhead Protection Areas are consistent with MassDEP Wellhead Protection Tips and Guidance (MassDEP 1995, MassDEP 2011) would better protect the Forest's drinking water.
- Evaluating current authorized and unauthorized trails to determine which trails should be rerouted or eliminated, in accordance with Closing and Restoring Trails and Trail Maintenance BMPs (DCR n.d.b, n.d.c), would better protect natural resources.
- Assessing the slopes of trails and management of stormwater runoff from trails, in accordance with DCR's Trails Guidelines and Best Practices Manual (DCR 2019) could alleviate some trail erosion and sedimentation in ponds, wetlands, and streams.
- Adding roadside guard rails or no parking signs along Route 31could help deter roadside parking and prevent further soil erosion.
- There is an opportunity to establishing a monitoring program and/or study to address forest resiliency and determine forest threats, including potential impacts of mountain laurel on biodiversity or efforts to mitigate issues related to mountain laurel, and better inform natural resource protection.
- Evaluating culverts and stormwater runoff from parking lots, roadways, and other developed areas to determine opportunities for improvements could minimize impacts on wetlands, streams, and ponds.
- There is an opportunity to enhance the Forest's ecological integrity and biodiversity through targeted removal of invasive plant species.
- Evaluating terrestrial, aquatic, and wetland invasive species would inform needed management of invasive species at Leominster State Forest.
- Adding monofilament and lead weight recycling containers to fishing areas, including Paradise Pond, will better protect aquatic species and systems from potentially harmful debris.
- Surveying Notown Reservoir and Paradise Pond for nesting birds could help better protect rare species at the Forest.
- Surveying the Ledges rock face for state listed species and determining potential recreational impacts to those species, including impacts from rock climbing, could help better protect rare species at the Forest.
- Within the Forest are occurrences of two types of rare species habitat, Regulatory and Non-Regulatory. Regulatory habitat is based on verified records of state-listed species and has associated mapped Priority Habitat. Non-Regulatory habitat is based on the presence of suitable habitat for state-listed species; there is no associated mapped Priority Habitat. On state lands, both are protected under the Massachusetts Endangered Species Act (MESA; 321 CMR 10.00). Requesting

pre-filing consultation with NHESP for "all works, projects, or activities" in the Forest, regardless of location in or out of Priority Habitat, will ensure continued protection of this habitat and compliance with the MESA.

- Approximately 324.6 acres of the Forest has no Landscape Designation (DCR 2012). Designation of these areas could help with management of associated natural resources. Assigning Landscape Designations to these portions of the Forest could help with management of associated natural resources and ensure management consistent with other DCR properties statewide.
- Undeveloped parcels adjacent to the Forest may provide opportunities for expansion.
- The Forest is located within the Quabbin-to-Cardigan Partnership's (Q2C) project area. This initiative is a public-private collaborative effort to conserve the Monadnock Highlands of north-central Massachusetts and western New Hampshire. The Forest's location within the project area offers opportunities to participate in organizational partnerships, grants, and land acquisitions in support of DCR's and Q2C's mutual conservation and recreation goals (Q2C 2023).
- The Main Street and Beamon Road tracts are land locked and both directly abut DWSP property. Intra-agency discussions between DWSP and State Parks could determine if it is appropriate to transfer control of specific tracts both to and from DWSP/DCR to ensure optimal resource protection.

Cultural Resources

Threats

- Approximately 4% of the Forest is within the 1.0%-change flood zone and 5% is within the 0.02%-chance flood zone. These percentages are based on the 1997 Paper FIRMS with outdated data, leading to more uncertainty about areas that might flood during flooding events. (These data are derived from the FEMA's paper Flood Insurance Rate Maps, or FIRMS, dating to 1997. Because of their age, FIRMS may only be used to portray zones of uncertainty and possible risks associated with flooding, not the absolute delineation of flood boundaries (MassGIS 1997).)
- Notown (MHC Inventory No. LEO.I) is an intact archaeological landscape from the lightly settled, briefly occupied, but unincorporated lands abutting Princeton, Fitchburg, Leominster, and Princeton. This archaeological district is potentially eligible for listing in the National Register of Historic Places (National Register). Archaeological site data for this district, and for the post-Contact period generally, could be improved. The sites may be threatened by unauthorized digging or other vandalism due to their visibility; locations close to roads and trails within remote (infrequently patrolled) areas; and possibly by unauthorized mountain bike trails.
- The Crow Hill Pond Area (MHC Nos. PRI.D/WST.C) is a CCC-built recreational landscape that includes the Upper Crow Hills Pond Dam (Dam No MA03273), pond, stone walls, and steps. These resources need repair to reverse inappropriate addition of granite features and to preserve the CCC landscape. Additional steps were added to the stairs, but the material (granite) is not compatible with the CCC landscape. The pond shoreline may be eroding, potentially undermining stone retaining walls.
- The Headquarters Building was built in 1956 and is therefore a potential historic property. The building is in active use and may need upgrades to meet building codes and to make the building more usable. Substantial changes should not be made to the building until it has been evaluated for National Register eligibility (see additional discussion in Opportunities, below).

- Construction and use of the previously mentioned unauthorized trails may disturb areas of the Forest that have potential archaeological resources.
- There are at least forty unapproved geocaches in the Forest. Inappropriately located geocaches may threaten sensitive cultural resources.

Opportunities

- The recreational landscape within the Crow Hill Pond Area (MHC Nos. PRI.D/WST.C) was developed by the CCC. The landscape's historical integrity has been diminished through addition of inappropriate asphalt dam material, modern granite stone steps, and erosion of the pond shoreline below a CCC retaining wall (Berg 1998). Planned improvements at Crow Hill Pond (Activitas 2023), provide an opportunity to both preserve this landscape and perpetuate its recreational use by conducting rehabilitation activities in accordance with the Secretary of the Interior's Standards (Grimmer 2017) and accompanying Guidelines for the Treatment of Cultural Landscapes (Birnbaum n.d.).
- Notown (MHC No. LEO.I), located partially within the Forest, is a potentially significant archaeological resource that is the site of an unincorporated 18th-century village (Siergiej 1983). In 2002, the agency collaborated with the Leominster Historical Society to explore nominating the site for listing in the National Register, although this nomination was never completed. There is an opportunity to increase the understanding, stewardship, and public interpretation of this unique resource through additional archaeological survey, and possibly National Register nomination, of the site in partnership with adjoining private landowners, the City of Leominster, and Native tribes.
- The Notown archaeological site (MHC No. LEO.I) may extend beyond the Forest boundaries into adjacent private and municipal water supply lands. There may be opportunities to enhance stewardship of the archaeological site through acquisition of land or of conservation restrictions on lands not already protected through these instruments.
- Historical and anecdotal information indicates that there are opportunities to expand DCR's understanding of historical architectural resources in the Forest:
    - Historical plans show that the Headquarters Building (and a woodshed, unknown if extant) was built in the 1950s, not in the 1930s CCC era (as indicated in existing survey data).
    - One CCC dam is documented in the existing survey data, but historical data shows that the CCC may have built two dams, and site visit shows at least three dams in the Forest.
    - Forest staff state that CCC-era water holes may exist within the forest.
    - A CCC Camp was located on the east side of Route 31, near the Administration Building, but its archaeological remains are not mapped.
- Stone features have been identified in the Forest; their origins and cultural significance remain undetermined. Assessing, inventorying, and preserving these resources are a high priority for DCR.
- The Forest is recognized for its scenic, natural, and historic qualities through inclusion in the Freedom's Way National Heritage Area, which offers opportunities for agency partnerships, grants, and potentially higher visibility for the Forest (Freedom's Way Heritage Association 2015).
- Approximately 324.6 acres of the Forest has no Landscape Designation (DCR 2012). Assigning Landscape Designations to these portions of the Forest could help with management of associated

cultural resources and ensure management consistent with other DCR properties statewide. Designation of these areas could help manage associated cultural resources and ensure management consistent with DCR properties statewide.

Recreation

Threats

- Approximately 4% of the Forest is within the 1.0%-chance flood zone and 5% is within the 0.02%-chance flood zone. Nearly 0.3 miles of trails may be exposed to 1.0%-chance and 0.02%-chance floods. (These data are derived from the FEMA's paper Flood Insurance Rate Maps, or FIRMS, dating to 1997. Because of their age, FIRMS may only be used to portray zones of uncertainty and possible risks associated with flooding, not the absolute delineation of flood boundaries (MassGIS 1997).)
- Unpermitted commercial rock-climbing groups use climbing areas at Leominster for paid programs, leading to decreased oversight by DCR. Staffing levels also limit ability to monitor rock climbing for potential overuse and safety related concerns.
- Trees near the entrance/exit to several parking lots, including the Princeton Lot, are obstructing the view of oncoming traffic and creating a hazard for visitors and passing motorists.
- The retaining wall at the day-use beach is currently being held together by plastic mesh to prevent loose rocks from falling; repairs are needed to prevent further degradation.
- The durability of the beach in the day-use area is unsuitable for daily use, impacting visitor experience and decreasing its overall quality.
- Many of Leominster's recreational amenities (i.e., beach, picnic facilities, comfort stations) are not constructed or positioned in a manner consistent with universally accessible standards, as outlined in the Universal Access (UA) assessment for Leominster (Institute for Human Centered Design (IHCD) 2021).
- Trail density within the Parkland Landscape Designation (0.0273 miles/acre) is slightly above the 0.0226 miles/acre (i.e., 9 km/km^2) threshold for Parklands and is considered Excessive (DCR 2019a).
- A network of unauthorized user-created trails, for both hiking and mountain biking, have been constructed without regulatory review or DCR consent, potentially causing visitors to get lost or confused about their location in the Forest.
- Though open year-round, the forest lacks a year-round comfort station, potentially limiting visitation for winter recreation. The Princeton Lot previously had a composting toilet, but it has been removed.
- Two year-round staff and eight seasonal staff manage the 4,567.7 acres at Leominster and an additional 150.2 acres at Johnny Appleseed State Park, a satellite property, making park operations and maintenance challenging. An additional 10 seasonal aquatics positions at Leominster keep the waterfront area guarded during the summer, but do not contribute toward larger property maintenance or operations at Leominster and Johnny Appleseed.
- Lower Crow Hill Pond has exceeded Enterococci testing thresholds eleven times from 2018 to 2021, with four recorded exceedances in 2018 and five in 2020, impairing a popular recreational resource at Leominster (Massachusetts Department of Public Health (DPH) 2019, 2020, 2021, 2022).

Opportunities

- Develop/improve permitting process for rock climbing activities at Leominster State Forest, allowing DCR to verify commercial provider's liability insurance and help offset DCR's related costs. Increasing staff visits to this area would help ensure compliance.
- Rehabilitation of the retaining wall at the day-use area beach can better ensure usability and visitor safety.
- Restoring the beach at the waterfront area through the addition of sand could enhance visitor experience.
- Continue replacing picnic tables in the picnic area to improve visitor experience and to maintain this recreational resource.
- Year-round restroom facilities could increase visitation in winter months and increase the Forest's winter recreation opportunities.
- Improving boat ramp access would increase water-based recreation and enhance water quality at the Forest.
- Implementing recommendations in the recent UA assessment (IHCD 2021) has the potential to increase the Forest's accessibility.
- Implementing an accessible trail in a central location, near other UA facilities, can improve visitor experience and increase recreational opportunities for users of all abilities.
- Adding a trailhead and connecting trail at East Road in Westminster could add another access point to the forest for nearby residents.
- Formalizing agreements with NEMBA and other Friends groups could improve communication. With increased interest, establishing a Friends group could increase trail maintenance and engage active community members.
- There is an opportunity to maintain actions outlined in the Memorandum of Agreement between DCR and the operator of the Fitchburg/Westminster Solid Waste Management Facility.
- Many navigational signs on the trail system have been updated or added. Continuing to maintain and add internal navigation signs, in accordance with Trail Maintenance BMPs (DCR n.d.b), will help orient visitors within the Forest.
- Working with the towns to improve road crossings for trails would improve visitor's experience crossing roads dividing Forest sections.
- Restricting and enforcing the appropriate recreational uses within Zone A for Surface Water Protection could help ensure quality of drinking water resources.
- Adding a shelter for hikers along the Mid-State Trail would provide hikers with an opportunity to rest along the route.
- The Emergency Action Plans for Crow Hills Pond Dam (Dam No. MA00645), Upper Crow Hills Pond Dam (Dam No. MA03273), and Paradise Pond Dam (Dam No. MA03183, all classified as a Significant Hazard Potential structure, provide detailed information on how field operations personnel are to respond to dam safety issues, from minor issues to impending failure (Pare Corporation 2018a, 2018b). There is opportunity to increase awareness of this plan among park staff and local first responders, thereby increasing public safety.

- Portions of the Forest are within and contiguous with an EJ tract. There may be opportunities to advance environmental justice and equity via DCR's Environmental Justice Strategy (see pages 79–88 in Massachusetts Executive Office of Energy and Environmental Affairs (EEA) 2024a), in alignment with the EEA's EJ Policy (EEA 2021) and the Executive Order on Environmental Justice (No. 552) (Patrick 2014).

CLIMATE CHANGE

Climate change impacts nearly every aspect of DCR's properties, from ecosystem health, to infrastructure, to recreation. (See DCR 2024 for an overview of these impacts.) The Department is actively working to mitigate and adapt to current and future impacts through such actions as forest management; decarbonizing DCR's buildings, vehicles, and power equipment; protecting wetlands; and using nature-based solutions to minimize stormwater impacts. Information on these, and other, efforts is incorporated into RMPs as available and appropriate.

Any discussion of climate change requires a shared understanding of terminology. Because of this, this RMP section adopts commonly accepted terms to the greatest extent possible. In general, climate-related technical terms used in this RMP are as defined in the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2021). Exceptions to this are the terms Adaptation, Risk, and Sensitivity, which are used as defined in DCR's Climate Change Vulnerability Assessment (CCVA; Weston and Sampson 2022).

DCR manages its forests to provide a range of ecosystem services such as recreation, clean water, wood commodities, and wildlife habitat (DCR 2020). For ecosystems under its management, DCR carefully considers both their vulnerability to climate change and their ability to mitigate the effects of climate change by storing carbon in ecosystems and harvested wood products. Several approaches are used to monitor DCR forests and to design forest management strategies to adapt to climate change and provide ecosystem services. (See Swanston et al. (2016) for information on adaptation strategies and approaches associated with DCR's forest management.) Established in 1957, DCR's Continuous Forest Inventory (CFI) system uses a network of more than 2,000 permanent plots on which repeated measurements are taken on an ongoing basis. The CFI measures the status, size, and health of over 100,000 trees; other vegetation; down woody material; and the forest floor. (See DCR 2022 for additional information on the CFI system.) This information helps DCR understand at a strategic scale the current character, condition, and trends of forest ecosystems under its care. DCR also uses operational inventory to help plan specific treatments and evaluate their outcomes. Using these different scales of information, remotely sensed data, and local and regional external expertise, DCR plans projects that help its stands, forests, and other lands adapt to climate change and mitigate greenhouse gas emissions. The conservation and science-based management of forest lands are an essential element to ensuring crucial carbon storage and advancing climate change resilience (EEA 2024b). For additional information on the relationship between DCR's forest management practices and climate change, please see pages 77–85 in Massachusetts Forest Action Plan 2020 (DCR 2020) and Managing Our Forests…For Carbon Benefits (DCR 2023).

The Department is actively assessing and addressing the vulnerability of its properties and facilities to the impacts of climate change. In 2022, DCR conducted a Climate Change Vulnerability Assessment (Weston and Sampson 2022). Findings from this CCVA are being used by DCR to enhance park operations and maintenance, inform resilient investment, and provide a framework for hazard mitigation and

climate adaptation for natural resources, cultural resources, recreational activities, buildings, facilities, and other infrastructure. Property-specific climate change information from the CCVA is included in the Climate Change (by 2070) table (Table 12) at the beginning of this RMP. An overview of the impacts of climate change on DCR facilities and operations is presented in the DCR Climate Impacts Story Map (DCR 2024).

Climate Exposure and Impacts

A summary of the ways in which the Commonwealth's natural, cultural, and recreational resources may be impacted by climate change is provided below. During the preparation of Resource Management Plans some resources may be identified as having particularly high exposure and/or sensitivity to the anticipated hazards or consequences of climate change. When this occurs, these resources and the projected impacts to them are described. In some instances, the potential impacts of climate change on a given resource are not well understood. When this occurs, only exposure is discussed.

Natural Resources—General Impacts

Climate change affects temperature, precipitation, and atmospheric and ocean chemistry, which in turn directly and indirectly affect the natural environment, including the plants, animals, and natural communities of DCR's forests, parks, and reservations.

Climate is known to influence the presence, absence, distribution, reproductive success, and survival of both native and non-native plants (Finch et al. 2021). Native northern and boreal species, including balsam fir, red spruce, and black spruce may fare worse under future conditions, but other species may benefit from the projected changes in climate (Janowiak et al. 2018). Some non-native invasive species will be affected by climate change while others will remain unaffected, and some non-invasive non-native species are likely to become invasive (Finch et al. 2021). In general, elevated temperature and CO2 enrichment associated with climate change increases the performance of non-native plants more strongly than the performance of native plants (Liu et al. 2017). Climate change may result in the presence of new non-native invasive plants on a property, and changes to the distribution and/or abundance of invasives already present on a property.

Exposure to a changing climate affects wildlife in a variety of ways. For animals that live in or near aquatic environments, "changes in habitat and hydrological regimes are expected to shift their abundance and distribution" (Isaak et al. 2018: 89). Impacts to terrestrial animals are expected to be highly variable (Halofsky et al. 2018) but may be considered to fall into the following four categories: 1. habitat loss and fragmentation; 2. physiological sensitivities (i.e., innate characteristics that influence the ability to cope with changing temperature and precipitation conditions); 3. alterations in the timing of species' life cycles; and 4. indirect effects (e.g., disruption of ecological relationships) (Friggens et al. 2018). Although all Northeast wildlife are exposed to hazards associated with climate change, some groups, "including montane birds, salamanders, cold-adapted fish, and freshwater mussels, could be particularly affected by changing temperatures, precipitation, sea and lake level, and ocean processes" (MassWildlife 2015: 357). In addition, it is the position of the Massachusetts Natural Heritage and Endangered Species Program that state-listed species and Priority Natural Communities are likely to be highly sensitive to climate change and that all state-listed species will be negatively affected by hydrologic changes, changes in water, soil, and air temperature, and changes in forest composition.

Natural Resources—Property-Specific Exposure and Impacts

Three of the Forest's streams have been identified as Coldwater Fisheries Resources by the Massachusetts Division of Fisheries and Wildlife. This includes Steam Mill Brook and two unnamed tributaries of Monoosnuc Brook. Such streams provide important habitat for coldwater species, which are typically more sensitive than other species to alterations in stream flow, water quality, and temperature (MassGIS 2021). The entire lengths of these streams within the Forest are exposed to climate impacts.

Climate change may cause some vernal pools to dry earlier in the season than they have historically, potentially interfering with amphibian life cycles (Cartwright et al. 2022). Because of this, some of the Forest's pools and associated wildlife may be negatively impacted.

Cultural Resources—General Impacts

Climate change may negatively affect cultural resources, their preservation, and maintenance (EEA 2022; International Council on Monuments and Sites (ICOMOS) Climate Change and Cultural Heritage Working Group 2019; Rockman et al. 2016: 3, 18; United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Center 2007). In Massachusetts, cultural resources may be exposed to the following natural phenomena that are correlated with adverse impacts: higher annual average temperature (especially in winter), increased numbers of freeze-thaw cycles, increased precipitation intensity, higher relative humidity, higher wind speeds, an increase in severe storm events, increased numbers and severity of wildfires, more severe seasonal droughts, increase in number and severity of inland flood events, increased coastal flooding and erosion, increased probability of landslides, changes in groundwater levels, shifts in native and invasive species distribution, performance, and phenology; and changes in oceanic and atmospheric chemistry (Rockman at al. 2016; Commonwealth of Massachusetts 2023: 5.1-31–5.1-61).

The phenomena listed above may produce a variety of adverse impacts to Massachusetts' cultural resources. Sensitivity and potential impacts vary based on resource category (i.e., archaeological sites, cultural landscapes, ethnographic landscapes and sites, and buildings and structures). Resource-specific factors such as location, design, materials, condition, etc. will also influence sensitivity and consequent impacts. All categories of cultural resources may be subject to complete or partial destruction through wildfire, inland flooding, sea level rise, storm surge, or landslides. Additionally, these resource categories may be subject to other types of impacts, as follows. Archaeological sites may have site stratigraphy disrupted by changes in hydrography, may suffer accelerated decomposition of artifacts and features, and may be impacted inadvertently during disaster response. Cultural landscapes may lose plantings due to a variety of stressors (e.g., drought or flood, pests, soil salinity), may be infiltrated by invasives, may be eroded by surface runoff, may experience more rapid deterioration of hardscaping and site furnishings, and may be damaged by high wind or heavy snow events. Ethnographic landscapes, traditional cultural places, and associated communities (including Indigenous peoples) may suffer both tangible and intangible impacts such as loss or diminishment of natural species used for food, ceremony, or medicine; alterations in timing of hunts, etc.; increased difficulty of vulnerable subgroups (e.g., the elderly) to perform outdoor tasks; and a loss of cultural knowledge associated with resources and practices. Buildings and structures may be damaged or destroyed by high wind or heavy snow events, suffer accelerated deterioration through a variety of mechanisms (e.g., elevated humidity, chemical reactions, destructive pests and organisms), may be destabilized by hydrological changes, or be damaged

by inadequate gutters or drainage systems (ICOMOS Climate Change and Cultural Heritage Working Group 2019: 73–89; Rockman et al. 2016: 20–24). (See Rockman et al. 2016: 19–24 for a detailed assessment of the potential impacts of climate change on cultural resources.)

Cultural Resources—Property-Specific Exposure and Impacts

No cultural resources with known elevated exposure or sensitivity to potential consequences of climate change were identified at this property.

Recreation—General Impacts

Outdoor recreation and park visitation are dependent on weather and climate and will be affected by a warming climate (Wilkins and Horne 2024). Higher temperatures positively affect participation in most outdoor activities, except snow-based activities (Wilkins and Horne 2024). "Winter is warming substantially faster than other seasons, and winter warming is especially pronounced in the...Northeastern United States" (Wilkins and Horne 2024: 15). Exposure to this climate change phenomenon is projected to significantly reduce the length of winter recreation seasons for downhill skiing, cross-country skiing, and snowmobiling, decreasing recreational opportunities and causing substantial economic impacts (Wobus et al. 2017). Whitewater rafting, primitive area use, and hunting are also projected to be negatively impacted by exposure changing weather patterns associated with climate change (Askew and Bowker 2024). Although "coldwater fishing habitat is expected to decline under a warming climate, which will likely result in fewer fishing days," overall fishing participation in the Northeast is projected to rise "due to the more favorable temperatures" (Wilkins and Horne 2024: 11). Horseback riding on trails, boating, swimming, and visiting interpretive sites are also expected to see higher participation in the Northeast under climate change (Askew and Bowker 2018). Temperature preferences of campers indicate that the "number of ideal days" for camping will also increase (Wilkins and Horne 2024: 13). Participation in biking is also projected to increase, especially in the winter and shoulder months (Wilkins and Horne 2024: 13). Climate change may also impact outdoor recreation through increased impacts to recreation infrastructure (e.g., flooding impacts), and increased exposure to disease vectors (e.g., mosquitoes and ticks), longer pollen seasons, and heat-related illnesses (O'Toole et al. 2019).

Recreation—Property-Specific Exposure and Impacts

Recreation activities at the Forest likely to be negatively impacted by exposure to weather changes resulting from climate change include hunting and snow-dependent sports (i.e., cross-country skiing, snowmobiling, and snowshoeing). Other recreation activities may see increased participation, especially those associated with the waters of Crow Hill Pond. Fishing, swimming, and other water-based activities may experience increased participation due the anticipated increase in temperature (i.e., more than 30 additional days with temperatures over 90° F; Table 12).

APPLIED LAND STEWARDSHIP ZONING

DCR assesses the appropriate uses and stewardship of its properties at two spatial scales: the landscape level and the property level.

Landscape Designation

In 2012, DCR engaged in a comprehensive system-wide assessment of lands managed by its Division of State Parks and Recreation, designating them as Reserve, Woodland, or Parkland. (See Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines (DCR 2012) for details.) Multiple Landscape Designations may apply to individual properties with diverse resources and levels of development. Sections of Leominster State Forest have been designated either Parkland or Woodland. Identification of Land Stewardship Zones within Leominster was performed in the contexts of the Parkland and Woodland Landscape Designations.

The following Land Stewardship Zoning is recommended to guide management and any future development. (See Figure 1. Land Stewardship Zoning Map, page 27.)

Zone 1

Zone 1 areas have highly sensitive ecological and/or cultural resources that require additional management approaches and practices to protect and preserve these special features and their values (DCR 2012). The following areas of Leominster have been designated Zone 1.

- No areas within the Forest have been designated Zone 1.

Zone 2

Zone 2 areas provide for a balance between resource stewardship and recreational opportunities that can be appropriately sustained. They include stable yet important cultural and natural resources. These areas provide a buffer for sensitive resources, recharge areas for surface and groundwaters, and large areas where existing public recreation activities can be managed at sustainable levels (DCR 2012). The following areas of Leominster have been designated Zone 2.

- All areas not identified as Zone 3.

Zone 3

Zone 3 areas include altered landscapes in active use and areas suitable for future administrative, maintenance, and recreation areas (DCR 2012). The following areas of Leominster are currently developed, appropriate for potential future development, or intensively used for recreation. They have been designated Zone 3.

- Crow Hill Ponds Day-Use Area, including the waterfront area, comfort station, picnic area, and parking lots (i.e., Beach Lot).
- Existing developed footprints of the following parking lots:
  - Beach Lot
  - Princeton Lot
  - Ledges Lot
  - Rocky Pond Lot
  - Paradise Pond Lot
- Justice Hill Trailhead including the maintained area up to the gate.

- The following dams, including all aprons, spillways, access roads, and other existing development needed to operate, maintain, or repair these dams:
  - Crocker Fish Pond Dam (Dam No. MA00644)
  - Crow Hills Pond Dam (Dam No. MA00645)
  - Upper Crow Hills Pond Dam (Dam No. MA03273)
  - Paradise Pond Dam (Dam No. MA03183)
  - Rocky Pond Dam (Dam No. MA02503)
- The Leominster State Forest Headquarters, building and yard, on Fitchburg Road/Route31 with additional area for potential expansion.

Significant Feature Overlay

Significant Feature Overlays provide precise management guidance in order to maintain or preserve recognized resources features regardless of the zone in which they occur. The following Significant Feature Overlays were developed for Leominster:

- **Sensitive Rare Species Overlay.** This overlay includes Priority Habitat 1624 and Notown Reservoir and Paradise Pond with a 100 ft buffer from the banks. Activities and projects introducing noise and/or habitat alteration should consult with NHESP before project development. The associated State-listed species and required Conservation Management Practices may be identified through a pre-filing consultation with NHESP.
- **Surface Water Supply Protection Zone A Overlay**. Land uses and activities within this overlay should be consistent with Massachusetts' Drinking Water Regulations to protect surface water supplies. Refer to 310 CMR 22.20B and 310 CMR 22.20C for specific guidance.
- **Watershed Protection Act Overlay**. Land uses and activities within this overlay should be consistent with Massachusetts Watershed Protection Act (WsPA) regulations. Overlay boundaries on map encompass WsPA Primary and Secondary Protection Zone and are approximate, other geographic areas may be regulated under the WsPA. See 313 CMR 11.00 for regulations and the associated guidance document (DCR 2017) for details on the processes used for implementation of the act.
- **Wellhead Protection Overlay.** This overlay includes two Zone I Wellhead Protection Areas, one at the Forest headquarters and the other at the Crow Hill Pond Recreation Area. Within this overlay, activities should be consistent with Wellhead Protection Tips (MassDEP 1995) and DEP Guidance (MassDEP 2011).

DCR Stewardship Map Tool

This RMP should be viewed in conjunction with DCR's Stewardship Map, a GIS-based tool that allows users to view a property's natural, cultural, and recreational resources. The Stewardship Map tool is dynamic, and information continues to be updated after adoption of an RMP. Guidance for using the tool, as well as Best Management Practices for resource stewardship, are located on the Stewardship Map site: https://dcrsgis-mass-eoeea.hub.arcgis.com/.

Because authorized trails are located within State-Listed Species Habitat on this property, managers should consult an additional GIS-based tool, the NHESP 2022 Guidance Codes for DCR Trail Maintenance Map. (https://mass-eoeea.maps.arcgis.com/home/item.html?id=cb252e8df40d408c81fe8fcf690e14f6)

This tool allows users to select specific trail segments and identify restrictions and regulatory review associated with performing 10 common trail maintenance activities on these segments. Because site-specific rare species information is confidential under Massachusetts law (M.G.L. c. 66, § 17D), access to this tool is restricted.

CONSISTENCY REVIEW

Resource Management Plans "shall ensure consistency between recreation, resource protection, and sustainable forest management" (M.G.L. c. 21, § 2F). For planning purposes, an activity is considered consistent with resource protection if it has no significant, long-term, adverse impact on resources. To this end, a series of indicators were developed to evaluate the impacts of recreation and forest management on natural and cultural resources.

Many activities with the potential to negatively affect resources are already subject to agency and/or regulatory review (e.g., forest management activities, projects within Priority Habitat). For these activities, compliance with state regulations, regulatory authority guidance, DCR policies and processes, and Best Management Practices (BMPs) is considered an indicator of consistency between park use and resource protection. New indicators were generated for activities not subject to agency or regulatory review, and are based on available data, information readily identifiable via aerial imagery or site visits, assessments by DCR subject matter experts, or the property manager's knowledge of park conditions and use. (See Table 18, page 28.)

Indicators are applied during the RMP planning process in order to ensure a standardized assessment of consistency across all properties in the DCR system. Inconsistencies identified via the application of indicators are used to inform the development of management recommendations.

The status of indicators (Yes, No, Unknown, and N/A) were accurate at the time this RMP was prepared and were used for planning purposes. However, they represent a snapshot in time and may not reflect future conditions. In addition, the status of indicators will change as recommendations get implemented.

MANAGEMENT RECOMMENDATIONS

Fifteen priority management recommendations were developed for Leominster State Forest. They are presented in Table 19, page 31. All recommendations are of equal importance.

Priority management recommendations derive from Threats, Opportunities, and Consistency Assessment information presented in this RMP. For a recommendation to be considered a priority and listed in the table, it must meet one or more of the criteria listed below. Maintenance and management needs not meeting one or more of these criteria are not included in the table but are identified in the Threats and Opportunities sections.

The following types of recommendations are considered priority:

- Natural resource stewardship and restoration activities consistent with park identity and intended to improve ecological function and connectivity.
- Cultural resource management activities consistent with park identity and intended to prevent the loss of integrity of significant cultural resources.
- Improvements consistent with park identity that are needed to support intended park activities.
- Actions required for regulatory compliance or compliance with legal agreements.

- Activities that prevent or ameliorate threats to the health and safety of park visitors and employees.
- Activities that address inconsistencies among recreation, resource protection, and sustainable forest management, as identified through use of the Consistency Assessment checklist.

Progress toward implementing priority recommendations is tracked through the use of DCR's Capital Asset Management Information System (CAMIS). The property manager should enter each recommendation listed in Table 19 (page 31) into CAMIS as a separate work order, noting "*RMP" in the description field. Non-traditional work orders (e.g., volunteer trail work, posting of DPH Fish Consumption Advisory posters, certification of vernal pools) should be closed out by the property manager, once the recommendation has been implemented.

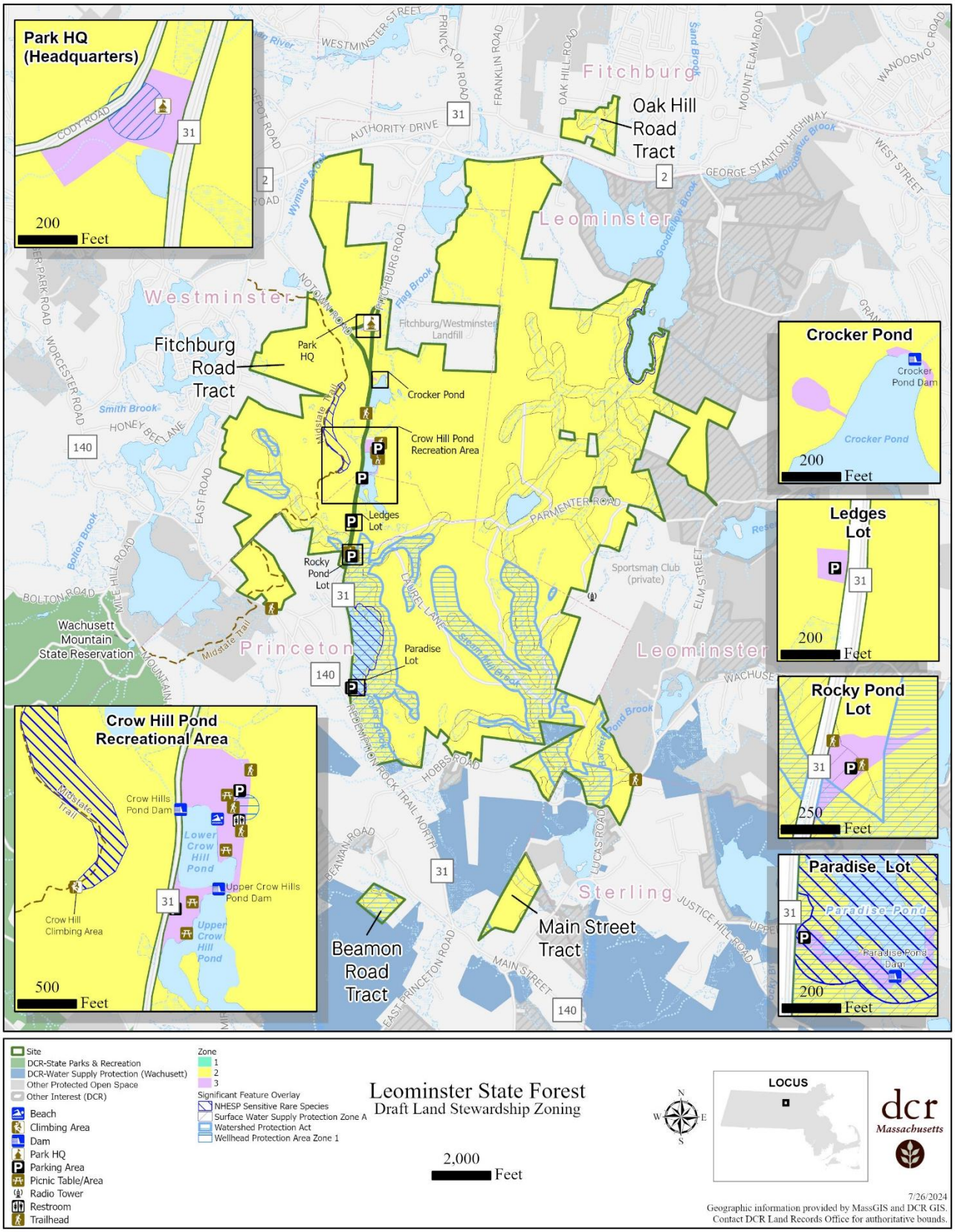

Figure 1. Land Stewardship Zoning Map.

Table 18. Consistency Assessment. This assessment represents a snapshot in time and may not reflect future conditions.

Category	Metric	Status
Landscape Designation	1. All development and uses of the park since 2012, or currently planned for the park, are consistent with its Landscape Designation(s).	Yes
Natural Resources	1. All projects (normal maintenance activities, special projects, volunteer projects) conducted within Priority Habitat were reviewed and approved through DCR's internal review process and by NHESP for potential impacts to rare species and their habitats.	Yes
Natural Resources	2. All projects conducted within areas subject to state and/or federal wetlands or waterways regulations were reviewed and approved through DCR's internal review process; reviewed and approved through the appropriate, local, state, and/or federal review process; and were carried out in accordance with the terms of a valid permit.	Yes
Natural Resources	3. Sensitive resource areas, such as steep slopes, riverbanks, streambanks, pond and lakeshores, wetlands, and dunes are free of desire paths and other user-created trails.	No
Natural Resources	4. Aquatic areas adjacent to beaches, boat ramps and launches, roads, and hiking trails are free of eroded sediments.	No
Natural Resources	5. The extent of exposed soil in campground and/or picnic sites is stable or decreasing.	No
Natural Resources	6. The extent of native vegetation in campground and/or picnic sites is stable or increasing. (As assessed by property manager.)	No
Natural Resources	7. Area of trail impacts in Reserves is less than 50% of total area. (See Naughton (2021) for information on primary area of trail impacts.)	N/A
Natural Resources	8. Congregations of breeding, migratory, or wintering wildlife are protected from disturbance by temporary (e.g., seasonal) restrictions on recreational access.	Unknown
Natural Resources	9. Geocaches, letterboxes, orienteering control locations, and other discovery destinations are located outside sensitive natural resource areas and their locations have been reviewed and approved by park personnel. (As assessed by property manager.)	No
Natural Resources	10. Zone I wellhead protection areas are free of vehicle parking, chemical storage, or concentrated recreation.	No

Category	Metric	Status
Natural Resources	11. All boat ramps and launches have cleaning stations and/or educational signs and materials on preventing the spread of aquatic invasive organisms. (As assessed by property manager.)	Yes
Natural Resources	12. For each barrier beach there is a current, approved Barrier Beach Management Plan and all beach-related activities are conducted in accordance with this plan.	N/A
Cultural Resources	1. All maintenance activities and projects with the potential to cause sub-surface disturbance are being reviewed by the DCR archaeologist for potential impacts to archaeological resources.	Yes
Cultural Resources	2. All maintenance activities and projects affecting historic properties (buildings, structures, and landscapes over 50-years-old) are being reviewed by the Office of Cultural Resources to avoid adverse impacts.	Yes
Cultural Resources	3. Historic buildings, structures, and landscapes are being used, maintained, and repaired in a manner that preserves their cultural integrity and conveys their historic significance to park visitors.	No
Cultural Resources	4. Recreational activities such as hiking, biking, and boating are not eroding cultural properties such as archaeological sites or historic landscapes through creation of desire lines, rutting in the landscape, damage to historic built features, or excessive scouring (erosion) of coastal and shoreline areas.	No
Cultural Resources	5. Geocaches, letterboxes, and other discovery destinations are located away from sensitive cultural resources, and their locations have been reviewed and approved by park personnel.	No
Cultural Resources	6. Historic buildings, structures, landscapes, archaeological sites, and concentrations of historic resources are located outside of areas predicted to be subject to flooding, storm surge, or sea-level rise.	No
Recreation	1. Types of recreation, levels of recreational use, and types and extent of recreation infrastructure are consistent with the park's identity statement.	Yes

Category	Metric	Status
Recreation	2. Trail density is consistent with the park's Landscape Designation(s). (See Trails Guidelines and Best Practices Manual (DCR 2019) for density thresholds.)	Yes
Recreation	3. All authorized trail construction was performed in accordance with an approved Trail Proposal Form.	No
Recreation	4. Over 90% of the park's official trails network is classified as being in Fair or better condition.	Yes
Recreation	5. Recurring use by OHVs is restricted to authorized trails. (As assessed by property manager.)	No
Recreation	6. There is a high level of compliance with dog leash regulations and policies. (As assessed by property manager.)	No
Recreation	7. Athletic fields are free of recreation-caused impacts (e.g., bare spots) to turf. (As assessed by property manager.)	N/A
Recreation	8. Water-based recreation is consistent with "Uses Attained" designation as identified by MassDEP in its most current integrated list of waters (e.g., MassDEP 2023); DPH fish consumption advisories; and/or water quality testing at waterfront areas.	Yes
Recreation	9. Recreation facilities are located outside of areas subject to flooding, storm surge, or sea-level rise.	No
Sustainable Forest Management	1. Forestry activities are consistent with Landscape Designation and associated forestry guidelines.	Yes
Sustainable Forest Management	2. Forestry activities are consistent with current Forest Resource Management Plan.	N/A
Sustainable Forest Management	3. Tree cutting is performed in accordance with an approved cutting plan, if required under the Massachusetts Forest Cutting Practices Act (M.G.L. c. 132, §§ 40–46).	N/A

Table 19. Priority Recommendations for Leominster State Forest. All recommendations are of equal importance. When multiple agency parties are responsible for implementing a recommendation, the lead party, or parties, are identified parenthetically in the Implementation column. Property managers should enter these recommendations as work orders in CAMIS to ensure their tracking and implementation.

Category	Recommendation	Implementation
Natural Resources	Survey, document, and submit documentation to certify potential vernal pools, in accordance with DCR (n.d.) and MassWildlife (2009), as warranted.	Office of Natural Resources (Lead), Volunteers
Natural Resources	Regularly inspect and clean culverts; replace as needed following appropriate internal and regulatory reviews.	Park Operations
Natural Resources	Assess appropriate locations to install monofilament and lead weight recycling containers and install containers as appropriate.	Park Operations
Natural Resources	Review and implement MassDEP Wellhead Protection Tips and Guidance (MassDEP 1995, MassDEP 2011) within the Park's Zone I Wellhead Protection Areas.	Park Operations
Natural Resources	Apply Landscape Designations to those portions of the Forest currently lacking such designations.	Management Forestry (Lead), GIS Program
Cultural Resources	Clear vegetation from cellar holes and rock walls, in accordance with DCR Best Management Practices for archaeological features (DCR n.d.d) and redirect paths around these resources	Office of Cultural Resources, Park Operations (Lead), Volunteers
Cultural Resources	Conduct an archaeological reconnaissance survey (950 CMR 70) in cooperation with municipal, tribal and non-profit partners. Complete appropriate Massachusetts Historical Commission archaeological site forms for identified archaeological resources, including the Notown site.	Consultant, Office of Cultural Resources
Cultural Resources	Work with Indigenous peoples partners to inventory, document, conserve, and interpret Indigenous resources and Indigenous history within the Forest.	Office of Cultural Resources (Lead), Partner

Category	Recommendation	Implementation
Recreation	As appropriate, promote EEA's Environmental Justice Policy goals at Leominster State Forest.	Land Protection Program (Co-Lead), Trails and Greenways Section (Co-Lead), Interpretive Services (Co-Lead), Partners
Recreation	Resolve trail-related threats and opportunities identified in this RMP, in accordance with Trails Guidelines and Best Practices (DCR 2019, or update), through the following actions: • Maintain authorized trails, as identified in the DCR Trail Data Layer provided to the Natural Heritage and Endangered Species Program in 2021, and in accordance with the Recreational Trail Maintenance and Biodiversity Conservation 2021 update. • Evaluate trail segments for discontinuation or active closure, including those that are: unauthorized, unsafe, connecting to privately-owned property, located in environmentally or culturally sensitive areas, or otherwise inconsistent with DCR Trails Guidelines and Best Practices. Provide an updated trail data layer to the Natural Heritage and Endangered Species Program. • Establish new trails, as warranted, following regulatory review. Provide an updated trail data layer to the Natural Heritage and Endangered Species Program.	Management Forestry, Office of Cultural Resources, Office of Natural Resources, Park Operations (Co-Lead), Partners, Trails and Greenways Section (Co-Lead)
Recreation	Identify opportunities to harden or reroute existing trails in areas where trail use has resulted in erosion.	Park Operations (Co-Lead), Trails and Greenways Section (Co-Lead)
Recreation	Develop a site plan to address issues within the Day Use Area, including the beach, accessibility, infrastructure improvements, and modifying the parking area to comply with well-head protection.	Contractor, Cultural Resources, Landscape Architecture Section, Universal Access program
Recreation	Implement recommendations as outlined in the Universal Access Program Accessibility Assessment (IHCD 2021).	Contractor, Facilities Engineering, Park Operations, Universal Access Program (Lead)

Category	Recommendation	Implementation
Recreation	Work with the geocaching community to ensure that caches located in sensitive natural and cultural resources are relocated out of those areas and that locations of any new geocaches are placed outside of sensitive areas and with the approval of the property manager.	Office of Cultural Resources, Office of Natural Resources, Park Operations (Lead)
Recreation	Increase awareness of the Emergency Action Plan for Crow Hills Pond Dam, Upper Crow Hills Pond Dam, and Paradise Pond Dam (Pare Corporation 2018a, 2018b) among Forest staff and local first responders.	Office of Dam Safety, Park Operations (Lead)

REFERENCES

Activitas. 2023. 100% Construction documents. Massachusetts DCR. Crow Hill Pond Beach Improvements. June 14, 2023.

Askew, A. E., and J. M. Bowker. 2018. Impacts of Climate change on outdoor recreation participation: Outlook to 2060. Journal of Park and Recreation Administration 36: 97–120. https://www.srs.fs.usda.gov/pubs/ja/2018/ja_2018_bowker_001.pdf (PDF)

Berg, S. P. 1998. Leominster State Forest – Crow Hill Pond Area (WST.C). Massachusetts Historical Commission Form A—Area Form. On file, Massachusetts Historical Commission, Boston, MA.

Birnbaum, C. A. n.d. The Secretary of the Interior's standards for the treatment of historic properties with guidelines for the treatment of cultural landscapes. https://www.nps.gov/crps/tps/landscape-guidelines/index.htm

BSC Group, Inc. (BSC). 2017. Invasive plant management plan: Central Region. Produced in association with: DCR Ecology & ACEC Program, June 2017.

Cartwright, J., T. L. Morelli, and E. H. Campbell Grant. 2022. Identifying climate-resistant vernal pools: Hydrologic refugia for amphibian reproduction under droughts and climate change. Ecohydrology 2022, 15, e2354. https://onlinelibrary.wiley.com/doi/epdf/10.1002/eco.2354 (PDF)

Commonwealth of Massachusetts. 2023. ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan. ResilientMass Action Team, Boston, Massachusetts. https://www.mass.gov/doc/resilientmass-plan-2023/download (PDF)

Finch, D. M., J. L. Bitler, J. B. Runyon, C. J. Fettig, F. F. Kilkenny, S. Jose, S. J. Frankel, S. A. Cushman, R. C. Cobb, J. S. Dukes, J. A. Hicke, and S. K. Amelon. 2021. Effects of Climate Change on invasive species. Chapter 4 *in* T. M. Poland, T. Patel-Weynand, D. M. Finch, C. F. Miniat, D. C. Hayes, and V. M. Lopes (Editors) Invasive species in forests and rangelands of the United States: A comprehensive science synthesis for the United States forest sector. Springer. https://library.oapen.org/bitstream/handle/20.500.12657/46792/2021_Book_InvasiveSpeciesInForestsAndRan.pdf?sequence=1&isAllowed=y (PDF)

Freedom's Way Heritage Association, Inc. (FWHA). 2015. Freedom's Way National Heritage Area management plan. https://freedomsway.org/wp-content/uploads/2021/10/FWNHAmanagementplan.pdf (PDF)

Friggens, M. M., M. I. Williams, K. E. Bagne, T. T. Wixom, and S. A. Cushman. 2018. Effects of climate change on terrestrial animals. Pages 264–315 *in* Halofsky, J. E., D. L. Peterson, J. J. Ho, N. J. Little, and L. A. Joyce (Eds.). Climate change vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 2. pp. 199–513. https://www.fs.usda.gov/rm/pubs_series/rmrs/gtr/rmrs_gtr375_2.pdf (PDF)

Grimmer, A. E. 2017. The Secretary of the Interior's standards for the treatment of historic properties with guidelines for preserving, rehabilitating, restoring & reconstructing historic buildings. Revised by Anne E. Grimmer from The Secretary of the Interior's standards for treatment of historic properties with guidelines for preserving, rehabilitating, restoring & reconstruction historic buildings. Kay D. Weeks and Anne E. Grimmer (1995).
https://www.nps.gov/orgs/1739/secretary-standards-treatment-historic-properties.htm

Halofsky, J. E., D. L. Peterson, J. J. Ho, N. J. Little, and L. A. Joyce (Eds.). 2018. Climate change vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 2. pp. 199–513.
https://www.fs.usda.gov/rm/pubs_series/rmrs/gtr/rmrs_gtr375_2.pdf (PDF)

Ham, S. H. 2013. Interpretation: Making a difference on purpose. Fulcrum Publishing, Golden, CO.

Institute for Human Centered Design (IHCD). 2021. Leominster State Forest, North Central, MA: Program Accessibility Assessment. Boston, MA. Prepared for the Department of Conservation and Recreation, Boston, MA.

Intergovernmental Panel on Climate Change (IPCC). 2021. Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2215–2256, doi:10.1017/9781009157896.022.
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_AnnexVII.pdf (PDF)

International Council on Monuments and Sites (ICOMOS) Climate Change and Cultural Heritage Working Group. 2019. The Future of our Pasts: Engaging Cultural Heritage in Climate Action. ICOMOS, Paris, France.
https://civvih.icomos.org/wp-content/uploads/Future-of-Our-Pasts-Report-min.pdf (PDF)

Isaak, D. J., M. K. Young, C. Tait, D. Duffield, D. L. Horan, D. E. Nagel, and M. C. Groce. 2018. Effects of climate change on native fish and other aquatic species. Pages 89–111 *in* Halofsky, J. E., D. L. Peterson, J. J. Ho, N. J. Little, and L. A. Joyce (Eds.). Climate change vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 1. Pp. 1–197.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd578946.pdf (PDF)

Liu, Y., A. M. O. Odour, Z. Zhang, A. Manea, I. M. Tooth, M. R. Leishman, X. Xu, and M. Van Kleunen. 2017. Do invasive alien plants benefit more from global environmental change than native plants? Global Change Biology (2017), doi: 10.1111/gcb.13579.
https://www.researchgate.net/profile/Xingliang-Xu/publication/310902903_Do_invasive_alien_plants_benefit_more_from_global_environmental_cha

nge_than_native_plants/links/5a20bb30a6fdcccd30e032dc/Do-invasive-alien-plants-benefit-more-from-global-environmental-change-than-native-plants.pdf (PDF)

Massachusetts Bureau of Geographic Information (MassGIS). 1997. MassGIS Data: FEMA Q3 Flood Zones from Paper FIRMs.
https://www.mass.gov/info-details/massgis-data-fema-q3-flood-zones-from-paper-firms

Massachusetts Bureau of Geographic Information (MassGIS). 2021. MassGIS data: MA Wildlife Coldwater Fisheries Resources. February 2021.
https://www.mass.gov/info-details/massgis-data-ma-wildlife-coldwater-fisheries-resources

Massachusetts Department of Conservation (DOC). 1923. Annual report of the Commissioner of Conservation and State Forester for the year ending November 30, 1922.
https://archives.lib.state.ma.us/handle/2452/786289

Massachusetts Department of Conservation (DOC). 1933. Annual report of the Commissioner of Conservation and State Forester for the year ending November 30, 1932.
https://archives.lib.state.ma.us/handle/2452/786299

Massachusetts Department of Conservation (DOC). 1939. Annual report of the Commissioner of Conservation and the State Forester and Director of Parks for the year ending November 30, 1938.
https://archives.lib.state.ma.us/handle/2452/786305

Massachusetts Department of Conservation and Recreation (DCR). n.d.a. Vernal pool certification on DCR lands: Best Management Practices.
https://www.mass.gov/doc/vernal-pool-certification-on-dcr-lands/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). n.d.b. Closing and restoring trails: Best Management Practices.
https://www.mass.gov/media/1182491/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). n.d.c. Trail Maintenance: Best Management Practices.
https://www.mass.gov/doc/trail-maintenance/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). n.d.d. Archaeological Features: Best Management Practices.
https://www.mass.gov/media/1177476/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). 2012. Landscape designations for DCR parks & forests: Selection criteria and management guidelines. March 2012. Boston, MA.
https://archives.lib.state.ma.us/handle/2452/200210

Massachusetts Department of Conservation and Recreation (DCR). 2017. Watershed Protection Act guidance document. For applicants of Advisory Rulings, Determinations of Applicability, Variances, and Exemptions of Tributaries. Massachusetts General Laws Chapter 92A½; 313 CMR 11.00. February 2017.
https://www.mass.gov/doc/guidance-document-for-making-applications-under-the-watershed-protection-act/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). 2018. Division of Water Supply Protection: 2017 Land Management Plan. Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection, Office of Watershed Management. January 2018. https://www.mass.gov/doc/2017-dcr-division-of-water-supply-protection-2017-land-management-plan/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). 2019. Trails guidelines and best practices manual. Updated July 2019. https://www.mass.gov/doc/dcr-trails-guidelines-and-best-practices-manual/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). 2020. Massachusetts State Forest Action Plan 2020. Executive Office of Energy & Environmental Affairs, Department of Conservation and Recreation, Massachusetts Bureau of Forest Fire Control and Forestry. https://archives.lib.state.ma.us/handle/2452/840801

Massachusetts Department of Conservation and Recreation (DCR). 2022. Manual for Continuous Forest Inventory field procedures. Bureau of Forestry, Division of State Parks and Recreation. Rev. March 2022.

Massachusetts Department of Conservation and Recreation. 2023. Managing our forests…for carbon benefits. https://www.mass.gov/info-details/managing-our-forests-for-carbon-benefits

Massachusetts Department of Conservation and Recreation (DCR)2023a. Wachusett Reservoir Watershed 2023 Public Access Plan Update. Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection, Office of Watershed Management. June 2023. https://www.mass.gov/doc/2023-wachusett-reservoir-watershed-public-access-plan-update/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). 2023b. Watershed Protection Plan. FY24–FY28. Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection, Office of Watershed Protection. June 2023. https://www.mass.gov/doc/dcr-watershed-protection-plan-fy24-fy28/download (PDF)

Massachusetts Department of Conservation and Recreation (DCR). 2024. DCR Climate Impacts. Story Map series highlighting the expected impacts caused by climate change across the DCR's facilities and operations in Massachusetts. https://storymaps.arcgis.com/collections/666258ae0e3543efa3612b9bf380bb30

Massachusetts Department of Environmental Protection (MassDEP). 1995. Wellhead protection tips for small public water supply systems. https://www.mass.gov/files/documents/2016/08/op/welltips.pdf (PDF)

Massachusetts Department of Environmental Protection (MassDEP). 2011. Implementation of Zone I requirements. DWP Policy 94-03. Effective Date: 3/10/2008. Amended Date: 5/01/2011. https://www.mass.gov/files/documents/2016/08/qs/9403a.pdf (PDF)

Mass Department of Environmental Protection (MassDEP). 2021. Final Massachusetts integrated list of waters for the Clean Water Act 2018/2020 Reporting Cycle: Appendix 19, Nashua River Watershed

Assessment and Listing Decision Summary. CN. 505.1. Prepared by: Watershed Planning Program, Division of Watershed Management, Bureau of Water Resources. https://www.mass.gov/doc/20182020-integrated-list-of-waters-appendix-19-nashua-river-watershed-assessment-and-listing-decision-summary/download (PDF)

Massachusetts Department of Environmental Protection (MassDEP). 2023. Final Massachusetts integrated list of waters for the Clean Water Act 2022 reporting cycle. CN. 568.1. May 2023. Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA. https://www.mass.gov/doc/final-massachusetts-integrated-list-of-waters-for-the-clean-water-act-2022-reporting-cycle/download (PDF)

Massachusetts Department of Public Health (DPH). 2019. Massachusetts freshwater beaches [2018]: Water quality data for public and semi-public beaches. https://www.mass.gov/doc/2018-freshwater-beach-data/download (PDF)

Massachusetts Department of Public Health (DPH). 2020. Massachusetts freshwater beaches [2019]: Water quality data for public and semi-public beaches. https://www.mass.gov/doc/2019-freshwater-beach-data/download (PDF)

Massachusetts Department of Public Health (DPH). 2021. Massachusetts freshwater beaches [2020]: Water quality data for public and semi-public beaches. https://www.mass.gov/doc/2020-freshwater-beach-data-0/download (PDF)

Massachusetts Department of Public Health (DPH). 2022. Massachusetts freshwater beaches [2021]: Water quality data for public and semi-public beaches. https://www.mass.gov/doc/2021-freshwater-beach-data-0/download (PDF)

Massachusetts Division of Fisheries and Wildlife (MassWildlife). 2009. Guidelines for the certification of vernal pool habitat, March 2009. https://www.mass.gov/doc/guidelines-for-the-certification-of-vernal-pool-habitat/download (PDF)

Massachusetts Division of Fisheries and Wildlife (MassWildlife). 2015. Massachusetts State Wildlife Action Plan 2015. Westborough, MA. https://www.mass.gov/info-details/state-wildlife-action-plan-swap

Massachusetts Executive Office of Energy and Environmental Affairs (EEA). 2021. Environmental Justice Policy of the Executive Office of Energy and Environmental Affairs. Updated June 24, 2021. https://www.mass.gov/doc/environmental-justice-policy6242021-update/download (PDF)

Massachusetts Executive Office of Energy and Environmental Affairs (EEA). 2022. 2022 Massachusetts Climate Change Assessment, Volume II – Statewide Report. Executive Office of Energy and Environmental Affairs, Boston, MA. https://www.mass.gov/doc/2022-massachusetts-climate-change-assessment-december-2022-volume-ii-statewide-report/download (PDF)

Massachusetts Executive Office of Energy and Environmental Affairs (EEA). 2024a. Environmental Justice Strategy. Secretariat and agency strategies for proactively promoting environmental justice in the Commonwealth of Massachusetts. February 2024.
https://www.mass.gov/doc/february-2024-environmental-justice-strategy-english/download (PDF)

Massachusetts Executive Office of Energy and Environmental Affairs (EEA). 2024b. Response to the report of the Climate Forestry Committee.
https://www.mass.gov/doc/forests-as-climate-solution-response-to-cfc-report/download

Massachusetts Historical Commission (MHC). 1984a. MHC Reconnaissance Survey Town Report. Leominster. Report Date: 1984.
https://www.sec.state.ma.us/mhc/mhcpdf/townreports/Cent-Mass/leo.pdf (PDF)

Massachusetts Historical Commission (MHC). 1984b. MHC Reconnaissance Survey Town Report. Princeton. Report Date: 1984.
https://www.sec.state.ma.us/mhc/mhcpdf/townreports/Cent-Mass/pri.pdf (PDF)

Massachusetts Historical Commission (MHC). 1984c. MHC Reconnaissance Survey Town Report. Westminster. Report Date: 1984.
https://www.sec.state.ma.us/mhc/mhcpdf/townreports/Cent-Mass/wst.pdf (PDF)

Midstate Trail Committee. n.d. Midstate Trail history.
http://www.midstatetrail.org/about-the-midstate-trail/midstate-trail-history/

Mountain Project. n.d. Crow Hill.
https://www.mountainproject.com/area/105905492/crow-hill

National Park Service (NPS). 1998. Planning for interpretation and visitor experience. Prepared by the Division of Interpretive Planning, Harpers Ferry Center, Harpers Ferry, WV. 1998.
https://www.nps.gov/subjects/hfc/upload/interp-visitor-exper.pdf (PDF)

Native Land Digital. 2023. Native Land Digital.
https://native-land.ca/

Naughton, M. 2021. Wildlife and recreation: Understanding and managing the effects of trail use on wildlife. Prepared for Vermont Fish and Wildlife and Vermont Forests, Parks, and Recreation. November 2021.
https://anr.vermont.gov/sites/anr/files/2023-01/wildlife_and_recreation_%20M_naughton_2021.pdf
PDF

O'Toole, D., L. A. Brandt, M. K. Janowiak, K. M. Schmitt, P. D. Shannon, P. R. Leopold, S.D. Handler, T. A. Ontl, and C. W. Swanston. 2019. Climate adaptation strategies and approaches for outdoor recreation. Sustainability 2019, 11, 7030.
https://www.mdpi.com/2071-1050/11/24/7030/pdf (PDF)

Pare Corporation. 2018a. Emergency Action Plan for Upper Crow Hills & Crow Hills Pond Dams, Westminster, Worcester County, Massachusetts. National I.D. Number MA 03273/MA00645. State ID Number: 3-14-332-27A/3-14-332-27. Plan Developed: 2018-03. Revision Number 0, Date 2018-03

Pare Corporation. 2018b. Emergency Action Plan for Paradise Pond Dam, Princeton, Worcester County, Massachusetts. National I.D. Number MA 03183. State ID Number: 3-14-241-5. Plan Developed: 2018-06. Revision Number 0, Date 2018-06

Patrick, D. L. 2014. Executive Order on Environmental Justice (No. 552), by His Excellency Deval L. Patrick, Governor. November 20.
https://www.mass.gov/doc/executive-order-552-mass-register-1276/download (PDF)

Quabbin-to-Cardigan Partnership. 2023. The Quabbin-to-Cardigan Partnership.
https://q2cpartnership.org/

Rockman, M., M. Morgan, S. Ziaja, G. Hambrecht, and A. Meadow. 2016. Cultural Resources Climate Change Strategy. National Park Service, Cultural Resources, Partnerships, and Science and Climate Change Response Program, Washington, D.C.
https://www.nps.gov/subjects/climatechange/upload/NPS-2016_Cultural-Resoures-Climate-Change-Strategy.pdf (PDF)

Siergiej, D.L. 1983. No Town Area (MHC No. LEO.I) MHC Form A–Area Form. On file, Massachusetts Historical Commission, Boston, MA.
https://mhc-macris.net/details?mhcid=leo.i

Swanston, C. W., M. K. Janowiak, L. A. Brandt, P. R. Butler, S. D. Handler, P. D. Shannon, A. Derby Lewis, K. Hall, R. T. Fahey, L. Scott, A. Kerber, J. W. Miesbauer, L. Darling, L. Parker, and M. St. Pierre. 2016. Forest adaptation resources: Climate change tools and approaches for land managers, 2nd ed. Gen. Tech. Rep. NRS-GTR-87-2. U.S. Department of Agriculture, Forest Service, Northeast Research Station. Newtown Square, PA.
https://www.fs.usda.gov/nrs/pubs/gtr/gtr_nrs87-2.pdf (PDF)

United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Center. 2007. Climate Change and World Heritage. Report on predicting and managing the impacts of climate change on World Heritage and strategy to assist States parties to implement appropriate management responses. World Heritage Reports 22. UNESCO World Heritage Center, Paris, France.
https://whc.unesco.org/uploads/activities/documents/activity-474-1.pdf (PDF)

Weston and Sampson. 2022. Climate change vulnerability assessment. September 2022. Report prepared for Massachusetts Department of Conservation and Recreation.

Wilkins, E. J., and L. Horne. 2024. Effects and perceptions of weather, climate, and climate change on outdoor recreation and nature-based tourism in the United States: A systematic review. PLOS Climate 3(4): e0000266.
https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000266 (PDF)

Wobus, C., E. E. Small, H. Hosterman, D. Mills, M. Rissing, R. Jones, M. Duckworth, R. Hall, J. Creason, and J. Martinich. 2017. Projected climate change impacts on skiing and snowmobiling in the United States. Global Environmental Change. 45(2017) 1–14.
https://www.sciencedirect.com/science/article/am/pii/S0959378016305556 (PDF)