



Vegetation Composition, Structure, and Function *Oregon Caves National Monument, 2013*

Background and Importance

Vegetation defines habitat for most other forms of life, makes up most of the biomass on the landscape, and plays an important role in energy pathways. Changes in vegetation composition, structure, and function will therefore have a profound effect on ecosystems. The vegetation of the Klamath parks contributes to the renowned biodiversity of the region. Climate and fire are major drivers of vegetation change. Fire suppression, climate change, local land-use changes, and non-native species invasions can result in significant changes in vegetation communities. Monitoring vegetation is critical to detecting and understanding status and trends in vegetation as well as other park vital signs.

The Klamath Network Inventory & Monitoring Program measures vegetation composition, structure, and function on selected sampling frames in each of six parks of the network every three years (Odion et al. 2011). Parks are paired to enable sampling to be timed well with plant development and flowering. Monitoring began at Oregon Cave National Monument and Crater Lake National Park in 2013, and occurred in other KLMN parks in 2011 and 2012.

Monitoring Objectives

Following are the vegetation monitoring objectives:

1. Describe the composition, structure, and function of vegetation communities in Klamath Network parks by installing and sampling a network of permanent plots established with a probabilistic sample design in safe, relatively accessible areas.
2. Quantify temporal and spatial change in these factors through the re-measurement of permanent plots.
3. Sample communities of special concern (alpine and riparian) at greater intensities to allow improved statistical sensitivity to ecological change and better identification of emerging threats.
4. Co-locate some vegetation plots with bird and stream sampling locations to provide more comprehensive status and trend data and evaluate interrelationships among biota.



Oregon grape
(*Mahonia aquifolium*)



Field crew member monitoring vegetation at Oregon Caves National Monument. Photo: NPS.

Monitoring Approach

The monitoring sampling frame used was constrained for safety and logistical reasons to exclude areas with slopes greater than 30 degrees, and locations less than 100 meters (m) or more than 1 kilometer (km) from a road or trail. Across all parks, three types of sampling frames are recognized: 1) Riparian (areas within 20 m horizontally of a perennial stream), 2) High Elevation (elevations above a specific elevation limit in each park), and 3) Matrix (remaining areas).

Ten randomly located matrix sites were established in Oregon Caves. Colocation with other types of monitoring projects was not possible. A 20 x 50 m plot was used for sampling matrix sites. A wide range of data is collected from each plot. On each forested plot, vegetation is assessed in four strata, from tree canopy to ground layers. Each plot consisted of ten 10 x 10 m modules, four of which are sampled intensively for species, ground cover, and seedling and sapling data (Figure 1). Other components of vegetation examined include down wood, litter, and duff.

10	9	8	7	6
1	2	3	4	5

Figure 1. The 20 x 50 meter matrix site layout. Each numbered square is 10 x 10 meters. Shaded squares are the four modules where more intensive sampling occurs.

Results

Vegetation Composition

Vascular plant species richness for the 0.1 hectare (ha) matrix sampling plots ranged from 46 to 62 species. (Figure 2). For all matrix plots, 113 species were recorded (135 when counting unknowns). The most frequently occurring understory species are summarized in Smith and Sarr (In review). No non-native species were observed. Tree species composition at Oregon Caves consisted of 9 species. Both white fir (*Abies concolor*) and Douglas-fir (*Pseudotsuga menziesii*) occurred in all plots. Figure 3 shows tree basal area composition percentage by site.

One new genus was observed at Oregon Caves. A species of cliff fern (*Woodsia*) was collected, but could not be identified confidently to species. This appears to be the first collection from the monument. Available material was sparse, thus collecting was kept to a minimum to avoid impacting the population. Future efforts could target the surrounding habitat looking for more individuals to collect.

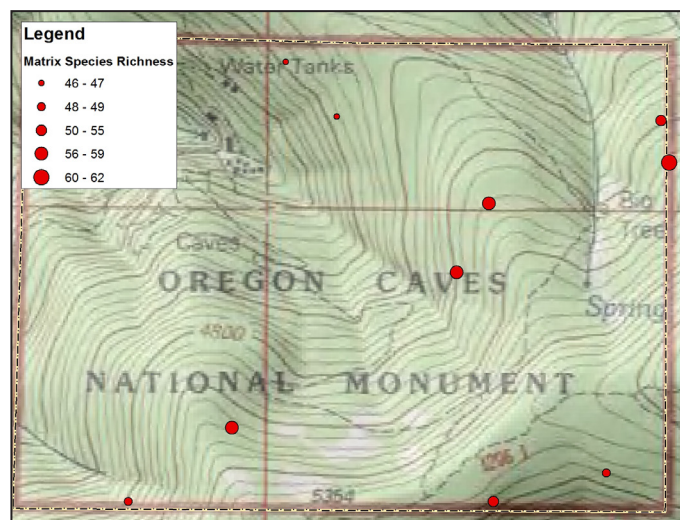


Figure 2. Species richness for each site sampled in Oregon Caves. Larger dots indicate larger numbers of species.

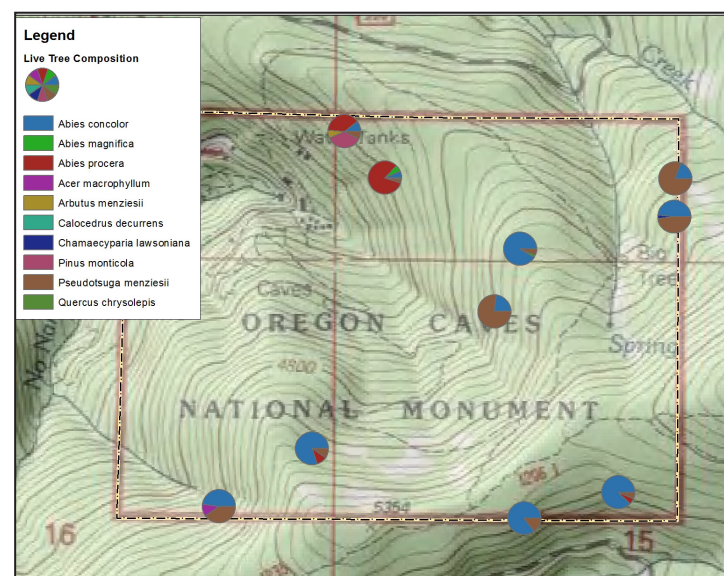


Figure 3. Basal area percentage of trees (>15cm dbh) by species for Oregon Caves matrix sites.

Vegetation Function (Regeneration)

Fir (*Abies spp.*) was the most abundant regenerating tree species in the smallest seedlings size class (2250 trees/ha). White fir (*Abies concolor*) (1750 trees/ha) was a close second. *Abies concolor* was the most abundant in all other size classes. See Smith and Sarr (In review) for regeneration counts for all tree species combined within size classes.

Vegetation Structure

The highest mean vegetation cover occurred in stratum 4 (<0.75m height)-- 60.5%; the second highest cover was in stratum 1 (> 5m height)--18.8%.

Mean plot basal area for the matrix sampling frame was 58.7 m²/ha for live trees and 0.9 m²/ha for snags. All ten matrix plots had trees >15centimeters (cm) diameter at breast height (dbh). Mean tree density was (303 trees/ha). Mean shrub height was 0.5 m. Additional structural summaries are available in Smith and Sarr (In review), such as mean tree height, height to crown, maximum height, mean snag density and heights.

Fine wood/litter dominated the ground cover. Litter and duff depths were similar, at 2.2 and 1.8 cm, respectively. Additional information about fuels is available in Smith and Sarr (In review).

Management Relevance

Annual reports from this project provide parks information about the status of vegetation community composition, function, and structure. This may include documentation of non-native species locations, plant species newly discovered for the monument, and vegetation responses to disturbances such as extreme weather events or fire. Over time, trend data will provide valuable information on spatial and temporal patterns of vegetation change, providing a foundation for resource stewardship activities and research projects that can be directed at better understanding the causes of observed changes.

References Cited

- Odion, D. C., D. A. Sarr, S. R. Mohren, and S. B. Smith. 2011. Monitoring vegetation composition, structure and function in the parks of the Klamath Network Parks. Natural Resource Report NPS/KLMN/NRR—2011/401. National Park Service, Fort Collins, Colorado.
- Smith, S. B. and D. Sarr. In review. Monitoring vegetation composition, structure, and function in Oregon Caves National Monument and Crater Lake National Park: Fiscal year 2013 annual report. Natural Resource Data Series NPS/KLMN/NRDS—2017/XXX. National Park Service, Fort Collins, Colorado.

More Information

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<http://science.nature.nps.gov/im/units/klmn/monitor/vegetation.cfm>