



Forest Vegetation Monitoring Summary, 2011–2015

Overview

The monitoring of forest vegetation communities is a key vital sign for the 14 Cumberland Piedmont Network (CUPN) parks. Forest vegetation communities were selected as a high priority resource for monitoring by all the parks within the Cumberland Piedmont Network (CUPN). Forests are a dominant part of the CUPN landscape and provide recreational opportunities and wildlife habitat, protect soil and water resources, influence weather patterns, and store carbon that would otherwise contribute to climate change. Studying the components of a forest provides information on the overall health of the forest vegetation community. Key stressors affecting forest vegetation communities include non-native plant species, insect/fungal pests, and climate change, just to name a few. The network's monitoring effort is designed to detect meaningful changes in species composition and vegetation structure within each park's forested habitats and determine whether these changes are correlated with trends in key stressors (e.g., forest pests) over time.

In the first phase of vegetation monitoring, permanent plots were established across all CUPN parks over a five-year period (2011–2015). These plots will be revisited every five years in order to monitor changes and trends in forest vegetation conditions. By the conclusion of the 2015 field season, 384 permanent plots had been established across the network, including 40 plots at Cumberland Gap National Historical Park (CUGA). This brief summarizes monitoring data collected from these 40 plots established at the park (Figure 1).

Monitoring plots are 20 × 20 meters with multiple nested sampling frames ranging in size from 1 to 100 square meters. Data collection is intensive, with data being grouped into the following broad categories: plot characteristics (slope, landform, etc.); species presence; frequency and cover (tree, sapling, seedling and herb layers); canopy cover; tree growth and health; evidence of forest pests; snags and coarse woody debris (CWD); and community characterization/

classification. The CUPN [Forest Vegetation Monitoring Protocol](#) provides detailed descriptions of the field and analytical techniques used for forest vegetation monitoring.

Significant Findings

Species Diversity

Species diversity is a function of community type which is influenced significantly by geology, slope position, slope aspect, and disturbance. In temperate regions, acidic forest types tend to have fewer overall species, while sites with more alkaline soils (i.e., limestone parent material) typically have more. Compared to other CUPN parks, plot-level plant species diversity is moderate at the park, averaging 50 species per plot (see Figure 2). However, of the 384 monitoring plots established across the CUPN, the park contains 2 of the top 20 most diverse plots—one with 108 species (the third most diverse plot in the network) and one with 95 species.

Non-native Plants

Non-native species are present at each of the 14 parks within CUPN. Ideally, forest vegetation baseline monitoring and revisits to plots will help park managers understand how heavily non-native plants are affecting the native plant populations in their parks. Because the park is such a large tract of mainly undisturbed land, and most of the vegetation monitoring plots are located in remote areas far from roads and trails, monitoring data at CUGA have shown that exotics prevalence is very low at plots. Of the 337 plant species identified at CUGA during forest vegetation monitoring, only 9 of them (2.6%) were non-native. Non-native plants comprised only 0.2% of the overall average plot-level species diversity at the park (see Figure 3), the second lowest average across the CUPN network. Of the forty plots established across CUGA, the most commonly found non-native plant species included Japanese honeysuckle (*Lonicera japonica*) and Japanese stiltgrass (*Microstegium vimineum*), occurring at three (7.5%), and two (5%) plots, respectively.

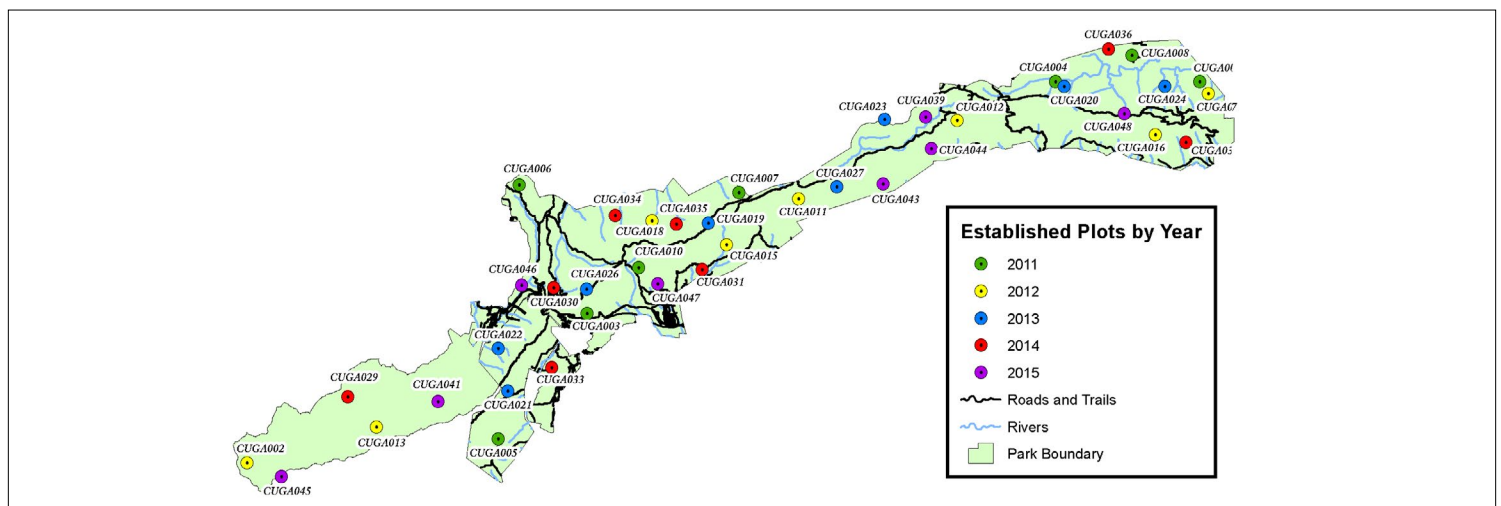


Figure 1. Map of forest vegetation monitoring sites at Cumberland Gap National Historical Park, Kentucky, Virginia, and Tennessee. NPS map by Lillian Scoggins.

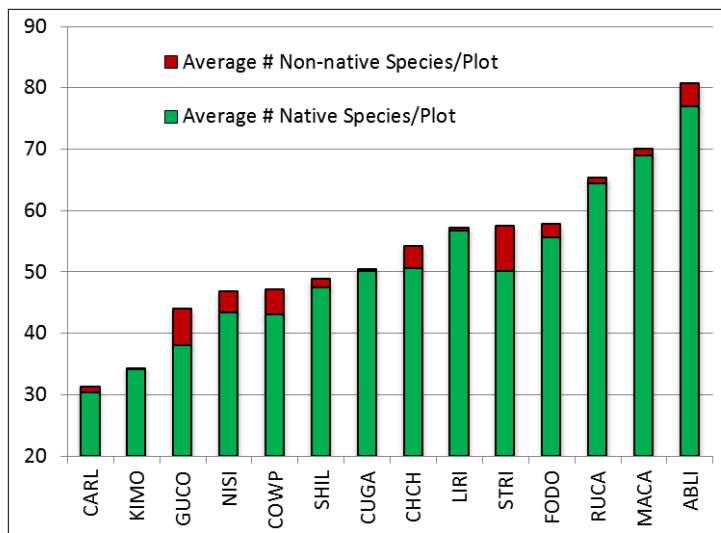


Figure 2. Plot-level average species diversity across CUPN parks, with native species shown in green and non-native species shown in red.

Significant Findings

Fortunately, no new non-native plant species at CUGA were found at any monitoring plots, but a small patch of Japanese knotweed (*Fallopia japonica*) was found near the more recent Fern Lake acquisition on the way to a monitoring plot. Japanese knotweed is a severe threat in all three states comprising the park and is a classic invader of temperate riparian ecosystems, roadsides, and waste places in North America.

Forest Pests

The non-native forest pest emerald ash borer (*Agrilus planipennis*) was confirmed in the counties of CUGA in 2012 and 2013 by the USDA, but the first signs of it in remote areas of the park were seen by monitoring crews in 2015 on a ridgetop approximately 0.5 miles west of plot CUGA048. While some trees were still living, several large dead ash trees were observed in the canopy. During 2016 plot revisits, signs were observed at CUGA003 (the only plot containing ash trees in the 2016 set of plot revisits). Of the two ash trees in the plot, one had died since the initial plot establishment in 2011, and the other was in severe decline. Both were healthy in 2011. Emerald ash borer is a serious forest pest originating in Asia that was thought to be carried into North America on packing material. Discovered

in Michigan in 2002, the larvae feed on the inner bark of ash trees, disrupting the tree's ability to transport water and nutrients and killing the tree within two years. It is estimated that more than 99% of ash stems greater than 2.5 centimeters in diameter have been killed in areas where emerald ash borer are established. However, monitoring data show that ash prevalence is relatively low at the park compared to other parks in the CUPN network, with tree-size plants occurring in only four plots and seedlings/saplings occurring in only about half of the monitoring plots. Therefore, it is not expected to cause large-scale tree mortality within the park.

Other Findings

At the completion of the 2015 field season, NatureServe botanists added 11 species to the park's current list as "present in park" as a result of this monitoring effort. In 2014, non-flowering stems of Blue Ridge catchfly (*Silene ovata*) were found during monitoring. This species is federally listed as special concern and is also listed as a state endangered species in Kentucky and Tennessee. Plots are monitored at CUGA during the third week of August.

About the Cumberland Piedmont Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as "Vital Signs Monitoring," to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystem,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and congressional mandates, and
- Provide a means of measuring progress towards performance goals.

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<http://science.nature.nps.gov/im/units/cupn/index.cfm>

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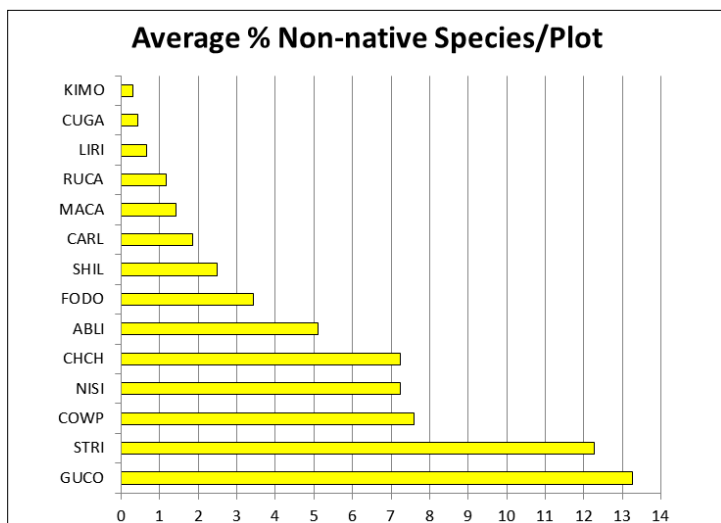


Figure 3. Plot level average non-native plant species diversity across CUPN parks by percent.