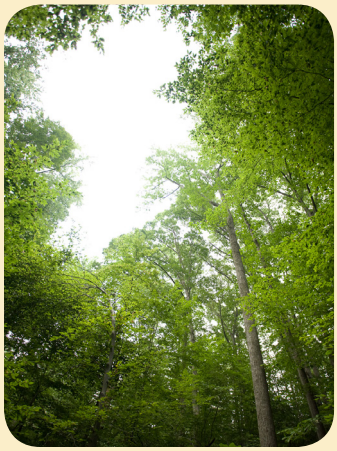
Forest Regeneration 2013 *Resource Brief*

Importance

Forests are the dominant natural vegetation in the parks of the National Capital Region Network (NCRN). In recent years, park managers have been increasingly concerned about forest "regeneration." Forest regeneration is simply the process of seedlings and saplings surviving to replace large forest trees that die.

One reason for this concern about regeneration is the high density of deer in most NCRN parks. A variety of studies have shown that at high densities, white-tailed deer can significantly reduce regeneration. Deer have also been shown to reduce the diversity (Tilghman 1989), density (Frelich and Lorimer 1985, McCormick et al. 1993), and average height of seedlings (Marquis 1981, Tilghman 1989, McCormick et al. 1993). Deer densities in NCRN parks are high enough to cause these impacts to forest vegetation (Bates 2012).



A gap in the tree canopy at Prince William Forest Park.

Photo: NPS/Paradis

Regeneration and the Stocking Index

Regeneration is a concern for commercial foresters who want to know if there are enough seedlings and small saplings for a commercially valuable forest to regrow after a clear cut. In response, scientists at the US Forest service developed a measure, called a "stocking index," to determine if seedling levels are sufficient for regeneration (Marquis and Bjorkbom 1982). They compared forest stands before and after harvesting to determine how many seedlings are required for a forest to recover (Grisez and Peace 1973).

The stocking index takes into account three different aspects of forest regeneration: the number of seedlings and small saplings found, their size, and their distribution. Obviously, the more seedlings and small saplings present the better. Size is important, as taller seedlings are more likely to survive than smaller seedlings. Finally, a forest is more likely to successfully regenerate if the seedlings are spread out than if they are concentrated in only a few places.

We calculated stocking indexes for all NCRN parks using NCRN forest vegetation monitoring data (Schmit et al. 2009) from 2010 to 2013. We included all tree species both native and exotic.

Each NCRN monitoring plot was scored based on the number and height of its seedlings. Plots that scored above a certain threshold are considered adequately stocked while those below the threshold are considered inadequately stocked. A higher threshold is used in forests with high deer density to take into account deer browse effects on seedling growth and survival. An entire forest is considered to be adequately stocked if 67% of monitored plots are above the threshold (Marquis 1982, Marquis and Bjorkbom 1982, McWilliams et al. 1995, Stout 1998).

Only seedlings over 15 cm tall and saplings less than 2.5 cm diameter at breast height were used to calculate a score for each plot. Every seedling or small sapling was assigned points and all points were added to generate a plot score. For an individual plot to be considered adequately stocked at high deer density (>8 km^2, Horsley et al. 2003) it must have a score of 115 (or at low deer density, a score of 38). The scoring system for each size of seedling is presented in Table 1 (next page). An entire park is considered to be adequately stocked if 67% of plots score above the threshold.

Results

No NCRN parks have adequate tree regeneration levels (Figure 1). Given the high deer density typical of the NCRN parks, slightly more than half of the parks have at least one plot that is adequately stocked, but no park has more than 25% of their plots adequately stocked. Even if deer densities were to be reduced to below the 8/km^2 threshold, no park had more than 40% of their plots adequately stocked. No significant changes have occurred in this index since the earliest monitoring period available (2006-2009).

This lack of forest regeneration is a cause for concern.

If low levels of regeneration persist, then the forests may undergo long term decline. Currently Catoctin and Rock Creek are reducing their deer population. An increase in the stocking index of these parks will be an important indicator that these programs are improving forest regeneration.

Stocking Index Scoring System	
Seedling Size	**Points**
15-30cm height	1
30cm – 1m height	2
1-1.5m height	15
1.5m+ height	30
Saplings (1-2.5 cm diameter)	4.25

Table 1: Scoring system used to determine stocking index for each plot. Points assigned are weighted to account for the difference in areas monitored for saplings versus seedlings.

Citations:

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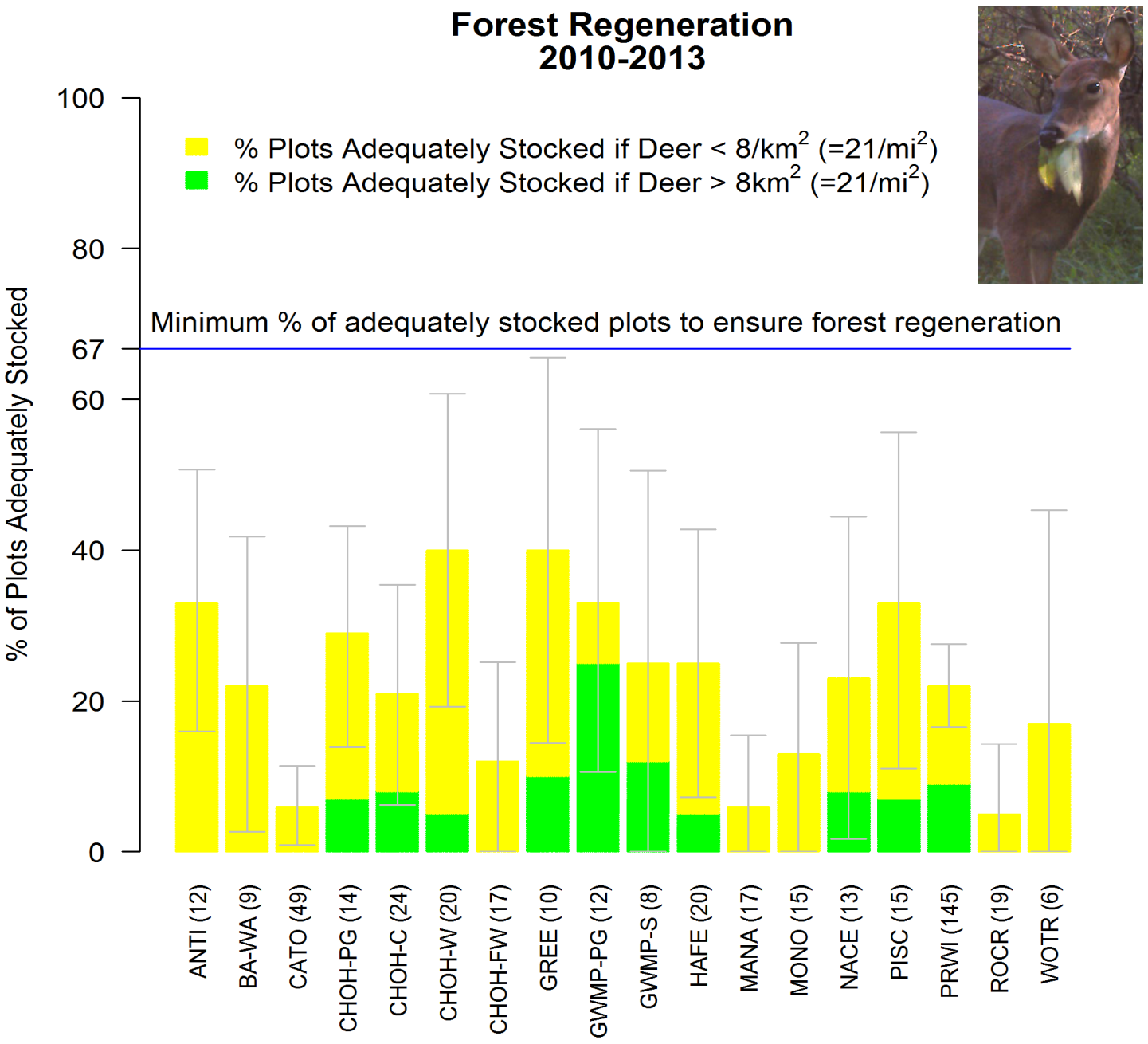


Photo: NPS

Figure 1: Percent of plots adequately stocked with seedlings at high and low deer densities. Park abbreviations are followed in parentheses by the number of forest plots monitored by NCRN. The blue horizontal line marks the percent of plots (about 2/3rds) that must be adequately stocked for a park as a whole to have adequate forest regeneration. T-shaped error bars indicate 95% confidence intervals for percent of plots with adequate seedling stocking at low deer density (yellow bars).

Park abbreviations: ANTI = Antietam National Battlefield, BA-WA = Baltimore–Washington Parkway, CATO = Catoctin Mountain Park, CHOH-C = Central part of C&O Canal National Historical Park from Violettes Lock to Harpers Ferry, CHOH-PG = Potomac Gorge managed by C&O Canal, CHOH-W = C&O Canal from Harpers Ferry to Four Locks, CHOH-FW = C&O Canal from upstream of Four Locks to Cumberland, GREE = Greenbelt, GWMP-PG = Potomac Gorge managed by George Washington Parkway, GWMP-S = George Washington Memorial Parkway south of Key Bridge, HAFE= Harpers Ferry National Historical Park, MANA = Manassas National Battlefield Park, MONO = Monocacy National Battlefield, NACE = DC portion of National Capital Parks - East, PISC = Piscataway and Fort Washington Parks, PRWI = Prince William Forest Park, ROCR = Rock Creek Park, WOTR = Wolf Trap National Park for the Performing Arts