Managing Firebreak Fuels to Promote Habitat of an Imperiled Moth (Massachusetts)

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The pitch pine-scrub oak barrens on the island of Martha's Vineyard provide important habitat for the barrens buckmoth (*Hemileuca maia*), a state-listed species that feeds on bear oak (*Quercus ilicifolia*) and dwarf chinkapin oak (*Q. prinoides*) (Wagner and others 2003). The vegetation in this fire-prone ecosystem is quite flammable and concerns both land managers and landowners. Early managers of the 5,000-acre (2,023-ha) Manuel F. Correllus State Forest (MFCSF) used harrowing to develop a gridwork of grassy firebreaks throughout the forest to reduce spread of fire and to allow firefighters easier access (Foster and Motzkin 1999). The Massachusetts Department of Conservation and Recreation has recently proposed widening existing firebreaks from 25 ft (7.6 m) to 75 ft (23 m) or more to mitigate the threat of fire moving across firebreaks to private properties. However, harrowing causes a shift away from shrub-dominated communities and toward grasslands, thus reducing the amount of habitat available for shrub-feeding species, like the barrens buckmoth.

Rather than widening the harrowed firebreaks, we proposed reducing the fuels along them using techniques that could maintain the habitats required by rare species and still reduce the fire danger. In 2002, we began a study in the southwestern portion of MFCSF that compared three fuel reduction treatments—overstory thinning of pitch pine (*Pinus rigida*), mowing of shrubs, and grazing of regrowth with sheep—in areas dominated by pitch pine, oak woodland, or scrub oak fuel types. We created three replicate, 0.5-acre (0.2 ha) plots for each treatment combination per fuel type (thinning/mowing and thinning/grazing in pitch pine, mowing and mowing/grazing in oak woodland, and mowing and mowing/grazing in scrub oak) within a 500-ft (152-m) wide treatment area. We left three untreated plots in each fuel type as controls, for a total of 27 plots.

In July 2002, we thinned pitch pines within the treatment area from 120 trees per acre (296/ha) to 30 trees per acre (74/ha) with a feller-buncher. Within oak woodland and scrub oak treatment plots, we mowed shrubs and small understory trees to ground-level with a brush-hog. After mowing, we waited a minimum of four weeks so that mow/graze plots could resprout, and then let the sheep graze until the new vegetation was removed (about two weeks per plot). Because of the time lag after mowing, only the scrub oak plots were grazed before winter 2002. The oak woodland and pitch pine plots were grazed in summer 2003.

Table 1. Mean values (±SE) of scrub oak density (stems/m²), canopy closure (%), and bear oak (*Quercus ilicifolia*) cover-abundance (categorized from 1 to 6, according to Braun-Blanquet's Abundance Scale) measured across treatment combinations in three habitat types.

	Scrub oak density	Canopy closure	Scrub oak cover
Buckmoth sites	20.2 ±3.8	27.0 ±7.1	4.5 ±0.7
Pitch pine			
thin + mow	5.2 ±1.4	55.3 ±2.4	1.3 ±0.0
thin + graze†	NA	NA	NA
control	4.9 ±2.3	81.9 ±4.3	1.8 ±0.4
Oak woodland			
mow	9.7* ±4.2	77.1 ±2.0	2.6 ±0.5
mow +graze†	NA	NA	NA
control	3.1 ±1.6	82.6 ±3.0	3.4* ±0.2
Scrub oak			
mow	62.9 ±10.3	14.3* ±3.1	4.0* ±0.4
mow + graze	35.3* ±12.7	24.1* ±10.9	3.0* ±0.0
control	20.7* ±5.5	51.3 ±6.6	5.7 ±0.3

* Mean values not significantly different from buck moth sites ($p > 0.05$).
† Grazing did not occur until 2003, so comparisons could not be made.

In summer 2002 (prior to treatment) and 2003 (one year post-treatment), we measured canopy closure, scrub oak stem density, and cover-abundance of vegetation on 15-m x 15-m subplots within the 0.5-acre plots. We did not include oak woodland and pitch pine graze plots in these surveys because they were grazed too late in 2003 for comparison. We measured the same vegetation characteristics on plots centered on buckmoth larvae sites and compared them to plots randomly located within the different fuel types. Using these data, we developed a logistic regression model that predicted the vegetation characteristics preferred by the moth. We then compared these characteristics to treatment plots to assess their potential for providing buckmoth habitat.

We found that buckmoth sites had fairly open canopies, high densities of scrub oak stems, and relatively high coverage of bear oak in the shrub layer (Table 1). Buckmoth sites did not differ significantly from random sites, except for having higher densities of scrub oak stems. When we compared the means of the three habitat variables between buckmoth and treatment sites (t-tests), we found that the scrub oak control plots, mowed/grazed plots, and oak woodland mow plots had scrub oak stem densities similar to buckmoth sites. However, only the mowed and grazed scrub oak plots were similar to the buckmoth sites for all three variables.

Our work suggests that reducing fuels can minimize the threat of fire without having to compromise buckmoth habitat. Because barrens buckmoth caterpillars in MFCSF prefer high densities of

scrub oak stems, it is possible to manage for this species by using customized fuel-reduction techniques, such as mowing and grazing combinations in scrub oak. However, long-term studies are needed to ascertain the ideal method for maintaining scrub oak densities of 1.6 to 2.7 stems/ft^2 (15-25 stems/m^2) for barrens buckmoths as well as the habitat requirements of other insect species dependent on pitch pine-scrub oak barrens.

As housing development increases and shrub-dominated habitats become less common, it becomes more critical to develop land management tools that benefit rare insect species associated with sandplain shrublands. When considering potential techniques for habitat manipulation, land managers should be aware that barrens buckmoths may not be a good indicator for all rare insects dependent on pitch pine-scrub oak barrens. Habitat requirements commonly vary between species, making it necessary to maintain a mosaic of habitats in order to support a diversity of invertebrates.

References

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