The Middlesex Fells Reservation:
The Case For A Resource Management and Maintenance Plan
Acknowledgements

This report was prepared by Vanessa Bittermann, Ryan Christenberry, Sean Sylver and Abby Yenco, students in the Tufts University Department of Urban and Environmental Policy and Planning (UEP). The authors created the report for The Friends of the Middlesex Fells Reservation as part of the requirements for UEP 255: Field Projects: Planning and Practice. While the report aims to reflect the focus and priorities of the client, it is based on research conducted by the authors. Therefore the content and any errors are the responsibility of the authors.

The UEP Field Projects Team would like to thank the following for their thoughtful and generous contributions to this project: Mike Ryan, Executive Director, Friends of the Fells, Bryan Hamlin, Friends of the Fells, Hue Holley, Friends of the Fells Mike Arnott, Friends of the Fells, Thomas Dugan, Policy Analyst, DCR, Julian Agyeman, DCR Stewardship Council, Maggi Brown, District Ranger, DCR, Elizabeth Wright, New England Wildflower Association, Heidi Ricci, Senior Environmental Policy Specialist, Mass Audubon Society, Deborah Holt, Volunteer Hike Leader, Sierra Club, Joe Sloane, Volunteer Coordinator, Blue Hills Trail Watch, Tom Palmer, President, Friends of the Blue Hills, Tom Grimble, President, NEMBA, Dan Small, Ranger, Lynn Woods, Bill Hocking, Advisory Council, Borderland State Park, Ed Myskowski, Geologist, Peabody Essex Museum Volunteer, Pat Flynn, Urban Parks Director, DCR

The authors would also like to thank Rusty Russell, Molly Mead, Audra Vernon and Sarah Reich for their guidance and input throughout the project.

Cover Photo Credits

1. Spot Pond, courtesy of The Friends of the Fells
2. Trail Workers, courtesy of The Friends of the Fells
3. Fox, courtesy of The Friends of the Fells
4. Lady Slipper, courtesy of Bryan Hamlin
5. Spot Pond Brook, courtesy of Abby Yenco
6. Boston Skyline, courtesy of Ryan Christenberry
# Table of Contents

i. Acknowledgements ........................................ 1  

ii. Table of Contents .......................................... 2 - 3

    Abstract

I. Executive Summary ........................................ 4 - 6

II. Introduction ................................................... 7 - 8

III. Methods ...................................................... 9

IV. Background .................................................... 10 - 13

V. Existing Conditions and Analysis ......................... 14 - 32

VI. Comparative Analysis ..................................... 33 - 38

VII. Critical Path Analysis ................................... 39 - 42

VIII. Recommendations ....................................... 43

IX. Appendices .................................................. 45 - 60

    Appendix A  
        - Annotated Bibliography  
        - Sources

    Appendix B  
        - GIS Maps  
        - List of Invasives

    Appendix C  
        - Visitor Survey
The Friends of the Middlesex Fells Reservation advocate for the creation of a master plan for the Fells that will guide not only day to day management, but will also lay out long term goals and provide implementation strategies to reach those objectives. The Department of Conservation and Recreation’s (DCR) Resource Management Planning (RMP) process aims to lay a foundation for management planning, although it does not promise to create exhaustively detailed plans for each park, nor will it focus on design recommendations. The goal of this report is to provide information and recommendations that can inform both the baseline RMP and a potential master plan. The report also offers recommendations for action steps that The Friends of the Fells can take to initiate first steps toward an effective management plan.
I. Executive Summary

Introduction

Created in 1894, The 2,575 acre Middlesex Fells Reservation serves as a popular escape from city living for an increasing number of Boston area residents every year. The reservation boasts a diverse landscape of rocky hills, meadows, wetlands, oak and hickory forests, quiet ponds, vernal pools, scenic vistas, and is home to a variety of animal life (Friends of the Middlesex Fells, 2004, 6). People come to the Fells for various forms of recreation, solitude, and a connection with nature that is largely unavailable in the heavily developed Boston area. However, as this user base continues to expand, problems have arisen in park maintenance and regulatory enforcement that reflect a critical need for a management and maintenance plan for the Fells.

Our client, The Friends of the Middlesex Fells Reservation (The Friends), engaged the UEP Field Projects Team to identify priority issues in three areas: natural resources, uses and user conflicts, and enforcement. Our goal is to make recommendations for improvement in these areas, while maintaining consistency with The Friends long term vision for a comprehensive management plan for the Middlesex Fells Reservation. These three areas of inquiry were chosen by The Friends, who feel they reflect the most important management concerns currently facing the Fells.

The goal of this report is to identify the most pressing issues currently impacting the Fells and establish a priority structure for addressing them in preparation for the forthcoming Baseline Resource Management Plan (RMP) effort by the Department of Conservation and Recreation (DCR). We will achieve this goal by examining the following research questions:

Research Questions and Objectives

1. Identify the natural resources of the Fells. How can recreational uses be managed and policies enforced to promote sound protection of these assets, given both the limited resources of the DCR as an agent of regulatory oversight and the high vision of The Friends for stewardship of the reservation?

2. The DCR RMP process represents a positive critical step forward for management of the Fells. How can groups like the Friends collaborate with state agencies to enhance and ensure sound management practices in the Middlesex Fells?

3. What are the components of a baseline RMP and what do The Friends need to do to prepare for the planning process?

Findings

By using the principles of critical path analysis, we prioritized management issues in the Fells and suggest ordered steps to effectively address them. A critical path graphically depicts the sequential order of steps necessary to achieve management goals.

A complete critical path analysis will involve the use of more specific data sets that were not fully available at the time of this report. Our recommendations include suggestions for obtaining missing data as part of the first steps of the critical path. We have developed a series of preliminary pathways based on our current understanding of management priorities in the Fells.
I. Executive Summary

**Recommendations**

We developed the following recommendations based on our initial areas of research: natural resources, uses & user conflicts, and enforcement, as well as from our critical path analysis.

1. Begin steps toward completing physical resource studies listed in Step 1 of critical path analysis.
2. Continue trail mapping initiatives in the Fells.
4. Begin to assemble a multi-stakeholder stewardship group.
5. Continue to develop enforcement of rules and regulations.
6. Continue to leverage political connections to meet reservation objectives.

**Resource Management Planning Process**

The Massachusetts DCR is the result of a 2003 merger of the former Metropolitan District Commission (MDC) and Department of Environmental Management (DEM), and has been given a mandate to create RMPs for all existing state properties over the next two years.

**Existing Conditions and Analysis**

The three components of our research included natural resources, uses and user conflicts, and enforcement issues within the Fells. We examined these three areas, analyzed how they interrelate, and identified possible strategies for addressing them. A comparative analysis of other urban parks within Massachusetts and across the country informed our discussion of the issues.

**Natural Resources**

Natural resource management in the Middlesex Fells Reservation began as an effort to preserve urban wilds as an amenity for Boston residents. Over time, the area has been subject to intermittent management; however, for the most part, it has been left relatively unmanaged. Today, priorities for natural resource management include water quality, invasive plant species, forest health, wildlife habitat protection, and trail erosion. To ensure the future integrity of natural resources in the Fells, a detailed resource inventory and management plan must be developed.

**Uses and User Conflicts**

The Middlesex Fells Reservation offers visitors a multitude of recreational activities, including walking, hiking, jogging, rock climbing, mountain biking, boating, fishing, horseback riding, cross-country skiing, picnicking, dog walking, and study of natural and cultural features. Several community groups offer organized recreational and educational activities within the Fells. The Fells is a popular destination for residents of surrounding cities and towns. Its very popularity, however, is creating pressure on the resources it contains.

Visitors create impacts on the natural resources within the Fells, including trail widening and erosion from high use, creation of redundant or “social” trails, fire, litter, graffiti, pollution or spread of disease from uncollected dog feces, and damage to flora and fauna.

Visitors also have impacts on other users, either due to direct verbal or physical conflicts or effects on others’ expectations or enjoyment. Typical concerns of Fells users stemming directly from other users’ actions include dogs off leash, litter, graffiti, vandalism, off-trail or off-season mountain biking, inappropriate sexual behavior, and general safety worries (Friends of the Fells, 2004).
I. Executive Summary

Enforcement
At its creation in 2003, the DCR was charged with the mission to establish a “world class park system.” While the DCR has worked toward establishing a framework to accomplish this, funding for the state’s parks have been minimal and staff levels low. The Fells has felt the impact of this lack of enforcement presence by Rangers in the reservation.

Intensified use of the Fells by specific user groups and their impacts has placed enforcement of the reservation’s regulations as a high priority issue. The question remains whether there is adequate staff to enforce regulations. Collaboration between multiple stakeholder groups to educate visitors and model responsible park behavior may promote voluntary compliance with regulations. This could serve to create a constructive, inclusive, and efficient means to achieve enforcement objectives.
The 2,575 acre Middlesex Fells Reservation serves as a popular escape from city living for an increasing number of visitors every year. The reservation boasts diverse landscape of rocky hills, meadows, wetlands, oak and hickory forests, quiet ponds, vernal pools, scenic vistas, and is home to a variety of animal life (Friends of the Middlesex Fells 2004, 6). People come to the Fells for various forms of recreation, solitude, and a connection with nature that is largely unavailable in the heavily developed Boston area. However, as this user base continues to expand, problems have arisen in park maintenance and regulatory enforcement that reflect a critical need for a management and maintenance plan for the Fells.

The Massachusetts Department of Conservation and Recreation (DCR), the result of a 2003 merger of the former Metropolitan District Commission (MDC) and Department of Environmental Management (DEM), has been given a mandate to create Resource Management Plans (RMPs) for all existing state properties over the next two years. This represents a promising opportunity for Fells advocacy. The only previous plan for any part of the Fells was a 1990 plan created by Radcliffe College students, which focused on the Virginia Wood section of the reservation.

The Friends of the Middlesex Fells Reservation (The Friends), a community based group, act as stewards of the Fells with an approach of preservation, education, and advocacy. The Friends envision a well-maintained, actively enforced, and sustainably-used reservation with a focused mission to protect and preserve the natural and historic resources of the area.

The Friends organized 21 years ago to assist the (then) MDC in providing public education about the reservation. They have developed popular programs open to the public that run 12 months a year.

The Friends have also been a strong voice in advocating for preservation. In recent years, they have mounted a powerful campaign with strong
II. Introduction

community support to oppose re-development of the former Boston Regional Medical Center site -- the only major privately held inholding in the Fells -- across from Spot Pond. While that battle proceeds, The Friends continue to lead educational hikes, help DCR staff with special events, coordinate trail maintenance efforts, visit local schools and community groups, and work with other recreational and environmental groups to protect the resources of the Fells.

The Middlesex Fells is unique because it is considered an “urban wild”, existing in a densely developed area only five miles north of downtown Boston. Its value as a free and open resource to members of the public cannot be understated.

The Fells is home to a variety of natural resources that are considered rare in surrounding areas due to extensive human impacts on nearly all available land. This makes resource protection a prime objective of any planning measure. The land is valuable for the functions it provides to native flora and fauna, as well as the human function it provides through the supply of clean drinking water from the Winchester and high use reservoirs.

Research Questions and Objectives

This report aims to assemble research on the most pressing management issues in the Fells and to suggest a path toward addressing those challenges. The Friends of the Fells identified natural resources, uses & user conflicts, and enforcement as areas of top priority for the upcoming RMP process. Our research objectives were as follows:

1. Identify the natural resources of the Fells. How can recreational uses be managed and policies enforced to promote sound protection of these assets, given both the limited resources of the DCR as an agent of regulatory oversight and the high vision of the Friends for stewardship of the reservation?

2. The DCR RMP process represents a positive critical step forward for management of the Fells. How can groups like the Friends collaborate with state agencies to enhance and ensure sound management practices in the Middlesex Fells?

3. What are the components of a baseline RMP and what do The Friends need to do to prepare for the planning process?
The Middlesex Fells: The Case for a Resource Management & Maintenance Plan

III. Methods

Information Gathering
Research was conducted in four ways; GIS mapping, literature review, interviews with experts and public officials, and Fells visitor interviews.

GIS Mapping
MassGIS information was used to gain a better understanding of surrounding development and how it relates to the natural resources contained within the Fells. The information gathered supports our recommendations; however, resource mapping by DCR should be conducted to gain a thorough understanding of the location of natural resources in the Fells.

Literature Review
We conducted a thorough review of existing literature prepared by the Friends of the Fells, various user group organizations, the DCR (and former MDC), reports and policies of several large urban parks, and academic literature. This content analysis framed the broader issues facing the Fells and helped identify models and policies for resource management. For a selected list of the literature we reviewed, please see the annotations in the bibliography in Appendix A of this Report. A complete reference list is also provided.

Interviews
Interviews with key informants have provided us with a range of perspectives on current issues, past conflicts and have helped shape ideas for alternative strategies. The following is a list of experts and public officials who contributed their insights to this report:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
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<tr>
<td>Maggi Brown</td>
<td>District Ranger, DCR</td>
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<td>Thomas Dugan</td>
<td>Policy Analyst, DCR</td>
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<td>Tom Grimble</td>
<td>President, NEMBA</td>
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<td>Bryan Hamlin</td>
<td>Friends of Fells</td>
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<tr>
<td>Bill Hocking</td>
<td>Advisory Council, Borderland State Park</td>
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<tr>
<td>Deborah Holt</td>
<td>Volunteer Hike Leader, Sierra Club</td>
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<td>Ed Myskowski</td>
<td>Geologist, Peabody Essex Museum</td>
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<td>Tom Palmer</td>
<td>President, Friends of the Blue Hills</td>
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<td>Heidi Ricci</td>
<td>Senior Environmental Policy Specialist, Mass Audubon Society</td>
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<td>Joe Sloane</td>
<td>Volunteer Coordinator, Blue Hills Trail Watch</td>
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<td>Ranger, Lynn Woods</td>
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<td>Elizabeth Wright</td>
<td>New England Wildflower Association</td>
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Visitor Interviews
We prepared a list of 16 questions and randomly interviewed individuals while they were visiting the park. A previous survey had been conducted in 2004 by The Friends. It was distributed to 1,703 members and other affiliates of The Friends, and received 509 responses. The aim of our informal survey was to collect additional anecdotal information about how visitors currently perceive some of the issues facing the Fells. We completed 22 interviews in March, 2006. A copy of the interview questions can be found in Appendix C.

Analysis
Our information gathering was important for informing our critical path analysis, which helped us develop a framework for prioritizing issues and distinguishing between urgent and more long term goals for The Friends to frame their advocacy.
The Middlesex Fells Reservation’s Historical Importance:

- Created in 1894 by the newly formed Metropolitan Park Commission (MPC)
- Virginia Wood, a 20-acre parcel, was the first land trust donation, given to the Trustees of Reservations, the world’s first private land trust organization
- The MPC was the first regional metropolitan park system in the United States
- The Fells was home to a thriving ice industry on Spot Pond in the mid-19th century, even exporting ice internationally
- Charles Goodyear developed his innovative rubber vulcanization process in the area later to become part of the Middlesex Fells Reservation
- In 1992, the Spot Pond Archeological District, including Virginia Wood, was added to the National Register of Historic Places

The Middlesex Fells: The Case for a Resource Management & Maintenance Plan

IV. Background

Overview

For over a century, Massachusetts has been at the forefront in the creation of public parks and recreational facilities. The Middlesex Fells Reservation occupies a distinguished—though not widely known—place in that history. This section provides a brief discussion of the history of the Fells as it relates to current efforts by the DCR to create a “world-class” parks system. The role of the newly formed Stewardship Council is discussed, along with an overview of the RMP process currently underway at the state level. It concludes with the goals of this project to inform future management and planning endeavors for the Fells.

Historical Importance of the Fells

In the late nineteenth century, public support grew for park preservation in the Boston region. Vocal residents lobbied the state legislature to set aside open space that would offer urban dwellers respite from the noises, smells, and overcrowding in city centers. Charles Eliot, a landscape architect and apprentice to Frederick Law Olmstead, championed the concept of a regionally connected network of parks. In 1891, the state created the Trustees of Reservations to act as the nation’s first land trust organization. The first gift of land made to the Trustees was a 20-acre parcel next to Spot Pond in Stoneham called Virginia Wood. In 1893, the state passed more groundbreaking legislation to create the Metropolitan Park Commission (MPC). This was the country’s first regionally coordinated metropolitan park management organization (Ryan, 2002).

As one of its first acts, in 1894 the MPC annexed...
land to create the Middlesex Fells Reservation. That same year, the legislature authorized the construction of the parkway system that would connect reservations around the Boston region to allow easy access and leisurely travel (Ryan, 2002).

The newly created regional park system around Boston served as a model for other cities across the United States and Europe. On a philosophical and governmental level, the early supporters and designers of the Boston park system led a worldwide movement to preserve open space for current and future generations. On a practical level, they created accessible spaces for everyday citizens to enjoy away from the dense urban core. Over the past century, the Middlesex Fells Reservation has provided residents of the Boston area a large open space for recreation and relaxation, with abundant natural and cultural features of interest. It has also become an oasis of habitat for wildlife in an increasingly urban region. The Fells lies within the densely developed Mystic River watershed, which is home to 400,000 people. The watershed contains eight percent of the state’s population on only one percent of its land (Mystic River Watershed Association). Because of its important history, as well as its geographical placement in a densely populated area, the Middlesex Fells represents an extremely valuable natural and cultural resource.

The DCR Stewardship Council and the Campaign for a World-Class Parks System

Despite the pioneering development of Boston’s urban park system, by the late 20th century, Massachusetts parks increasingly suffered from a lack of clear resource management policy and scant operating expenses to cover day to day management (Green Ribbon Commission, 1996). In 2003, at the creation of the DCR, Governor Mitt Romney stated a renewed intention to create a “world-class parks system,” founded upon a “world-class management system” (Department of Conservation and Recreation 2005, A). To help achieve that vision, the state legislature mandated the creation of a thirteen-member citizen advisory group called the Stewardship Council to oversee the Department and lend the DCR transparency and accountability with the public. The Stewardship Council is responsible for creating “an oversight strategy of park management plans, capital planning, and policy development” (Massachusetts General Laws, ch. 21, section 2G).

Resource Management Plans “shall include guidelines for operations and land stewardship, shall provide for the protection of natural and cultural resources, and shall ensure consistency between recreation, resource protection, and sustainable forest management.” - MGL ch. 21, section 2F

Although the Stewardship Council has broad policy and budget-setting authority over DCR, its specific legal and functional powers continue to be developed (Julian Agyeman, Thomas Dugan, personal communication, April 12, 2006). In its October 2005 Oversight Strategy statement, the Council enumerated the three elements propelling its activities:

- Overseeing the transformation of the DCR organization into a high performance model for park and conservation agencies in other states.
- Overseeing DCR’s meaningful progress toward the delivery of one, and then more, world class parks in the Commonwealth.
- Establishing widespread public support for DCR and for the resources it manages.

However, the state has not clearly defined what is meant by “world-class parks,” nor has it articulated a timeline for achieving that goal. It will be difficult to assess the Stewardship Council’s progress without such targets. Even without a clear definition, the DCR may find it
difficult to make meaningful progress because it faces continued budget cuts. The Environmental League of Massachusetts (ELM) reported that, “as of 2000 Massachusetts ranked 44th out of 50 states in environmental spending per capita, and 48th as a proportion of the total budget” (ELM, 2005). The ELM also reported that the DCR budget had been cut by 43% between 2001 and 2004, making it difficult—if not impossible—to carry out its mission of stewardship for Massachusetts’s public land. The DCR has been working to develop alternative funding sources through its Office of Public/Private Partnerships to supplement state appropriations.

**DCR’s Resource Management Planning Process**

In order to fulfill its legislative mandate and its stated agenda, one of the Stewardship Council’s major initiatives is to develop a Resource Management Planning (RMP) process that will guide park management across the state. The purpose of this process is to create a framework for managing public lands based upon a comprehensive inventory and assessment of environmental and recreational resources, an identification of the unique characteristics of a property or management unit, the development of clear management goals and objectives, and an implementation plan to guide the short and long-term management of the parks, forests and reservations under the stewardship of the Massachusetts Department of Conservation and Recreation (DCR Resource Management Planning Website).

The first stage of the RMP process is the creation of baseline management plans (“baseline RMPs”) for each of DCR’s approximately 225 properties across the Commonwealth. Baseline RMPs are meant to provide working management plans that the DCR can execute. They will inventory existing resources, describe current conditions, lay out management goals, and offer suggested priorities for implementation, given resource limitations. The public will have a chance to comment on each draft RMP before DCR finalizes the plan and responds to comments. The baseline RMPs will follow a standardized, streamlined format that will allow managers to allocate funds and address operational issues based on the priorities set forth.

**Elements of an RMP Baseline:**

1. Executive Summary
   - Priority findings (including short and long-term implementation)
   - Brief description of planning process

2. Property Basics
   - Overview of unique characteristics of property or facility
   - Purpose or mission statement
   - Management goals and objectives

3. Property Description and Uses
   - Environmental resources and assessment
   - Recreational uses and assessment
   - Management resources and assessment

4. Management and Implementation Plan
   - Land stewardship zoning
   - Special management considerations
   - Monitoring and evaluation

5. Business Plan
   - Staffing
   - Operational costs
   - Capital costs
   - Partners

**Appendices**

(DCR, 2005, C)

Once the RMPs are completed, they will be submitted to the Stewardship Council for adoption. After they have been adopted, the Commissioner is responsible for implementing the
plans, according to M.G.L. Chapter 21, Section 2F. It remains unclear what kind of legal “teeth” baseline RMPs will have with regard to their implementation. Heidi Ricci of the Massachusetts Audubon Society, who helped to draft the RMP legislation, believes that once adopted by the Stewardship Council, RMPs will have some legal power. For instance, citizens could potentially take legal action if DCR acts counter to its plans (personal communication, March 23, 2006).

The proposed schedule for the RMP process calls for all plans to be completed by 2008 (DCR, 2005d). To date, one management plan (not a baseline RMP) has been adopted by the Stewardship Council. Two pilot RMPs are underway to test the baseline RMP process and methodology, but the majority of the baseline plans have not commenced. Timelines for the two pilot RMPs suggest that creating a baseline RMP could take from two to twelve months. And while the Stewardship Council originally proposed that the state should provide funds to hire seven internal planners to undertake the baseline RMPs, the state has since decided to hire private planning firms instead (Julian Agyeman, personal communication, April 29, 2006). The DCR has not yet publicized any criteria it will use to prioritize RMPs, so it is unclear exactly when the baseline RMP for the Fells will be completed.

**Difference Between RMPs and Master Plans**

The DCR’s RMP process is designed to follow a streamlined process to address immediate needs and resource constraints. Baseline RMPs, while providing a basic working management plan, are different from master plans. Master plans focus more on facility design and program improvement, although they also contain many of the same elements covered by resource management plans. In essence, both baseline RMPs and master plans contain assessments of current conditions and make management recommendations, but a master plan extends the discussion to cover design and facility planning.

**Goals of this Report**

The Friends of the Middlesex Fells Reservation advocate for the creation of a master plan for the Fells that will guide not only day to day management, but also lay out long term goals and provide implementation strategies to reach those objectives. The DCR’s RMP process aims to lay a foundation for management planning, although it does not promise to create exhaustively detailed plans for each park, nor will it focus on design recommendations. The goal of this report is to provide information and recommendations that can inform both the baseline RMP and a potential master plan. The report also offers recommendations to address priority issues in the Fells through multi-stakeholder collaboration, both because such cooperation can encourage public-private funding initiatives and because it can enhance community participation.
V. Existing Conditions and Analysis

Natural Resources

Overview
Natural resource management in the Middlesex Fells Reservation began as an effort to preserve open space as an amenity for Boston residents. Resource management in the Fells occurred in two periods. The first included surveys, species inventories, and forest designs undertaken by Olmsted, Olmsted and Eliot shortly after the Fells was created (Eliot, 1898). Dams and infrastructure were added to increase reservoir capacity. The next major management actions occurred in the 1930s, when red pines and hemlocks were planted and trees were cleared from the areas surrounding the Winchester reservoirs in an effort to preserve drinking water quality for area residents (Ryan, 2002). Few resources were devoted to natural resource management of the forested areas in the latter half of the twentieth century. The result is an area that preserves the wild quality early Fells advocates worked to protect. Currently, the Friends of the Fells continue to promote the work of early champions by advocating for the protection of natural resources found in the reservation.

Ecologically sustainable resource management relies on the conservation of biological diversity at the genetic, species, landscape, and ecosystem levels (Lindenmayer et al., 2000). To ensure the future integrity of natural resources in the Fells, a detailed resource inventory and management plan must be developed. This overview of natural resources is intended to serve as a baseline source to inform short-term management priorities. It is not intended to be used as an end product, but rather a starting point for future research and comprehensive management plans.

Open Space

The area known as The Sheepfold is the largest contiguous open space in the Fells Reservation. It is an open hillside that slopes downhill toward the Middle Reservoir, and is primarily covered by short, mowed grasses. The Sheepfold is bordered by predominantly oak-hickory forest and could provide important edge habitat for wildlife species in the Fells. It is adjacent to a parking lot, and is therefore subject to high human use. Due to high numbers of dogs off leashes, grasses closest to the parking lot have been killed, resulting in patches of bare earth. Over time, these patches will continue to widen, leading to hillside erosion during heavy rains or wet seasons. The concentration of dogs in the area leads to widespread feces left on the hillside. Over time, this concentration of waste may lead to increased nitrogen loads in the soil, which drains toward the Middle Reservoir. In addition to posing a threat to soil and water quality, the high concentration of feces in the area poses human and wildlife health risks.

An open field exists to the southeast of the Sheepfold parking lot. This field is unmowed and is less frequented by humans and pets than
The Sheepfold area. As a result, the area provides important habitat for wildlife species. Small mammals such as vole and skunk proliferate in this area. Their presence attracts raptors including hawks and owls as well as predators such as fox (Brown, 1999). A small unmowed clearing on the summit of Bear Hill provides similar habitat, though the area is subject to more frequent human use, which may impact the prevalence of small mammals.

Greenwood Park includes a playground and playing field directly across the street from the Stoneham Zoo. This area is preserved predominantly for human use, but may provide an important buffer for terrestrial wildlife in the bordering forest.

The open space over the MWRA covered reservoir is fenced in, and has not been examined for evidence of wildlife.

Vegetation

The first vegetation study in the Fells was published by Walter Deane in 1896. Deane and his associates developed a list of plants as well as a vegetation map, which provides insight for comparative vegetation studies in the Fells.

In 1996, Brian Drayton published a vegetation study to mark the centennial of the Fells. Though some areas west of I-93 overlap, the Drayton Study does not include areas east of I-93. Friends of the Fells member Bryan Hamlin and Betty Wright of the New England Wildflower Association are conducting a more comprehensive survey of current vegetation found in the Fells (Hamlin, personal communication, March, 2006).

Trees

The Fells contain three major categories of tree cover species composition. They include predominantly deciduous, predominantly coniferous, and mixed composition. Mature deciduous tree cover includes oak-hickory forests that also contain maple, ash, beech and birch. Coniferous cover includes red and white pine, pitch pine on high elevations, fir, spruce, and hemlocks. Mixed composition areas occur in transition areas where fire, planting or forest succession has taken or is taking place.

Since the planting of red pines near the Winchester reservoirs in the 1930s, little forest management has occurred in the Fells. The result is that trees in many areas are of uniform age and size. This is particularly true in coniferous stands. While the current conditions provide

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<th>Trees in the Fells: Management Priorities</th>
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<tr>
<td><strong>Species Health</strong></td>
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<tr>
<td>• Inspect hemlocks for wooly adelgid damage</td>
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<tr>
<td>• Survey oaks to determine areas at risk for gypsy moth damage</td>
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<tr>
<td><strong>Forest composition preservation</strong></td>
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<tr>
<td>• Assess coniferous stands for age variation and concentration of viable saplings in understory</td>
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important canopy habitat, they may restrict seedling growth. Should these areas be struck by fire, disease, or storm damage, other tree species may proliferate. The result would be a change in forest composition and a loss of biodiversity if the coniferous stands were to disappear. A Fells management plan should identify coniferous stands of uniform age, such as the red pine plantings, and outline a course of action to replant coniferous stands in the event of a natural disaster.

Hemlocks
One of the valuable assets of the Fells is the presence of mature eastern hemlock stands. Such stands exist in Virginia Wood as well as in the vicinity of Long Pond. Eastern hemlocks are currently threatened by a variety of factors, the most dangerous of which is the Adelges tsugae, the wooly adelgid. The wooly adelgid is an Asian insect that feeds exclusively on hemlocks. First recorded in 1951, it has spread throughout the eastern U.S. causing widespread species loss (Evens). While some measures have been taken to mitigate the impacts of the wooly adelgid, few solutions have been found.

A resource management plan must include a detailed inventory of the current health of hemlock stands and the prevalence of saplings growing in the Fells to evaluate resiliency. Planting hemlock saplings in a protected area and transplanting them to current stands may help protect current stands until lasting adelgid protection is in place.

Deciduous Species
Deciduous species comprise the bulk of tree cover in the Fells. Over time, the forest has progressed through stages of succession. The open spaces that characterized the Fells in its early history have given way to mature species, dominated by red oak. As red oaks mature, they spread their canopy and out-compete other hardwood species such as hickory and ash (Yahner, 2000). While this process is a natural part of forest succession, a forest management plan should include any intentions to thin red oak stands to allow other hardwood species to compete in the Fells. A resource management plan must include a monitoring strategy to track pest damage in deciduous species. The European gypsy moth was introduced to North America in 1869, when it escaped from the silk industry in Medford, Massachusetts. The moth caterpillar feeds on deciduous tree leaves, causing defoliation, reduced growth rates, and tree mortality.
Infestations of the gypsy moth present a serious concern for broadleaf trees in the Fells, and are of particular concern for oak trees. As a major food source for terrestrial wildlife and nesting habitat for bird species, the health of oaks in the Fells is critical to maintaining the overall health of the ecosystem. Losses of acorn productivity leads to food shortages and reduced leaf cover increases predation of bird nests (Yahner, 2000).

Since oak trees are most impacted by gypsy moth damage when they are already under stress, Fells managers should monitor oak trees for the impacts of drought and disease to predict the potential degree of future gypsy moth infestations. Symptoms of stress in oak trees should be treated where possible to mitigate the impacts of gypsy moth damage.

Other threats to deciduous species include beech bark disease, shoestring root rot, dogwood anthracnose (caused by a fungus) and animal browsing. White-tailed deer pose a particular threat to forest regeneration since their population is increasing and they target saplings as a major source of food. Soil erosion, especially on heavily used trails exposes tree roots and renders them vulnerable to damage and disease.

To ensure the long-term health of the trees in the Fells a management plan must include a more specific inventory of important tree stands and their spatial relationship to determine the presence and potential of spreading disease and pest species.

Vegetation: Groundcover

The Fells includes a wide variety and dispersion of plant species. While some areas in the Fells are likely to have specific species, many species are located in small patches distributed throughout the reservation. One reason for this phenomenon is the acidity and concentration of calcium in the soil (Hamlin and Wright, 2006).

The decentralized pattern makes protection of important groundcover species difficult, rendering management practices site-specific. Despite the challenges in preserving groundcover biodiversity in the Fells, efforts can be made to increase public awareness about sensitive species, and management techniques such as restricting use in areas where sensitive species are found may help preserve groundcover plants in the Fells.

Invasive Species

Introduced plant species are becoming more prevalent in the Fells. According to Bryan Hamlin and Betty Wright, as many as 15% of the plants found in the Fells are invasive species. As development encroaches on Fells borders and...
more people use the area, non-native plant species spread from the edges of the Fells toward the interior. Though not all introduced species are harmful, some species out-compete native plants, disrupting the natural Fells ecosystem and limiting the degree of plant species diversity. Such patterns may negatively impact insect and animal populations by causing imbalances to which native species may not immediately or effectively adapt. A preliminary list of invasive species identified in the Fells is provided in Appendix B.

Two observed invasives present in the Fells may require immediate attention. David Brown noted purple loosestrife around Doleful Pond during the course of his tracking survey (Brown, 1999). Betty Wright noted that garlic mustard is choking out columbine on Bear Hill (Wright, 2006). The status of these species should be evaluated soon, and appropriate measures should be taken to mitigate the situation. The Fells resource management plan must include a strategy for prioritizing and dealing with harmful invasive plant species.

Wildlife

Land Use and Wildlife in the Fells
The diversity and concentration of wildlife species in the Fells provides insight into the overall health of the Fells ecosystem as well as the health of the regional ecosystem. As an urban forest, the Fells provides a critical resource for preserving biodiversity in the Boston metro area. Wildlife management goals should be set with an understanding of the role of the Fells in the regional ecosystem. Broad goals include the preservation of undisturbed interior areas in the Fells and an assessment of the permeability of the Fells for wildlife species movement. Landscape permeability promotes healthy wildlife populations by ensuring genetic diversity within species and facilitating a wider range of wildlife species (Foreman, 2004).

Land use within and surrounding the Fells determines the degree to which the Fells is connected with other habitat areas. As an urban reservation, the Fells is primarily surrounded by residential areas. Industrial and commercial zones border the northern and southern edges of the reservation. The hospital site on the border of the Virginia Wood creates an island of human development within the Fells. Route 93 bisects the reservation, and several paved roads cross the eastern half of the Fells (MassGIS, 2006). Heavy human development encroaches on wildlife habitat, but does not preclude a wide range of animal life in the Fells. To better understand the importance of the Fells in the regional ecosystem and to promote continued conservation of the area, a management plan should include a long-term assessment of wildlife corridors that should be preserved for regional connectivity. Potential known corridors of wildlife travel include the edges along Route 93 and routes connecting the Lynn Woods to the Fells (Brown, 1999, 13).
V. Existing Conditions and Analysis

Trails and fire roads impact the presence and dispersion of animals in the Fells (Brown, 1999). While 11 sanctioned single track trails exist in the Fells, the actual number of trails exceeds that number due to the prevalence of redundant trails (Middlesex Fells Reservation Trail Map, 2002). Confusion over inadequate trail markings and a lack of enforcement have led to the creation of redundant trails that reduce contiguous areas of uninterrupted wildlife habitat in the Fells. Redundant trails may reduce kinds and numbers of species present in the Fells by disturbing sensitive species. Areas where trails and fire roads are less prevalent may provide valuable habitat that can support larger animal species, such as whitetail deer (Brown, 1999).

To provide adequate wildlife habitat in the Fells, a management plan should prioritize areas that reflect minimum human use and attempt to preserve them from redundant trail creation. These zones could include the area east of Grinding Rock Hill, Deer Hill, the peninsula in the northwest corner of Spot Pond, and restricted areas surrounding the Winchester reservoirs. Next, redundant trails should be identified, mapped, and barriers should be introduced to maximize the available areas for undisturbed wildlife habitat. Barriers may include but are not limited to, signage denoting restoration areas, seedling plantings, and boulders blocking redundant trails.

**Predator Species**

In 1998 and 1999 David Brown conducted a wildlife survey of the area, providing important insights into habitat and animal species found in the Fells. The presence of predator species provides a metric by which to measure the health of an ecosystem. Since they rely on other animals and ecological systems, analyzing their health will help wildlife managers assess the status of plants and prey species (Foreman, 2004). Key predator species in the Fells include eastern coyotes, fishers, hawks, and owls (Brown, 1999).

Fishers in particular have been noted as a wilderness quality indicator species, since they prefer large tracts of coniferous forest and are sensitive to human encroachment on their habitat (Foreman, 2004, Audubon, 1998). The presence of fishers in the Fells should be monitored as a means of assessing habitat suitability for species more commonly found in rural settings. Preservation of coniferous stands in the Fells will maintain important fisher habitat.
V. Existing Conditions and Analysis

Eastern coyotes have been frequently noted in the Fells. Examination of their scat reveals the presence of species not observed in Brown’s tracking survey, most notably the cottontail rabbit. Cottontails are easily disturbed, and the presence of humans and domestic dogs in the Fells may account for low population density (Audubon, 1998). They are an important prey species for both coyotes and hawks, and would benefit from a management plan that establishes areas restricted from human use.

*The presence of predator species provides a metric by which to measure the health of an ecosystem.*

Common species missing from the Fells
Porcupines and red squirrels are usually found in this region and were notably absent from the Fells. Brown notes surrounding development and a scarcity of wildlife corridors connecting the Fells to other areas as potential causes for the absence of these species (Brown, 1999).

Bobcats, which are becoming more numerous in New England, are also missing from the Fells. The relative isolation of the Fells as well as the prevalence of domestic dogs may account for their absence.
V. Existing Conditions and Analysis

Soil and Geology

The Middlesex Fells Reservation is home to various geological phenomena that are certainly unique to the area. Geologist Ed Myskowski describes the Fells as a place that was “set aside to give people inspiration.” Knowing this, the Friends of the Middlesex Fells hold programs several times a year to explore the geologic features of the reservation. Myskowski has been leading walks in the Fells for fifteen years, and has guided as many as forty people at a time on the journey (Ed Myskowski, personal communication, April, 2006).

The name of the reservation is derived directly from the rocky characteristics of the land, as the word “Fells” is an English term for rocky, windblown hills. The landscape is comprised mostly of sedimentary rock, formed from compressed ocean sediments millions of years old, and the molten rock that flowed over it, known as igneous rock. Igneous rock in this region can be described in several ways. Felsites are a dense, fine-grained composite of quartz and feldspar, while sections of granites and diorites also exist, as well as the combination of the two, known as granodiorites (Middlesex Fells Reservation Trail Map, 2002).

The Cascades at Shilly Shally Brook represents one of the most beautiful and popular geological feature in the Fells, as water drops over 200 feet in a series of picturesque falls. Many people visit the Cascades to take photographs and the area will soon be more accessible thanks to the addition of stone steps. Throughout the Fells, visitors can see the glacial striations in the exposed bedrock caused by the advance and retreat of the glaciers thousands of years ago. This movement and the melting of the ice left a layer of glacial till which serves as a layer of substrate in the Fells (Ed Myskowski, personal communication, April, 2006).

The thin soil cover in the Fells is acidic, characteristic of the mineral layer beneath. This has a distinct effect on the types of plants that can be found in the Fells, as well as the amount of erosion that occurs in well-traveled areas. A site-specific erosion study is therefore essential before any decisions in trail management take place.
V. Existing Conditions and Analysis

Water Resources

The Fells contains a wide variety of water resources, from the scenic 340 acre Spot Pond and Spot Pond Brook, which are the principal aquatic features in the Spot Pond Archaeological District, to the Shilly Shally Brook, Dark Hollow Pond, Long Pond, Quarter Mile Pond, Bellevue Pond, Doleful Pond, Wright’s Pond, and Shiner and Hemlock pools. In addition, three reservoirs supply water to the town of Winchester. All of these resources perform a wide variety of functions for wildlife and humans.

For instance, vernal pools are small, temporary wetlands that are abundant throughout the New England landscape, most holding water only during the spring months. Some amphibian species have evolved to take advantage of these areas, such as the spotted salamander, wood frog, and fairy shrimp, all of which are present in the Fells. The Friends annually tracks the activities of spotted salamanders in the Fells as they make their annual visit to the reservation’s numerous vernal pools.

Spot Pond serves as a backup reservoir to the Quabbin for the Massachusetts Water Resource Authority (MWRA), holding 1.8 billion gallons. A second covered reservoir for MWRA use exists in the southeast portion of the reservation. Three large reservoirs to the west of Route 93 serve as water supply for the town of Winchester. The Winchester Water Department is authorized to withdraw 1.06 million gallons a day from these sources, while the Winchester Country Club is allowed to consume 160,000 gallons a day for 180 days of the calendar year (Massachusetts Watershed Initiative, 2005, 3-3). The areas surrounding these important reservoirs are restricted to the public, however, several fenced in access points have been breached, resulting in illegal hiking and biking, as well as dogs swimming in the reservoirs. This represents a potentially serious public safety issue on several levels.

The Middlesex Fells lies within the Mystic River watershed, which is a collection of streams, lakes, and ponds that drain a 76 square mile area north of Boston. The reservation is mostly located within the Aberjona, Malden, and Mystic River 1 subwatersheds, thus one may suspect it to be privy to the same problems that plague these areas. This is not entirely the case; perhaps due to its relative seclusion, no body of water located in the Fells is listed as “impaired” on the state list for non-compliance with 314 CMR 4.00 guidelines (Massachusetts Watershed Initiative, 2005, 4-2). However, there is a concern over the aquatic weeds in Bellevue Pond, a phenomenon which can be traced back to extremely high test levels of nitrogen and phosphorus in the subwatershed (Massachusetts Watershed Initiative, 2005, 4-17). This problem is pervasive throughout developed areas of Massachusetts, and can be attributed to a number of human causes.

Erosion

The thin, rocky trail structure makes erosion a concern for the Middlesex Fells. Park visitors have moderate to high impact on the trail system. Users have long strayed off marked trails in the Fells without enforcement, resulting in a series of disorganized, redundant trails. Visitor use of redundant trails impacts plant life and wildlife. Mountain bike and all-terrain vehicle use on trails that aren’t designed to support the activity and during the off-season (January 1st to April 15th)
V. Existing Conditions and Analysis

has led to unchecked erosion and trail widening that has become a major cause of conflict in the reservation.

Currently, mountain biking is allowed on 25 miles of fire roads in the Fells and a 6.5 mile “mountain bike loop” which includes a mile of narrow, single-track trails. The loop was originally implemented as a pilot program to be reviewed after one year but it has never been reconsidered. Some users of the Fells feel the trail system is unable to support mountain biking, while others consider it a model park for the activity and disagree with what they feel is a restrictive policy. Regardless of opinion and conjecture, it is impossible to manage erosion impacts from any activity without adequate attention to detail, education of the public, and empowered enforcement of regulation, as many users of the Fells are unaware or indifferent to mountain bike regulations and are unchecked in their exploration of hiker-only trails.

Hundreds of pages of literature have been devoted to the study of trail erosion and the impacts of mountain biking. Lathrop (2002) and Vandeman (2004) cite impacts such as plant trampling, damage to exposed roots, wildlife disturbance, and erosion due to the manner in which many users ride their bikes. In addition, they introduce the idea that bikes traverse more ground than hikers and thus contribute more to erosion. To the contrary, Gary Sprung cites studies that conclude bicycling creates no more erosion than hiking. While various US and international bike use impact studies represent different conclusions, what is of paramount importance would be an on the ground trail impact study of conditions within the Middlesex Fells Reservation itself.

Lathrop proposes that “managers can limit unplanned compaction and vegetation damage by appropriately planning and building the trail in the first place.” In similar fashion, Sprung writes “trail design, construction, and maintenance are important factors in controlling erosion.” The trails in the Fells are long established, but this does not mean planning and maintenance should be discounted. Sprung notes “managers need scientific studies that compare the impacts of the various user groups.” This is a must in the Fells. Using the results of a site-specific erosion study, groups like the Friends of the Fells and the New England Mountain Bike Association can perform appropriate maintenance procedures on hiking trails and trails that are available to bicycles to ensure the stability of the trail system.

The 2002 Bureau of Land Management (BLM) Mountain Biking Strategic Action Plan considers mountain bicycling “an acceptable use of public lands wherever it is compatible with established resource management objectives” (Bureau of Land Management, 2002, 2). A thorough review of the Fells situation would include establishment of monitoring criteria, indicators, standards, and threshold levels to determine if biking is compatible. This would include analysis of a Fells wide natural resources inventory to factor in use recommendations for areas of greater environmental sensitivity. The BLM also suggests that a combination of education and training proves easier than regulation, and cooperation amongst Fells stewardship groups will be essential to inform the user base. Until steps are taken to address the current policy and build a new one based on sound science that can be enforced, the Fells will continue to suffer from the effects of erosion.
Fire

Brush fires have become a serious issue in the Fells. While fire is a natural function in the forest ecosystem, years of fire suppression efforts have left the area vulnerable to dry forest conditions and thick ground cover. These conditions render the Fells vulnerable to significant fire spread and damage if brush fires are not controlled immediately. Fires can create clearings in the forest that act as edge habitat for wildlife and in the long-term restore nutrients to soils. Fires also scorch soil, killing important organisms and root systems essential to forest health. Some tree species, such as Hemlock seedlings, are easily destroyed by fire (Yahner, 2000). Almost all fires in the Fells are caused by humans, many of which are deliberately set.

Firefighting responsibilities in the Fells are divided between DCR fire crews and town fire departments. While DCR maintains staff and equipment, the bulk of fire suppression efforts rest on local fire chiefs, who also serve as forest wardens (MGL Sec. 13, Ch. 48, Sec. 43). Town fire departments receive limited funding from the state to prevent and extinguish forest fires. Towns may receive up to $500 from the state for prevention efforts such as building water holes, clearing protective zones, and purchasing firefighting equipment. Towns may receive up to $100 from the state to replace fire prevention equipment (MGL Sec. 13, Ch. 40, Sec. 11). In cases where fires spread outside of the control of the fire warden, the commonwealth assumes half of the expenses associated with extinguishing the fire (MGL Sec. 13, Ch. 48, Sec. 24).

Monitoring and enforcing fire policies in the Fells is difficult, at best. Open fires are prohibited in the Fells, and fire wardens and foresters may arrest anyone found lighting fires without warrant (MGL Sec. 13, Ch. 48, Sec. 15). Even if adequate funding were provided from both the state and municipal governments, it would be impossible to monitor the entire area. Therefore powers of arrest are difficult to use in enforcement. Public education efforts may help to increase fire prevention awareness and help neighbors and visitors to the Fells reduce the frequency of fires.
Managing Recreational Use in the Fells

Overview
This section reviews current recreational uses and the major visitor management challenges in the Fells. It discusses mountain biking and dog walking issues in particular. Next, we highlight several current and potential future public education programs that support enhanced visitor experiences. The section concludes with an analysis of recreational management priorities.

Current Recreational Uses
The Middlesex Fells Reservation offers visitors a multitude of recreational activities, including walking, hiking, jogging, rock climbing, mountain biking, boating, fishing, horseback riding, cross-country skiing, picnicking, dog walking, and study of natural and cultural features. Several community groups, including the Friends of the Fells, Sierra Club, the Appalachian Mountain Club (AMC), and the New England Mountain Biking Association (NEMBA) also offer organized recreational and educational activities within the Fells.

Many visitors also enjoy other uses of the Fells. Those responding to a 2004 survey conducted by The Friends of the Fells reported the following activities in addition to the ones noted above: enjoying solitude, visiting observation towers, photography, berry picking, snowshoeing, geological study, observing butterflies, playing ball or frisbee, birding, orienteering, and searching for mushrooms (Friends of the Fells, 2004). A large number of visitors bring their dogs to the Sheepfold area west of I-93 to socialize and play in the field off-leash. This is a popular, although unsanctioned, use.

There are several stakeholder groups who use the Fells. Organized groups include the Friends of the Fells, Sierra Club, AMC, NEMBA, Rage On Boston, and Massachusetts Audubon Society.

Stakeholder groups that may have similar interests but who are not organized as groups include dog walkers and tot lot users (parents with small children).

Mountain Biking
Management of mountain biking in the Fells has been plagued by a lack of enforcement of reservation policies. There are also differences in ideology of the major user groups. However, it is clear that the resource of the Fells stands as the principal concern, and ideology must be put aside when examining methods to preserve the resource and foster positive user experiences. Therefore, this section will consider a variety of approaches to managing mountain biking.

The Friends of the Middlesex Fells represents a wide variety of users of the reservation and supports participation in an educational program for all users, with preferably mandatory participation for all bikers, who would also have to acquire annual permits to use the resource. DCR Urban Parks Director Pat Flynn is a strong supporter of a licensing program. The education and licensing initiative would consist of viewing a video of accepted practices in the Fells, taking a simple test based on the reading of a brochure, a signed agreement to follow policy, fixing of...
V. Existing Conditions and Analysis

A permit decal on the bike at time of issuance, and agreement to allow confiscation of the bicycle if found in violation of Fells policy. An accompanying measure to this approach would be the improvement of trail signage.

The Friends would be happy to lend support and even initiate many of these educational measures, but their success is clearly contingent on enforcement of existing regulations. Other approaches, absent appropriate effective enforcement, include a thorough review and rerouting of the bicycle loop to exist only on fire roads, closure of the Fells to bicycles in all areas east of Route 93, or a total closure of the Fells to biking. The latter two measures reflect an anticipated problem in securing the appropriate enforcement, and the Friends cite several examples where park managers chose to close off the resource to bikers in their 2004 report “Managing Visitor and Other Impacts in the Middlesex Fells Reservation.” Additional recommendations on user issues in the reservation are available in this document.

At the present time, absent appropriate and effective enforcement of existing regulations and an analysis of actual trail conditions in the Fells, the Friends of the Fells opposes various proposals for expansion of mountain bike use in the Fells which have been put forward by the New England Mountain Bike Association (NEMBA).

DCR Urban Parks Director Pat Flynn is a strong advocate for a Trail Watch approach to management of the reservation, and he lauds the merits of the program in the Blue Hills Reservation (Pat Flynn, personal communication, April 14, 2006). This approach would stress the need for collaboration between groups like NEMBA and the Friends, and would have to be rooted in the fundamental areas of science, cooperation, education, and enforcement. The Friends believe the acreage, level of use, and terrain of the Fells make this a difficult measure to implement, and cannot support any proposal that has not been subjected to strict analysis. “We are ready to subject this to the most rigorous of scientific questioning,” says Friends Executive Director, Mike Ryan (personal communication, April 13, 2006).

Dog Walking
The two primary concerns pertaining to dog walking in the Fells are the off-leash culture that has evolved among dog owners who visit the reservation, along with an increasing number of professional dog walkers that visit the park, often with as many as 12 dogs at a time.

A lack of enforcement of the leash policy and a failure to limit the number of dogs an individual can enter the reservation with, raise safety concerns for not only other users of the reservation, but for the dogs as well. Given the “dog park” culture that has arisen in certain areas, such as Sheepfold, a fenced in, off-leash area might be one way to meet user expectations while also ensuring that the area is safe for all users. The increase in instances of dogs swimming in the reservation’s reservoirs has arisen from the lack of enforcement of the Fells leash policy, as well.
Management Challenges
The Middlesex Fells is a popular destination for residents of surrounding cities and towns. Its very popularity, however, is creating pressure on the resources it contains. There is a lack of statistics on visitor patterns and uses, in part because the reservation’s design allows visitors to enter at many different points, making it difficult to assess recreational patterns. However, as a general comparison, Massachusetts’ state forests and parks saw a 34% increase in visitorship between 1989 and 2002 (Forests and Parks Partnership, 2002). South Region Supervisory Ranger Maggi Brown, who oversees the visitor management of the Blue Hills Reservation south of Boston, believes that use is increasing there as well (personal communication, March 14, 2006). These trends match anecdotal evidence we collected during our visitor interviews: five of the 22 Fells visitors we spoke with declared that one of the changes they had noticed over the time they had been visiting was an increase in the number of people using the reservation. Even without statistical evidence, there seems to be a perception among managers and some users that overall use is increasing.

Visitors create impacts on the natural resources within the Fells, including trail widening and erosion from high use, creation of redundant or “social” trails, litter, graffiti, pollution or spread of disease from uncollected dog feces, and damage to flora and fauna. The extent of these impacts varies from point to point within the Fells. Visitors also have impacts on other users, either due to direct verbal or physical conflicts or effects on others’ expectations or enjoyment. Typical concerns of Fells users stemming directly from other users’ actions include dogs off leash, litter, graffiti, vandalism, off-trail or off-season mountain biking, inappropriate sexual behavior, and general safety worries (Friends of the Fells, 2004).

Existing Recreational Management
Currently, there is one full-time year-round DCR Ranger responsible for patrolling the Fells to enforce state policies and oversee reservation maintenance. Additional seasonal rangers work during the summer months. Community groups including the Friends of the Fells, the Appalachian Mountain Club (AMC), and the New England Mountain Biking Association (NEMBA), organize trail maintenance days and litter clean-ups. The Friends of the Fells also coordinates the Trail Adopter program, part of an initiative funded by the DCR in 2005. Under this program, volunteers take on a specific length of single track trail and ensure that it is properly marked and maintained. Trail adopters typically spend three or four days per year working on their portion of the trail, ensuring that brush is cleared, soil is stabilized, litter is removed, and sufficient signage is in place (Friends of the Fells, Fells Activities web page). This cooperative program exemplifies the kind of public-private partnerships that can involve private groups, community members, and the DCR in enhancing the reservation. The 2005 grant from the DCR provided funds not only for trail

Middlesex Fells Trail Adopter Program
The Trail Adopter program, a model from the Appalachian Mountain Club, is organized by Friends of the Fells Volunteer Coordinator Mike Arnott. Funded in part by a grant from the DCR, trail crew volunteers “adopt” a section of trail where they are responsible for:

- clearing brush
- stabilizing trail soil
- removing litter
- ensuring that proper trail signage is visible
- improving drainage near waterways

This program exemplifies the kind of public/private partnerships that can involve private groups, community members, and the DCR in enhancing the reservation.
restoration equipment, but also for the creation of a seasonal Visitor Services Supervisor position (Mike Ryan, personal communication, April 5, 2006).

Public Education, Visitor Services, and Public/Private Partnerships
Part of visitor management also includes public education and the ongoing maintenance of cultural resources. The Friends of the Fells offer educational programs such as nature hikes, interpretive historical walks, wildlife tracking events, salamander viewings, as well as birding, botany and geology walks. Many events are family-oriented and draw a diverse age group.

The seasonal Visitor Services Supervisor will work this year with a newly hired Forest and Park Supervisor to bolster public education activities in the Fells. Plans are underway to improve the visitor’s center at the Botume House on Woodland Road, which has been operating at a reduced capacity in recent years. This summer, staff will create a permanent photo display, host a photo contest, publicize tracking events, show a video on spotted salamanders that live in the Fells, and host a “bat bonanza” event for the public (Mike Arnott, personal communication, April 13, 2006).

The DCR has partnered with the Friends of the Fells on a cultural resource improvement project by offering a matching grant through its Office of Public/Private Partnerships. The Friends raised $15,000 matched by the DCR in 2005 to repair and restore the historical Tudor Barn on Woodland Road near Spot Pond. The grant was provided as part of the DCR’s “Fix it First” capital campaign attempting to address the backlog of maintenance and repair work across the state.

Current Perceptions of Fells Visitors
The Friends of the Fells conducted a user survey in 2004 to gather data useful in setting priorities for a management and maintenance plan. The survey, which was distributed to approximately 1,703 Fells users contained in the Friends’ database, garnered over 509 responses. It indicated that while many visitors appreciated the resources offered by the reservation, they were concerned about damage to those resources. A large majority of respondents viewed actions of other users as problematic—either to the quality of the reservation or to the enjoyment of fellow visitors. Top concerns relating to use of the Fells included litter, graffiti, dirt bikes, damage to historic structures, mountain bikes riding offtrail or on prohibited trails; uncontrolled dog behavior, paintball debris, and inappropriate sexual behavior among men seeking men (Friends of the Fells, 2004).

The concern that received the most comments on the survey was mountain biking. Comments included support for, neutral observation of, and negative opinions of mountain biking, though the latter were most common. Respondents who held negative opinions cited trail erosion, habitat destruction, lack of bike policy enforcement, and disturbance of walker/hiker experience as the major problems with mountain bike use.

Our team interviewed 22 Fells visitors at random in March 2006 to gather additional anecdotal information about how visitors currently perceive management and maintenance issues facing the Fells. Few of those interviewed said that they perceived conflicts between users. While we did not survey a statistically significant sample of the visitor population, and winter conditions at the time of the survey may have limited the range of visitors, the interviews provided a snapshot of public opinion about their experiences in the Fells. Several themes emerged:

- everyone we interviewed was either satisfied or very satisfied with their overall experience in the Fells (they rated it a 4 or 5 on a 1-5 scale);
V. Existing Conditions and Analysis

- people greatly appreciate the Fells as an open space or forest that is easily accessible from the city;
- visitors expressed safety concerns, especially for women alone in the park;
- several people commented on their discomfort about the rear parking lot and trails east of the Sheepfold area, where men seeking men reportedly meet;
- visitors noted that the trails west of I-93 were poorly marked and it was easy to get lost in the area;
- many people were unaware of the dog walking policies, or knew that dogs were to be leashed but said that they valued the opportunity to have an off-leash place to let their dogs play at the Sheepfold;
- several visitors suggested that bathroom facilities at the main parking areas would enhance their experience.

Information from the Friends’ 2004 User Survey and from our informal interviews indicates that the major uses in the Reservation are walking, hiking, seeking solitude, nature appreciation, dog walking, and mountain biking. It is difficult to assess the level and timing of each use or to rank them in terms of relative popularity without an in-depth, year-long study. However, the information we gathered suggests that these are the most popular uses.

Management needs/challenges going forward
Current damage to natural resources in the Fells due to user impacts, as well as perceived conflicts between user groups, constitute the major management challenge facing DCR. These challenges, as indicated by the Friends’ 2004 user survey, our visitor interviews, and interviews of other key informants, can be broadly categorized as follows:

- habitat destruction (due to noise, redundant trail creation, dogs off leash)
- damage to cultural resources (due to litter, graffiti, and vandalism)

Priorities for Future Visitor Management:
1. Clearly assess user desires and perceptions
2. Gather stakeholders to discuss desires and perceptions
3. Encourage and implement joint stakeholder strategies to enhance natural and recreational resources

- trail erosion and widening (due to high use by hikers and mountain bikers)
- multi-user trail conflicts (between users with differing values and expectations)

Many visitors and stakeholders we interviewed have pointed to a lack of DCR enforcement as a stumbling block to resolving these issues. The reasoning is that with little threat of citations or other penalties, users are more likely to abuse resources or defy regulations. However, while an increased enforcement presence could well reduce some of the problems in the Fells, it appears unlikely that DCR will have dramatically increased staff resources to devote to enforcement. Therefore, alternative or low-cost enforcement strategies should be explored.

In addition, focusing on an increase in enforcement alone may not address other underlying issues. First, research has shown that park users respond better to prescriptive than proscriptive management (Schneider, 2004; Wirsching, Leung, & Attarian, 2003). This indicates that education, positive messages, and indirect management may be more effective than heavy regulations and enforcement. Second, without a sound management plan, enforcement of existing regulations may not ultimately resolve such problems as poorly designed trails or ineffective user policies.

The overarching goal for the Fells should be to manage the reservation in a way that promotes
sustainable recreational use while protecting and enhancing the natural and cultural resources. This requires careful balancing and a recognition that members of the public hold a range of different priorities: some wish the reservation to remain as wild as possible as a habitat set aside for flora and fauna; others view it as a place for recreation, solitude, or social gatherings.

It is of utmost importance to encourage cooperative public participation in the management process. The RMP process builds in opportunities for public comment on the creation of the plan, but this must be extended to the daily care and management of the reservation. In order to best protect and enhance the resource, the first step is to clearly assess user desires and perceptions. The second priority, once that is accomplished, is to gather together the full range of stakeholders to discuss how to realize those desires within the bounds of the reservation’s carrying capacity. The third priority is to encourage and implement joint strategies among stakeholders to improve the physical and recreational resources in the Fells. By fostering this kind of cooperation, the combined strengths of various groups may have a larger overall positive impact than when groups work in isolation on group-specific priorities.

There are several ways to achieve these goals. Conducting a detailed visitor survey with questions about desired uses and perceived management/maintenance priorities could be a first step, either by mailing surveys to user group lists or distributing surveys to visitors at the park, or both. Holding public meetings or focus groups to gather community members’ perspectives might also offer a way to deepen the discussion. Placing suggestion boxes at kiosks also leaves open the opportunity for visitors to communicate their ideas with park managers on an ongoing basis. Finally, inviting stakeholder groups to roundtable discussions would facilitate the creation of collaborative strategies where the power of a coalition could be harnessed.
Enforcement

This section examines current enforcement policies in the Fells and provides alternative strategies for thinking about enforcement of reservation regulations, given the limited resources of the DCR.

The DCR has worked toward developing a framework to accomplish the goal of creating a “world class park system”, beginning with the RMP Baseline process. However, actual funding for the state’s parks has been minimal and staff levels low. The Fells has felt the impact of this lack of funding, most notably as a lack of Ranger presence in the reservation. Currently, there is only one DCR Ranger assigned to the Fells, along with a couple of seasonal Rangers available in the summer months.

Intensified use of the Fells by specific user groups and their impacts has placed enforcement of the reservation’s regulations as a high priority issue. Dog walkers and mountain bikers have been primarily responsible for the deterioration of trails in certain areas of the Fells, while vandalism and the threat of fire remain a problem throughout the reservation. The increase in these activities are due in large part to a real and perceived lack of the enforcement capability of DCR Rangers, as well as decreased involvement of agencies like the Massachusetts Environmental Police and the Massachusetts State Police. Resource degradation can also be attributed to more intensified use of the Fells by a greater number of visitors in general.

In addition to more intensive use is a lack of clearly posted reservation regulations and signage guiding visitors toward appropriate use of the reservations resources. Hiking trails are often not clearly marked or differentiated from mountain biking trails. Many of the kiosks located at the various entrances to the reservation do not have the regulations posted for visitor reference. Increased efforts to make the reservation’s regulations more transparent to users requires limited monetary resources and is likely to increase appropriate use behavior by visitors. The question remains whether there is adequate staff to enforce regulations within the park, beyond the parking lots, and protect the reservation from graffiti, fire, inappropriate sexual behavior and vandalism. In the absence of healthy staff levels due to funding, strategic enforcement objectives should be identified for the areas of the park most in need and staff should concentrate on enforcement of regulations in those areas. For instance, after a rock formation has been sanded of graffiti, staff should make repeated visits to that area over the course of several weeks to prevent the problem from returning.

Limited ability to enforce regulations not only has consequences for the natural resources, but also
V. Existing Conditions and Analysis

presents a safety concern for visitors. Rangers have the ability to issue citations, as long as the persons in violation are cooperative. For more effective enforcement, trained officers of the law with detain and arrest powers are required. The MDC police had this enforcement capability. The DCR does not yet have a similar relationship with an appropriate arm of law enforcement and it is unlikely that Rangers will be trained in the area of detain and arrest, nor is that their function. However, in the absence of this type of enforcement capability, users are placed in situations where they must resolve conflicts on their own, which raises obvious safety concerns.

Activities currently lacking enforcement in the Fells are: dogs off leash, nighttime mountain biking, biking on hiking trails, off-season biking (January 1st - April 15th) graffiti, drinking, vandalism and inappropriate public sexual behavior.

Enforcement Analysis

The Code of Massachusetts Regulations (CMR), 350 Section 2 is the basis for policies regulating use of the Fells. Section 2.02 deals specifically with the enforcement capabilities of Rangers, which largely limits their ability to the issuance of citations.

Through the user interviews we conducted, we were able to gain some understanding of the public’s perception of enforcement levels in the Fells. All respondents felt there were very limited levels of enforcement, but only several respondents felt this was a concern.

A system for tracking visitors would greatly benefit the ability to identify appropriate staff levels to enforce the reservations rules and regulations so that all users have a safe experience when visiting the Fells. Parking lots counts on high use days could provide a low cost method for roughly estimating visitation.

Positive steps to reinforce Fells regulations are being implemented through a combined effort of DCR Rangers and local stakeholders. For instance, bag dispensers and disposal containers for dog waste have recently been installed by DCR at the Sheepfold parking area. The Friends of the Fells are working with DCR Rangers to post appropriate use signs on trails for mountain bikers and hikers. These methods of positive enforcement encourage appropriate behavior recreational users of the Fells.

These are steps in the right direction, however a greater enforcement presence must be felt for the natural resources of the Fells to be protected, as well as its visitors.
VI. Comparative Analysis

Comparable Natural Resources

Overview
The conditions, trends, and management approaches of several other parks in Massachusetts, and a similar urban park in Portland, Oregon, are examined in this section. We consider the challenges, the stakeholders, and progress made at each site to resolve conflicts and protect resources. The section concludes with a summary of the common themes emerging from the comparative case studies.

Maudslay State Park (Newburyport, MA)

Case Study Highlights:

- Restrict access to highly sensitive wetland areas.
- Monitor changes to the park on a year-to-year basis and evaluate methods of managing those changes.
- Collaborate with volunteers who can provide resources to attain objectives.

In 2003, a Management and Maintenance plan was compiled for Maudslay State Park, a 480 acre former family estate site in Newburyport, MA. This site seemingly holds an advantage over the Fells because many of its concerns have already been identified in a comprehensive document. Despite its more rural location, smaller overall size, less intensive visitor use, and the presence of manicured, formal gardens that don’t exist in the Fells, the management objectives are similar. The 2003 plan advocates preservation of the historic spirit of the park, minimization of alterations inconsistent with that vision, and recognition of contemporary community needs and compatible uses (Department of Environmental Management, 2003, 5).

The plan touts Maudslay as a place for passive recreation, with limits on activities such as mountain biking and horseback riding. Many of the management concerns of the park are similar to those in the Fells, such as eutrophication in ponds, pest and invasive species control, lack of adequate signage, and limited parking. Suggestions that arose include setting aside sensitive wetland areas as preservation zones free from human contact and the high suspended solid levels in water that result from trail erosion, as well as closure of trails to mountain bikes with augmented enforcement measures during wet seasons and rainy days (Department of Environmental Management, 2003, 58, 105).

The Maudslay plan also promotes community and volunteer involvement in the stewardship of the resource. One suggestion is the creation of a monitoring system to examine changes to the park on a yearly basis: what caused damage, what was the extent of damage, how much is considered “acceptable,” how to repair the damage, and what resources to use in fixing it (Department of Environmental Management, 2003, 77).

Considering the limited funding potential of the DCR, when implementing such a plan, it is particularly beneficial to identify stakeholders who would actively promote the interests of the park and work together maintain the resource and solve problems.
VI. Comparative Analysis

Blue Hills Reservation

Case Study Highlights:

- Similarities to the Fells: large, wooded Boston-area urban reservation
- Historic user conflicts surrounding mountain biking issues
- Trail Watch model involves citizens in reservation management

The Blue Hills Reservation was created in the 1890s along with the Fells as part of the MPC’s effort to institute a regional metropolitan park system. It is located south of downtown Boston in the towns of Milton, Quincy, Dedham, Braintree, Canton, and Randolph, and contains approximately 7,000 acres. The Blue Hills Reservation offers an instructive comparison with the Fells because it is part of the same urban park system around Boston, offers many of the same recreational activities, and has broadly similar history, environment, management and usage patterns.

There are three full-time rangers on duty in the Blue Hills, as well as a lieutenant and a supervisory ranger responsible for approximately 15 parks in the South Metropolitan Region. Currently, this staff of five largely directs the visitor management of the reservation at semiannual planning meetings where the rangers create a list of their goals for the next six months (Maggi Brown, personal communication, March 14, 2006). In this way, management priorities for the reservation are reviewed and prioritized twice yearly, based upon the staff’s own assessment of physical conditions and public programs offered at the Blue Hills.

In addition, the supervisory ranger, Maggi Brown, acts as a liaison with a local volunteer group called Trail Watch. A group of concerned trail users (mainly mountain bikers at the time) formed Trail Watch in 1992 at a time when mountain bike use in the Blue Hills was rapidly increasing and newly implemented MDC bike policy was contested in the community (Joe Sloane, personal communication, March 20, 2006). Some stable owners in particular were wary of mountain bikers’ use of the reservation because of their perception that accidents could occur when horses were startled by passing bicyclists. Trail Watch volunteers worked to educate trail users, promote responsible reservation use, and act as “goodwill ambassadors” of the mountain biking community.

Today, however, Trail Watch has developed into a more broad-based community group that fulfills several functions. Current membership is at approximately 50 members, only half of whom are mountain bikers (Maggi Brown, personal communication, March 14, 2006). Other members are mainly walkers/hikers. With full support but minimal funding from DCR, Trail Watch acts as extra eyes and ears for Blue Hills rangers. Volunteers walk or bike the trails, wearing easily identifiable Trail Watch t-shirts. They carry maps to reorient visitors who may be lost, and advise them of reservation policies where necessary. Volunteers submit reports to DCR staff after each outing regarding trail conditions, litter or other damage, and inappropriate visitor behavior.

Key elements for a successful Trail Watch program:

1. DCR management must encourage and support a Trail Watch group, devoting time to supervision.
2. Trail users must receive consistent messages from top to bottom: DCR management, rangers, and Trail Watch volunteers must engage in consistent messaging on policies and trail etiquette, and Trail Watch volunteers must be perceived as part of the management landscape.
3. User groups and Trail Watch members must foster true collaboration and cooperation to promote responsible use and a collective sense of ownership among the user community.
such as walking dogs off leash and off-season or off-trail mountain biking. The Blue Hills Reservation has a similar bike policy to the Fells: only certain trails and roads have been designated for mountain bike use, and there is a winter riding restriction from January 1 to April 15 when no bikes are allowed. In addition to maintaining a positive presence on the trails, Trail Watch volunteers also help at DCR special events throughout the year and help organize an annual Mountain Bike Day that draws hundreds of mountain biking enthusiasts and their families each year (Ravitz, 2004). Brown estimates that Trail Watch volunteers provide thousands of hours of donated time annually (personal communication, March 14, 2006).

This could be a valuable model to apply in the Fells; however, Trail Watch Volunteer Coordinator Joe Sloane stresses the importance of three key elements that have made for a successful program in the Blue Hills. First, DCR management must support and devote time to working with such a group; otherwise, volunteers will feel powerless and unappreciated and may soon lose interest. Second, messages to trail users must be consistent from top to bottom, from DCR management to rangers to Trail Watch volunteers. This means that reservation policies and Trail Watch roles and responsibilities must be clear and consistent. Finally, there must be true collaboration and cooperation among user groups in order for the program to be effective. In the Fells, this seems to be particularly applicable to mountain bikers and hikers. A Trail Watch program must be a positive force that assists, educates, and encourages proper etiquette among all users, and not be seen as a heavy enforcement presence, which only exacerbates conflicts. According to Sloane, Trail Watch volunteers are most effective as goodwill ambassadors and observers for reservation staff.

A successful Trail Watch program can help to change the culture of use in a reservation, such that the majority of users do abide by the rules and regulations. In the absence of enforcement and education, users tend to abuse the resource and violate regulations. This result is evident in the Fells. The Trail Watch model offers a softer and more affordable approach to user management because it comes from within the community and focuses on positive reinforcement rather than heavy enforcement (which DCR is unable to implement in many cases anyway, due to gaps in staff resources). A Trail Watch crew is not a substitute for proper enforcement, but it could augment the effectiveness of DCR Rangers.

Blue Hills Trail Watch fulfills several functions:

- Provides assistance and maps to visitors
- Promotes responsible trail use
- Educates visitors about reservation policies
- Acts as extra “eyes and ears” for DCR: reports trail conditions and inappropriate visitor behavior
- Helps at special events coordinated by DCR
- Organizes an annual Mountain Bike Day for biking enthusiasts

VI. Comparative Analysis

Blue Hills Trail Watch crew photo courtesy of Joe Sloane

Blue Hills Trail Watch crew
VI. Comparative Analysis

Lynn Woods Reservation (Lynn, MA)

Case Study Highlights:

- Active community participation in projects can yield great benefits.
- An extensive education and enforcement program is essential to back up any mountain biking policy for public land.
- Invasives removal projects can be conducted by various groups, as long as the process is informed and well-planned.

The Lynn Woods is a 2,200 acre forest consisting of ponds, wetlands, streams, deciduous evergreen forest and rocky ledge located just north of Boston. It is visited by 100 species of birds on a yearly basis and serves as habitat for predators such as owls, red-tailed hawks, and foxes (Friends of the Lynn Woods website). Ponds located on park grounds provide drinking water for the city of Lynn. Thus, the Lynn Woods performs many of the same ecological functions as the Middlesex Fells. However, the management of the park is conducted on the municipal level, and is shared by the Lynn Department of Public Works, Park Commission and the Lynn Water & Sewer Commission.

In the early 1990’s much of the park was in disrepair and the city government and citizen volunteer groups worked together to clean up areas of the park, by 1994 rededicating a once thriving, popular rose garden that had been overgrown to the people of Lynn. The current master plan for the restoration and management of the Lynn Woods exists to prevent the neglect and abuse that had once destroyed the resource (Dan Small, personal communication, March 8, 2006). Again, this type of example illustrates the effectiveness of partnerships in the maintenance and restoration of sensitive natural areas.

There is some concern over the intensity of visitor use in the Lynn Woods, particularly trail erosion that is believed to be the result of heavy mountain bike use in the reservation. There is no specific mountain biking policy for the Lynn Woods, and according to Ranger Dan Small, many of the trails “paid dearly.” Small frowns upon the conditions of many trails in the reservation (Dan Small, personal communication, March 8, 2006). However, he does express optimism that many riders, particularly those affiliated with NEMBA, refrain from damaging practices such as riding in muddy conditions, and venturing off-trail. Once again, this points to the potential for a partnership between park advocates (such as the Friends of the Lynn Woods) and bicycle groups to create a sustainable policy and educate all users on regulations. Invasive species have created another major issue, and since their removal should be an informed and calculated process, it presents the opportunity for another planned community project.

Borderland State Park (Easton, MA)

Case Study Highlights:

- An Advisory Council comprised of various users of the resource can be effective as a consulting body if properly utilized by the agency of oversight.
- Drainage measures should be implemented and respected by users to solve trail damage problems.
- Decisions should be made at a park-level to respect the uniqueness of the resource.

Borderland State Park is a 1,570 acre park 20 miles south of Boston that has similarities to the aforementioned Maudslay State Park, as it is also a former family estate, as well as the Fells, because it exists in a college town and serves a comparable demographic. The park supports a diverse population of plants, trees, and geological features, as well as streams, ponds, bogs, and thriving vernal pools. The fields at
Borderland represent a fast disappearing habitat in Massachusetts. The site is popular for disc golf, and a system of gravel roads make an effective loop for 5k foot races. Borderland also boasts an impressive 19th century mansion, but this and other areas of the park are constantly in need of more maintenance than is currently provided (Bill Hocking, personal communication, April 11, 2006).

Bill Hocking is the Chair of the Advisory Council for Borderland State Park, a group created by the Legislature when the park was originally purchased. The council is comprised of local residents and representatives of the park’s user groups. The role of the council is to give advice and consent for any planned changes to the park. However, Hocking feels the council, and the Friends group at Borderland could be utilized more effectively in the management and maintenance of this resource.

Hocking believes management decisions should be made at the “park level,” in order to address site specific issues such as staffing at the appropriate times of the year, maintenance of areas that need it most, and retaining revenue generated by the park for use in on-site improvements. He feels “decisions are made before (the Advisory Council) is even asked.” Collaboration with a knowledgeable team such as the council, as well as a Friends group that at one time was very active, would establish specific standards and goals for Borderland State Park. An advisory council for the Middlesex Fells is an intriguing idea, as the Friends of the Fells already have a strong interest in park stewardship, and combined with other stakeholders, could make informed decisions to improve the reservation.

Another commonality with the Middlesex Fells is the popularity of Borderland as a mountain biking spot. Hocking considers biking to be an acceptable use, albeit one that can accelerate trail erosion. Keeping with his vision of decision making at the park level, Hocking advocates that decisions be made as to whether certain trails can withstand the amount of use, which may result in some areas being restricted. However, he also lauds the New England Mountain Bike Association for their work in “opening up” trails to all users of the park by bridging “wet areas” that are common trouble spots in all parks and reservations. Bridging and drainage measures in the Fells, if they are supported by the user base, can help to combat trail damage. Knowledge of carrying capacity, soil composition, and existing conditions will inform trail management decisions in the Fells.

Forest Park, Portland, Oregon

Case Study Highlights:

- 5,000 acre wooded urban park facing increased use, pressure on natural resources, lack of public funding
- Public-private partnerships allow citizens’ groups to contribute to enhancement of the park through education, invasive species removal, and land acquisition

Park managers across the country have seen increased visitor numbers that create larger and larger impacts on natural areas already stressed by pollution, declining forest health, and invasive plant species (Manning et al., 1998). Forest Park, a 5,000 acre urban wild in Portland, Oregon, is similar to the Fells in many ways. It has few amenities and no permanent full-time rangers. Yet use has been increasing rapidly, leading to trail degradation and some conflicts between user groups. Mountain biking impacts and dogs off-leash are the most problematic issues. Invasive species, particularly English ivy and garlic mustard, have made serious intrusions on the native flora. Encroaching development in
the areas surrounding the park places increasing pressure on wildlife as it disturbs subwatersheds and wildlife corridors. Finally, the risk of a seriously destructive wildfire grows each year as undergrowth collects at ground level. Without managed burns, this brush remains as potential fuel that could cause major damage to the park and surrounding neighborhoods. In 1995, the Portland Parks and Recreation department created a Natural Resources Management Plan (NRMP) for Forest Park, but over the past decade, the city has provided very little funding to implement the plan (Leeson, 2005).

In the absence of public funding, community groups such as the Friends of Forest Park and the No Ivy League work to protect the park through education, advocacy, trail maintenance, invasive species removal, and land acquisition. For instance, in 2004, the Friends of Forest Park partnered with Portland United Mountain Pedalers to create a reproducible mountain biking map designating open trails and elevations for mountain bikers. The Friends Group has also raised more than $1 million over the past 15 years to fund or co-fund land purchases and easements for inholdings slated for development (Friends of Forest Park, n.d.). The No Ivy League, formed in 1994 through a partnership between the Parks and Recreation Bureau and the Friends group, organizes volunteers and youth groups to remove English ivy throughout the park (Ivy Removal Project, n.d.).

While Forest Park has found no easy solutions to managing increased use while protecting and enhancing its natural resource assets, it is clear that cooperative community involvement has been key to making steps toward accomplishing these two major goals identified in the 1995 NRMP. Community groups provide volunteers and funding sources, as well as advocacy and publicity. They act as liaisons between public and private interests to strengthen the total set of resources available to manage an urban park.

**Summary**

The common trends in these comparisons of other urban parks can be summarized as follows:

- use and visitor impacts are increasing, putting greater pressure on resources and management capabilities.
- water quality, invasive species, erosion, litter, and fire constitute major management and planning challenges.
- government funding is often inadequate to effectively address all of these challenges.
- the involvement of community members and local organizations can help to supplement funding, increase cooperation among user groups, and provide expertise in holistic management plans.

The Middlesex Fells already benefits from this kind of community involvement. However, there are opportunities to strengthen ties between groups, collaborate on alternative management strategies, and increase public awareness of the resources that the reservation has to offer.
VII. Critical Path Analysis

Critical Path Analysis: Introduction

By using the principles of critical path analysis, our goal was to prioritize management issues in the Fells and suggest ordered steps to effectively address them. A critical path graphically depicts the sequential order of steps necessary to achieve management goals. A formal critical path analysis involves the use of more specific data sets that were not fully available at the time of this report. Our recommendations include suggestions for obtaining missing data. Preliminary pathways are based on our current understanding of management priorities in the Fells. These steps provide an organizational structure for moving forward at this point. The Friends of the Fells, working with DCR, should re-evaluate these paths as more information becomes available via early steps. Successful long term management of the Fells will depend on procedural flexibility and adaptability.

Because our three areas of research (natural resources, uses & user conflicts, and enforcement) are interrelated, we organized our critical path analysis by three categories of practical management: Managing Physical Resources, Managing Recreational Uses, and Stakeholder Collaboration. Steps within each flow chart are intended to follow sequentially to ensure efficient management practices and completion of long term goals. The Friends of the Fells may choose to begin or continue work on categories simultaneously.

Critical Path Analysis: Organization

Time Frame for Steps in Critical Path Analysis

- All Step 1 action items to be completed within 1 to 3 years
- All Step 2 action items to be completed within 2 years of completing Step 1
- Step 3 items should be evaluated and assigned an appropriate timeframe for execution, upon completion of Step 2 items
- All subsequent action items are considered long-term and are contingent upon successful completion of previous steps. An appropriate time frame evaluation should be assigned at the beginning of each item.
VII. Critical Path Analysis

Critical Path Analysis: Managing Physical Resources

Trails

Step 1
- erosion study
- DCR trail mapping
- continue to update trail marking
- develop forum for users to comment on trail conditions

Step 2
- summarize and rank needed trail repairs
- map redundant trails for elimination
- post trail info at kiosks/visitor center
- publish updated trail map
- determine trail use by carrying capacity and resistance

Step 3
- eliminate redundant trails
- repair damaged trails
- site historical/nature walk trails as needed for educational/enforcement purposes
- bolster trail adopter program

Step 4
- continue long term trail maintenance plan thru trail adopter program

Vegetation

Step 1
- wooly adelgid study
- Bryan Hamlin’s groundcover study
- invasive species study

Step 2
- wooly adelgid management plan
- remove redundant trails to protect sensitive vegetation and habitat
- establish needs for re-vegetation

Step 3
- develop comprehensive vegetation management plan

Step 4
- implement the plan based on results of previous steps
VII. Critical Path Analysis

Critical Path Analysis: Managing Recreational Resources

Use Management

Step 1: User impacts study (erosion, water quality)
Step 2: Analyze visitor levels and patterns
Step 3: Establish minimum standards based on desired conditions
Step 4: Determine carrying capacity
Step 5: Create management response plan based on results of previous steps, available resources, and a public visioning process

Public Education

Step 1: Clearly post regulations at all kiosks
Step 2: Update information regularly
Step 3: Make educational program changes where necessary in response to feedback

Step 6: Execute chosen plan
Step 7: Continue to monitor indicators

Periodically re-evaluate effectiveness of plan
The Middlesex Fells: The Case for a Resource Management & Maintenance Plan

VII. Critical Path Analysis

Critical Path Analysis: Stakeholder Collaboration

Stakeholders

Step 1
- identify stakeholders and seek opportunities to build new partnerships
- create multi-stakeholder group
- research funding sources, connect them with public/private partnerships where appropriate

Step 2
- survey visitor expectations, satisfaction/concerns
- develop user feedback forum
- conduct public outreach campaign
- create trail watch ambassador group
- collaborate on enhancement of educational/cultural resources and facilities

Step 2
- use information gathered in Step 2 to inform future projects and programs
We offer the following recommendations to the Friends of the Fells as a preliminary strategy toward achieving the Step 1 action items contained in the critical path analysis.

**Recommendation #1:** Begin steps toward completing physical resource studies listed in Step 1 of critical path analysis.

- Implementation: Compile existing information on erosion, wooly adelgid, invasive species, and general vegetation studies. Determine information still needed to complete those studies. Work with DCR and other partners to continue to gather information and complete the studies.

**Recommendation #2:** Continue trail mapping initiatives in the Fells.

- Implementation: Using established DCR process, complete trail mapping for western section of the reservation. Work with DCR to post current trail map in all kiosks. Work with DCR to continue to mark current trails.

**Recommendation #3:** Strengthen public education campaign.

- Implementation: Organize multi-stakeholder public awareness days in the Fells. Work with DCR to post regulations in all kiosks. Increase awareness about visitor center (kiosks, newsletter, etc.) Develop programs and displays to improve visitor center.

**Recommendation #4:** Begin to assemble a multi-stakeholder stewardship group.

- Implementation: Invite different groups to participate in Fells awareness days. Approach leadership of other user groups to continue Fells survey efforts to gauge user feedback. Identify collaborative funding opportunities, including public/private partnerships.

**Recommendation #5:** Continue to develop enforcement of rules and regulations.

- Implementation: Identify alternative enforcement strategies, such as promoting responsible use through public education efforts, and establishing a volunteer monitoring group. Define priority areas for enforcement and develop a campaign to target the problem. Request additional seasonal Rangers from DCR.

**Recommendation #6:** Continue to leverage political connections to meet reservation objectives.

- Implementation: Invite key politicians to Fells events. Send updates on key initiatives to those individuals. Identify politically active fells constituents and start a campaign for increased funding.
IX. Appendices

Appendix A

  Annotated Bibliography
  Source List

Appendix B

  Natural Resource Maps
  List of Invasive Species

Appendix C

  Interview Questions
Appendix A

Bibliography

Bureau of Land Management. 2002. National Mountain Biking Strategic Action Plan. This document presents a comprehensive approach to managing mountain biking on public lands, and should be read by anyone interested in creating a policy related to this activity. This plan describes biking as an acceptable use within the framework of natural resource objectives and advocates science, cooperation, and thorough review as tools for creating effective management plans and maintaining public lands to high standards.

Brown, D. 1998 and 1999 Middlesex Fells Reservation Tracking Survey. Commissioned by the Metropolitan District Commission and The Friends of the Middlesex Fells Reservation. This report highlights key wildlife species found in the Fells and provides detailed tracking maps and habitat descriptions. The survey was completed primarily in the winter months resulting in a seasonally specific study. Issues concerning ecosystem health and human impacts on the Fells are related to wildlife management in the reservation. Overall, the report blends specific information on wildlife concentration and distribution and makes general recommendations concerning future resource management that will best support wildlife needs.


Friends of the Middlesex Fells. 2004. Managing Visitor and Other Impacts in the Middlesex Fells Reservation – Recommendations Submitted to the Department of Conservation and Recreation. This document presents a comprehensive set of suggestions to improve the Middlesex Fells based on a growing number of user impacts. It stresses continued education and enforcement as avenues to create a responsible user base. It also includes an in-depth discussion on the issues of dog walking and mountain biking, and recommends policies to control the activities.


This compilation of photographs and maps dating from 1986 contains images that provide insights into early Fells management. Some images and maps may be used to create baseline datasets that would be useful in historical and comparative studies of the area.

This book outlines strategies for preserving and promoting healthy ecosystems. Foreman advocates the use of wildlife corridors and the presence of predator species as indicators for ecosystem health.
Appendix A

Friends of the Middlesex Fells Reservation. 2004. Middlesex Fells User Survey 2004. This report summarizes the results of a survey conducted by the Friends of the Middlesex Fells Reservation in 2004. The purpose of the survey was to gather comments from the Fells community regarding their interests and concerns, in order to inform future management of the reservation. Responses from the survey, which was distributed to Friends of the Fells members and other supporters, numbered over 500. The report includes transcriptions of comments and tabulations of top areas of concern.

Green Ribbon Commission. 1996. Enhancing the future of the metropolitan park system: final report and recommendations of the Green Ribbon Commission. Boston, MA: The Commission. The Green Ribbon Commission was appointed by Massachusetts Governor William Weld in 1993, the centennial year of the Metropolitan Park System, to evaluate the system and make recommendations for future management. The report traces the historical background of the park system, identifies current issues affecting its future, and makes recommendations to ensure that the natural resources will be protected for future generations. The Commission’s broad recommendations include enhanced stewardship initiatives; creation of deeper links between the parks and the public; and strengthening the commitment to management and funding for the system.


Lathrop, Jason. Ecological Impacts of Mountain Biking: A Critical Literature Review. Prepared for Wildlands CPR through the University of Montana. Lathrop provides a comprehensive review of existing scientific data on the effects of mountain biking. He addresses all known effects of mountain biking: on plants, trails, and wildlife, and outlines results from studies related to each. The author also pushes for selection of sites appropriate to the activity and for active trail maintenance efforts.


The Forests and Parks Partnership is made up of the Appalachian Mountain Club, Environmental League of Massachusetts, Massachusetts Audubon Society, MASSPIRG, and Massachusetts Sierra Club. This report highlights the importance of public lands in the state and the great need for the (then) Department of Environmental Management (DEM) to address threats to parks and forests. It stresses in particular the lack of funding provided for proper stewardship. The Partnership’s core recommendations to the DEM are to create long-term management plans for each forest and park that include accountability and measurable goals; to provide enough funding and staff support for resource management; and to better involve citizens and NGOs in the management of forests and parks in Massachusetts.


This is the first of two recent documents submitted by the New England Mountain Bike Association that focus on an expansion of the trail system in the Middlesex Fells to bicyclists. The plan outlines measures to support the expansion, such as improving signage, educating riders, and increasing trail maintenance efforts. The document is critical of the lack of oversight into the current biking policy and sets up the second proposal, which has the same focus but tries to be more diplomatic.


This pamphlet traces the history of the Middlesex Fells Reservation, placing its creation in the context of the progressive Boston metropolitan parks movement of the late 19th Century, driven by individuals such as Elizur Wright, Charles Eliot, and Sylvester Baxter. The pamphlet also describes the creation of the Metropolitan Park Commission, the Trustees of Reservations, and the Parkways system.

Schneider, who is Director of the University of Minnesota Tourism Center and Research Association at the Department of Forest Resources, describes different kinds of visitor conflict in recreational settings and discusses various management approaches to respond to conflict. The author details the stress
approach of understanding visitor conflict and presents results from studies at several recreational sites. She suggests that communication between managers and visitors is very important in alleviating conflict. Information and educational messages are most effective at changing behavior of new or novice users, while experienced users require multiple messages in various formats that are direct, detailed, and aimed at their sense of responsibility. Schneider also suggests that engaging visitors in volunteer patrols can positively influence visitor behavior.

Sprung, Gary. 2004. Natural Resource Impacts of Mountain Biking. International Mountain Bicycling Association. http://www.imba.com/resources/science/impact_summary.html. Gary Sprung is one of the more notable mountain bike advocates of the last two decades. Sprung maintains that “no scientific studies show that mountain bikers cause more wear to trails than other users,” and outlines a variety of studies performed in the United States and on an international level that support his statement by considering the areas of trail erosion, vegetation damage, and wildlife disturbance.

U.S. Department of the Interior, National Park Service. 1997. VERP: The Visitor Experience and Resource Protection Framework. A Handbook for Planners and Managers. Denver: U.S. Department of the Interior. This handbook describes the VERP framework developed by the National Park Service to balance visitor use and resource protection in national parks in the U.S. It introduces the concept of park carrying capacity, which can be defined in relation to ecological, social, physical, or economic parameters around desired conditions for visitor experiences and resource conditions. The handbook includes a nine-step guide for planners to follow when applying the VERP process.

Vandeman, Michael J., Ph.D. Impacts of Mountain Biking on Humans and People – A Review of the Literature. 3 July 2004. Vandeman’s document references a number of scientific studies conducted over the years to determine the impacts of mountain biking and foot traffic on trails. As an advocate “to keep bicycles out of natural areas,” he uses a foundation of common sense and science to dispel what he sees as factual inaccuracies being peddled by advocates of mountain biking. After dismantling these arguments, he proceeds to demonstrate the limitations of previously conducted scientific studies and uses their data to support a counter-argument for keeping bikes off hiking trails.

Wirsching, A., Y. Leung, and A. Attarian. 2003. Swatting litter bugs. Parks & Recreation. Vol. 3, issue 11, pp.16-22. Wirsching, Leung, and Attarian review research on communication techniques that natural resource management agencies can use to address negative visitor impacts. The authors consider “depreciative behavior” that which destroys public resources, decreases other visitors’ park experiences, and/or creates additional management and maintenance costs. They conclude that getting visitors’ attention, understanding their preferences for various communication methods, and improving educational techniques may help to change visitor behavior; however, additional research is required to more fully understand the effectiveness of non-intrusive educational signs.

Appendix A

Massachusetts Code of Regulations, 350 CMR, Metropolitan District Commission, Section 2.00 - Use of Reservations and Parkways.

Sources

Maggie Brown, District Ranger, DCR  Interviewed 3/14/06
Thomas Dugan, Policy Analyst, DCR  Interviewed 2/20/06
Pat Flynn, Urban Parks Director, DCR  Email Correspondence 4/14/06
Tom Grimble, President, NEMBA  Interviewed 3/25/06
Bryan Hamlin, Friends of Fells Board Member  Interviewed 3/1/06
Bill Hocking, Advisory Council, Borderland State Park  Interviewed 4/7/06
Deborah Holt, Volunteer Hike Lead, Sierra Club  Interviewed 3/19/06
Ed Myskowski, Geologist, Peabody Essex Museum  Interviewed 4/11/06
Tom Palmer, President, Friends of the Blue Hills  Interviewed 3/3/06
Heidi Ricci, Senior Environmental Policy Specialist,  Interviewed 3/23/06
Joe Sloane, Volunteer Coordinator, Blue Hills Trail Watch  Interviewed 3/20/06
Dan Small, Ranger, Lynn Woods  Email Correspondence 3/8/06
Elizabeth Wright, New England Wildflower Association  Interviewed 3/1/06
Mass Audubon Society

The Middlesex Fells: The Case for a Resource Management & Maintenance Plan  51
Appendix B

DCR Trail Mapping

Created by Abby S. Yenco
Orthographic Map Data from MassGIS, 2005
Trails Data from MA Department of Conservation and Recreation, 2006

Current Status of DCR Trail Mapping in the Middlesex Fells Reservation
Middlesex Fells Reservation Soil Types

Information from MassGIS and http://soildatamart.nrcs.usda.gov, 2005

Map Created by Abby S. Yenco and Sean Sylver
Areas Suitable for Wildlife Habitat Preservation

Map Created by Abby S. Yenco
Appendix B

Invasive Species in the Middlesex Fells

Map Created by Abby S. Yenco
Information from MassGIS and Independent Research, 2006
## List of invasive species

The following information was obtained from a vegetation study being conducted by Bryan Hamlin and Betty Wright, except where noted. Species noted had been found in the Fells before publication of this report. Questions concerning the location of these plants in the Fells should be referred to Bryan Hamlin and Betty Wright.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Latin Name</th>
<th>Threats to Fells Ecosystem (information from <a href="http://www.invasive.org">www.invasive.org</a> except where noted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesser Celandine</td>
<td>Ranunculus ficaria</td>
<td>exotic spring ephemeral and a vigorous growing groundcover that forms large, dense patches on the forest floor, displacing and preventing native plants from co-occurring. (<a href="http://www.nps.gov/plants/alien/fact/rafi1.htm">http://www.nps.gov/plants/alien/fact/rafi1.htm</a>)</td>
</tr>
<tr>
<td>Creeping Buttercup</td>
<td>Ranunculus repens</td>
<td>may displace native plants (<a href="http://www.illinoiswildflowers.info/weeds/plants/cr_buttercup.htm">http://www.illinoiswildflowers.info/weeds/plants/cr_buttercup.htm</a>)</td>
</tr>
<tr>
<td>Japanese Barberry</td>
<td>Berberis thunbergii</td>
<td>shade-tolerant and can form dense stands which shade out and displace native species</td>
</tr>
<tr>
<td>Common Barberry</td>
<td>Berberis vulgaris</td>
<td>rust-susceptible host Black stem rust is a serious fungal disease of wheat that has been under federal regulation since 1918. (<a href="http://www.mda.state.mn.us/appd/barberry.htm">http://www.mda.state.mn.us/appd/barberry.htm</a>)</td>
</tr>
<tr>
<td>Celandine</td>
<td>Chelidonium majus</td>
<td>unknown</td>
</tr>
<tr>
<td>White Mulberry</td>
<td>Morus alba</td>
<td>threat by displacing native species, possibly hybridizing with and transmitting a root disease to the native red mulberry</td>
</tr>
<tr>
<td>Japanese Knotweed</td>
<td>Polygonum cuspidatum</td>
<td>invades disturbed areas with high light, Reproduction occurs both by vegetative cuttings and seeds, making this plant extremely hard to eradicate. The dense patches shades and displaces other plant life and reduces wildlife habitat</td>
</tr>
<tr>
<td>Red or Sheep Sorrel</td>
<td>Rumex acetosella</td>
<td>able to form dense stands and displace native grasses and forbs. This plant contains oxalic acid which can be poisonous to livestock and may be toxic to wildlife species (<a href="http://akweeds.uaa.alaska.edu/pdfs/species_bios_pdfs/Species_bios_RUAC.pdf">http://akweeds.uaa.alaska.edu/pdfs/species_bios_pdfs/Species_bios_RUAC.pdf</a>)</td>
</tr>
<tr>
<td>Garlic Mustard</td>
<td>Alliaria petiolata</td>
<td>can form dense stands which shades and out-competes native understory flora</td>
</tr>
<tr>
<td>Dame’s Rocket</td>
<td>Hesperis matronalis</td>
<td>will readily invade disturbed ground but is rarely found in undisturbed areas. (<a href="http://www.cwma.org/nx_plants/dames.htm">http://www.cwma.org/nx_plants/dames.htm</a>)</td>
</tr>
<tr>
<td>Multiflora Rose</td>
<td>Rosa multiflora</td>
<td>forms impenetrable thickets in pastures, fields and forest edges. It restricts human, livestock and wildlife movement and displaces native vegetation</td>
</tr>
<tr>
<td>Black Locust</td>
<td>Robinia pseudoacacia</td>
<td>Dense clones of locust create shaded islands with little ground vegetation, blossoms of black locust compete with native plants for pollinating bees. (<a href="http://www.nps.gov/plants/alien/fact/rops1.htm">http://www.nps.gov/plants/alien/fact/rops1.htm</a>)</td>
</tr>
<tr>
<td>Purple Loosestrife</td>
<td>Lythrum salicaria</td>
<td>can quickly form dense stands that displace native vegetation. Purple loosestrife can spread very rapidly due to its prolific seed production;</td>
</tr>
</tbody>
</table>
List of invasive species continued

<table>
<thead>
<tr>
<th>Species</th>
<th>Plant Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winged Euonymus</td>
<td>Euonymus alata</td>
<td>invades moist forested sites creating dense thickets that can shade out native herbs and shrubs (<a href="http://www.paflora.org/Euonymus%20alatus.pdf">http://www.paflora.org/Euonymus%20alatus.pdf</a>)</td>
</tr>
<tr>
<td>Cypress Spurge</td>
<td>Euphorbia cyparissias</td>
<td>reduces the forage value of pastures, contaminates hayfields, and can displace native vegetation</td>
</tr>
<tr>
<td>European Buckthorn</td>
<td>Fallopia japonica</td>
<td>becomes the dominant understory vegetation in some cases, and it has been identified as a major threat to native biodiversity (<a href="http://www.cnr.umn.edu/FR/CFHE/buckthorn.html">http://www.cnr.umn.edu/FR/CFHE/buckthorn.html</a>)</td>
</tr>
<tr>
<td>Common Buckthorn</td>
<td>Rhamnus cathartica</td>
<td>limits growth of other woody seedling species (<a href="http://tncweeds.ucdavis.edu/esadocs/documnts/franaln.pdf">http://tncweeds.ucdavis.edu/esadocs/documnts/franaln.pdf</a>)</td>
</tr>
<tr>
<td>Porcelain Berry</td>
<td>Ampelopsis brevipedunculata</td>
<td>thick mats formed by this climbing vine can cover and shade out native shrubs and young trees. It spreads very quickly due to the seeds being eaten and dispersed by birds and mammals.</td>
</tr>
<tr>
<td>Tree of Heaven</td>
<td>Ailanthus altissima</td>
<td>tolerant of poor soil conditions, thrives in disturbed forests or edges, Dense clonal thickets displace native species and can rapidly take over fields and meadows</td>
</tr>
<tr>
<td>Norway Maple</td>
<td>Acer platanoides</td>
<td>has the ability to shade out the native understory and out-compete the native tree species</td>
</tr>
<tr>
<td>Black Swallowwort</td>
<td>Vincetoxicum nigrum</td>
<td>troublesome in open areas and along edges and banks where it grows over other vegetation, blocking light and creating tangled thickets. It alters and degrades natural habitat by crowding out native plants and is a threat to rare species in some locations in New England (<a href="http://www.umext.maine.edu/onlinepubs/htmpubs/2523.htm">http://www.umext.maine.edu/onlinepubs/htmpubs/2523.htm</a>)</td>
</tr>
<tr>
<td>Bittersweet Nightshade</td>
<td>Solanum dulcamara</td>
<td>ALL parts of the plant are toxic to humans and animals. (<a href="http://www.co.stevens.wa.us/weedboard/other%20weeds/bittersweet%20nightshade.htm">http://www.co.stevens.wa.us/weedboard/other%20weeds/bittersweet%20nightshade.htm</a>)</td>
</tr>
<tr>
<td>Ground Ivy</td>
<td>Glechoma hederacea</td>
<td>grows mostly in disturbed, degraded places (<a href="http://www.dnr.state.mn.us/invasives/terrestrialplants/herbaceous/creepingcharlie.html">http://www.dnr.state.mn.us/invasives/terrestrialplants/herbaceous/creepingcharlie.html</a>)</td>
</tr>
<tr>
<td>Tartarian Honeysuckle</td>
<td>Lonicera tatarica</td>
<td>invades open woodlands, old fields and other disturbed sites. It can spread rapidly due to the seeds being dispersed by birds and mammals</td>
</tr>
<tr>
<td>Spotted Knapweed</td>
<td>Centuria maculata</td>
<td>outcompetes native plant species, reduces native plant and animal biodiversity, and decreases forage production for livestock and wildlife. Spotted knapweed may degrade soil and water resources by increasing erosion, surface runoff, and stream sedimentation. (<a href="http://www.nps.gov/plants/alien/fact/cebi1.htm">http://www.nps.gov/plants/alien/fact/cebi1.htm</a>)</td>
</tr>
<tr>
<td>Colt’s-foot</td>
<td>Tussilago farfara</td>
<td>spreads both by seed and rhizomes, allowing it to form large colonies which can displace native species</td>
</tr>
<tr>
<td>Helleborine</td>
<td>Epipactis helleborine</td>
<td>unknown</td>
</tr>
<tr>
<td>Phragmites</td>
<td>Phragmites australis</td>
<td>discourages other species from germinating, push other species out and form monotypic stands. Phragmites are only a problem where they are not native and are spreading to reduce numbers of other important species (<a href="http://tncweeds.ucdavis.edu/esadocs/documnts/phraaus.pdf">http://tncweeds.ucdavis.edu/esadocs/documnts/phraaus.pdf</a>)</td>
</tr>
</tbody>
</table>
User Survey

UEP 255: Field Projects
Middlesex Fells Reservation - User Opinion Survey

1. Gender:
2. Age:
3. Town/City:
4. How long have you been visiting the Fells?
5. How often do you visit the Fells? (# of times daily, weekly, monthly)
6. How do you travel to the Fells? (if by car, is there adequate parking?)
7. What is your primary reason for visiting the Fells?
8. Do you use a map to guide your activity? If not, do you feel the rules, policies, and hours of the reservation are clearly displayed for visitors to see?
9. How satisfied are you with your Fells experience? (5: very satisfied, 4: satisfied, 3: neither satisfied nor dissatisfied, 2: dissatisfied, 1: very dissatisfied)
10. What is your perception of the current management of the Fells?
11. What do you feel is unique about the Fells?
12. Do you feel safe when you visit the Fells?
13. Have you ever met or seen a DCR Ranger on duty in the Fells?
14. How has the Fells changed over time, in your opinion?
15. Are there facilities or opportunities you would like to see within the Fells that are not present now?
16. Are there other parks you visit often?