

Type of Presentation: Oral

Authors and affiliation: Scott Esser (Rocky Mountain National Park), Jason Sibold (Colorado State University) and Ben Bobowski (Rocky Mountain National Park).

Email address for corresponding author:scott_esser@nps.gov

Title: Subalpine Forest Change 1972-2013, Rocky Mountain National Park, USA

Abstract (maximum 300 words):

Many forest ecosystems are expected to experience novel climates and disturbance regimes, which may lead to shifts in forest structure, composition and species distribution. In some cases, changes in forest composition and structure may already be evident due to warming and increased disturbance in recent decades. In Rocky Mountain NP, we expect tree species that are not tolerant of drought to respond to the future warmer climate by moving upslope to cooler, wetter conditions. However, this climate-based view of species distribution does not incorporate the significant influence of ecological disturbances or fine-scale topography in shaping patterns of species distributions. Here, we ask how has disturbance and topography interacted with novel climates to influence species migration and forest structure?

In 2013-2014, we resampled 68 subalpine forest plots originally surveyed in 1972-73 in Rocky Mountain NP to investigate forest change in the context of recent climate, topography and disturbance. Five plots were highly disturbed, four from fire and one from mechanical thinning. Furthermore, many sites had been impacted from the recent mountain pine beetle outbreak.

Overall, our results indicate species richness has remained relatively stable, with new species arriving in only 8% of plots. However, shifts in species composition occurred within the 40-year period. For instance, shade-tolerant species are becoming more abundant. Within post-fire plots, the response was typical of classic successional species composition with increases in aspen. In undisturbed plots at lower elevations, forest composition is shifting towards more drought tolerant species. This suggests that disturbance may also be a more important factor in determining which species will migrate. This information can aid land managers in helping to prioritize areas that are more vulnerable to impacts from climate change and shifting disturbance regimes, while also helping to disentangle whether expected changes in composition and structure from climate change can be overridden by disturbance.

Questions (maximum 100 words):

1. Honor the past: Provide a brief historical context for your work.

While the formidable peaks of Rocky Mountain NP have stayed relatively constant over the last 100,000 years, forest composition is dynamic and trees have moved upslope and down to track suitable climate. For instance, evidence from sediment and tree cores suggests that the dominant species in the subalpine has shifted in Rocky Mountain NP between spruce/fir and pine dominated communities. Treeline has been both higher and lower in elevation than present. This study examines relatively recent change, from the last 40 years, by revisiting plots that Dr. Peet set up in 1972.

2. Celebrate the present: How is your work relevant to park visitors?

From aspens turning yellow in autumn to the sweeping views from Trail Ridge Road, forests in Rocky Mountain NP provide the backdrop for visitor experience. While trees are long-lived, forest composition is not constant and it can change quickly after disturbances such as fires and beetle outbreaks. Understand past change and predicting future forest changes, will provide visitors with greater context and recognition of the importance of forests in the landscapes of Rocky Mountain NP.

3. Inspire the future: How might your work inform park management?

Forest health across the Western US is threatened by more frequent drought, increase wildfire severity, and large beetle outbreaks. Understanding how forests recover and respond to these stressors and whether specific locations will provide refuge is critical for park management. For instance, in some areas park managers may be able to facilitate recovery by providing seed source and in other cases, passive recovery may be preferable. Managers may be able to prioritize restoration and management efforts, if there is a clearer understanding of which species will be successful in novel climates and disturbance regimes.

Key Words: forest, climate change, species migration

Type of Presentation: Oral

Authors and affiliation: Ben Baldwin (Rocky Mountain National Park), Melinda Merrill (Estes Institute), Dan Cribby and David Kline (Westview Middle School).

Email address for corresponding author:ben_baldwin@nps.gov

Title: Plains to the Park: integrating STEM initiatives into national parks

Abstract (maximum 300 words):

Plains to the Park is a park-based STEM (Science, Technology, Engineering, Mathematics) experience hosted by Westview Middle School in partnership with the Continental Divide Research and Learning Center (CDRLC) of Rocky Mountain NP and the Estes Institute. In summer 2014, students, teachers and park staff participated in a two week STEM Academy at Westview Middle School and within Rocky Mountain NP. Students and teachers worked with CDRLC staff and volunteers to learn scientific methods and collect data in Horseshoe Park to answer questions relevant to current park management.

For two weeks in July, 22 middle school citizen scientists used standardized protocols as they conducted research on migratory birds, willow habitat, wildlife populations, and mountain lions. Students learned scientific field skills and gained experience in conducting basic point counts, vegetation and wildlife transects, and using GPS units, trail cameras, and field guides. In addition to citizen scientist crews, students participated in a film course over the summer to document and produce a video about their citizen science experience in the park.

Questions (maximum 100 words):

1. Honor the past: Provide a brief historical context for your work.

For over 30 years, Rocky Mountain NP has provided K-12 students hands-on educational experiences through the Heart of the Rockies Programs. These environmental education programs are linked to Colorado standards and students can experience activities such as snow shoeing, building beaver lodges, and monitoring elk exclosures. The CDRLC has recently initiated a science literacy program that complements the Heart of the Rockies. The CDRLC efforts focus on teaching smaller groups of students the scientific process. Students engage in hands-on activities at the park to help them develop questions, follow established protocols, and participate in scientific data collection.

2. Celebrate the present: How is your work relevant to park visitors?

Plains to the Park helps engage youth in discovering the park and science at an important age. For students that connect through environmental education, this program is the next step towards deeper connections and stewardship. These students as visitors on their public lands, see interactions between science and stewardship first hand. This program provides a model of engagement for citizen scientists of all ages fostering a next generation of informed park stewards that will continue to protect these public lands.

3. Inspire the future: How might your work inform park management?

As a pilot program, the students learned about and collected data related to several important issues. Mountain lions are a keystone predator in the park and elusive, the camera traps will add to our understanding of where and when lions are active. The student efforts related to migratory birds

complements park efforts to understand connections with sister parks in Costa Rica and investigate spatial and temporal scales. Overall, this program brings youth to the park which provides unique insights on how they connect to the park, use technology to engage and share that message with others through social media.

Key Words: youth engagement, mountain lions, song birds, camera traps, STEM