

**FUTURE OF CALIFORNIA
FLORISTICS AND SYSTEMATICS:
WILDFIRE THREATS TO THE CALIFORNIA FLORA**

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ABSTRACT

The primary threat to the California flora posed by wildfires is through human intervention with the natural fire cycle. Fires at frequent intervals, e.g., less than 5 years, can have devastating impacts on the survival of fire-adapted species. Aerial seeding of burned habitats poses another significant threat, as seeded species are capable of competitively displacing natives as well as creating conditions conducive to repeat fires.

Much of the California flora is adapted to disturbance by wildfires and indeed species in some communities, such as chaparral and coastal sage scrub, have been described as "fire-dependent". Today, fires typically occur at intervals of 20–50 years, but there is some controversy as to what the natural fire frequency was (Keeley et al. 1989). Resilience of the flora to deviations from the contemporary fire regime is highly dependent upon the direction of the deviation; i.e., fires at less frequent intervals result in quite different community responses than fires at higher frequencies.

Theoretically, anthropogenic fire suppression, resulting in longer than natural fire-free durations, could have negative impacts on fire-dependent species, although, due to a largely unsuccessful fire-prevention program, few areas escape fire for unusually long periods. Studies of remnant stands of century old chaparral have not revealed evidence that even this extreme length of fire-free conditions poses a threat to the persistence of any species (Hedrick 1951, Keeley 1992). Additionally, century old stands appear to recover normally from fire (Keeley and Zedler 1978), although this has not been studied in great detail.

A far greater threat to the California flora are deviations on the short end of the fire return interval. In chaparral and coastal sage scrub, fires at frequencies of every few years are largely anthropogenic in origin. Humans provide a ready source of ignition during the driest time of the year and often coinciding with extreme Santa Ana conditions. In addition, humans create conditions conducive to wildfires through so-called postfire rehabilitation projects. Aerial seeding of burns with ryegrass and other non-native species creates

an ideal fuel bed for recurrent fires; these species typically dry out sooner in the spring than natives and form a more continuous plant cover, which more readily carries a fire. Zedler et al. (1983) showed how a seeded chaparral site was exposed to a second reburn after one year and this resulted in the extirpation of *Ceanothus* from the site. Recent studies have also shown how frequent fires can replace the native flora with non-native grasses and forbs (Fig. 1). Even so-called fire-annuals, specifically adapted to postfire conditions, can not persist under repeated fires, as they are poorly equipped to compete with the non-native weeds.

Multiple fires during periods of five to 10 years have been implicated in the type conversion of chaparral and coastal sage scrub to non-native annual grasslands (Keeley 1990). Even longer intervals may be threats for some species. For example, *Cupressus forbesii* Jepson (Tecate cypress) has been shown by Zedler (1977) to be reduced by fires at 30-year intervals and greatly threatened by fires at 10-year intervals.

An additional threat of postfire seeding is the potential competitive displacement of the native flora. An example of a couple such sites that have received this sort of postfire treatment over many decades are shown in Table 1. The Kinneloa (or Altadena) Fire burned in the foothills of the San Gabriel Mountains above Altadena, California in autumn 1993. In addition to the native flora having to compete with the dense growth of ryegrass *Lolium multiflorum* Lam. (ryegrass) and zorro fescue *Vulpia myuros* L. C. Gmelin (zorro fescue) seeded by the U.S. Forest Service, they are also being choked by a dense stand of other non-natives, largely the mustard *Hirshfeldia incana* (L.) Lagr.-Fossat (formerly *Brassica geniculata* [Desf.] Ball). The dominance of this species possibly reflects the "ghost of seedings-past", as mustards were the species of choice for postfire rehabilitation projects beginning in the 1930's and lasting several decades, particularly in the San Gabriel Mountain foothills (Went et al. 1952, Barro and Conard 1991). The persistence of these mustards is in part due to their polymorphic seed bank, a portion of which is dormant and fire-stimulated (Keeley et al. 1985). On the bright side, botanists should be thankful that 40 years ago resource managers recognized the invasiveness of mustard species and halted their use in postfire rehabilitation projects.

Increasingly resource managers are recognizing the negative impacts of postfire seeding and are proposing alternative approaches to management of burned habitats. One approach considered more environmentally-sound is the use of native species in postfire seeding of burns. However, two potential threats to these communities are:

1. The ecological consequences of broadcasting natives into situations where their natural occurrence may be low. For example, many species are quite restricted in their natural distribution, such

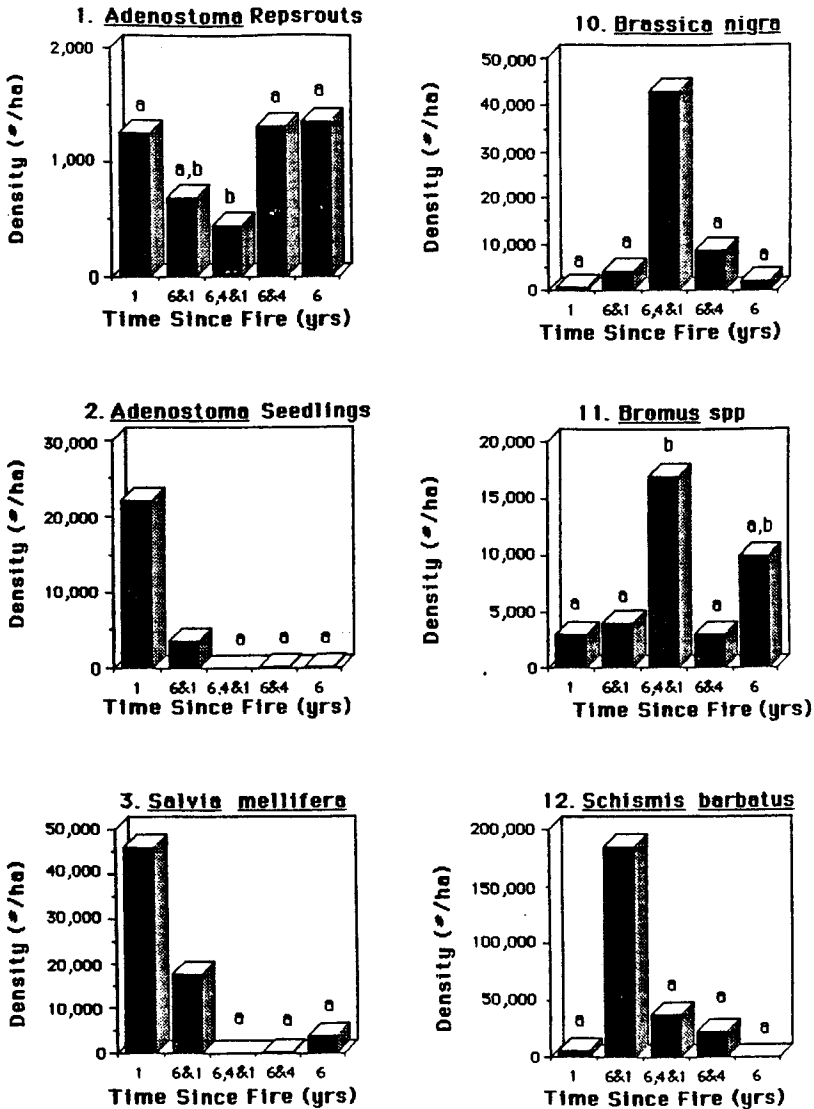


FIG. 1. Density of dominant shrubs (left) and non-native herbs (right) in adjacent chaparral sites subjected to different fire frequencies (horizontal labels, left to right are: site burned 1-year prior to study, 1 & 3 years prior, 1, 4, & 6 years prior, 4 & 6 years prior and 6 years prior; bars capped with same letter are not significantly different at $P > 0.05$ with 1-way ANOVA). Data from Haidinger and Keeley (1993).

TABLE 1. PLANT COVER ON TWO SITES WITHIN THE SEEDED PORTION OF THE 27 OCTOBER 1993 KINNELOA FIRE. Sites were aerially seeded with *Vulpia myuros*, *Trifolium hirtum*, *Lolium multiflorum*, *Lotus scoparius*, and *Eschscholzia californica* 16–18 November 1993 and sampled 7–28 March 1994. Data from Keeley unpublished. * Native species seeded on the site were indistinguishable from those same species arising from indigenous seed; all are included under “seeded species”.

Site	Coverage (cm ² plant cover/m ² ground surface)					
	Seeded species*		Natural regeneration			
	Native	Non-native	Perennial herbs	Annuals	Shrubs	Non-natives
Eaton Cyn	200	826	610	716	547	8313
Lake Ave	442	4860	21	913	162	5514

as only on south-facing slopes. Their introduction onto north-facing slopes by seeding may result in undesirable competitive interactions with the north slope plant species.

2. The genetic effects of seeding must be considered, as introduction of non-local seeds may swamp local genotypes, or outbreeding depression may reduce seed set or the vigor of the subsequent generations.

CONCLUSION

Human intervention in the natural fire cycle poses a significant threat to some components of the California flora.

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