

An innovative training program enhances science-based management

By Kathleen Kodish Reeder



Figure 1. Formed during the last Ice Age, kettle ponds are a primary resource of Cape Cod National Seashore. One of the first participants of the Natural Resource Professional Development Program, Krista Lee, studied the geochemical processes that influence water quality of the ponds.

The Northeast Region's FY 2001–2005 Natural Resource Challenge plan emphasizes that information derived from rigorous scientific research is the best foundation for making management decisions affecting natural resources. Many natural resource managers are working to make their parks centers for broad scientific and scholarly inquiry by using science-based standards to determine the condition of their natural resources, and to evaluate the success of resource preservation and restoration strategies. Accordingly, the Northeast Region (NER) has established agreements with scientists at universities and research agencies such as the U.S. Geological Survey to conduct research in the parks. In many instances, however, natural resource managers believe that they can implement science-based management most effectively by improving the level of scientific expertise within the parks.

In 1998 this belief led the Northeast Region to create an ongoing program designed to support two National Park Service (NPS) employees, one from the New England Cluster and the other from the Chesapeake-Allegheny Clusters, in their pursuit of an approved, graduate-level course of study in the natural and physical sciences. According to Marie Rust, Regional Director, "It is our intent, through this Natural Resource Professional Development Program [NRPDP], to enhance the natural resource academic credentials and skill levels of our region's resource managers so that we will have the ability to effectively resolve the many complex issues threatening our park resources." Once a participant has completed the development program, new applications are accepted from that cluster for the subsequent fiscal year.

Program profile

Participants, who must be permanent park or support office employees, are competitively chosen by a panel comprising

regional and park natural and human resource professionals. While individuals may pursue advanced training in any of the natural or physical sciences, certain academic disciplines are given priority: hydrology, limnology, coastal geology, fisheries biology, aquatic ecology, botany, forestry, and wildlife ecology. In the essay that accompanies the application, applicants describe their previous or current graduate-level courses and explain the field of study or research (if appropriate) they would pursue. If selected for the program, they sign an agreement that formally describes their objectives and stipulates the length of time that they are expected to continue working for the National Park Service after training (typically time equal to the length of participation in the program). To remain in the program, individuals must maintain a "C" grade point average; employees who fail to complete the program or meet any of the other requirements are liable for the full cost of any funds received while participating in the program. Since the purpose of facilitating advanced education is to raise the staff's level of scientific expertise, the review panel gives priority to individuals who show promise, but have limited or no experience designing or supervising research studies involving natural resources in the parks.

According to Mary Foley, Regional Chief Scientist of the Boston Support Office, the Natural Resource Professional Development Program offers the flexibility and financial support that make pursuing advanced study more feasible than traditional post-graduate or training options. For example, the regional Natural Resource Program provides each participant up to \$25,000 per year to cover the costs of tuition, books, or research activities while the employee continues to receive regular pay and benefits. After completion of training or study, the employee returns to his or her duty station. The training objectives are individually designed by the selected applicant, his or

her supervisor, the support office chief scientist, and the appropriate university faculty so that the skills being acquired (and even the research activities themselves) can complement the park's natural resource goals. Within the parameters of the program (a maximum of three consecutive years), the natural resource professional and his or her park manager can determine the best schedule for the employee and the park, resulting in a variety of possible combinations of part- or full-time study and regular duty. Negotiations can also result in unused program funds being made available to the applicant's park if they are needed to fill the vacated position while the participant is in training.

With the recent completion of the program by the first two participants, it has already become clear that there is a strong "return-on-investment" on several levels. The knowledge and experience acquired by these graduates have shown that the program can benefit not only the individuals and their respective parks, but also the National Park Service as a whole, and many of the agencies and institutions that are their partners in natural resource conservation.

Cape Cod case study

Krista Lee, a chemist with the North Atlantic Coastal Laboratories at the Cape Cod National Seashore (Massachusetts), was accepted into the development program in fall 1998 and concluded her studies in December 2000. Ms. Lee's course of study included earning 32 credit hours at Boston University and writing her master's thesis in earth sciences with a concentration in environmental geochemistry. When she was not in classes or conducting field research, she was working at her position with the National Park Service. The motivation for her research was the need to analyze the geochemical processes that influence the water quality of the cape's freshwater kettle ponds. These ponds, formed during the last Ice Age, are a primary and unique natural resource at Cape Cod National Seashore.

To understand the influence of groundwater on the kettle ponds, Ms. Lee needed a basic understanding of Cape Cod's hydrologic budget. In this phase of her research she employed mathematical hydrologic modeling and GPS (global positioning system) technology to assess the local hydrologic setting around two of the ponds. Duck Pond, an isolated basin primarily influenced by precipitation and groundwater, and Gull Pond, which is stream-fed, were chosen by Ms. Lee because their differences offered the opportunity to learn the effects of several variables on kettle pond geochemistry (fig.1).

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In order to analyze the water quality of both sites and the surrounding groundwater, Ms. Lee quantified trace elements by using a spectroscopy technique that reveals very low levels of elements in the samples based on the light energy those elements emit. Ms. Lee identified the nutrients present in the pond water and groundwater by conducting flow injection analysis, a technique that uses color chemistry to indicate levels of nutrients in the samples. Identifying the primary internal and external sources of nutrients yielded the "nutrient budget" of the ponds. Knowing how to determine the typical annual budget for a pond will be helpful in determining the source and impact of nutrients and trace elements on the ponds in the future.

Ms. Lee's advanced studies have already benefited Cape Cod National Seashore because they quantify the trace elemental and nutrient levels of the surrounding groundwater influencing the ponds. Since the quality of the kettle ponds will be affected by future development and visitor use, managers must have the ability to monitor groundwater and pond water changes. With her new analytical skills, Ms. Lee will be able to participate in ongoing monitoring programs and new initiatives, as well as recommend strategies to address external threats, such as septic tank leaks. According to Ms. Lee, "I can

now provide additional analytical and technical assistance to park management regarding water quality issues, and I have learned a bit about the hydrologic processes that influence the ponds on the cape." She has begun sharing both her research findings and the techniques she has learned by attending professional conferences and making presentations.

Assateague Island case study

The effectiveness of the development program has also been evident in the accomplishments of Christopher Lea, a plant ecologist at Assateague Island National Seashore (Maryland). In 1994, Mr. Lea, a full-time National Park Service employee, began using his personal time to take courses and gather field data to earn his Master of Science degree at George Mason

Figure 2. An early participant in the Natural Resource Professional Development Program, plant ecologist Chris Lea of Assateague Island National Seashore described the relationship between the plant communities near the Potomac River Gorge and the flooding of the river. Part of the project involved recording data on bedrock cover on South Bear Island, which floods every five to ten years on average.



University in Fairfax, Virginia. When the Northeast Region created its professional development program in 1998, Mr. Lea applied for the program to facilitate completing the last stage of his studies. From August 1998 (when he was accepted in the program) until April 2000, he continued to work for the National Park Service while taking his last required course, analyzing data, and writing his thesis. Although he most likely would have completed the requirements for a degree without NRPDP assistance, the program (combined with other resources) alleviated educational expenses and enabled him to expedite his studies and conduct a research effort that was much more sophisticated and challenging than a typical research project at the master's level.

Mr. Lea's master's thesis reflects his desire to understand ecological theory and to apply his research to the resolution of park conservation issues. His two objectives were to describe the nature of the relationship between the vegetation (plant communities) near the Potomac River and the flooding of the river; and to classify and describe the plant community types (associations) in the Potomac River Gorge (Great Falls Park, Virginia, and part of the C&O Canal National Historical Park, Maryland) by using the National Vegetation Classification System (NVCS) (fig. 2, page 35). The sophistication of this research is evident in the cross-sectional diagram (fig. 3, below) depicting an imaginary "slice" across the gorge. In this side view (taken from a larger, conceptual model), Mr. Lea depicts the correlation of plants growing at various elevations with the frequency that flooding inundated those areas. As he developed his conceptual model, he incorporated field data

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about the various vascular plant communities relative to flooding frequency and "flood energy." Concepts such as the energy of a flood (river volume and speed) were based on calculating the percentage of rock covered in "high energy" areas, and by determining the mean soil texture in "low energy" areas.

The prestige of Mr. Lea's research has already enhanced both his career and the reputation of the National Park Service. His study has been one of the few that examines fluvial environmental effects on vegetation by directly measuring flooding frequency, and one of the first to measure the effect of

river energy as a factor affecting riparian vegetation. Mr. Lea has also provided vegetation classification data for several parks, and the first classification of vegetation in the Potomac River Gorge, an area well known for its nationally significant biological diversity. While classifying vegetation, he identified several community types that are currently believed to be globally rare, including *Quercus bicolor*-*Fraxinus pennsylvanica*-*Chasmanthium latifolium* woodland. His survey also revealed new locations of rare, threatened, or endangered plant species, including some that had not been found in

the area for more than 70 years. These inventory results have been used in two Expedition Into The Parks research projects funded by Canon U.S.A., Inc., and included in the USGS-NPS Vegetation Mapping Program.

Other professional opportunities for Mr. Lea to share his findings have been plentiful. Individual parks in the Northeast have asked for technical assistance in classifying vegetation, and several conservation-oriented agencies and national associations have asked him to address conferences and to assist

them in conservation planning. Among those interested in—and benefiting from—his research are The Nature Conservancy, the Maryland Department of Natural Resources, the Ecological Society of America, the Virginia Natural Heritage Program, and the Washington Botanical Society. In referring to the significance of these interactions, Mr. Lea observes, "The NRPDP allowed me to create professional presentations, both in the thesis (which will be further used in publishing) and at meetings. The public relations benefits and professional recognition for the National Park Service cannot be underestimated."

From a management perspective, the skills Mr. Lea developed while participating in the development program have enabled him to conduct his duties

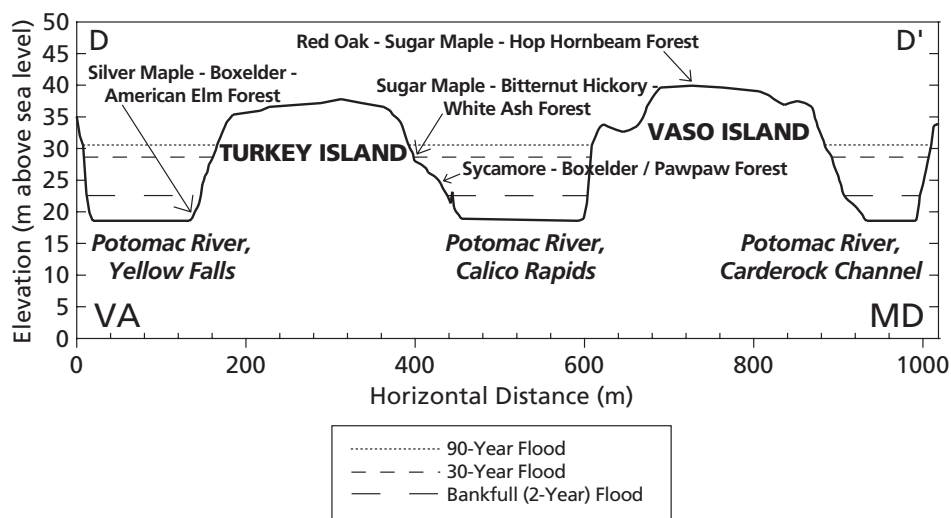


Figure 3. Taken from a larger conceptual model, this side view of the Potomac River Gorge depicts the correlation of vegetation growing at various elevations with flood frequency. Mr. Lea was able to conduct a research effort that was much more sophisticated than a typical research project at the master's level because of the support he received in the development program.

with a degree of professionalism that has made him indispensable. For example, when a threatened plant species, the seabeach amaranth (*Amaranthus pumilus*) was recently re-discovered on Assateague Island after an absence of 30 years, the park needed a comprehensive protection and restoration plan that included evaluating the species' habitat requirements and testing several restoration strategies. Carl Zimmerman, Assateague Island National Seashore's Chief of Resource Management, states that "this effort demanded strong analytic skills, the ability to research and synthesize a broad range of disparate ecological information, and a thorough understanding of research design and hypothesis testing—all of which were markedly enhanced by Chris' participation in a graduate degree program."

Acadia participant

Both Ms. Lee's and Mr. Lea's newly acquired skills have clearly benefited their respective careers and their parks. Most importantly, these participants are fulfilling the purpose of the development program by using science-based standards when they assess the condition of park natural resources and propose management strategies. A newly approved participant, Linda Gregory, also illustrates the multiple—and mutual—advantages of the program. On leave from her duties as a botanist at Acadia National Park in Bar Harbor, Maine, Ms. Gregory will receive full pay and benefits while attending graduate classes and conducting research in her park. Moreover, as part of a team examining the effect of exotic plants on the pollination of native species, she will combine the results of her graduate work in botany with the results of research by biologists with the USGS Biological Resources Division, the USGS Patuxent Wildlife Research Center, and the University of Maine.

Such a close synchronization of goals among career-minded individuals, the National Park Service, and affiliated conservation agencies is what David Manski, Chief of Resource Management at Acadia National Park, envisioned as one of the developers of the Natural Resource Professional Development Program. The equation for the program's success is aptly summarized by his observation that "Park employees earned advanced degrees before the NRPDP was established, but this program formally promotes and supports graduate study in a way that attracts and motivates employees." In effect, the Northeast Region has confirmed that designating funds and time for the development of the parks' human resources is one of the most effective strategies for meeting the Natural Resource Challenge. 

About the Author

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