



Long-term Forest Change in Great Lakes National Parks

Forest change in the Great Lakes region, like elsewhere, can be a normal, healthy process. Over time, the tree species that comprise a forest shift from early successional, fast growing species that need a lot of sunlight to mid- and late-successional specialists that are slower growing and persist for years in the relatively deep shade of a canopy before eventually reaching the canopy themselves. Natural disturbances such as wind, fire, and flooding typically reset this cycle.

Since the settlement period in the upper Midwest, altered disturbance processes, as well as logging, have greatly affected the natural cycle of forest change. Fire suppression and high deer browse pressure have largely reduced the dominance of oaks and pines, while the channelization of rivers has affected cottonwoods, silver maples, and other flood-dependent species.

Methods to Test for Change

We conducted a study to determine how forests in the Great Lakes Network parks have changed since the settlement period. We used freely-available data from the Public Land Survey, which was carried out in the region between 1838 and 1892. Surveyors identified *witness trees* to delineate townships, ranges, sections, and smaller parcels. Data from the size and composition of these witness trees was then compared with that of the Great Lakes Network's long-term forest monitoring program, collected from 2008 to 2014. For each park, we determined the change in basal area for key species and species groups between time periods. One way we viewed this was to construct maps showing the species with the greatest basal area in each plot at both time periods. These are shown on the following pages.

What We Found and Why It Is Important

There was a broad-scale loss of pine and hemlock between the two time periods due to logging, with corresponding increases in maples. Fire-dependent species, such as those in the white oak group, have declined, replaced by maples and red oaks. Fire-dependent red pine and jack pine have been replaced with aspen, maples, and in some cases, ash (likely due to altered hydrology).

Changes in the tree composition can alter ecosystem functions, such as providing habitat and managing floods. As climate change continues, our most important goal is to maintain cohesive groups of species: those that grow well together and perform complementary ecosystem services. This in turn, will provide the strongest backdrop to facilitate new species, as they move into the area.

For Further Reading

Paulson, A.K., S. Sanders, J. Kirschbaum, and D.M. Waller. 2016. Post-settlement ecological changes in the forests of the Great Lakes national parks. *Ecosphere* 7(10):e01490. 10.1002/ecs2.1490.

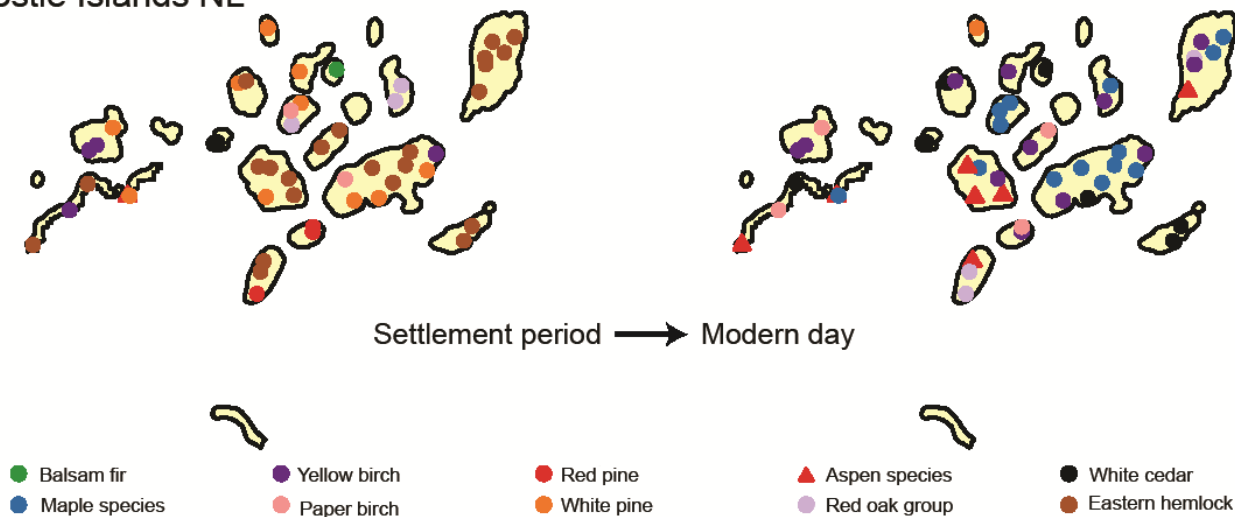


Fire is a natural disturbance that is important to the health and growth of most Great Lakes forests. Many oaks and pines are dependent on fire to regenerate, but fire suppression is promoting dramatic changes in park forests.



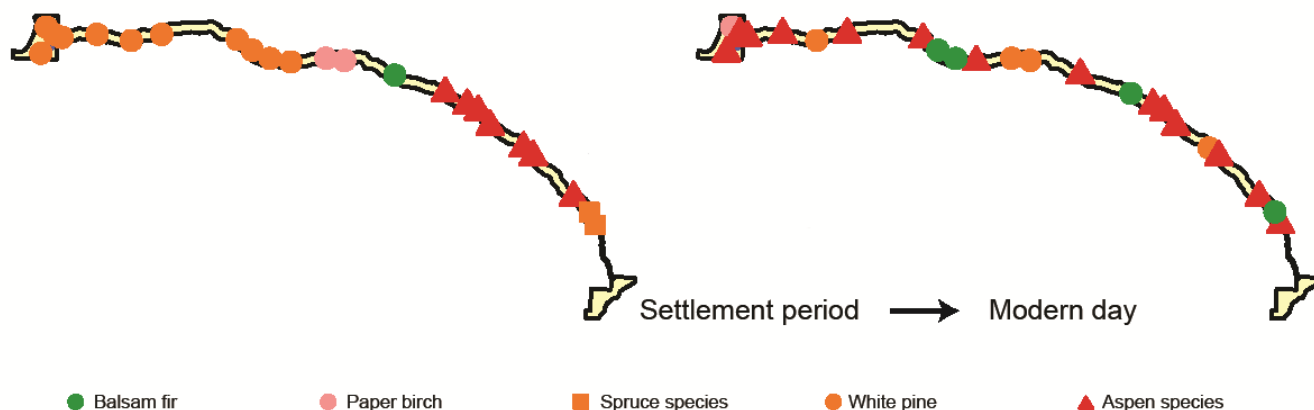
Great Lakes Network parks. NP: national park, NL: national lakeshore, NSR: national scenic riverway, NRR: national river and recreation area.

Apostle Islands NL



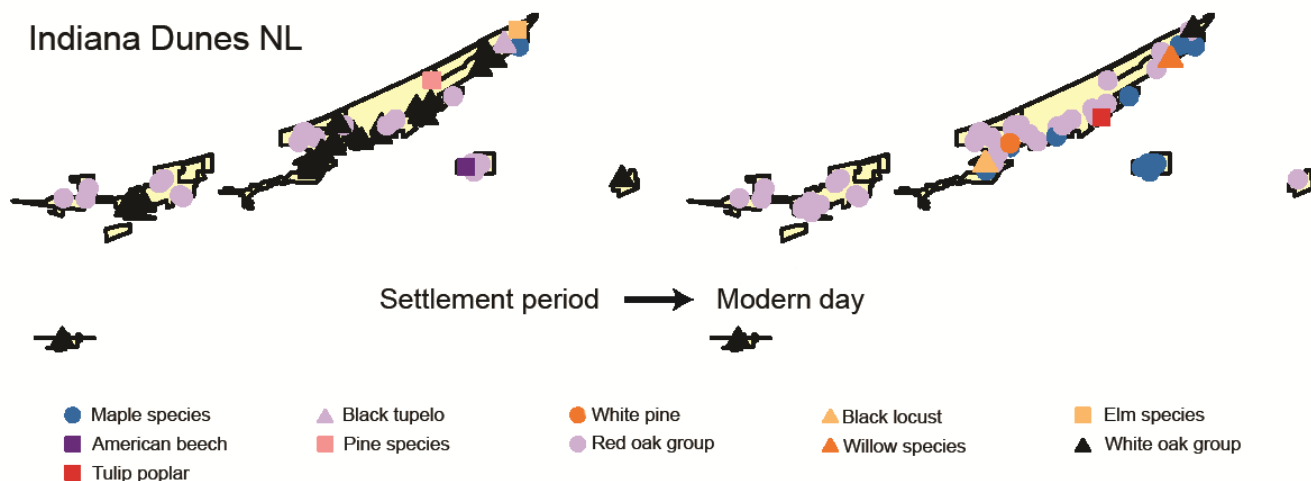
Apostle Islands National Lakeshore. Changes largely reflect historic broad-scale logging in the park, and the subsequent replacement of hemlock with sugar and red maple. While hemlock is still common, its basal area is not as great as that of maples and birches in many plots. Unlike the region-wide trend of cedar loss due to browse, the limited deer populations on most islands have allowed cedar to thrive at many locations.

Grand Portage NM



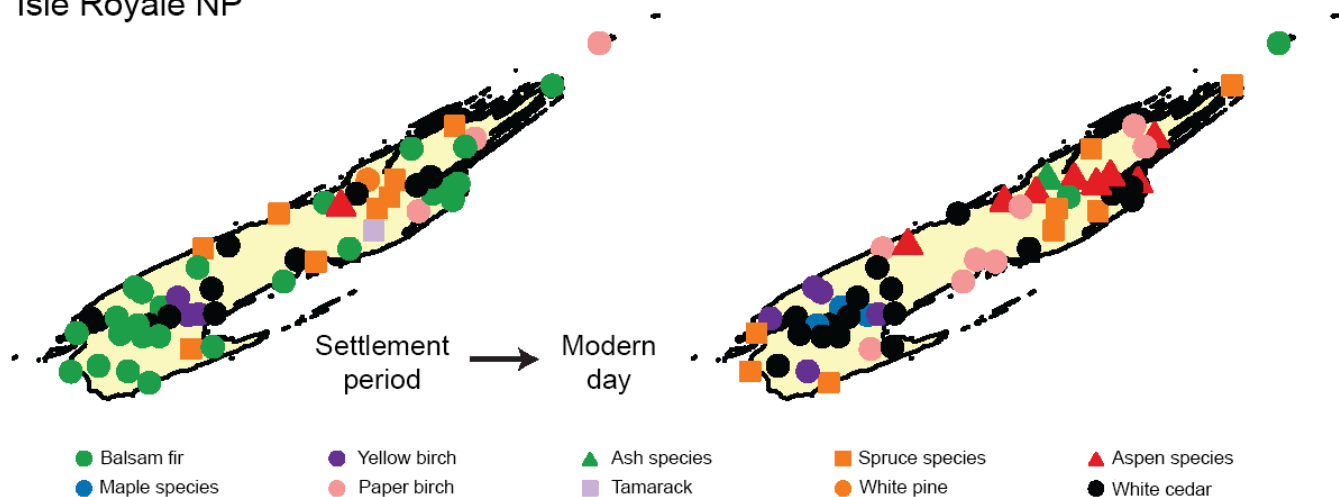
Grand Portage National Monument. Prior to European settlement, white pine dominated the western half of the park, away from Lake Superior, although this was heavily logged around the turn of the 20th century. Today, white pine is susceptible to white pine blister rust—a disease complex involving a non-native fungus which is common in the area. Park managers are working to restore white pine using source populations resistant to the disease.

Indiana Dunes NL



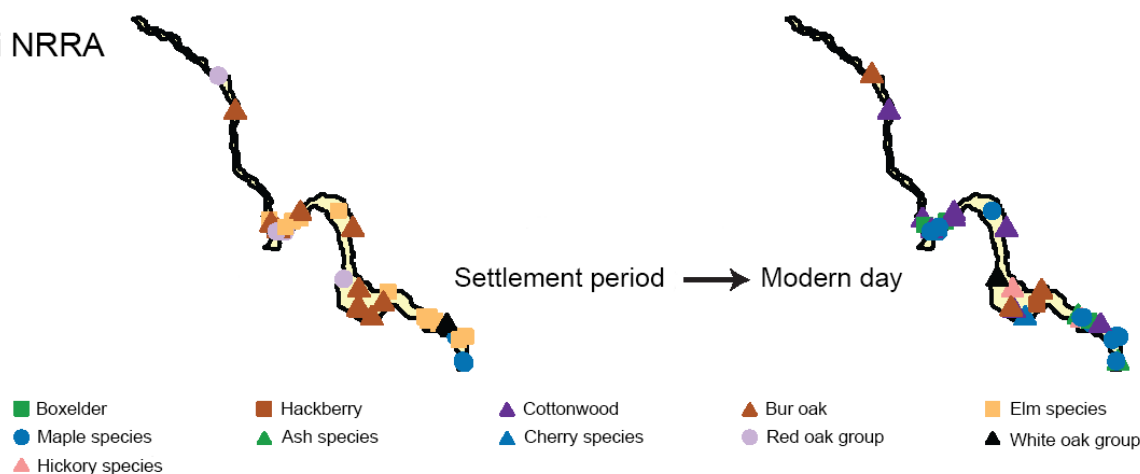
Indiana Dunes National Lakeshore. White oaks throughout the park have been replaced by red oaks. This is largely due to reductions in fire, though the park has initiated a fire management program and conducts prescribed burns throughout the park, especially in the western half. Black oak, which is part of the “red oak group,” is a fire-dependent species and was likely the dominant species in the western side of the park prior to European settlement. Modern efforts to promote fire in the park have ensured that this species is still common on coarse-textured soils (i.e., sands).

Isle Royale NP



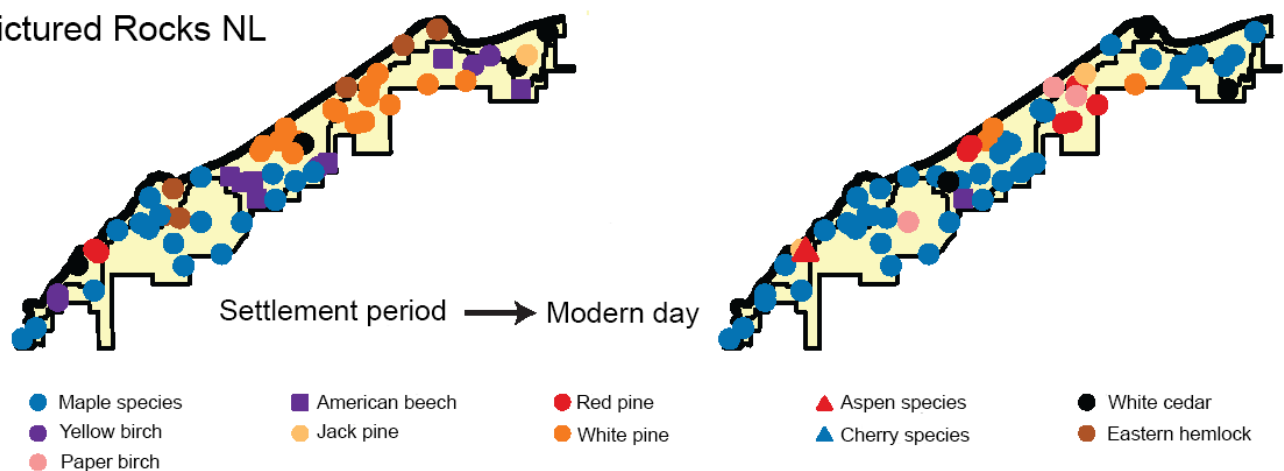
Isle Royale National Park. Changes largely reflect browse of fir by moose, which arrived on the island in the early 20th century. On the southwest side of the park, the forests are largely a mix of cedar, yellow birch, and sugar maple. Early successional species dominate the eastern side of the island.

Mississippi NRRA



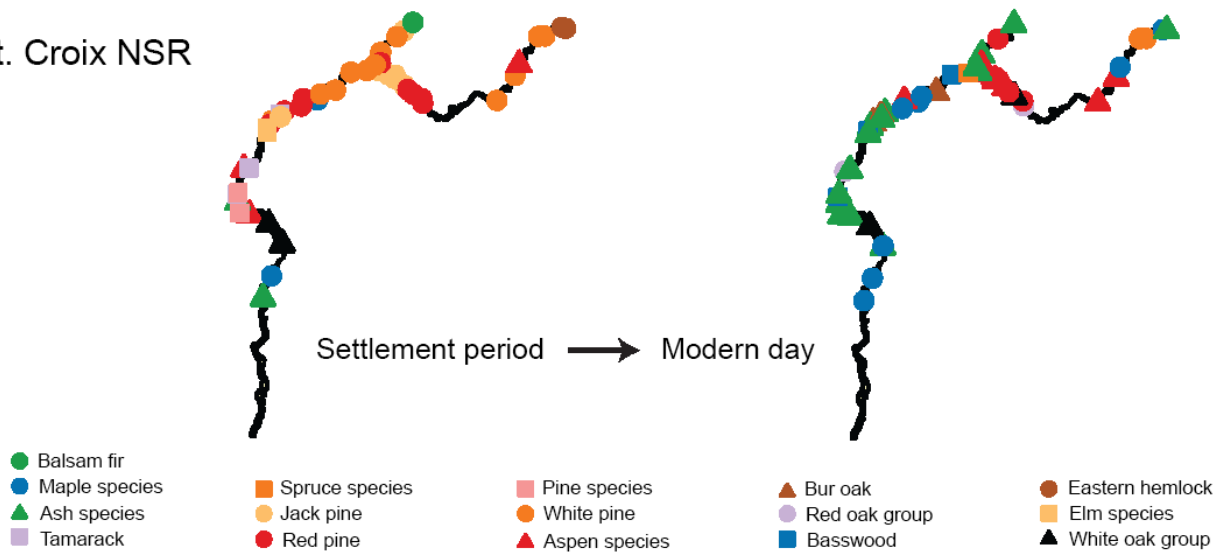
Mississippi National River and Recreation Area. In much of the park, fire-dependent bur oak has been replaced by more moisture-tolerant species. In the downstream area of the park, maples (typically silver maples) and cottonwoods are now dominant. This may be due to altered hydrology; three dams were constructed during the 20th century within the length of the current riverway.

Pictured Rocks NL



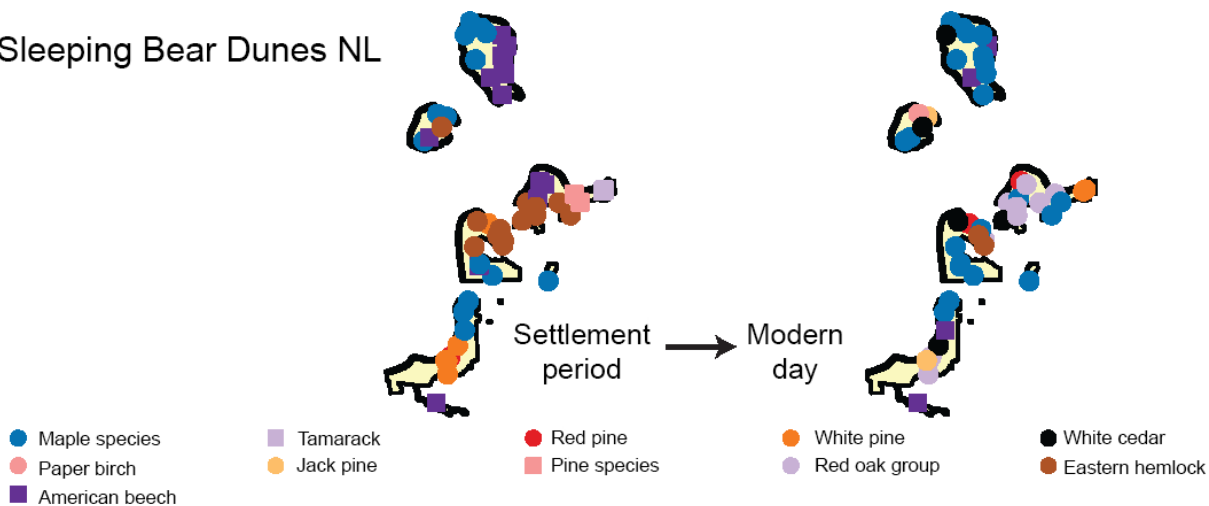
Pictured Rocks National Lakeshore. Throughout the central and northeastern areas of the park, white pine and hemlock were common prior to European settlement. These species were heavily logged around the end of the 19th century. Today, maples dominate this area, with jack pine present in places on the Kingston Sand Plain.

St. Croix NSR



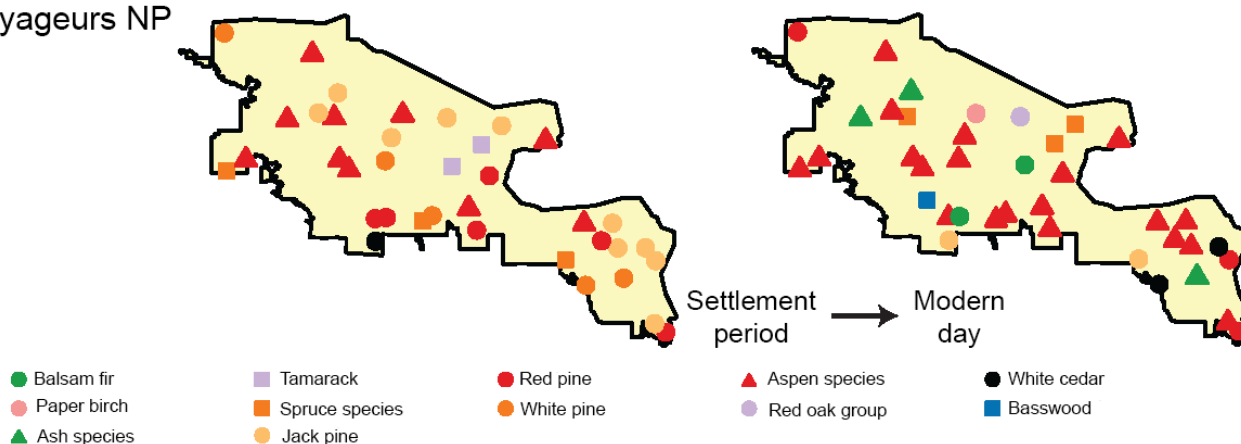
St. Croix National Scenic Riverway. The hydrology of this park has been altered considerably by the construction of dams—low-head dams to assist with the downriver transport of logs during the logging boom, and a large dam at St. Croix Falls to provide hydroelectric power. Prior to European settlement, two fire-dependent species (jack pine and red pine) were common along the middle stretch of the St. Croix River, but these have largely been replaced by black ash.

Sleeping Bear Dunes NL



Sleeping Bear Dunes National Lakeshore. During the presettlement period, hemlock and white pine were abundant within the mainland portion of the park, although these species were subsequently heavily logged. On North Manitou Island, much of the beech was replaced with sugar maple.

Voyageurs NP



Voyageurs National Park. Throughout the park, jack pine (a fire-dependent species) and white pine have been replaced by early successional aspens. Prior to European settlement, canopy fires would occur with some regularity, helping to maintain the jack pine. While the park has a fire management program, the frequency and extent of prescribed burns are not sufficient to mimic the historic fire cycle.