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Heat and smoke effects on red brome soil seed banks

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Heat and Smoke Effects on Red Brome Soil Seed Banks

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Management of exotic plants that are annuals entails understanding and managing their soil seed banks. We completed a study of the influences of heat and liquid smoke on red brome (*Bromus rubens*) soil seed banks collected from Red Rock Canyon in southern Nevada as part of a collaborative fire effects monitoring effort with Bureau of Land Management - Las Vegas. We collected the samples from the 2005 Loop Fire, where we observed in a monitoring field study that exotic grasses such as red brome were relatively sparse in the first 2-3 years (which were during a dry period) following the fire. Based on these observations, we were interested in assessing whether the direct exposure to heat and smoke during fire may influence brome's seed banks.

We collected the seed bank samples in 2007 from different microsites (interspaces between shrubs, below shrubs) from the burned area and an adjacent unburned area. We then heated some of the soil samples in an oven until the soil reached 100°C (to simulate typical temperatures at soil surfaces during desert fires) for one minute, applied liquid smoke to other samples, both heated and applied smoke to another subset of samples, and placed all samples in a greenhouse where we watered them and counted emerging seedlings during a six-month period.

We found that seed density patterns of brome reversed among microsites with burn status. Seed density was greatest below shrubs on the unburned area, but least on the burn (Figure 1). Heating samples sharply reduced the density of emerging seeds. Smoke, on the other hand, had little effect. In some other species, smoke is known to promote germination.

(Continued on page 5)

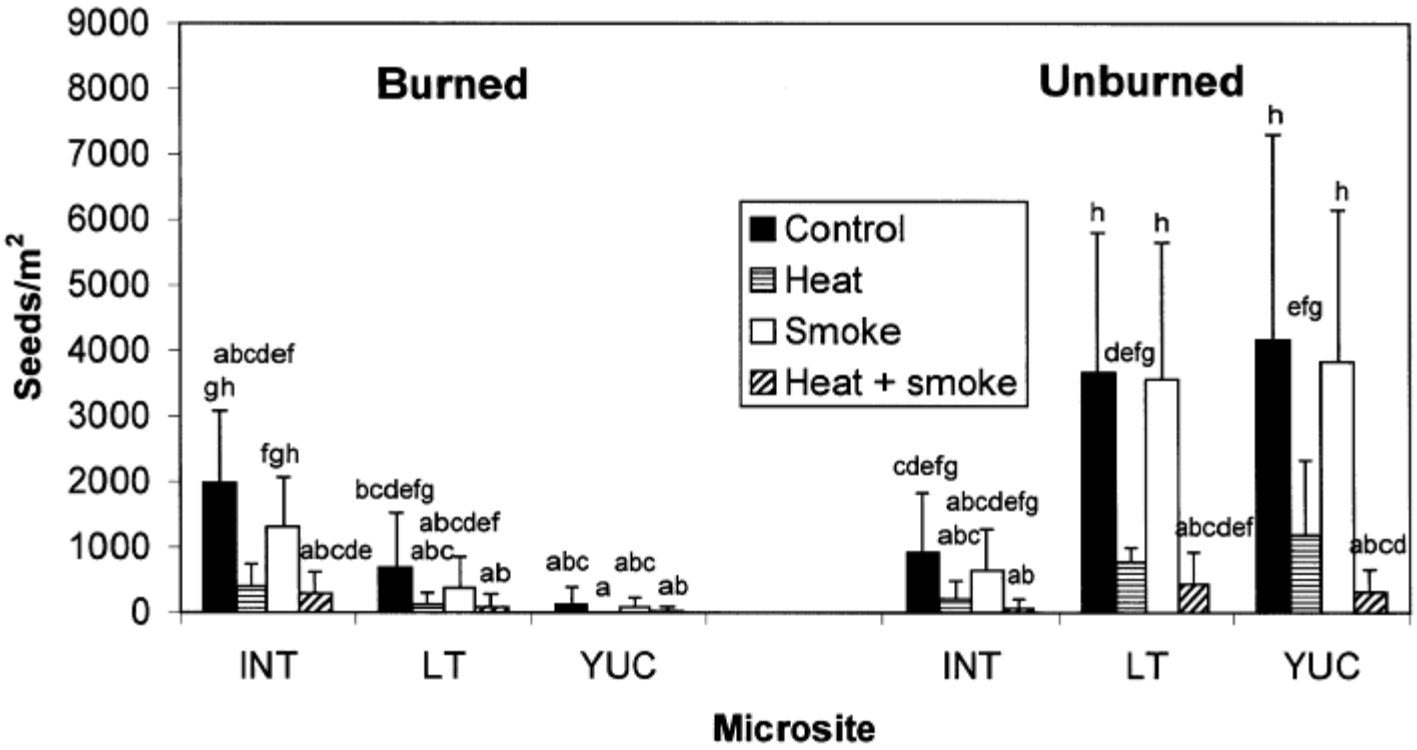
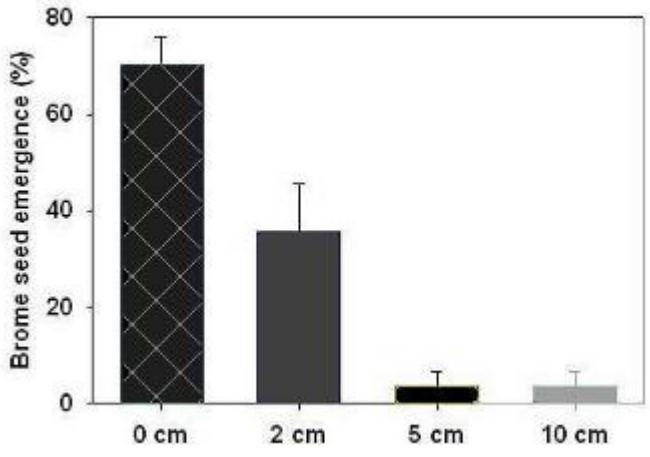


Figure 1. Emergence density of red brome among treatments performed on 0-5 cm soil seed bank samples collected from different microsites (INT = interspace, LT = below creosote bush, YUC = below Mojave/ banana yucca) in a burned and unburned area. Error bars are one standard deviation. Means without shared letters differ at $P < 0.05$ and were compared using Tukey's test.

Effects of Burial Depths and Substrate Treatments *(continued from page 4)*

Figures 1 through 4 show the percent seed emergence of Sahara mustard and red brome, with relation to burial depths and substrate treatments. The data indicate decreased percentages of emergence for seedlings with increasing burial depth, as well as low percent emergence for pots containing gravel as a treatment. The high percent emergence of seedlings containing thatch as a treatment indicates that the treatment does not act as a functional barrier to seedling emergence. The results therefore suggest that gravel and increased burial depths both act as effective agents for controlling the invasive species Sahara mustard and red brome in a desert community.



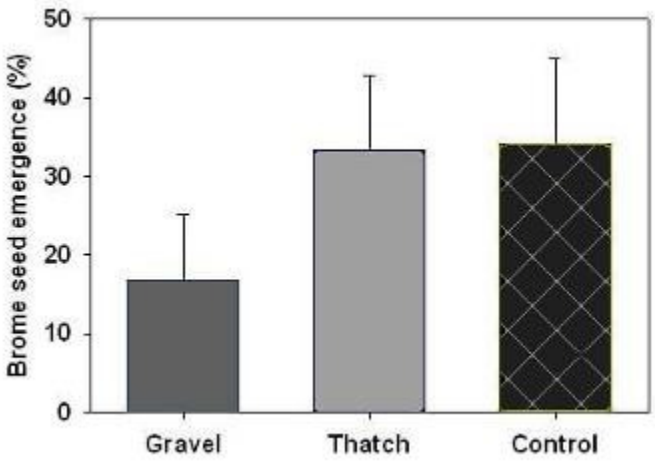


Figure 3. Percent emergence of red brome seed under four burial depths (0, 2, 5 and 10 cm). Figure 4. Percent emergence of red brome seed treated with substrate additions (gravel, thatch and control).

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Some of our thoughts on these results are:

- The experiment was not set up to identify whether heating actually killed seeds versus inducing some type of deep dormancy, though we suspect that seeds were actually killed.
- This idea is supported by the fact that below-shrub microsites on the burn contained low seed densities (in contrast to the unburned area). Fire intensity is anticipated to be greater below shrubs because of larger fuel loads. Therefore, we surmise that the fire did in fact kill seeds as also occurred during the experimental heating.
- Native species were sparse in the seed bank compared to brome, precluding an analysis of how experimental heatings may affect native species. Determining temperature thresholds more finely for red brome and comparing across species could be informative for explaining post-fire colonization patterns observed in the field.
- We do not yet have a good understanding for the relative importance of factors such as direct fire effects and climate on soil seed banks in dictating post-fire regeneration of brome. We hope to conduct further studies to better understand dynamics of these exotic grass seed banks.