



Research Brief for Resource Managers

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Immaturity Risks with Frequent Fire for Tecate Cypress

Brennan, T.J., and J.E. Keeley. 2019. Postfire population dynamics of a fire dependent cypress. *Plant Ecology* 220:605-617. DOI: [10.1007/s11258-019-00939-8](https://doi.org/10.1007/s11258-019-00939-8).

Tecate cypress (*Hesperocyparis forbesii*) is a rare species restricted to four geographically disparate metapopulations in southern California, USA (Fig.1), as well as a few small isolated populations in northern Baja California, Mexico. It is a closed-coned, fire dependent species that occurs in small, even-aged stands within a matrix of chaparral and therefore undergoes the same fire regime as the surrounding shrubland. Recently it has become of conservation concern due to an increase in the number of human-caused wildfires that have shortened the interval between fires within many of its remaining populations.

Research pertaining to this species is both limited and conflicting. These researchers took advantage of the opportunity to study this species following the 2003 Mine/Otay Fire, which burned nearly the entire metapopulation of Tecate cypress on Otay Mountain (Fig. 1). They used the fire as a baseline to monitor the postfire recruitment, survivorship, and reproductive maturity of trees within 16 randomly located plots over a 14 year study period. They also evaluated the temporal window of immaturity risk, along with influencing factors like burn severity, environmental site characteristics, pre-fire stand demographics, and postfire recruitment levels.

No trees survived the 2003 fire but ovulate cones were present on every site. The bulk of seedling

Management Implications

- The most significant factor affecting the immaturity risk threshold of Tecate cypress is prefire stand age.
- The immaturity risk of this species is also influenced by the reproductive capacities as the climatic variables affecting their growth over time.
- Future management strategies for Tecate cypress need to be focused on the characteristics of individual populations and to consider the possible fire-climate interactions that may potentially impact the persistence of the species moving forward.

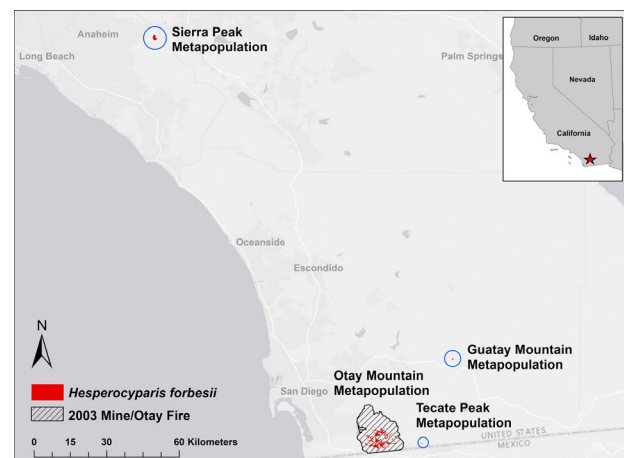


Fig. 1 Location of the four metapopulations of *Hesperocyparis forbesii* in Southern California, USA and the 2003 Mine/Otay Fire that burned the Otay Mountain metapopulation.

recruitment occurred in the first year after the fire (90%), with a small secondary pulse in year two (10%) due to the extremely wet winter in between. The most important factor influencing the recruitment density of seedlings was the stand age of trees at the time of fire, which ranged from 7 to 53 years old (Table 1). There were no statistically significant relationships between recruitment density and various other site characteristics, however in certain plots it was evident that burn severity and prefire tree density had an effect on recruitment.

Seedling mortality was highest in the first and second years after the fire but dropped to less than 3% across plots by year fourteen. The average survivorship of seedlings to the end of the study was 25% and four out of the sixteen sites

are projected to have stand densities less than that of stand replacement before they reach the same age at which they burned (Fig.2).

There were two substantial drought periods over the course of this study, yet there was no apparent drought related mortality of Tecate cypress. Tree growth however was slow and cone production was lower than expected with only 38% of the trees growing cones by the end of the study.

Overall, it was concluded that the immaturity risk threshold for Tecate cypress is not only a function of the prefire stand age but also of the reproductive capacities of trees based on their size and density and the climatic variables that affect their growth over time.

Table 1. *Hesperocyparis forbesii* prefire density, recruitment density, and postfire year 14 density, by prefire stand age including seedling to parent ratios for sixteen 0.10 hectare sites burned in the 2003 Mine/Otay fire on Otay Mountain in San Diego County, CA, USA, mean and (standard error).

Prefire stand age	# of sites	Prefire density # / ha (SE)	Recruitment density # / ha (SE)	Seedling to parent ratio	Postfire year 14 density # / ha (SE)
7	2	2,205(35)	0(0)	---	0(0)
24	4	48(14)	10,000(2,345)	226:1	606(52)
33	4	3,430(308)	18,500(9,385)	6:1	6,788(2,814)
42	4	233(136)	29,000(18,443)	294:1	11,745(8,854)
53	2	400(240)	182,000(92,000)	927:1	22,562(8,451)

Figure 2. Postfire stand age when the extrapolated density of *Hesperocyparisforbesii* trees will fall below the prefire stand density of the parent cohort for sixteen 0.10 hectare sites burned in the 2003 Mine/Otay Fire in San Diego County, CA, USA. Tree densities were extrapolated after postfire year 14 using the average mortality rate of 3% observed during the final year of the study. The first number to the right of the bar is postfire stand age and the number in parentheses is the prefire density of trees.

