

Reaching Conservation-oriented goals: Perspectives from the 2008 Park Break Program at Delaware Water Gap National Recreation Area

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MANAGEMENT OF THE NATIONAL PARK SYSTEM is replete with complex challenges. Teaching the next generation of park scientists, managers, and conservation professionals about the intricate interrelationships between natural and human systems is of great importance. The future of protected area management is particularly dependent on the opportunities provided to young scholars to learn about park administration, conservation policy, and the research process, especially given increasing demands for natural resources, diversifying visitor populations, and demographic shifts in the work force. To address this challenge, in 2008 the George Wright Society organized a field seminar program in cooperation with the National Park Service (NPS), U.S. Geological Survey (USGS), Texas A&M University, Colorado State University, and the Student Conservation Association. This program, titled “Park Break,” enabled a select number of graduate students to engage in conversations with park managers, conservation and recreation scientists, administrators, and other professionals through field and classroom activities in national park settings.

In 2008, the inaugural year of Park Break, we were fortunate to be part of a group that went to Delaware Water Gap National Recreation Area, one of four host parks. The session at Delaware Water Gap was designed around the theme of conservation policy in natural resources and visitor management. A variety of invited experts from local, regional, and national levels exchanged perspectives with eight national and international graduate students, exploring past NPS policies, major challenges facing the parks, and key tenets of the political system that influence park decision-making.

Structure and design

This article, from the perspective of two Delaware Water Gap Park Break fellows, uses conservation policy as a lens to examine six components of park management that fall within the context of ecological systems and visitor experiences: (1) sensitive ecological resources, (2) non-native and invasive species, (3) water resources, (4) outdoor recreation, (5) environmental interpretation and education, and (6) cultural resources. To explore these six components, we utilized the knowledge gained in our preparation for the 2008 Park Break program, our on-site experiences, and conversations shared with park managers, local stakeholders, and guest speakers.

We begin this essay with background information on both the underlying policies that

help govern management decisions in the NPS and the context of the Delaware Water Gap National Recreation Area. In the following section, we discuss the six components mentioned above. More specifically, we explain how Delaware Water Gap has integrated these aspects of management into decisions about natural, cultural, and historical resources. Finally, we present lessons that we learned throughout the Park Break program. We hope that our description of the strategies and approaches applied at Delaware Water Gap will help park managers more effectively address common challenges associated with protecting the integrity of the national park system.

National Park Service policy

Management policies provide a framework to help guide decisions about public resources that fall under the purview of NPS. Decisions about park management are grounded in a complicated yet artfully constructed mandate, the Organic Act of 1916. This act directs NPS to “promote and regulate the use of ... national parks, monuments, and reservations ... to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same ... as will leave them unimpaired for the enjoyment of future generations” (16 USC 1). The agency is thus challenged with an inherently contradictory charge to preserve the America’s most precious natural resources and maintain the quality of the visitor experience (Winks 1997).

All NPS administrators must, in addition to the 1916 Organic Act, take into consideration a complex mix of other directives and a hierarchy of laws, regulations, and policies that help govern management of park natural resources and visitor experiences. In addition to federal mandates such as the Organic Act, appropriate use of resources at the individual park level are determined by the legislation set forth in each park’s enabling statutes. Various designations of NPS units (e.g., national recreation area, national historical park, national seashore) help managers to prioritize their efforts, in that policies concerning preservation versus visitor access often differ. For example, a national recreation area emphasizes the visitor experience and, as such, may face challenges in terms of public relations. In a national park, the answer for many questions regarding activities and consumptive uses of natural resources is “you cannot do that here.” In national recreation areas however, the answer, more often than not, is “yes but” and the “but” is where all of the controversy arises (John Donahue, personal communication, June 9, 2008).

Delaware Water Gap National Recreation Area

Delaware Water Gap National Recreation Area is located in Pennsylvania and New Jersey, in close proximity to several large population centers in the eastern United States, including New York City and Philadelphia. Embedded in the metropolitan area that runs from Washington, D.C., to Boston, Delaware Water Gap is the tenth-most-frequently-visited U.S. national park. One of the driving considerations to designate Delaware Water Gap as an NPS unit in 1965 was preserving the scenic and resource values of the Delaware River. The Middle Delaware Scenic and Recreational River was designated thereafter in 1978. The river spans 331 miles, 40 of which are included in the national wild and scenic rivers system within Delaware Water Gap (Wild and Scenic Rivers Act Amendments 1978).

As with many other NPS units, the history establishing Delaware Water Gap was controversial. In 1955, a major flood occurred in the Delaware River Valley and the U.S. Army Corps of Engineers responded with a proposal to construct the Tocks Island Dam. The intent of this project was to provide flood control, create a water supply and recreation area, and generate hydroelectric power (Albert 2005). The resulting reservoir would have flooded nearly 60,000 acres that were partially occupied by private landowners. Congress authorized the proposed dam in 1962 but abandoned the project due to problems with geology, high cost during the Vietnam War, and a local grassroots movement that opposed construction (Shukaitus 2007). In 1965, Congress established Delaware Water Gap in place of the Tocks Island Dam and recreation area, leaving the Delaware River as the last major undammed river in the eastern United States.

Environmental components of management

Sensitive ecological resources In our discussions with managers and other guest speakers during and after the 2008 Park Break program, a number of environmentally relevant components of management emerged, the first of which related to sensitive ecological resources. The National Park Service is charged to protect native flora and fauna, restore former native populations extirpated by human activity, and minimize anthropogenic impacts to individual animals, populations, and ecosystems (NPS 2006). Given the susceptibility of rare and/or fragile species, this aspect of NPS management is particularly important to ensure that natural resources are unimpaired for future generations.

To manage for this first component, Delaware Water Gap decision-makers have identified areas in the park that require special attention and taken steps to minimize unnecessary biophysical impacts, despite the challenges (e.g., temporary closures for visitors) associated with maintaining sensitive resources. The Delaware Water Gap park staff has been engaged in managing wetlands and protecting state-listed species such as timber rattlesnakes (*Crotalus horridus*), wood turtles (*Glyptemys insculpta*), and Jefferson salamanders (*Ambystoma jeffersonianum*). Managers have also monitored habitats such as river bedrock, cactus barrens, and shale cliff outcrops. A number of federally protected species are also monitored, including bald eagles (*Haliaeetus leucocephalus*), peregrine falcons (*Falco peregrinus*), bog turtles (*Clemmys muhlenbergii*), and Indiana bats (*Myotis sodalis*). Human activity is prohibited and/or redirected to minimize disturbance near nest sites and other areas used by rare, threatened, or endangered species. Several examples include restrictions on hang-gliding near known timber rattlesnake habitat, swimming near wood turtle habitat, and road traffic during the seasonal migration of salamanders.

Park managers at Delaware Water Gap are also taking an active role in managing a hemlock-dominated forest that is declining due to infestations of two non-native insects: the hemlock woolly adelgid (*Adelges tsugae*) and elongate hemlock scale (*Fiorinia externa*). Upon establishing permanent forest monitoring plots to track infestation levels and hemlock health, empirical research attributed the loss of hemlocks to insect infestation. From 1993–2006, 28% of hemlock trees in the monitoring plots died, with a predicted 80% mortality by 2022 (Evans and Shreiner 2008). Management responses to this issue have included releasing biocontrol agents, applying insecticides to thousands of individual trees and herbicides

to suppress invasions of non-native plants, constructing deer fences, and initiating reforestation projects.

Non-native and invasive species The second component of environmental management at Delaware Water Gap that we would like to highlight relates to non-native and invasive species. One definition of exotics species is “those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities” (NPS 2006). Exotic species should be prioritized within a management plan, because of their ability to displace native plants, reduce biodiversity, and alter ecosystem functions (Vitousek et al. 1997; Stohlgren et al. 1999). One potential solution that park managers might consider to combat the spread of non-native species includes identifying indicators of stress, such as loss of species and increased numbers of threatened or exotics species (Jarvis 2007).

The spread of invasive and non-native species has been identified as a particularly relevant component of management at Delaware Water Gap given its linear shape and limited land base. The park’s resource management and science division at is going to great lengths to eradicate invasive species and has taken a landscape-level approach to minimize the probability of introducing non-native plants. The park’s efforts to create contiguous open space more amenable to harboring endemic flora and fauna is challenging because the Pennsylvania side of the Delaware Water Gap is largely dominated by private land. However, park managers have engendered public and political support through collaborations with permittees and lessees to clear invasive species from cultivated lands that exist in areas designated for agriculture. By including the cost of acquiring property from willing sellers in the planning process, the park has connected tracts of open space and created buffer zones to more effectively manage for non-native plant invasion.

Water resources The final component of environmental management that we found to be relevant at Delaware Water Gap related to water resources. Maintaining high standards for surface- and groundwater in NPS units is important for both aquatic and terrestrial ecosystems, especially given the limited hydrological resources available to most U.S. population centers (Pimental et al. 1997; Vörösmarty et. al 2000). NPS is mandated to protect park waters in accordance with local, state, and federal regulations such as the Clean Water Act; work with governmental bodies to obtain the highest standards; and cooperate with other agencies to maintain and restore water resources (NPS 2006).

Managers at Delaware Water Gap have consistently prioritized high water-quality standards and have been monitoring the Delaware River since the late 1970s. Through public outreach and education, both legislators and the public have acknowledged the benefits derived from maintaining high water-quality standards that affect public health, quality of life, and recreational opportunities such as boating, swimming and fishing. As a “bottom of the watershed” park that includes 40 miles of a designated scenic and recreational river under the Wild and Scenic River Act, this resource plays an integral role in the conservation of a host of species. For example, the dwarf wedgemussel (*Alasmidonta heterodon*) is a federally endangered species that is highly sensitive to flow regulation of the river.

Park managers at Delaware Water Gap have demonstrated that maintenance of exceptionally good water quality can be accomplished through sustained monitoring and partner-

ships with outside entities such as the Delaware River Basin Commission (DRBC) and the USGS. The DRBC and USGS have worked closely with park managers to monitor water quality and use the resulting data to create regulatory standards that prevent unnecessary degradation. In 1992, the DRBC officially designated the Delaware River and its tributaries within and surrounding Delaware Water Gap as outstanding basin waters and subsequently instituted special protection regulations to prohibit declines in existing water quality. Public health standards through state and federal regulations on public drinking water have also influenced water quality at the park, because the upstream river corridor that feeds into the park is diverted to provide drinking water for New York City.

Social components of management

Outdoor recreation In our discussions with managers and other professionals who presented at the 2008 Delaware Water Gap Park Beak session, outdoor recreation was emphasized as a central component to management of park visitor experiences. Providing opportunities for the greatest number of people to enjoy park resources in perpetuity, while limiting unnecessary environmental impacts, are key ingredients in conservation policy that should be prioritized in management agendas. In particular, supporting recreation science can help determine how much change should be allowed to take place within the resource (e.g., environmental conditions), social (e.g., visitor crowding), and management (e.g., interpretive signage) dimensions of opportunities for visitors (Manning 2007).

Park managers at Delaware Water Gap have strategically planned for appropriate levels of use and development by anticipating the levels of impact associated with recreational activities and settings. For example, Delaware Water Gap managers have constructed a well-planned trail system that provides access to visitors, clearly directs traffic to discourage off-trail use, and avoids creating unnecessary social trails at popular, high-use areas in the park. In addition, special use permits and fees have been implemented to limit resource impact, allow for monitoring of sensitive resources, and fund services and/or maintenance of facilities. The park has also responded to over-utilization of resources at popular destinations such as points along the Delaware River used for swimming, canoeing (e.g., Bushkill-Dingmans Ferry, Milford, Smithfield Beach in Monroe County), and waterfall trails. In areas where user fees are collected, temporary closures have been instituted when capacity levels are reached.

Environmental interpretation and education Environmental education and interpretation are important components of visitor management in NPS. Environmental interpretation can be defined as the communication of ideas that express certain qualities and clarify meanings of a given area while building relationships between people and the environment (Ham 1992). Interpretation is used by NPS to educate the public about park resources and provide justification for actions such as temporary closures (Marion and Reid 2007). The agency also employs interpretation to conceptualize themes focused on political and historical significance, and convey the values associated with the agency's mission (NPS 2006).

At Delaware Water Gap, we found that a variety of interpretive devices have been utilized to communicate NPS ideals, including guided tours, community education, signs, and exhibits. For example, the Pocono Environmental Education Center, a private non-profit

organization, has worked with the park to provide environmental and cultural education for park visitors to become more familiar with natural resources in and around Delaware Water Gap. The center attracts a variety of youth and other members of the public from local and regional areas and aims to encourage conservation ethics through environmental interpretation. Additionally, historical re-enactments are available to the public at the home of Gifford Pinchot, the first chief of the U.S. Forest Service. The majority of Park Break meetings were held at this locale, and all participants in the program were able to view interpretive demonstrations of Pinchot's life.

Cultural resources The final component of visitor management that we would like to highlight relates to the preservation and interpretation of cultural and historical resources. NPS is challenged to remain in compliance with federal laws protecting cultural resources, while maintaining accurate representations of the communities that identify with and surround the park areas. More specifically, the agency is mandated to understand, document, and evaluate cultural resources; integrate cultural resources management and communication with researchers into planning strategies; and protect and provide opportunities for public enjoyment of cultural resources (NPS 2006).

Historical and cultural resources, such as structures and related properties either owned or managed by NPS, play an important role in the scope of management at Delaware Water Gap. There are 550 buildings under the jurisdiction of the park that contribute to the cultural landscape, 39 of which have been identified as historic and/or significant. This collection is approximately the thirteenth largest in the national park system. While the park recognizes that the commemorative histories associated with these buildings are valued by the public, there have been budgetary constraints and limits on personnel to repair and maintain these facilities.

Cultural resources management at Delaware Water Gap is a sensitive topic among community members, in part due to the history that unfolded during the formation of the park. The Army Corps of Engineers acquired much of the land to establish Delaware Water Gap using eminent domain, and some local community members have consequently directed negative attitudes toward the government (Shukaitus 2007). Because community members who were displaced by plans to build the Tock's Island Dam have expressed the desire to protect and maintain historic buildings, Delaware Water Gap management has taken steps to form partnerships within the community and sustain these special places. For example, one historic area managed by Delaware Water Gap, Millbrook Village, illustrates the lifestyle of the surrounding community during the 19th century. This site comprises approximately 25 original and reconstructed buildings that come alive through interpretation by park staff and volunteers. Visitors can witness and participate in period demonstrations of crafts and skills, in which volunteers of the Millbrook Village Society proudly highlight the stories of local history.

Lessons learned

In the 2008 Park Break program, we learned a number of lessons concerning the management approach taken at Delaware Water Gap. Overall, we believe the park has been largely successful in protecting the integrity of the natural environment while providing high-quality

ty visitor experiences. We found three efforts employed at the park to be particularly effective in overcoming the challenges associated with applications of conservation policy: (1) inventorying and monitoring park conditions, (2) communication of NPS ideals among park staff members and public constituencies, and (3) strategic management actions (see Table 1).

Conclusions

We would like to highlight Delaware Water Gap’s strong focus on building collaborations because we feel this has been instrumental in helping the park achieve its conservation-oriented goals. Park administrators have taken into consideration the challenges associated with managing relatively limited and narrow tracts of land. Through collaborative efforts, buffer zones and wildlife corridors have been created—an initiative directed personally by the park superintendent. Inventorying and monitoring of water quality, stream fish and macroinvertebrates, and amphibian populations have been undertaken in partnership with USGS scientists, and opportunities for environmental education have been offered through cooperation ventures with the Pocono Environmental Education Center, local community members at Millbrook village, and U.S. Forest Service employees. At the national and state levels, Delaware Water Gap management has forged mutually beneficial relationships with the National Parks Conservation Association, Trust for Public Lands, The Nature Conservancy,

Table 1. Summary of lessons learned at Delaware Water Gap National Recreation Area during the 2008 Park Break program.

Lessons Learned	Applications to park and protected area management
Inventorying and monitoring park conditions	<ul style="list-style-type: none"> - Complete thorough management inventories and relevant monitoring to set regulatory standards, document invasive species and identify at-risk ecosystems - Designate areas of low and high use, monitor access points, and support research on visitor preferences for management - Conduct “cutting-edge” research that links inventories and monitoring directly to management decisions - Establish anti-degradation water quality standards ▪ Focus efforts on particularly susceptible resources and institute more stringent practices during important periods
Communication of NPS ideals among park staff and public constituencies	<ul style="list-style-type: none"> ▪ Communicate reasons for management actions through environmental interpretation and education ▪ Share information with other decision-makers and researchers ▪ Hold workshops for public constituencies to foster a conservation ethic, connect community with historic and cultural resources, and highlight the benefits potentially derived from park resources ▪ Instill a common vision among park staff that builds and maintains leadership
Strategic management actions	<ul style="list-style-type: none"> ▪ Be proactive and set regulatory standards to prevent impairment of park resources before problems arise ▪ Identify areas of concern to potentially compensate funding constraints ▪ Rely on empirical support for guidance on decisions ▪ Build positive relationships with public, private, and nonprofit organizations to create wildlife corridors and connect protected areas through land acquisition ▪ Take a landscape level approach to science and management

and Pennsylvania Department of Conservation and Protection. The park's dedication to collaborative management has also helped spread the NPS mission and teach today's youth important lessons about natural resources management, as reflected by its involvement in the Park Break program, which has fostered a sense of stewardship among the leaders of tomorrow.

While Delaware Water Gap management has been largely successful from our perspective, we believe that the park could more effectively further the NPS mission with a stronger focus on a recreation science program that would allow them to better understand the biophysical and experiential impacts associated with visitor use (Cole 2006). For example, adopting Visitor Experience Resource Protection (VERP) or Limits of Acceptable Change (LAC) frameworks would help to establish a baseline understanding of visitor preferences for management, monitor conditions over time, and ensure the continuance of high-quality experiences. An updated general management plan would contribute to the park's ability to accomplish this end by identifying aspects of management that could be strengthened. While these recommendations may bring to light a few challenges still to be addressed at Delaware Water Gap, our intention is to demonstrate how the park may further integrate the strategies outlined in the essay into management priorities for resource stewardship and visitor experiences.

As 2008 Park Break fellows, we found that Delaware Water Gap National Recreation Area is reaching toward its conservation-oriented goals through successful inventorying and monitoring of park resources, communication of NPS ideals among park staff and public constituencies, and strategic management actions. Six components of management emerged in our experiences surrounding Park Break, and the strategies applied at the park provided valuable insights into the complexities associated with park management. We have presented the methods employed at Delaware Water Gap to encourage critical thinking about common challenges and common solutions in NPS management.

Acknowledgments

We would like to extend our appreciation to John Donahue, Robert Karotko, Suzette Kimball, Gillian Bowser, Corliss Outley, Debbie O'Leary, and many others involved in the Park Break program. A special thanks to Robin Winks, Richard Evans, and Sally Corrigan for their valued feedback on drafts of this essay.

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