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COMMENTARY

Attacking invasive grasses

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Abstract

In grasslands fire may play a role in the plant invasion process, both by creating disturbances that potentially favour non-native invasions and as a possible tool for controlling alien invasions. Havill et al. (*Applied Vegetation Science*, 18, 2015, this issue) determine how native and non-native species respond to different fire regimes as a first step in understanding the potential control of invasive grasses.

Eradication of invasive plant species represents a formidable challenge for resource managers, as many techniques provide only short-term reductions and fail to achieve sustainable control of exotic species (e.g. Kyser & DiTomaso 2002). One reason is that eradication techniques such as burning, cutting and herbicides can disrupt ecosystem processes and create disturbance sites for future colonization (D'Antonio & Meyerson 2002). A significant challenge to control of exotic plant invasions is selection of control methods that have minimal impact on native species. Invasion of grasses into grasslands is problematic in that many native species have similar growth forms and respond to eradication treatments in a similar manner. Havill et al. (2015) address the issue of how to target invasive species without causing collateral damage to native species in the fire-prone shortgrass prairies of central Texas, by comparing the impacts of different burning and cutting treatments on the response of an introduced grass and a native grass.

The response of plant populations to fire is hypothesized to be the result of several factors, but most important are (1) event-dependent factors such as seasonal timing or severity, (2) fire intervals that affect the length of recovery time between fires for sequestering resources or accumulating seed banks, and (3) environmental filters such as precipitation, soils and topographic position (Keeley et al. 2005). Pyke et al. (2010) provide one approach to predicting how fire will impact plant populations that depends on the plant's life form and vital attributes for establishment and survival, and their interaction with fire regime. In the recent study of Havill et al. (2015) they took into account Pyke et al.'s (2010) framework and focused on two C_4 perennial grasses, one introduced and the other native. They examined how the timing of burning and cutting treatments would impact recovery of these two target species and the relationship of recovery to drought. Despite the life-history similarities between these two species, subtle differences in growth form and phenology resulted in significant differences in fire effects on recovery, and these responses provided clues to potential treatment options for using fire to alter the balance between native and non-native species.

One of the important contributions from Pyke et al.'s (2010) decision framework is the delineation of key plant attributes that lead to divergent responses to fire regime characteristics. This is particularly important when considering invasions where native and non-native life forms differ, e.g. invasion of non-fire-adapted forests by flammable grasses (D'Antonio et al. 2001) or invasion of fire-adapted shrublands by annual grasses (Keeley & Brennan 2012); in the former case fire severity plays a key role in the invasion process, whereas in the latter example fire frequency is more critical to determining invasions.

A primary motivation behind Havill et al.'s (2015) comparison of native and non-native plant responses to fire is to understand the extent to which fire may be used in the restoration of invaded grasslands. Their results led them to suggest both the timing of the fire event and its interaction with environmental filters such as drought were important determinants of the conditions required to favour native over non-native species. It should be emphasized that these conditions are very specific to their situation and other scenarios will likely lead to a different subset of conditions. For example, in a study of cheatgrass invasion into yellow pine forests (Keeley & McGinnis 2007) it was shown that due to the oligotrophic nature of the substrates grass biomass never achieved fire intensity levels sufficient to kill cheatgrass seeds, but it was demonstrated that with increased pine needle accumulation, which accompanies longer fire return intervals, the potential existed for significantly reducing this invasive grass. However, on more fertile California native grassland sites higher fire intensities

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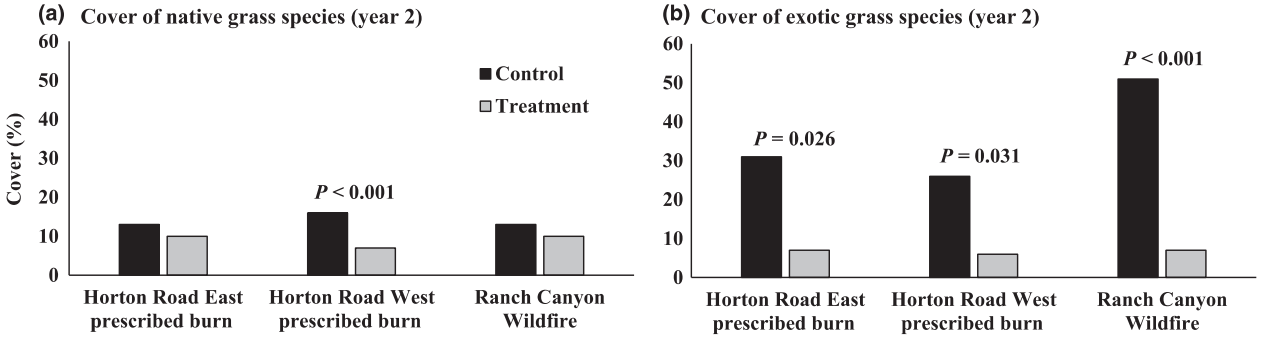

Fig. 1. Cover of native and non-native grasses 2 yr after experimental burns on San Clemente Island, CA. After Keeley, Brennan and Lawson, reported in Keeley & Syphard (2015).

were generated and these had a substantially larger impact on the exotic annual grasses relative to the native perennial grasses (Fig. 1). By the second year after fire, native grass cover had recovered to close to control level at two of the three sites, but exotic grass cover was still largely reduced on all three burned sites.

This marked impact on the non-native species illustrates potential effects of fire when applied to species of differing growth forms, and illustrates the inherent difficulty Havill et al. (2015) acknowledged in their situation with exotic and native species of similar growth form.

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