

RESTORATION

Hydrologic Restoration of Peat Soils on Great Dismal Swamp National Wildlife Refuge



Great Dismal Swamp National Wildlife Refuge (GDS) is a 113,000-acre forested wetland given to the U.S. Fish and Wildlife Service (USFWS) refuge system in 1974 by The Nature Conservancy. GDS is one of the only places in Virginia with pocosins—wetland bogs that contain peat soil and woody shrubs. Peat sequesters a large amount of carbon and is critical to mitigate the impacts of climate change. Historical drainage has disrupted the hydrology of the swamp. In response, the USFWS has undertaken hydrologic restoration to rewet the peat and reduce wildfire risk by installing water control structures across the refuge over the course of decades.



Project Location



Regenerating Atlantic White Cedar on GDS Post-2011 Wildfire/USFWS

KEY ISSUES ADDRESSED

The peatland on GDS was drained over the last two centuries for logging, disrupting the natural hydrology of both groundwater and surface water. Existing peat has dried out from draining, leading to increased flood frequency and a higher risk of wildfire. Wildfires are more likely to occur during a drought and burn dried peat quickly, because of the fuel that peat is made of (e.g., leaves and twigs). When peat burns, carbon that has been stored in the soil for thousands of years is released into the atmosphere, adding to climate change impacts. While pocosins are naturally adapted to fire, the swamp's proximity to a major metropolitan area necessitates proper fire management.

PROJECT GOALS

- Install water control structures to slow drainage, rewet the peat, and restore the Great Dismal Swamp's natural hydrology
- Reduce the risk of and increase resilience to high-intensity fire at GDS
- Use water management capabilities to meet habitat goals and objectives to restore or enhance historic forest communities

IMPORTANCE OF PEAT FOR FORESTS

Rewetting peat also improves the health of the swamp's forest ecosystems, which include pond pine pocosin, Atlantic white-cedar, maple-blackgum, tupelo-bald cypress, and sweetgum-oak-poplar.



Wildland Firefighters During Catastrophic Fire on GDS/B. Clontz/TNC

PROJECT HIGHLIGHTS

Rewetting the Peat: Refuge staff installed, replaced, or repaired water control structures in existing ditches to reduce drainage and raise the water table in neighboring peat soils. The structures increased the distance that water travels as it leaks out of the swamp by directing it away from main canals. This increases the time peat soil is wet, increasing its water-storage capacity and subsequently minimizing flooding and reducing habitat and soil loss from fire damage. Since 2014, surface and groundwater levels have been raised by 0.5 to 1 ft in the swamp.

Wildfire Management and Habitat Resiliency: The frequency of wildfires on the Refuge has decreased. However, this could be attributed to more precipitation events. Notably, the return on investment for installing water control structures is high: the installation of one water control structure requires \$50,000-\$100,000 and can influence hundreds of acres of land, whereas one fire can cause \$2 million of damage per acre burned.

Habitat Restoration or Enhancement: With increased water management capability through the installation of the structures, refuge staff can manage water levels to better meet forest hydrological requirements in priority management units.

Collaborators

- The Nature Conservancy, VA and NC
- Ducks Unlimited

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LESSONS LEARNED

Data collected at surface elevation tables (SETs) indicate peat accretion is not occurring post restoration; however, the rate of peat subsidence is decreasing in re-wetted areas. This indicates adding water control structures to slow drainage has made the swamp wetter, but it has not returned the swamp to its pre-disturbed hydrology. More thorough restoration needs to occur to restore pre-disturbance hydrologic conditions, but this would require removing or repurposing legacy infrastructure such as the road and ditch network. This work would require significant monetary resources and may or may not be practical. Although the infrastructure limits the ability to restore the natural hydrologic processes of the swamp, the roads provide access for refuge management and the ditches provide wildlife habitat and a water source for fighting wildland fires.

The Service has successfully partnered with the U.S. Geological Survey (USGS) to conduct a significant amount of research on the swamp's ecology and hydrology since the refuge's establishment. This previous research played a critical role informing restoration design and evaluating the effectiveness of the work. Additionally, this research helped refuge staff communicate project goals and likely outcomes to the local community to build additional support.

NEXT STEPS

- Continue monitoring the water control structures impact on peat rewetting
- Utilize future grants and funding to add more water control structures to rewet peat and increase GDS's resilience to drought and wildfire

For more information on this project, contact the Refuge
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Largest Water Control Structure of GDS/USFWS