



Rock Creek Park

Background

The Eastern Forest Working Group of the National Park Service Inventory and Monitoring Program (I&M) has been monitoring forest health in permanent plots across 39 eastern national parks for 12+ years (Fig. 1). Plots are sampled on a 4-year rotation using similar methods across parks. Currently nearly all plots have been sampled three times (i.e., cycles). This brief summarizes results of a trend analysis of invasive plants, a widespread concern in eastern parks, and compares park-level results for Rock Creek Park (ROCR) in the National Capital Region Network (NCRN) with broader regional patterns across the parks in our study.

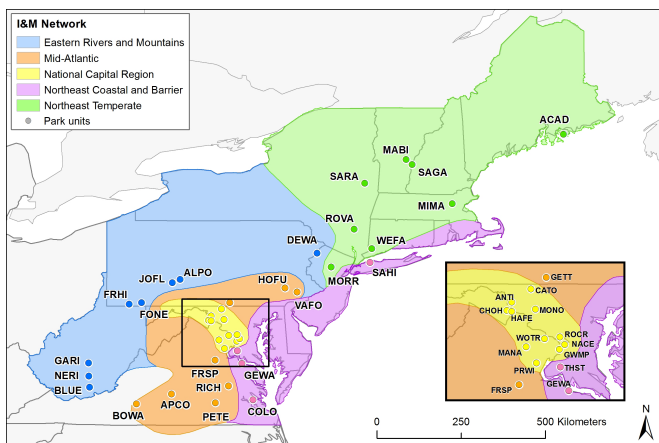


Figure 1. Map of parks included in the analysis.

Methods

We used linear mixed models to assess trends in Average % cover, Quadrat % frequency, Quadrat richness and logistic mixed models for Plot % frequency. Average % cover is averaged across 1 m² quadrats per plot. Quadrat % frequency is the percent of 1 m² quadrats per plot with an invasive species. Quadrat richness is the average number of invasive species per quadrat. Plot % frequency is the % of plots invaded by one or more invasive species and we used logistic regression to model the odds of a plot being invaded in subsequent cycles. We assessed trends for total invasives and the following guilds: Trees, Shrubs/Vines, Graminoids (i.e., grasses, sedges and rushes), and Forbs. We only included exotic species considered invasive, and only modeled guilds that were present in >10% of the plots in a park. Note that NCRN does not collect quadrat % cover of tree species, and quadrat % cover and frequency data are only collected for indicator species in NCRN and MIDN. While the indicator list includes the most common invasive species in network parks, invasive abundance and richness may be higher than our results suggest. We modeled each park individually and used random intercepts to account for repeated measures. Trends cover up to three cycles, and for most parks, cycle 1= 2007-2010, cycle 2= 2011-2014, and cycle 3= 2014-2018. To determine whether trends were significant, we used parametric bootstrapping to generate empirical 95% confidence intervals around model coefficients (e.g. slope).

Results: Overall

Averaging over 50% cover in cycle 3, MONO had the highest invasive % cover of parks in the study (Fig 2). ANTI, CHO, FRHI, HOFU, and MORR averaged over 30% cover in cycle 3. Average % cover increased significantly in 14 out of 39 parks (Fig. 2). Quadrat % frequency was highest in ANTI, GETT, MONO and SAHI with a roughly 90% of quadrats containing an invasive species in cycle 3. Invasive quadrat % frequency increased significantly in 15 out of 39 parks, and decreased significantly in PRWI. Invasive quadrat richness in cycle 3 was greatest in CHO, GETT, MONO, MORR, and FRHI, averaging over 2 invasive species per quadrat. Invasive quadrat richness increased significantly in 23 out of 39 parks and decreased significantly in PRWI. Plot % frequency of invasives increased significantly in 3 out of 39. Invasive shrubs/vines were most abundant and often increased over time in northern parks, and both graminoids and shrubs/vines followed similar patterns in southern parks.

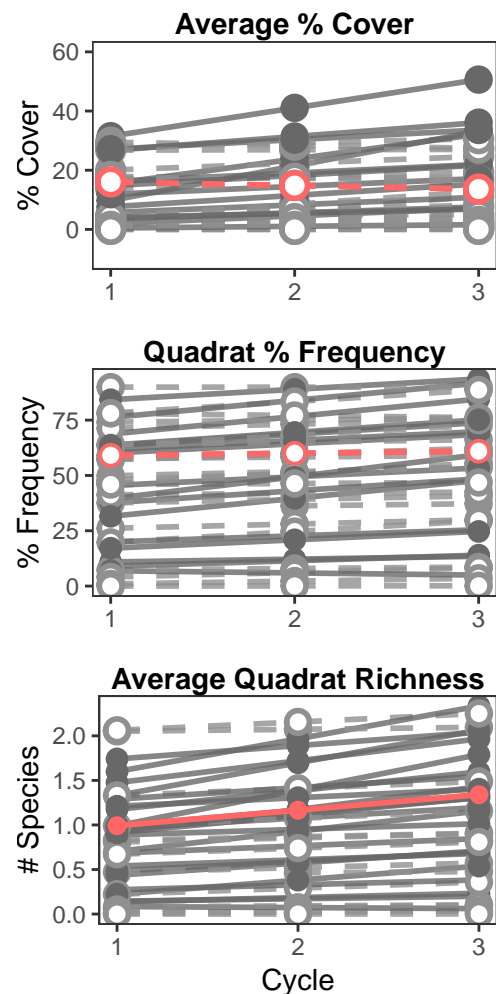


Figure 2. Modeled trends in total invasive plants. Each line represents a park. Solid lines indicate significant trends at alpha < 0.05. ROCK CREEK PARK (ROCR) is highlighted in red.



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Results: Park-Level

Trends in total invasives varied across metrics in ROCR. In cycle 3, average % invasive cover was 13.63%, which was the 18th highest out of 39 parks in this study. There was no significant trend in invasive % cover. Quadrat % frequency in cycle 3 was 60.95%, which was 16th highest out of 39 parks in this study. There was no significant trend in invasive quadrat % frequency. Quadrat richness averaged 1.34 invasive species/quadrat in cycle 3, which was 13th highest out of 39 parks. Invasive quadrat richness significantly increased by 0.17 invasive species/quadrat per cycle.

Invasive guild trends varied by metric in ROCR (Figs 3-5). Invasive forbs had the highest guild % cover in ROCR in cycle 3, averaging 13.35 % and ranking 4th highest out of 39 parks for this metric. Averaging 58.92%, forbs had the highest quadrat % frequency in ROCR, and ranked 5th highest out of 39 parks for forbs quadrat % frequency. Forbs had the highest plot % frequency in ROCR, with 89.47% of plots invaded by forbs in cycle 3, and ranking 2nd highest out of 39 parks.

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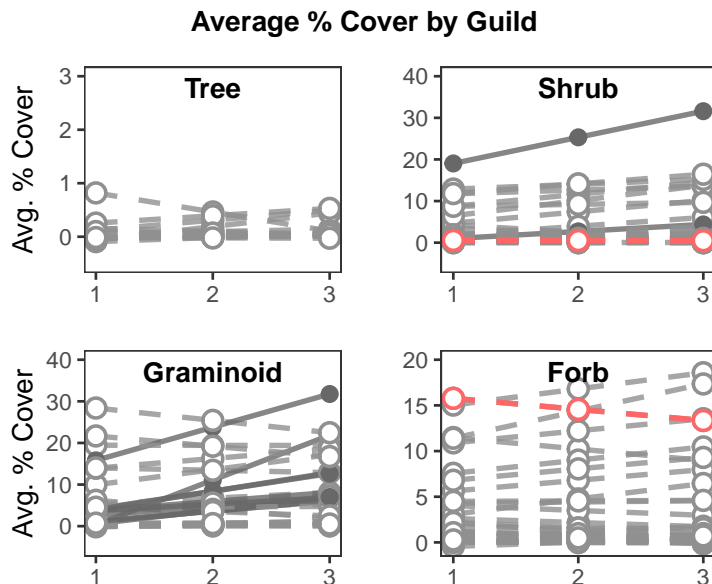


Figure 3. Modeled invasive plant cover trends by guild. Each line represents a park. Solid lines are significant trends. ROCR is highlighted in red. Guilds found in <10% of a park's plots and NCRN Trees (% cover only) were not modeled or displayed.

Quadrat % Frequency by Guild

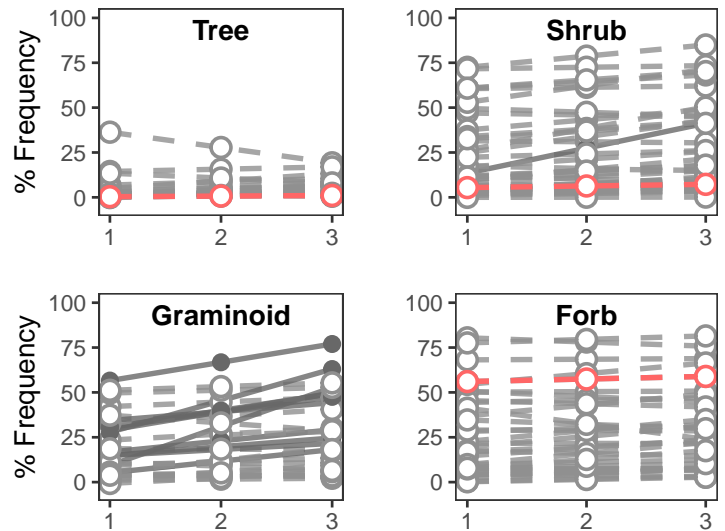


Figure 4. Trends in modeled invasive quadrat frequency by guild. See Figure 3 caption for more information.

Plot % Frequency by Guild

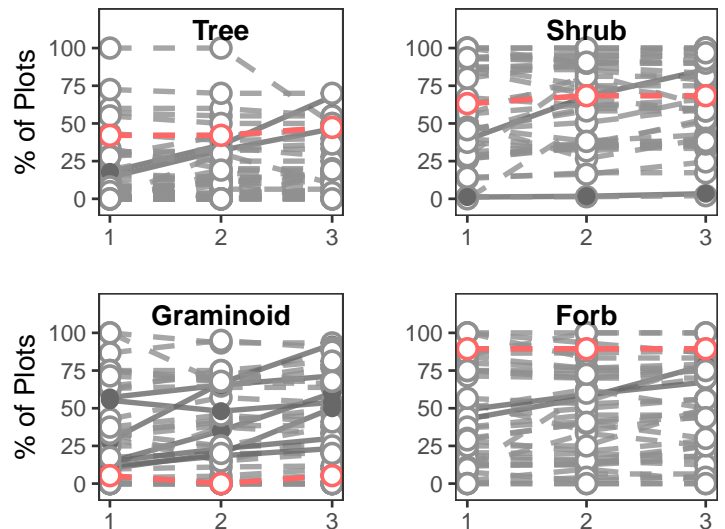


Figure 5. Trends in actual plot % frequency by guild. Significance was determined with logistic regression. See Figure 3 caption for more information.

More Information

More information about this study can be found on the NCRN website (<https://www.nps.gov/im/ncrn>), or by contacting:

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