Thesis-Schmesis

J. Hillert

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# Abstract

# Introduction

Upper montane treeless meadows - otherwise known as balds - command high floral diversity, panoramic views of the landscape, and origins shrouded in mystery (Murdock 1968, Gersmehl 1970). Most of these balds exist above 4,000 feet in elevation, however in ecological terms, true balds occur above 4,600 feet elevation. According to Murdock (1968), true balds only occur in the Southern Blue Ridge Physiographic Province. Two types of balds have been identified; heath balds - dominated by woody ericaceous species or grassy balds - dominated by herbaceous vegetation such as, grasses and sedges (Cain 1930, Murdock 1968). After extensive review of existing literature, Gersmehl (1970) concluded that balds were formed as cultural artifacts that were maintained mainly by grazing of livestock and some form of burning. For these biodiverse balds to persist the mystery of their origin and their management needed to become separate concepts or else they will have vanished by the end of the century, as posited by Lindsay (1976). Management ensued with the most beneficial practice employed differing among agencies; the U. S. Forest Service (USFS) has committed to maintaining all grassy balds through mowing, while the Great Smoky Mountains National Park and Shenandoah National Park maintain some but not all balds (Murdock 1968).

Round Bald is located about 16 miles North of Bakersville, North Carolina and 14 miles South of Roan Mountain, Tennessee next to Carver’s Gap. This bald crests at 5,800 feet in elevation and has slope of approximately 21-degrees from northern edge to southern edge. Since the 1980’s, the management practice responsible for slowing succession on USFS’ Appalachian balds has been mowing to promote the diversity of the native grasses and sedges. However, these balds have been facing habitat loss due to woody encroachment of blackberry, *Rubus alleghaniensis*, signalling succession to the surrounding spruce-fir stand (Stokes and Horton (2022); Murdock (1968); Lenze (2015)). Mowing has proven successful in improving the coverage of grasses and sedges but encroachment by blackberry is a continued threat that needs further study. In February of 2022 a low-intensity surface fire broke out on Round Bald and burned approximately 4 acres, with little visible effect on blackberry. Fire has been show to be effective at combating woody encroachment, and a preferred method of management over mowing (Murdock 1968), but the effects on the rare and endemic species is not entirely known.

The intention of this study is to examine the changes in the plant community and soil seed bank caused by the fire. Differences in plant community and examining what germinates from the seed bank following two growth seasons would provide incite whether this type of fire could be beneficial or detrimental to biodiversity on Round Bald. The goal is to provide data following disturbance to improve bald management and maintain these scenic wonders.

# Methods

Round Bald is located in the Roan Mountain Massif of the Unaka mountain range of the Southern Appalachian Mountains, at an elevation of 1,775 m and approximately 36°06’N and 82°60’W. The Appalachian Trail (AT) runs along the study site and acts as the center line for the plant community transects. Round Bald is located about 12.8 miles north of Bakersville, North Carolina in the Pisgah National Forest and 12.4 miles south of Roan Mountain, Tennessee in Cherokee National Forest. The first four transects established by Stokes and Horton (2022) were relocated and used in this study, as the fire did not extend to the subsequent transects. Here we are looking at differences in plant community composition and soil seed bank following low-intensity ground fire.

In this study we sampled the first four transects established by Stokes and Horton (2022) using the new AT as the central line. Individual plots were relocated from Gaia GPS data (Trailbehind Inc. 2017) and then marked again to reflect current plot location. Distance north and south was measured from each plot to the AT. Plots were laid out as perpendicular to the new AT as previous waypoints indicated. Transects were separated by 150 meters, as established by Stokes and Horton (2022), and plots were 8-12 meters from each other. Historic plots described by Hamel and Somers (1990) were not sampled. Plant Community percent covers data were collected for the first growing season in June 2022 and the second season *in June 2023*. Soil seed bank samples were only taken during the first sampling season and grown for one year.

Plant community percent cover was measured using a 1 x 1 square meter PVC quadrat divided into 100 equal sized squares. Quadrat was placed about 2 feet above the ground and was photographed at each plot. Digital photographs were marked to indicate dominant vegetation type determined by visual estimation of each square, plot coverage totals were tallied at the end of the sampling day. Vegetation types were categorized following recommendations from USFS botanist Gary Kauffman and used previously by Stokes and Horton (2022). At the time of sampling little to no vegetation was greater than one meter in height so vegetation was recorded as ground layer (<1 m). Four soil probes were depressed until they met resistance at each quadrat corner to measure average soil depth. In total, 99 plots were sampled along four transects, 47 of which were out of the fire and the other 52 plots were in the fire.

Following plant community sampling, data was input into excel to determine soil seed bank samples from the existing plant community plots. Plots were pooled in either of two categories; greater than 50% blackberry or less than 25% blackberry. Those categories were divided into plots within the fire and those outside of the fire. Six soil seed bank samples were individually picked at random from each of the four pools. Soil collections followed a method from Price et al. (2010) and modified for this study. Approximately 225 grams of soil was collected from each plot and placed into 8-oz deli containers marked with plot number, blackberry percent category, and whether or not fire occurred. This approach was modified following Price et al. (2010) and the samples were placed into growing trays (36.8 x 22.9 x 5.6 cm³) with enough soil (*Miracle-Gro Moisture Control Potting Mix*) to reach a depth of 5 cm. All seed bank samples were collected on July 9th and transferred to growth trays on July 13th, 2022. In total there were 30 seed bank trays in five categories each with six samples; >50% blackberry - in fire, >50% blackberry out of fire, <25% blackberry in fire, <25% blackberry out of fire, and control. Temperature and relative humidity were recorded on a twice daily basis using a *Govee Wireless Thermometer Hygrometer*. Trays were then randomly placed in two rows of fifteen trays at ambient temperature and humidity in the greenhouse anteroom and watered every 2-3 days. Each month trays were randomly reorganized to reduce error from fluctuations in air flow, temperature, or humidity. Trays were relocated into the greenhouse following completion of construction and trays were watered, rotated, and identified as previous.

Seed bank trials followed the seedling emergence method from Price et al. (2010), in which, seedlings were identified as they emerged, counted, and removed or transplanted until identifiable.

## Statistical Methods

Data sets were imported to the statistical program R studio for analysis (R Core Team 2021).

# Results

# Discussion

# Tables

# Figures

# References

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