National Capital Region

National Park Service
U.S. Department of the Interior

Big Trees and Woody Debris — *Resource Brief*

Summary

A new study shows that National Park Service (NPS) protection allows forests in the eastern U.S. to age gracefully. Without logging or large human manipulations, NPS forests tend to have more trees that live longer and grow larger and more dead and rotting wood material providing habitat for creatures large and small.

In the National Capital Region Network (NCRN), parks like Rock Creek, protected for more than 125 years, show some characteristics consistent with old age forests. In contrast, forests in battlefield parks, which have not been protected for as long, are on average still in earlier phases of growth and succession. Yet taken as a whole, NCRN parks show more mature forest structure than nearby non-park forests.

Photo: NPS/Brolis

Large, old trees are more common in park forests—like this one being measured at Chesapeake & Ohio Canal National Historical Park.

Forest Structure

In a young forest that is recovering from logging, wind storms, or fire, the trees are all about the same age, there is little variation in tree height, and there are few gaps in the canopy. The ***density of trees*** (the number of individuals in a given area) is usually high, but because individual trees are small, the amount of area they collectively occupy (***basal area***) tends to be low. As a forest ages, the density of trees will decrease and basal area will increase. Gaps will form in the canopy as early successional trees die and fall.

Forest structure strongly influences the total number of animal species and which species are present in a forest. For example ovenbirds (*Seiurus aurocapilla*), yellow-rumped warblers (*Dendroica coronata*), and other sensitive bird species need habitat with at least 80 large trees per hectare. Forest structure also affects amphibians, reptiles, and invertebrates that rely heavily on dead wood for shelter.

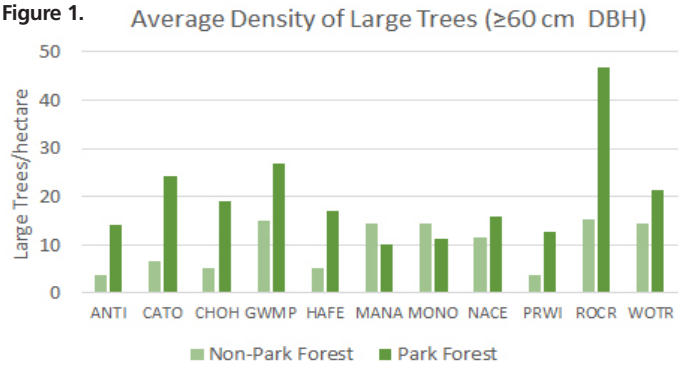
Older forests are characterized by a lower density of trees and higher basal area with many large ***snags*** (standing dead trees). This creates complex forest structure with a variety of habitat niches that can support many different species of wildlife.

Parks Have More Big Trees

In a recent comparison study, eastern NPS (park) forests averaged 33% higher basal area than nearby non-NPS (non-park) forests. In the NCRN, we observed lower basal areas at the battlefield parks of Antietam, Manassas, and Monocacy. The highest basal area was in Rock Creek Park.

When it comes to the density of large trees (≥60cm diameter at breast height or DBH) NPS forests averaged 81% higher than non-park forests. Again, Rock Creek Park, largely undisturbed since its establishment in 1890, has the second highest number of large trees per unit area among all the eastern parks studied (Figure 1). Only the small forest at Sagamore Hill National Historic Site in New York had a higher density (Sagamore is not shown in Figure 1 since it is not part of the NCRN). Other NCRN parks with many large trees are GW Memorial Parkway and Catoctin Mountain. The lowest densities of large trees occurred at the battlefield

Figure 1.



More Information

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parks of Manassas and Monocacy.

Dead Trees and Coarse Woody Debris

Whether standing as a snag or on the forest floor as coarse woody debris, dead and rotting wood material is essential habitat for certain woodland species.

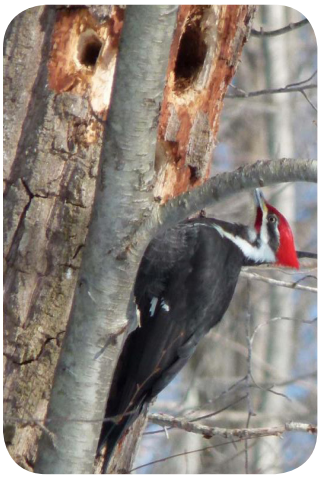


Photo: NPS/Lafever

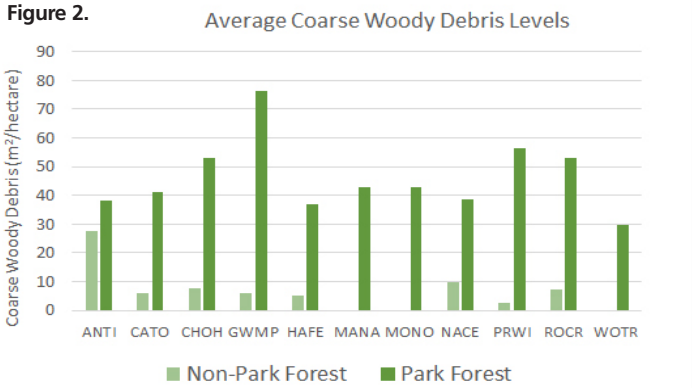
A pileated woodpecker searches a snag for insects to eat.

Large diameter snags (standing dead trees) are more abundant in parks than non-park forests. In the NCRN, Catoctin Mountain had significantly more large diameter (≥30 cm) snags as did GW Memorial Parkway, National Capital Parks - East, and Wolf Trap.

The density of dead trees (all sizes combined) across eastern parks averaged more than twice the amount (135% higher) found in non-park forests.

The average volume of ***coarse woody debris*** (dead and rotting tree matter on the forest floor) was consistently higher in parks than non-park forests. In the NCRN, GW Memorial Parkway stands out for having the greatest volume of coarse woody debris (Figure 2).

Figure 2.



Discussion

Forests in eastern parks and in surrounding lands share similar land use histories (e.g., logging, clearing for agriculture). Following their designation within the National Park Service, different land management practices (e.g., NPS forests are largely protected from logging) have created clear distinctions between park and nearby non-park forests.

Park forests have consistently higher basal area, more living and dead large trees, and considerably higher volumes of coarse woody debris. These are all characteristics of older, later-successional forests.

Many bat species in the eastern U.S. depend on roost sites in large trees, which are most common in mature forests. Similarly, some bird species, such as brown creepers (*Certhia americana*), nest under pieces of bark on snags or dying trees and, therefore, depend on a certain density of standing dead or dying trees.

Coarse woody debris provides a cool, moist, and stable environment sought by many species of salamanders. And the insects and fungi that often occupy CWD are an important food source to other wildlife.

Photo: NPS/Horton

A red salamander climbs over a piece of coarse woody debris.

Because park forests are allowed to age without large human disturbances, they play an important role in maintaining regional species diversity by providing habitat for wildlife and plant species that can only thrive in older, more structurally complex forests.

Park Abbreviations

ANTI = Antietam National Battlefield
CATO = Catoctin Mountain Park
CHOH = Chesapeake & Ohio Canal National Historical Park
GWMP = George Washington Memorial Parkway
HAFE = Harpers Ferry National Historical Park
MANA = Manassas National Battlefield Park
MONO = Monocacy National Battlefield
NACE = National Capital Parks - East
PRWI = Prince William Forest Park
ROCR = Rock Creek Park
WOTR = Wolf Trap National Park for the Performing Arts

This resource brief is based on analysis from the article: Miller, Kathryn M., et al. 2016. National Parks in the eastern United States harbor important older forest structure compared with matrix forests. Ecosphere 7(7):e01404. 10.1002/ecs2.1404