

# NSRC Progress Report 2022

# Oak at the Edge: Investigating the Importance of Fire as a Tool in Oak Range Expansion

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#### **Project Abstract**

Northern red oak is one of the most valuable tree species for wildlife and timber in the Northeast. Forest managers need to better understand regeneration ecology of oak as climate change expands its potential range into the Northern Forest and beyond. Even where it is currently abundant, red oak regeneration has proven challenging to forest managers seeking to maintain its dominance. NSRC researchers will investigate whether fire plays a unique role in promoting oak establishment and recruitment near its northern range limit, thereby providing critical silvicultural information specific to its management in the Northern Forest. Through a combination of tree-ring analysis, regeneration studies in silvicultural prescribed burns, and controlled mesocosm (potted seedling) experiments, researchers will expand our understanding of how fire influences oak regeneration and how it can best be used in silviculture to meet this goal. The lack of previous studies on fire's role in oak regeneration specifically in the Northeast makes this project scientifically novel and necessary to inform future management.

Researchers will also investigate how soil is transformed by fire and may benefit oak regeneration. Researchers will collaborate with stakeholders at many stages of the project, providing immediate educational benefits through field work with community scientists, prescribed fire demonstrations, and active collaborations with local forest groups. The project will provide fundamental information on oak regeneration and the use of prescribed fire as a tool to help create more resilient and climate-ready forests and will help others to adopt and accept this approach in ways that are supported by data.

#### Progress in 2022

All candidate prescribed burn study sties were revisited in September 2022 by the UNH and Cornell PIs, and final decisions were made on which sites will best fit the needs of the study. Over twenty candidate historic wildfire sites across NH and VT were also visited to evaluate their suitability for the dendrochronology component of this project. So far, at least four sites appear suitable, with known burn dates ranging from 1903 to 1947. Several others may be suitable if we can learn more about the fire history of the site. Conversations are in progress with the landowners. A master's student, Khanh Ton, was recruited to start at UNH in the spring semester of 2023. Khanh will implement the collection of field data for this project and lead at least one publication for her master's thesis. A Rx burn led by John Neely is being planned to occur on WMNF lands in Conway NH in an oak stand in April 2023.

### Problems or Changes

Considerable effort went into identifying sites that fit our sampling criteria for the dendrochronological study of oak stands with a known history of wildfire. While large areas of the WMNF are known to have burned, the vast majority of areas we scouted either did not have oak, were designated as Wilderness areas, or have been managed since the fire, altering the population age structure. We expanded our search beyond the WMNF and have identified several candidate sites on State of NH and private lands. Permission discussions for sampling these locations are pending.



Collecting local acorns (not damaged by weevils) was unexpectedly challenging due to the poor acorn crop across the region in 2022. After extensive searching, over 1,000 sound acorns were collected from mother trees in Gorham and Woodstock NH. These acorns will be used to establish the potted seedling experiment this spring.

An additional study site not anticipated in the original study design was identified in Crawford Notch State Park, where a May 2022 wildfire induced substantial canopy tree mortality, including in areas with oak (see figure).

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One of the most severely burned parts of the May 2022 Bemis Fire in Crawford Notch State Park. Photo was taken in July 2022.

## Plans for 2023

In spring of 2023, we plan to collect soil from before and after a planned prescribed

USFS burn in an oak-dominated stand in Conway, NH. This soil will be used to establish a potted seedling experiment investigating the distinct effects of fire on seedling success via changes in nutrient availability and soil pathogen loading, independent of effects via light and root competition. We are investigating alternative Rx burn locations on UNH property in Durham as well. In summer of 2023, transects will be established in Rx burned and similarly managed but unburned stands to assess density and growth rates of oak and non-oak seedling regeneration. Sampling to characterize light availability and soil properties will also commence in summer of 2023. Once permissions are secured, increment cores will be collected from several oak stands with a known or strongly suspected history of wildfire. Collection of cores will occur in summer or fall as logistics dictate, and analysis of cores will begin in the fall semester. Mature seed-source trees in and adjacent to the study sites will be selected during the summer and will be monitored for metrics of seed production in September. If sufficient local acorns are available, grids of acorns will be established within studied Rx-burn sites and paired unburned sites to quantify seed vs. site limitation to regeneration.

### Collaboration

We continue to collaborate with USFS partners in finalizing the sampling design in the context of existing data about recent prescribed burns on USFS lands, including Marko Yamasaki at Bartlett Experimental Forest and John Neely at the White Mountain National Forest. In October 2022, the PI attended an online workshop and a field trip organized by the North Atlantic Fire Science Exchange entitled "Restoring Fire-Adapted Oak-Pine Communities at The Dome, Green Mountain National Forest." He spoke to the group of ~40 management professionals and scientists about this project and had several useful discussions with other participants during the field visit to a large and successful recent prescribed burn in the Green Mountain National Forest.