



Forest Structure In and Around Great Lakes National Parks



What Is Forest Structure and Why Is It Important?

Forest structure begins with the types and abundances of ground cover plants and the amount of dead wood lying on the ground. It continues up into the lowest branches of young trees and shrubs and includes their height and girth. It also includes the amount of standing dead trees, or snags. It then rises into the highest boughs of the canopy where openings created by windfall and fire influence the quantity and quality of light that reaches the ground. This, in turn, dictates which understory species are favored in a given site.

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 few gaps in the canopy. The *density* of trees (number of individuals in a given area) is generally very 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 will decrease and basal area will increase. Gaps will form as early successional individuals (e.g., aspens and birches) die and fall. Old growth forests are characterized by low density and high basal area with numerous large snags.

Patterns in forest structure have a strong influence on what kind and how many bird and mammal species are found there. Forest structure also affects amphibians, reptiles, and invertebrates. These groups rely heavily on dead wood for shelter.

Forest Structure in Great Lakes National Parks

Forest structure data collected in the Great Lakes Network parks (*see map*) were part of a larger study to examine how forest structure within our parks differs from that of the surrounding land.

It is well known that logging in the region keeps large tracts of forest in earlier successional states than would naturally occur. While logging is no longer permitted in most national parks (there are some exceptions in limited areas of Pictured Rocks and St. Croix), the length of time that has passed since the last cutting occurred affects the current structure, as do altered patterns in natural disturbances, such as fire suppression and deer browse. By learning the degree to which park forests differ from the forests outside of parks, we can begin to understand the role



The nine parks of the Great Lakes Network. Park forests range from oak savannas at Indiana Dunes to boreal forests on Isle Royale, and include river floodplain forests, fire-prone conifers on coarse-textured soils, and hardwoods on rich soils.

that park forests play in providing wildlife habitat and promoting diverse and healthy understory plant communities.

What We Found

The basal area of living trees at eight of the nine network parks was statistically greater within park boundaries than it was outside of them (see Panel A at right). Density of large living trees was also greater inside these same eight parks (Panel B). We define “large” trees as 30 cm (12 inches) or more in diameter at breast height (DBH).

The basal area of standing dead trees (i.e., snags) was statistically greater at three network parks (Apostle Islands, Grand Portage, and Isle Royale) (Panel C), while the density of large snags was also greater at these three parks (Panel D). The amount of downed trees (i.e., coarse woody material) was statistically greater within park boundaries at all network parks except Sleeping Bear Dunes (Panel E).

What It Means and Why It's Important

Forests in most of the Great Lakes Network parks appear to be considerably different from those on the surrounding lands. Higher density and basal area of living trees promotes groundlayer shading, which leads to greater moisture retention. Large snags, especially those over 30 cm (12 in) DBH, like the one pictured below, provide nest habitat and food sources for cavity-nesting and insectivorous birds. These include saw-whet owls, hooded mergansers, and eastern bluebirds.

Downed trees (i.e., coarse woody material) provide habitat for amphibians such as the eastern red-backed salamander, and small and mid-sized mammals including the fisher and American marten.

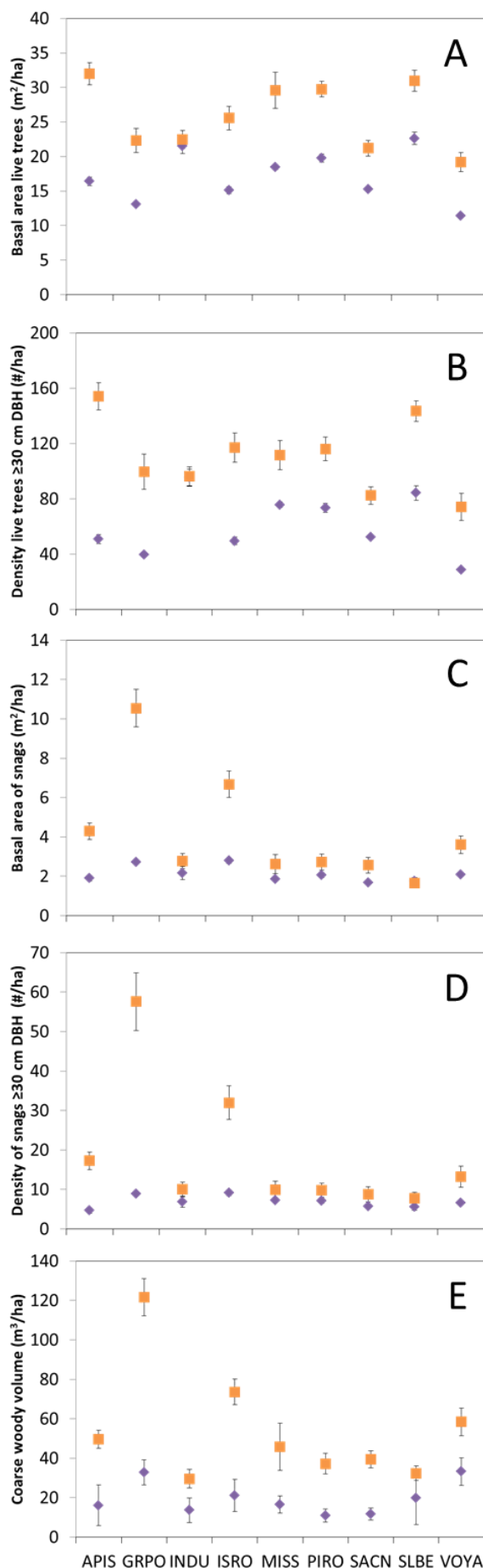
Remnant marten populations have recently been confirmed at both Isle Royale and Apostle Islands. Martens use large, decaying snags and logs for both cover and denning, so understanding existing forest structure can help guide forest management and promote long-term recovery of this species.



Besides woodpeckers, large snags provide nest habitat and food sources for saw-whet owls, hooded mergansers, and eastern bluebirds.

For Further Reading

Miller, K.M., F.W. Dieffenbach, J.P. Campbell, W.B. Cass, J.A. Comiskey, E.R. Matthews, B.J. McGill, B.R. Mitchell, S.J. Perles, S. Sanders, J.P. Schmit, S. Smith, and A.S. Weed. 2016. [National parks in the eastern United States harbor important forest structure compared with matrix forests](#). *Ecosphere* 7(7):e01404. 10.1002/ecs2.1404.



Five characteristics of forest structure. Orange squares indicate plots within parks, while purple diamonds represent areas outside of parks. See map on front page for park name codes.