

REGENERATING THE HISTORIC FOREST AT GETTYSBURG NATIONAL MILITARY PARK

One of the mission goals of Gettysburg National Military Park (Pennsylvania) is to protect, rehabilitate, and maintain in good condition the landscapes, buildings, monuments, structures, archaeological sites, artifacts, and archives that are significant to the outcome and commemoration of the Battle of Gettysburg. In the 1980s, park staff observed that an important component of the landscape—the woodlots—did not represent the 1863 historical condition of the forest at Gettysburg, detracting from the authenticity of the interpretation of the historic battle.

Small-diameter trees, especially oaks and hickories, were so few that the regeneration of these species in the woodlots was in doubt. Three factors were considered to be responsible for the low tree seedling and sapling densities: (1) white-tailed deer were intensively browsing desirable native seedlings, threatening forest sustainability and species composition; (2) nonnative plants were invading the woodlots and outcompeting native plant species; and (3) the overstory canopy had grown closed, limiting the development of understory trees. (Historically the woodlots were heavily exploited to supply firewood and lumber, leaving openings in the canopy where sunlight penetrated.)

Park managers believed that mitigating these factors would achieve the goal of restoring the woodlots. In order to match the vegetation density of the 1863 woodlots, the park targeted a 60% stocking level, meaning that only 60% of the overstory canopy would be closed.

In 1986, scientists from Pennsylvania State University and Elizabethtown College initiated long-term inventories

of woodlot vegetation (see Niewinski et al. 2006). Two additional objectives were to determine quantitatively the browsing impact of deer, and to measure understory response to openings in the canopy.

In 1995, the deer population at the park had reached 325 deer per forested square mile (125 per km²). Staff then initiated the White-tailed Deer Management Program to reduce the population to 25 deer per forested square mile (10 per km²), a size calculated to allow the forest to regenerate and achieve the stocking goal. When the study concluded in 2002, deer density had been reduced to 49 deer per forested square mile (19 per km²).

Initially, investigators set up study plots in pairs, fenced and unfenced. In 1990, they added several more unfenced plots to compare vegetation status at that time with changes that might occur after the deer management program was instituted. Finally, in 1992, they established canopy treatment plots to evaluate the understory response to openings in the overstory. In the control plots, the closed canopy was not altered; in the second treatment, 60% of the canopy was left standing; and in the third treatment, all overstory trees were removed.

From 1986 to 2002, investigators repeatedly inventoried seedlings and saplings of tree and shrub species for density and diversity, and inventoried herbaceous plants for diversity and coverage. They also recorded the presence and abundance of nonnative species.

Investigators compared data from 2002 to that from previous inventories, 1996 in particular, to evaluate the effects of reduced foraging by white-tailed deer and various light levels on the development of understory vegetation. Results were not consistent among the study plots, but overall, the data enabled the researchers to discern clear trends that suggest that deer reduction is allowing the forest to regenerate and the park's woodlot stocking goals to be achieved.

In the canopy treatment plots, seedling tree densities increased from 1996 to 2002, exceeding the stocking-level goals. The closed and partially open canopy treatments showed the greatest seedling tree densities in 2002. Sapling tree densities also improved in those plots between 1996 and 2002, but were still substantially below the stocking-level goal. The reason for the lower sapling tree densities may be a combination of continued browsing by deer (still more numerous than the park's goal), intense competition among shrub species, and light restrictions. In the completely open canopy, nonnative shrubs increased because of their unpalatability to deer and rapid growth.

The research suggested that, as of the last inventory in 2002, there was good potential for a healthy diversity and density of native species that will recreate the historic 1863 woodlots. The researchers recommended that park managers (1) continue to implement the deer management

not include how to avoid damaging reefs. Hence, the study concludes that ensuring that dive leaders intervene underwater, as well as lead by example in keeping fins and equipment clear of the reef will reduce diver damage. Additionally, extra vigilance at the beginning of dives, on night dives, and toward camera users will result in substantial reductions in damage to coral reefs.

Reference Cited

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