

6 Research, Inventory, and Monitoring Needs

The Division has supported a wide variety of watershed research, by providing access to its properties, directed management activities, and/or limited direct funding. Some of this research has primarily benefited the researcher, but the vast majority has also informed DWSP managers and improved or supported watershed management practices. While the research budget at DWSP is not constant, the value of contiguous, undeveloped watershed properties generally behind secure gates or patrolled on a regular basis has attracted many researchers who have their own funding. In addition, watershed properties have provided fertile backdrops for a wide range of graduate student research.

Listed below is a variety of research, inventory, or monitoring needs in the general areas of forests and forestry, wildlife, and cultural resources. These are listed in part to direct the Division's own efforts in the coming decade, but also as a specific reference for potential researchers who are looking for a project that would address the needs of the Division.

6.1 Forest and Forestry Needs

Understanding the complex interactions between forests, forestry, and water supply requires regular review of current research in combination with inventory, monitoring, and site-specific research within the properties under the care and control of DWSP. The following list of research needs is a sampling of projects that could begin to address knowledge gaps to better inform the process of watershed forest management on the lands surrounding and protecting Quabbin Reservoir.

1. **Continuous Forest Inventory Data Merging and Analysis.** The Division has maintained a fixed-plot, Continuous Forest Inventory system since 1960. The trees and other features of these plots have been remeasured at least every 10 years since their establishment. Given the large leaps in computer technology and data management each decade, there is a significant need to bring all past records, which were initially stored on paper and then punch cards, into a current, comprehensive and readily accessible modern database. Some of this process requires laborious data entry and merging, but once this is accomplished, it will be possible to mine this dataset for a very wide variety of information, including uncommon empirical evidence of growth and mortality rates, a comparison of these to known patterns of disturbance or climate change, or comparisons of changes in forest structure and composition among disturbed and undisturbed sites.
2. **Continuation of Research Comparing Natural and Deliberate Disturbances.** The Division initiated, in partnership with academic researchers, a long-term paired watershed study comparing the effects of deliberate (timber harvesting) versus natural (insect defoliation) disturbances to the background conditions of unmanaged controls during the previous management period. This study has included the installation of low-cost V-notch weirs to study water quantity in conjunction with stations for monthly grab sampling to document nutrient and sediment backgrounds, as well as automated water quality sampling to capture differences during storm and snowmelt events. This research is labor intensive and requires a commitment of personnel from both partners that has been difficult to maintain. However, having gathered a multi-year background of data from these first-order tributaries, it would be valuable to build this research to its full potential during the coming decade in order to provide the agency with site-specific quantification of water supply effects of land management practices and natural disturbances.
3. **Watershed Forest Management Information System.** In order to more directly relate the cumulative effects of long-term watershed forest management to changes in associated water resources, the Department of Natural Resources Conservation at the University of Massachusetts has been developing a Watershed Forest Management Information System (WFMIS). As this

model reaches full development, it would be beneficial to test its effectiveness for guiding management of the Quabbin forest. The WMIS currently includes three components.

- a. **Watershed Management Priority Indices.** The Watershed Management Priority Indices (WMPI) delineates zones that relate forest management practices to soils, water resources, and aquatic ecosystems and incorporate readily available spatial information to identify areas and/or practices with the greatest potential to either maintain or restore stream water quality.
- b. **Forest Road Evaluation System.** Forest roads provide critical access to forest management areas, but also represent the most likely source of sediment transport to associated water resources. The Forest Road Evaluation System (FRES) is designed to identify and describe the stability of overlaps between the road system and water bodies in order to direct maintenance efforts to the most pressing priorities and prevent unacceptable non-point source pollution of these resources. During the summer of 2007, a seasonal worker will be hired to begin to gather information on the current status of culverts, a basic component of the FRES.
- c. **Harvest Scheduling Review System.** The Harvest Scheduling Review System provides a systematic method to use commonly available GIS data to track the cumulative hydrologic effects of period harvesting across the watershed forest in order to remain below threshold increases in water yield and associated water quality changes.

6.2 Wildlife and Wildlife Management Needs

The following projects represent a few areas where technical data would assist in more effectively managing wildlife resources.

1. **Biological Surveys and Inventories.** In order to minimize or avoid negative impacts of land management activities on wildlife and critical habitats, all proposed activities are reviewed by the wildlife biologist. However, only two biologists are responsible for all 4 watersheds within the Division, and it would be impossible to physically inspect the hundreds of proposed acres. The Division must rely on records of known occurrences of critical habitat or species. Although new information is added as it becomes available, the database is far from complete. Biological surveys conducted by qualified persons can provide critical additional information that will aid Division efforts to protect these resources during land management activities. Information should also be incorporated into GIS datalayers.
2. **Vernal Pool Surveys.** The Division completed a contract that mapped potential vernal pools on the watershed using color infrared photos. Over 500 potential pools were identified. These pools need to be surveyed to determine their status and to try and locate other unmapped pools. This mapping will be incorporated into GIS to facilitate land management planning.
3. **Habitat Use and Population Dynamics of an Expanding Moose Population in the Southern Portion of Its Range.** Moose populations continue to expand at Quabbin and throughout the state. Watershed lands within Quabbin most likely serves as corridors and core habitat for the species within the state. Little research has focused on moose populations in the southern extent of their range. There is a current effort to collar moose with GPS collars that is being conducted by UMass and MassWildlife. The Division should strive to support this research and potentially initiate other research projects. Research should focus on the habitat use and population dynamics of moose and the potential impact of an increasing moose population on forest growth and regeneration.

4. **An Independent Assessment of Deer Density on Quabbin Reservation.** In order to gain a better understanding of deer population dynamics at Quabbin, an independent assessment of deer density is necessary. Decisions about deer management strategies are currently based on information gained from the annual deer harvest and on periodic regeneration and browse surveys. Obtaining information on deer density, herd composition and reproduction through surveys (distance sampling, spotlight), mark-recapture, or aerial surveys would provide a much more detailed summary of deer dynamics and aid in the management process.
5. **Regional Population Dynamics, Sources of Food, and Movement Patterns of Gulls in Central Massachusetts.** Gulls (ring-billed, herring, and black-backed) are a critical water quality concern on Quabbin Reservoir. Seasonal increases in gull numbers can have direct and substantial impacts on the quality of water leaving the reservoir. Little is known, however, about the movements of these gulls, both locally and regionally. In addition, it is often assumed that regional landfills might provide gulls with their food supplies, but the importance of other sources of food (agricultural areas, commercial properties) is unclear. Finally, understanding population characteristics of these species can be useful when determining management strategies. Research to tag/mark and follow a sample of all 3 species of gulls would provide a wealth of useful information.

6.3 Biological Diversity Maintenance Needs

1. **Invasive Species Inventory and Monitoring.** During FY2008, the Natural Resources Section of the Division will produce a Division-wide invasive plant management plan. One of the first chores associated with this planning effort will be to design inventory methods and conduct or supervise an initial inventory of current populations of invasive plants. Monitoring the status of these species as active management is implemented will provide feedback on the effectiveness of the control efforts and guide priorities for limited management resources.
2. **Rare Species Inventory and Monitoring.** The Division has worked for many years to find and monitor populations of rare animal and plant species. However, it is highly likely that many populations exist that have yet to be identified. Since the critical first step to protecting these species is knowing where they are, there is an ongoing need to continue to prospect in likely habitats for their presence, and to then incorporate their protection in planning for overlapping or adjacent management activities.
3. **Rare or Uncommon Habitat Inventory.** During the last management period, as described in Section 2.6.2.3, the Division contracted with the University of Massachusetts Department of Natural Resources Conservation to classify and begin to identify rare and uncommon habitats on the Quabbin watershed. This report was completed and gave examples of these habitats. To continue this effort would next require a more thorough identification of all examples of these rare habitats in order to protect their critical features during management activities. While this occurs to some extent as part of the internal review process for proposed timber harvesting or road maintenance activities, there remains a significant amount of work to complete this inventory and then to map the results.

6.4 Long Range Cultural Resource Inventory and Management Initiatives

A great deal of progress has been made in the past decade identifying cultural resources and improving databases and mapping to make certain these resources are apparent when management activities overlap their locations. Nonetheless, more remains to be accomplished in order to provide full protection for these resources.

1. **Historic Sites Inventory.** Improve the Quabbin inventory of historic sites by adding attributes such as site age, owner, activities, and buildings, to the database. These data will be used to prioritize vegetation management efforts and improve the review of silvicultural operations.
2. **Prehistoric Sites Inventory.** Add known prehistoric sites to the Quabbin GIS database. Current protection for these sites is provided through the application of site location criteria for their likely occurrence, but this model has not been extensively tested at Quabbin.
3. **Effects of Historical Cultivation on Prehistoric Sites.** Conduct archaeological sampling of red pine plantations, which were primarily planted on previously cultivated land, to determine the nature of sub-surface disturbance and survival factor for prehistoric sites.
4. **Educational Signage.** Develop educational signs and displays on Native American land use of the region.
5. **University Field Schools.** Encourage local universities to conduct archaeological field schools on watershed lands to further test and refine site location criteria.