CALIFORNIA FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

Research Brief for Resource Managers

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Impact of Short Interval Fires in Shrublands

Zedler, P.H., C. R. Gautier and G.S. McMaster. 1983. Vegetation change in response to extreme events: the effect of a short interval between fires in California chaparral and coastal scrub. Ecology 64:809-818.

Fire in chaparral is a natural process, but only when it occurs within the range of conditions represented by its fire regime. Historically, fires occurred at long intervals of several decades to a century or more. When fires occur too frequently such fires represent an "extreme event" and can result in sudden shifts in vegetation. Paul Zedler at San Diego State University and students investigated one such event where two fires occurred a year apart. They observed that for most woody species, the first fire either increased species abundance through seed germination or, for resprouting species, abundance remained the same. In stark contrast, the second fire caused a substantial decline, even for resprouters. The high mortality dramatically altered the vegetation composition and placed the community on a trajectory of change for the foreseeable future.

In August 1979, an arson fire burned over 2000 hectares on San Diego County's Otay Mountain. The California Department of Forestry promptly seeded the land with ryegrass, *Lolium multiflorium*, and watched it flourish after an exceptionally wet winter. This luxuriant stand of flashy fuels made the site vulnerable to a repeat fire set by arsonists in July 1980. Paired plots were established at five sites with two treatments: burned once and burned twice. Species density and frequency were recorded for mature shrubs and shrub seedlings in 1981.

Management Implications

- The vast majority of chaparral and sage scrub species are resilient to a single fire but are drastically reduced by a second fire before the shrubs reach maturity.
- Even a largely grass-fueled fire that occurs within one year of a shrubland fire produces sufficient heat to kill sensitive seedlings and resprouts.
- Vegetation after repeated fires is very different from its original association and the change will persist for a long time. Local extinction and permanent population declines can occur in the most sensitive species.

The only **obligate seeder** in the study, *Ceanothus oliganthus*, had a seedling density 40 times higher than the density of mature shrubs after the 1979 fire, but reburning in 1980 killed every seedling and extirpated the species from those sites.

The **facultative seeder** *Adenostoma fasciculatum* suffered considerable shrub mortality after the first fire, but it increased in overall abundance because of high seedling establishment coupled with resprouting. The second, 1980 fire killed most seedlings as well as resprouts and reduced

abundance by about 50-95% after the second fire (Table 5).

Obligate resprouter species like *Cercocarpus minutiflorus, Heteromeles arbutifolia* and *Rhamnus crocea*, were unaffected by the repeat fire as they are vigorous resprouters that suffered very little mortality, even after the second fire.

The **obligate resprouter** *Xylococcus bicolor* abundance was unaffected by one fire, but despite being a vigorous resprouter, it was reduced by 1/3 after the second fire. This species is not known to reproduce from seed so any decline in the population density should be considered a permanent population change.

The **Coastal Sage** species, *Artemisia californica, Eriogonum fasciculatum* and *Salvia apiana*, varied in their degree of resprouting and relative seedling production after the first fire; *S. apiana* and *E. fasciculatum* declined by 33% and 90% respectively and *S. apiana* was further reduced by the second fire. *Artemisia californica* was the only species to increase in abundance after the second fire due to prolific seedling production after the first fire, and 15% of the first year seedlings resprouting after the second fire.

The **pattern** of the **reburn** was irregular with unburned patches where grass cover was light. While the heat of a fire from first year growth was sufficient to kill the resprouts and seedlings of many shrub species, the patchier nature of the second fire left unburned areas that acted as refugia for fire-sensitive seedlings of *A. fasciculatum* and *C. oliganthus.* In the absence of these patches, *C. oliganthus* would have been completely extirpated within the perimeter of the reburn.

TABLE 5. Postfire abundance for mature shrubs and seedlings combined, expressed as a proportion of pre-1979 fire mature shrub abundance. Estimates are based on data from the 1/4-m² quadrat sample in which both mature shrubs and seedlings were recorded. Discrepancies between values in this table and previous tables are due to the use of data from the smaller quadrats. Main table entries are computed from frequency data. Entries in parentheses are computed from density data. N/P means not present.

Species	Site	Burned 1979 only	Burned 1979 and 1980
		Relative abundance (postfire/prefire)	
Adenostoma fasciculatum	Powerline	2.14 (6.10)	0.29 (0.64)
	Fireline	3.00 (24.41)	0.29 (0.56)
	Trucktrail	2.91 (10.00)	0.16 (0.06)
	Bellview	1.06 (2.10)	<0.04 (<0.03)*
Artemisia californica	Pio Pico	9.20 (12.00)	0.78 (1.50)
Ceanothus oliganthus	Bellview	24.67 (41.52)	<0.25 (<0.33)
Cercocarpus minutiflorus	Powerline	1.00	1.00
Eriogonum fasciculatum	Pio Pico	<0.50 (0.08)	<0.25 (<0.10)
Heteromeles arbutifolia	Powerline	1.00	1.00
Keckiella cordifolia	Powerline	1.33	1.15
Lonicera subspicata	Powerline	1.00	1.00
Rhamnus crocea	Powerline	1.00	1.00
Rhus laurina	Powerline	1.00	1.00
Salvia apiana	Pio Pico	1.20 (0.67)	0.11 (0.33)
	Powerline	1.00	0.83
	Fireline	1.00	0.64
	Trucktrail	1.00	0.25
Xylococcus bicolor	Bellview	1.00	N/P

* Proportions preceded by a < sign indicate that individuals were present but were not encountered in the sample. The number given is the proportion that would be obtained if only one individual was present in the sample.