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The Great Dismal Swamp
Human Impacts & Management Needs

1. INTRODUCTION

The Great Dismal Swamp is an ecosystem with essential water sources, various species of wildlife, and vegetative communities that are extremely unique. The Swamp runs from Virginia to northern areas of North Carolina with the refuge in its entirety consisting of over 111,000 acres (USFWS, 2014). Created in 1973, the U.S. Fish and Wildlife Service's Great Dismal Swamp was established only beginning with 49,100 acres of land donated from Franklin, Virginia (USFWS, 2014). The refuge has three "zones": Lake Drummond, the transition zone, and the forested wetland area. The Great Dismal Swamp contains over 200 species of birds and a large variety of other species which makes it one of the last remaining natural wildlife areas on the East coast and it is important for research and education (USFWS, 2014).

2. ANTHROPOGENIC HAZARDS IMPACTING THE GREAT DISMAL SWAMP

Anthropogenic changes to the refuge have altered the water and drainage systems and increased road and gravel pollution. Natural wildfires have also increased due to low amounts of water in the swamp. The dry spells for the swamp, are increasing as a result of hydrology change, this causes the massive wildfires to become more frequent. In the years 2008 and 2011, peat fires took place costing over $20 million dollars and taking months to extinguish (The Nature Conservancy, 2017). Wildfires can cause poor air quality for humans and other animals native to the swamp, destruction of habitat, and possible breach of surrounding private properties. The swamp also has a long history of ditching which effects the ability of the swamp to naturally hydrate itself (Barrd, 2006). Peat soils and weakened mature forest stands have subsided in the areas that were ditched. Because of this, storms and hurricane events easily knocked down hundreds of acres of trees (USFWS, 2014). When the soils lose their moisture and the hydrology of the system is interfered with, the organic soils are susceptible to fire. (Phipps et al.,1979). This buildup of peat from weakening of the organic soils are

thought to have ultimately changed the drainage patterns where streams once existed (Phipps et al.,1979). Due to the succession of the water table because of the hydrology issues in the swamp, the swamp itself has been shrinking since the 18th century; this is even with the extensive amount of land that is being donated (Rose, 1992). Human activities such as road building, field tilling, and housing are responsible for the amount of surface inflow pollution that has significantly increased which reduces water quality (Rose, 1992). When the fields are tilled too quickly to remove excess water from the crops, the water enters the swamp in a matter of hours instead of days after a rain event and must be discharged or wasted when it exceeds the swamp's storage capacity. It is believed that Lake Drummond will cease to exist if it is continuously compounded with sediment and inflow from nearby farms and private lands (Rose, 1992). This increase of inflow can contribute to higher surface water levels during seasons with high storm events but reduced volume of water for the summer months and dry seasons (Otte, 1985).

3. VULNERABILITIES OF THE GREAT DISMAL SWAMP TO ANTHROPOGENIC HAZARDS

Increased wildfires and hydrology are changed mostly due to anthropogenic activity in and around the swamp make this area vulnerable. Vegetation found on the ground floor under the canopy of the swamp has suffered from inadequate seasonal hydrology, as well as lack of fire (Barrd, 2006). Recreational roads, driveways, and side roads have proven to be an increasing issue for the swamps hydrology cycle. Because compaction from the roads has altered the surface, the refuge cannot manage incoming surface water from neighboring croplands; the small amount of road access is often used to maintain wildfires (Barrd, 2006). Evapotranspiration in this area is a main cause of water removal in the Great Dismal Swamp and exceeds rainfall (Barrd, 2006). As a result, about 39 inches of rainfall are lost from the refuge (Barrd, 2006). Flooding and excess water in some of these

areas during the storm and winter seasons can yield less food for the many species of migratory birds and can affect productivity of adjacent privately-owned lands (Barrd, 2006). Organic soils in the refuge are acidic but fertile and can yield soybeans, corn, and grain (Barrd, 2006). Although some are still fertile, uncontrolled drainage can contribute to organic soils loss in and around the road-ditch corridors. Drainage has also contributed to the excessive drying of the swamps natural soils which used to be 85-95% water and now are dry enough to be prone to burning (Barrd, 2006). Water that used to recharge the shallow aquifers and enter the swamp as much delayed ground water, is now intercepted and diverted into the refuge as surface water. This increase in the volume of surface water contributes to higher surface water levels during winter and storm events when the water table comes up and may be partially responsible for reduced volumes of water to recharge the swamp during the abnormally dry summer periods (USFWS, 2006). Distance between surface elevation and the water table is an important factor to maintaining the saturated soils for the wetland vegetation (Barrd, 2006). In ditched areas of the swamp, drainage can also reduce the quality of cover for migratory birds and important native species to the area (Barrd, 2006). These ditched areas, when dry, are extremely prone to wildfires in the dry and summer seasons. Although the wildfires are becoming an issue due to increased dry time-spans, the use of prescribed burns allows organic soils to accumulate. Unfortunately, prescribed burns are made to be nearly impossible due to a lack of water for fire suppression. Uncontrolled wildfires can remove organic soil from the swamp and facilitate intrusion of vegetation that is typical in drier areas (Barrd, 2006). Wildfires prove as an important issue for the swamp but also for humans as well. Air quality in nearby urban communities can be affected and can reduce visibility and yield high levels of ozone (USFWS, 2006). This carbon-rich smoke can stretch from Hampton Roads, Virginia and North Carolina to as far north as some areas of Maryland (The Nature Conservancy, 2017).

4. LONG-TERM PERSPECTIVE FOR ANTHROPOGENIC PRESSURE ON THE GREAT DISMAL SWAMP

If the Great Dismal Swamp continues with its current or little anthropogenic management processes and standards, the water levels during winter and storm seasons would continue to be exceptionally high and be prone to road pollution and inflow from neighboring private lands and farms. The dry seasons would yield increased number of wildfires especially due the increase in temperature as a result of climate change and peat and surface grains drying out. The wildfires yield harmful carbon-rich smoke to as many as three states. If human management is more advanced and increased, better hydrology recovery can be established. This involves installation of water control systems and re-wetting the swamp by mimicking seasonal floods and managing wildfires using roadways that are still intact (The Nature Conservancy, 2017). Keeping areas of the Great Dismal Swamp road-less, creation of new road systems is not necessary but keeping old road systems keeps already compacted surface in-check and also gives accessibility to refuge to combat wildfires. While there is a need for mitigating more of the water control systems, there are currently 30 structures maintained in the refuge that have seen success. These installations and construction activities have been funded by a grant from the North American Wetlands Conservation fund in the amount of $1.4 million dollars (USFWS, 2014).

5. OPTIONS FOR THE MANAGEMENT OF THE GREAT DISMAL SWAMP

Interaction with local governments, state and federal representatives, and other partnerships are already in the works and are necessary. The Great Dismal Swamp as part of the National Wildlife Refuge has partnered with Army Corps of Engineers (COE) , Virginia Department of Game and Inland Fisheries (VDGIF), The Nature Conservancy (TNC), and the cities of Suffolk and Chesapeake, VA to establish issues dealing with rights of their lands and establishing areas of maintenance to even creating opportunities for tourism strategies and educational programs (Barrd, 2006). The refuge also

participated on the Stakeholder Advisory Committee to prepare for Black Bear management plans and worked to establish control of species issues. In terms of academic partnerships, colleges such as George Mason University, Clemson University, and Southern Methodist University have partnered with the US Geological Survey (USGS), the Fish and Wildlife Service, and the Nature Conservancy to research carbon emissions in the Great Dismal Swamp. This is to conduct ecosystem service assessments led by the USGS to tie hydrology of the swamp and wildfires to change in carbon balance (USGS, 2014). Connections with important organizations and small groups like these are important for developing options for the future and mitigating the management of the Great Dismal Swamp.

6. FRAMEWORK FOR MANAGING THE GREAT DISMAL SWAMP NWR (NATIONAL WILDLIFE REFUGE)

The National Wildlife Refuge and the U.S. Fish and Wildlife Service are involved in different decision-making frameworks. Conservation agreements and other conservation efforts such as listing species as threatened or endangered under the Endangered Species Act, including decisions on whether the conservation efforts make listing necessary or not. With this kind of power, these organizations can enlist multiple partners such as the Army Corps, local government representatives, local fire departments, the Virginia Department of Forestry, the Nature Conservancy of Virginia, Virginia Department of Conservation and Recreation, and the Virginia Prescribed Fire Council. Cooperation and communication between organizations can create more adequate planning for prescribed burning, land use management tactics, and even hydrological plans. There are also academic partnerships that can be made to restore and protect these areas. Academic partnership requires a multi-disciplinary approach to resource management. Resource management and direction must be evaluated and guided by studies and surveys conducted by biologist, ecologist, foresters, hydrologists, ornithologists, ichthyologists, entomologists, soil scientists, mammologists,

herpetologists, mycologists, geologists, archeologists, botanists, taxonomists, botanists, plant physiologists, and morphologists, geneticists, historians, limnologists, remote sensing specialists, wildlife epidemiologists, and GIS specialists (USFWS, 2006). George Mason University, Southern Methodist University, William and Mary, and Clemson University are just a few academic partners that already contribute to the hydrologic management in the Great Dismal Swamp.

7. RECOMMENDATIONS

a) Prescribed Burning and Fire control:
   - Use of Prescribed burning in between seasons of dry and wet can create organic nutrient rich soil and lower or prevent risk of natural wildfires going more prone to the area due to hydrology change;
   - Maintain connections with state and local fire agencies to promote detection of wildfires and maintain safe practicing of prescribed burns;
   - Mechanical clearing and prescribed burning to restore and maintain habitat;
   - Maintain acceptable road and ditch system to sustain equipment access and water transport for restoration operations;

b) Hydrology Development and Safeguarding:
   - Monitor levels of surface water and water table levels;
   - Maintain water level in areas affected by ditching to help combat fire and prescribed fire occurrences;
   - Maintain roads already established in the Refuge to support fire detection agencies;

c) Educate public and private landowners on importance of natural wildlife refuges and the species inside them:
   - Establish boundaries between private landowners and refuge;
   - Develop relationship with local communities to become familiar with surrounding residents to mitigate inflow that may contain pollutants, fertilizers, or insecticides harmful to refuge area;
   - Urban Interference with highway designs accessible for natural wildlife in refuge such as bears and deer (corridors)

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