

Incorporating Consideration of Ecosystem Services into Plans for the Great Dismal Swamp National Wildlife Refuge

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FEDERAL AGENCY EXPLORATIONS AND APPLICATIONS: CASE 5
U.S. FISH AND WILDLIFE SERVICE

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into Plans for the
Great Dismal Swamp National Wildlife Refuge**

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About This Document

This case is part of the Federal Resource Management and Ecosystem Services (FRMES) Guidebook created by the [National Ecosystem Services Partnership](#) (NESP). NESP, housed at the [Nicholas Institute for Environmental Policy Solutions](#), seeks to enhance collaboration within the ecosystem services community and to strengthen coordination of policy implementation and research at the national level. The FRMES Guidebook represents a collaborative effort by federal agencies and outside experts to develop a credible and feasible approach to incorporating ecosystem services into the decision-making processes of federal agencies.

Cases are written and approved by the author(s)' agency, but they have not been peer reviewed. They describe the decision-making context within which that agency is considering or testing an ecosystem services management framework, and they present approaches or innovations that the agency is using to incorporate ecosystem services into its planning and decision-making processes. Cases informed development of the FRMES Guidebook and could be of value to others embarking on ecosystem services planning and management efforts.

To read other federal agency explorations and applications of an ecosystem services management framework, visit www.nespguidebook.com.

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Incorporating Consideration of Ecosystem Services into Plans for the Great Dismal Swamp National Wildlife Refuge

The Great Dismal Swamp National Wildlife Refuge (NWR) is located on the border of northeastern North Carolina and southeastern Virginia, where it provides ecosystem services to a population of more than 1.6 million in the adjacent Virginia Tidewater metropolitan area.¹ These services include recreation opportunities, carbon sequestration, moderation of the release of mercury and other soil-bound pollutants into regional waterways, and natural cooling.

The refuge was established in 1974 to conserve peat lands and more than 112,000 acres of seasonally flooded wetland forest—the largest intact wetland forest on the East Coast. Comprising 20% of the Fish and Wildlife Service (FWS) Region 5 land base, the refuge includes the 3,100-acre Lake Drummond, one of only two naturally occurring lakes in the state of Virginia (Figure 1), and it has a significant hydrological connections to the Albemarle Sound and Chesapeake Bay.

Figure 1. Great Dismal Swamp National Wildlife Refuge.



¹ http://www.fws.gov/refuge/great_dismal_swamp/.

The Great Dismal Swamp has experienced perturbations from human activities over several hundred years. George Washington once helped form a group of shareholders to form the Dismal Swamp Company in order to drain, farm, and log portions of the swamp. Since that time, an estimated 150-plus miles of roads have been constructed to provide access for timbering, and associated ditches have been dug to facilitate timber harvesting by drying out swamplands. These activities have significantly altered the natural water regime of the Great Dismal Swamp, making it drier in some locations and prone to flooding in others. As a result, cypress and cedar trees, which had difficulty surviving, were slowly replaced by red maples and other forest species.

The Great Dismal Swamp NWR is working to restore and maintain the natural biological diversity and associated natural swamp ecosystem that existed prior to human alterations.

Management Challenges

Under the Dismal Swamp Study Act of 1972, a 210,000-acre area of the swamp was identified for study. At that time, it was decided to protect only 123,000 acres of the ecosystem. Since then, much of the unprotected land has been developed and converted to other uses. The corresponding loss of natural habitat has created several challenges:

- Increased frequency of droughts and tropical storm events associated with climate change,
- Altered hydrology due to ditches,
- Restrictions on the use of prescribed fire and hydrologic management due to the proximity of urban centers, and
- Lack of wildlife corridors.

The refuge area has experienced increasingly frequent drought events and, consequently, more severe fire events; 15 fires occurred in one particularly dry month. Since the early 2000s, the average size of fires has increased by an order of magnitude, from less than 100 to hundreds of acres. One of these fires burned more than 5,000 acres. In 2008 and 2011, the Great Dismal Swamp experienced wildfires lasting 121 and 111 days, respectively—the longest-duration fires in Virginia’s history.

Due to altered hydrological conditions, the refuge is even more susceptible to intensified wildfire conditions under drought conditions as well as to microbial decay of peat soils, resulting in loss of its carbon reserves and land subsidence. Land subsidence in turn destabilizes growing conditions for Atlantic white cedar, one of the refuge’s highest-priority conservation targets.

The proximity of urban area affects use of natural means such as prescribed fires and hydrologic management to minimize the frequency and intensity of wildfires. Limits on fire use can result in undesirable habitat changes and increased accumulation of downed wood, which can fuel intense wildfires.

Construction and widening of highways and encroaching human development will bring more residential and commercial development, along with potential conflicts between people and wildlife. Groundwater withdrawals on the western edge of the swamp (along the Suffolk escarpment) can reduce important groundwater inflows that drive the swamp’s hydrologic regime. Development of flood-prone areas to the north and east of the refuge may constrain hydrologic management opportunities on the refuge. It also may ecologically isolate the refuge, threatening the survival of unique species such as the black bear.

Management Efforts

In 2006, the Comprehensive Conservation Plan (CCP) for the refuge, required by statute under provisions of the 1997 National Wildlife Refuge System Improvement Act, was completed.² The CCP does not specifically address restoration of the Great Dismal Swamp NWR's hydrology and white cedar forest stands. To achieve CCP goals, the refuge is working on a habitat management plan that will protect and restore those areas within the Great Dismal Swamp ecosystem that are remnants of the Great Dismal Swamp or that can be restored to Great Dismal Swamp habitat while supporting protection and restoration of adjacent habitats that directly affect the ecosystem's vitality and viability.

The cities of Chesapeake and Suffolk—arguably the refuge's two most important municipal partners—are revising their comprehensive plans, and the Great Dismal Swamp NWR, The Nature Conservancy, and others are working with them to examine which natural resources they should aim to protect and how they can reap the development opportunities associated with rural, outdoor recreation and protection of natural landmarks. Portsmouth, Camden County, and Gates County are also slated to update their comprehensive plans. Ecosystem services concepts may help them understand the benefits of open lands and swamp protection as they consider their land and water management options.

Although there is no statutory or regulatory mandate for the Great Dismal Swamp NWR to incorporate ecosystem services into its planning, the FWS has signaled a general interest in better understanding and evaluating these services, an interest that has resulted in production of two studies. One study examined the effects on housing values of proximity to a national wildlife refuge (Taylor, Liu, and Hamilton 2012). The other study examined the ecosystem services and valuation associated with the wetland characteristics of four refuges (Patton, Bergstrom, Covich, and Moore 2012). These two studies prepared for the FWS Division of Economics could serve as a basis for conducting a quantitative assessment of some of the ecosystem services provided by the Great Dismal Swamp NWF.

Incorporating consideration of ecosystem services into plans for the Great Dismal Swamp NWR means, in part, evaluating the contribution of the refuge to air quality, water quality, and carbon sequestration and calculating the economic benefits associated with managing habitat for trust resources. This knowledge could help refuge managers and the larger community better assess resource management trade-offs.

Weighing Tradeoffs

Restoring the swamp's hydrological functioning could reduce peat exposure, which could reduce the severity and duration of wildland fires, in turn reducing surrounding communities' exposure to smoke (particulates), which can adversely affect public health. An Environmental Protection Agency linked peat bog wildfire smoke exposure in northeastern North Carolina with significant increases in relative risks for asthma, pneumonia, and acute bronchitis as well as increases in emergency department visits associated with cardiopulmonary symptoms and heart failure (Rappold et al. 2011). If its hydrological functioning is restored, the refuge could lessen not only flood risk but also the duration and adverse impacts of fire, thereby yielding public health benefits.

But restoring the refuge's hydrology to reduce peat exposure will affect the adjacent Dismal Swamp Canal, which is part of the Intracoastal Waterway managed by the U.S. Army Corp of Engineers.

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http://www.fws.gov/uploadedFiles/Region_5/NWRS/South_Zone/Great_Dismal_Swamp_Complex/Great_Dismal_Swamp/FinalCCP_GDS.pdf; <http://www.fws.gov/northeast/planning/downloads/NWRSImprovementact.pdf>. CCPs are 15-year plans, developed with public input, identifying management issues, goals, objectives, and strategies for each national wildlife refuge. For more information, see <http://www.fws.gov/mountain-prairie/planning/overview/index.html#ccp>.

Originally built for transportation purposes, the canal now largely serves recreational interests. The North Carolina Department of Transportation's Visitor Center reports some 600,000 annual visitors, more than 200,000 of them boaters. Lake Drummond is a primary source of water for the canal, which the Army Corp of Engineers manages through the Feeder Ditch that connects the two water bodies. The Dismal Swamp Study Act stipulated that the primary use of water from Lake Drummond and other waters is to be used to maintain and enhance the ecology of the Great Dismal Swamp. In accordance with an agreement with the refuge, the corp is authorized to draw water from the lake to supplement low flows on the canal, as long as the lake is not drawn down beyond a specified level.

Using an ecosystem services framework could assist in evaluating trade-offs between off-refuge recreation benefits associated with canal flows and broad public health, carbon sequestration, and other benefits associated with different levels of restoration of hydrological function in the refuge.

Options

Past drainage and flows of refuge waters into a canal system that supports high levels of recreation preclude restoration of historic water levels and patterns in the Great Dismal Swamp. However, the refuge is striving to restore enough hydrological function to prevent peat loss, to reduce the severity and duration of wildland fires and associated air quality impacts, and to provide biodiversity benefits. Restoring some of the natural hydrology of the swamp may even help the Norfolk metropolitan area, which is experiencing accelerated erosion, increased vulnerability to storm events, and unstable soils with a drawing down of the water table.

Key Players

The Fish and Wildlife Service is not the only agency making decisions regarding hydrological function, fire management, recreation, and public health associated with the Great Dismal Swamp NWR. Other federal, state, and local agencies involved in these decisions include the U.S. Army Corps of Engineers, the U.S. Department of Transportation, the Virginia Department of Environmental Quality, the North Carolina Department of State Parks, wildlife management agencies in Virginia and North Carolina; two cities, three counties, the Hampton Roads Planning District Commissioner, and the Dismal Swamp State Park.

A longtime nongovernmental partner of the refuge is The Nature Conservancy (TNC), which has helped acquire and transfer lands to the refuge as well as assist with restoration, management, and resilience enhancement efforts. TNC is interested in better characterizing and managing the ecosystem services associated with the refuge.

Other non-governmental partners include the Conservation Fund, the Trust for Public Land, and the Isaac Walton League. In addition, the refuge interacts with business organizations through the Hampton Roads Partnership and the Community Foundation. These partners have not been actively engaged in exploring how to consider ecosystem services concepts in planning and managing the area's natural resources.

FWS is moving toward adopting a landscape conservation design process to ensure that future refuge management plans consider the refuge's broad connected ecological landscape and the inter-dependence of trust resources when making management decisions on a refuge-wide scale. The plans will reflect an adaptive management philosophy and the collaboration of managers, scientists, and other stakeholders.

Funding and Resources

The United States Geological Survey (USGS) has recently initiated a study to better understand a subset of ecological services associated with the refuge. The study will look at ecosystem services such as carbon sequestration, biodiversity, wildlife viewing, and education that were all identified as providing potentially highly valued services to visitors and surrounding communities.

Needs

As noted above, the FWS Division of Economics has conducted several preliminary studies measuring the ecological services associated with refuge amenities. In general, natural wildlife refuges across the country desire this information to convey the benefits associated with the refuges and conservation-related management, particularly benefits that may not be immediately recognized and that may be difficult to convey without scientific study. This information is particularly important for refuges located in more urban areas, where communities are much more likely to be focused on active use benefits rather than on passive or non-use benefits.

In California and elsewhere, some studies have attempted to account for carbon sequestration in peat and carbon emissions associated with peat losses. As part of its study, the USGS will investigate the feasibility of doing something similar for the Great Dismal Swamp.

Conclusion

Assessing and evaluating ecosystem services associated with the Great Dismal Swamp National Wildlife Refuge—especially, services from restored hydrological function—would help refuge managers communicate the benefits of these services to surrounding communities, (2) work with the Army Corps of Engineers to evaluate trade-offs between the canal's recreational uses and the refuge's water needs, and (3) assess within-refuge trade-offs among carbon sequestration, biodiversity, and public health.

If the economic benefits associated with fewer days of high smoke exposure, including fewer adverse impacts on tourism, could be demonstrated, they might translate into surrounding communities' willingness to support and assist in paying for hydrological restoration.

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About the National Ecosystem Services Partnership

The National Ecosystem Services Partnership (NESP) engages both public and private individuals and organizations to enhance collaboration within the ecosystem services community and to strengthen coordination of policy and market implementation and research at the national level. The partnership is an initiative of Duke University's Nicholas Institute for Environmental Policy Solutions and was developed with support from the U.S. Environmental Protection Agency and with donations of expertise and time from many public and private institutions. The partnership is led by Lydia Olander, director of the Ecosystem Services Program at the Nicholas Institute, and draws on the expertise of federal agency staff, academics, NGO leaders, and ecosystem services management practitioners.

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