Excluding deer using low-cost exclosures to improve water quality in the Mid-Atlantic region

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Abstract

White-tailed deer (Odocoileus virginianus) overabundance in the mid-Atlantic region has significantly suppressed forest succession and regeneration[1], which, in turn has negatively affected local water quality[2]. Management is necessary to re-grow forests in riparian areas to restore ecosystem services that maintain high quality water. This multiple year study examined the efficacy of short-stature, small plot exclosures in the exclusion of white-tailed deer. The results indicate that deer have an innate tendency to avoid small, enclosed areas suggesting that these short-stature exclosures are a viable, low-cost alternative for managing deer impact and re-growing forests.

Introduction

The landscape of the Mid-Atlantic region can be characterized as a mosaic of open pastures, small woodlots and suburban sprawl. The interface between open pastures and woodlots along with suburban plantings has created a very favorable habitat for white-tailed deer (*Odocoileus virginianus*, deer)[3]. The current landscape is suspected to have a historically high carrying capacity for deer[4] allowing for an unusually large population.

The browsing pressure exerted by this historically high deer population is suppressing forest regeneration and forest succession from open pastures[1]. The resultant lack of forest biomass from suppressed succession and regeneration has had negative implications on water quality[2]. The regrowth and maintenance of forests, especially in riparian zones, is critical in ensuring sustainable, high quality water for future generations of humans and wildlife.

Deer exclosures have are used extensively to reduce browsing pressure in areas of interest. Traditional exclosure designs target the jumping ability of deer and as a result are expensive to construct, laborious to maintain and inhibit land access by humans and animals. This study proposes the use of low-stature, small plot exclosures to reforest riparian areas. The low stature reduces materials costs and the small plot facilitates access to land.

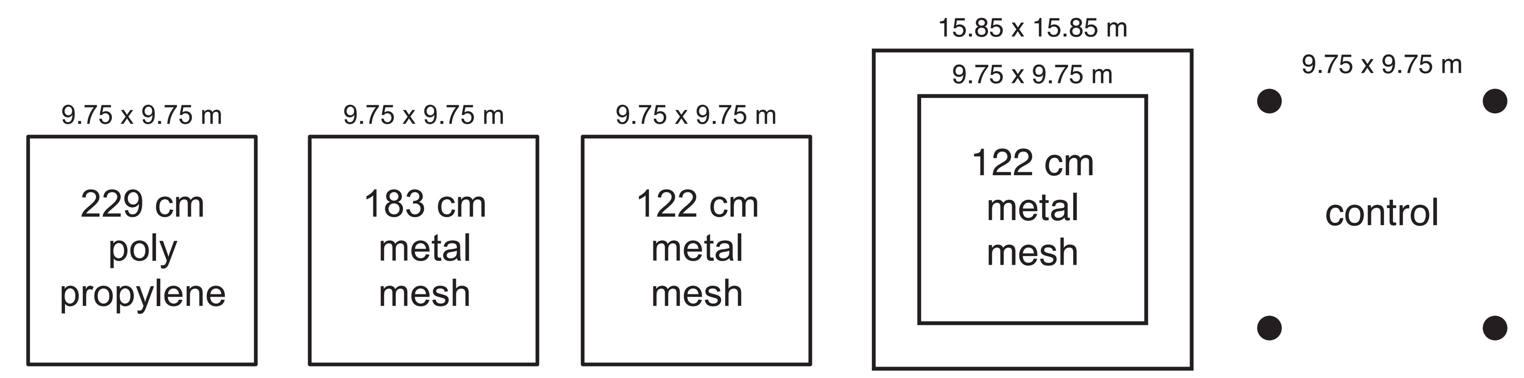

Figure 1. Fence configurations and measurements tested.

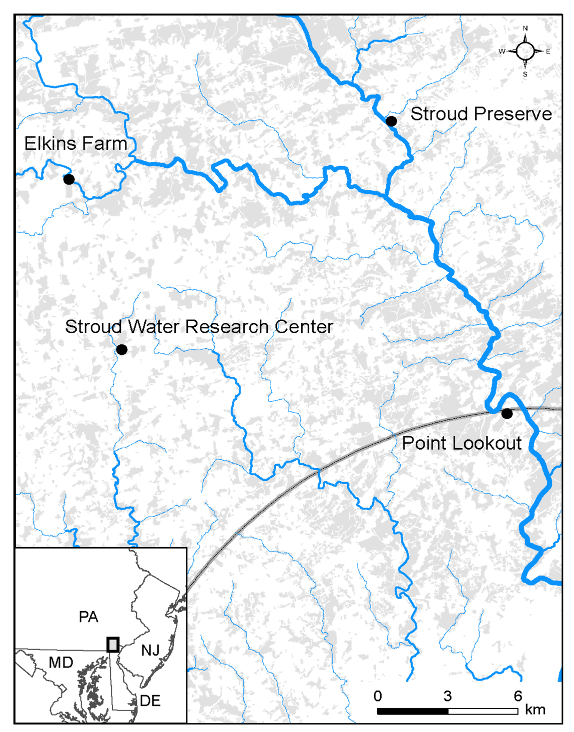

Figure 2. Location of deer exclosure study sites. Grey Shading indicates extent of forested areas (Source: NLCD – http://www.mrlc.gov)

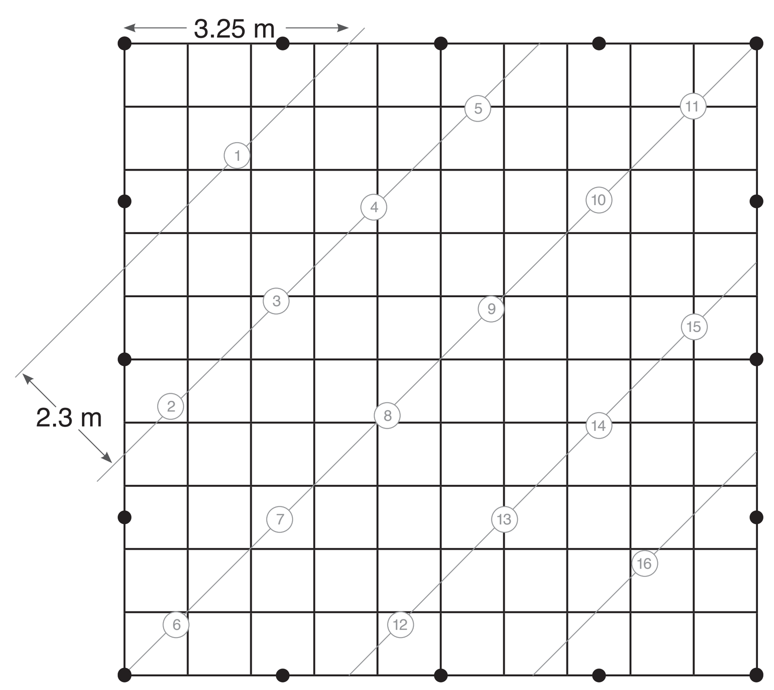

Figure 3. Schematic of seedling plantings within each exclosure.

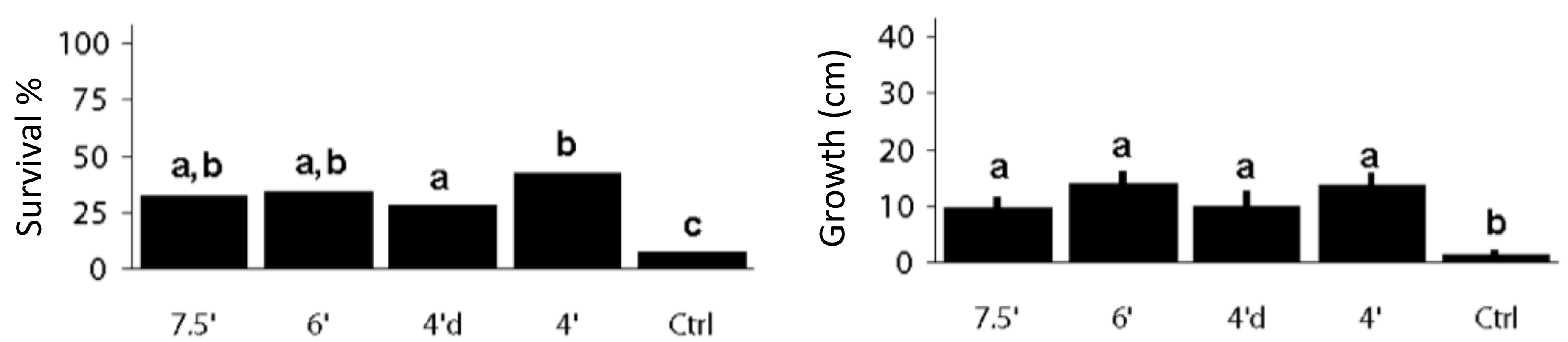

Figure 4. Survival and growth of seedlings across all sites for each fence configuration. Different letters above each bar indicate significant statistical differences between associated values

Methods

- 4 fence configurations were tested: Single fences measuring 7.5 ft. (229 cm), 6 ft. (183 cm) and 4 ft. (122 cm) tall were built in a 9.75 meter square plot. A second 4 ft. tall exclosure was further surrounded by another 4 ft. fence approximately 3 meters out from the first fence. A non-fenced control square measuring 9.75 meters on the side was demarcated with metal posts (Figure 1).
- Multiple replicates of each configuration were set up in Southeastern Pennsylvania and Northern Delaware, two in open pastures (Stroud Water Research Center & Stroud Preserve) and two in woodlots (Elkins Farm & Point Lookout) (Figure 2).
- 16 seedlings were planted in each exclosure. Scarlet Oak (*Quercus coccinea*) and White Oak (*Q. alba*) were planted at SP, EF & PL. Scarlet Oak and Silky Dogwood (*Cornus amomum*) were planted at SWRC (Figure 3) during the fall of 2007 and spring of 2008.
- In the summer of 2012, seedling growth and survivorship was measured and evaluated at each site.

Discussion & Conclusion

This study shows that there was a statistically significant difference in both seedling survivorship and growth when comparing any of the four fence configurations to un-fenced control plots across all sites and all replicates (Figure 4). There is also a strong correlation between the 4 ft. fence configuration and the 7.5 ft. configuration. Previous studies have shown that deer are physically unable to jump over fences greater than 7.5 ft. tall and therefore the correlation found between fences 7.5 ft. tall and lower suggest that the shorter fences provide total exclusion of deer[5].

Further study is needed for the future implementation of short-stature, small-patch exclosures to optimize the goals of riparian forest regeneration. There is still little consensus as to the optimal width of riparian buffer zones and how long exclosures need to remain in place before trees growing within the exclosures are able to withstand deer browsing and antler rubbing. Furthermore, the joining of fragmented woodlots to create larger, contiguous forests that more closely resemble a pre-European settlement landscape could have the side effect of restoring a more natural carrying capacity.

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