PRESCRIBED FIRE IMPROVES RED OAK (*QUERCUS RUBRA*) REGENERATION IN NORTHERN NEW HAMPSHIRE

Khanh Ton, Matt Vadeboncoeur, Nat Cleavitt, Abigail Powell, and Heidi Asbjornsen

PURPOSE AND SCOPE

Quercus rubra currently faces many regeneration problems in the Northeastern United States, with further uncertainties as climate change expands its potential range northward (Iverson et al. 2019). It has been hypothesized that prescribed fire might be the answer (Abrams 1992). Fire has been integral to upland oak systems in the Eastern United States for millennia. Over time, *Q. rubra* became more adapted to a periodic fire regime than other hardwoods and, as a result, can take advantage of the postfire environment. However, fire suppression became mainstream policy in the 1920s and promoted forest mesophication (Nowacki and Abrams 2008). As the eastern landscape becomes wetter and shadier, mesic microenvironmental conditions improve and favor the regeneration of shade-tolerant species. This positive feedback loop further shrinks suitable habitats for *Q. rubra* over time. Therefore, bringing back fire in a controlled manner to reverse the feedback loop may help restore upland oak ecosystems (Abrams 1992).

METHODS AND APPROACH

In summer 2023, 43 transects were established in 6 pairs of burned and control study stands across the White Mountains, including a total of 393 plots. Along each transect 1-m^2 plots were spaced 10 m apart from their centers. Woody species <2 cm in diameter at breast height (d.b.h.) were identified, and their stems counted. Oak seedlings were tagged, aged, measured for height and diameter at root collar, and checked for herbivory and pathogen damage. Within the 5-m radius of each quadrat, trees >2 cm d.b.h. were identified and measured, and oak seedlings were counted. Seedlings continue to be monitored, along with soil analysis and leaf area index measurements. We also established a mesocosm experiment, in which acorns were planted in soil collected from the wildfire stand and its paired control, to separate the mechanisms facilitated by the fire-altered soil.

Khanh Ton, The University of New Hampshire, College of Life Sciences and Agriculture, Durham, NH 03824, USA

Matt Vadeboncoeur, The University of New Hampshire, Earth Systems Research Center, Durham, NH 03824, USA

Nat Cleavitt, Cornell University, College of Agriculture and Life Sciences, Ithaca, NY 14850, USA

Abigail Powell, Duquesne University, Pittsburgh, PA 15282, USA

Heidi Asbjornsen, The University of New Hampshire, College of Life Sciences and Agriculture, Durham, NH 03824, USA

FINDINGS AND IMPLICATIONS

In burned stands, red oak (*Q. rubra*) mainly competes with early successional seedlings such as raspberries (*Rubus* spp.), pin cherry (*Prunus pensylvanica*), birches (*Betula* spp.), and stump sprouts of beech (*Fagus grandifolia*) and red maple (*Acer rubrum*). In control stands, species reflect tree composition particular to the sites including ash (*Fraxinus* spp.), sugar maple (*Acer saccharum*), and hophornbeam (Ostrya virginiana). Oak seedling density increased threefold in burned stands (30 ±2 per ha) relative to control stands (9 ±2 per ha) (P <0.0001). Diameter at root collar was greater for seedlings in burned stands (4.51 ±0.46 mm) versus control stands (3.35 ±0.54 mm) (P = 0.01) (fig. 1). Oak germination rates rose substantially during at least the 3 years following the burns. In the mesocosm experiment, fastest seedling growth was observed in unsterilized soil from the burned stand.

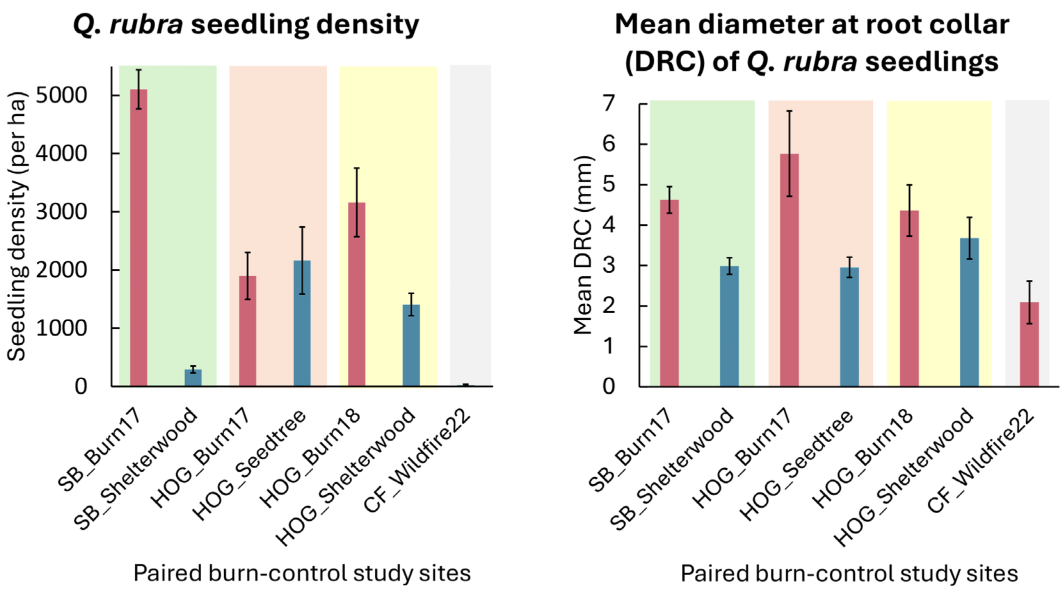

Figure 1—Oak seedling density and mean diameter at root collar (DRC) in Stevens Brook (SB), Hogsback (HOG), and Crawford Notch (CF). Error bars represent +1 standard error from the mean.

Our preliminary results show promise that fire plays a unique role in advancing oak regeneration. Seedlings were more abundant and greater in size in burned stands, where heavy recruitment was observed in the first 3 years since the burns. Potted seedlings similarly matched this trend with higher growth rates, suggesting fire alteration of soil properties, whether physical, chemical, or biological, may help promote oak establishment and recruitment in the northern hardwoods of New Hampshire.

LITERATURE CITED

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