

LONG-TERM IMPACTS OF NURSE PLANTS ON SAPLING PERFORMANCE IN CALIFORNIA OAK SAVANNAS

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PURPOSE AND SCOPE

To mitigate challenges facing California oaks and foster regeneration, leveraging natural ecological processes such as nurse plants presents a promising avenue. Nurse plants, such as the coyote brush (*Baccharis pilularis*), play a crucial role in facilitating the establishment and growth of oak saplings. They provide a protective microenvironment that shields young oaks from harsh abiotic conditions and herbivory pressure, thereby enhancing their survival and growth rates. This facilitative interaction not only buffers oak seedlings from stress but also expands their ecological niche, potentially enabling their persistence in changing environments.

Though the benefits of nurse plants for oak seedlings have been documented, their long-term effects on saplings remain less understood. Understanding how nurse plants influence the growth, distribution, and survival of oak saplings is critical for developing effective conservation strategies. Such insights can inform land management practices aimed at promoting the resilience and regeneration of California oaks amidst ongoing environmental challenges.

The primary objectives of this study were to:

1. Evaluate the impact of nurse plants on the height growth of oak saplings over time.
2. Compare the facilitative effects on deciduous and evergreen oak species.
3. Analyze how fluctuations in herbivore density influence the spatial distribution of beneficiary oaks under nurse plants.

METHODS AND APPROACH

The study was conducted at two sites in northern California's Silicon Valley: Jasper Ridge Biological Preserve 'Ootchamin 'Ooyakma, characterized by high herbivore stress (HHS) due to abundant deer populations, and the Stanford Dish Area, with lower herbivore stress (LHS). The study focused on three oak species—evergreen coast live oak (*Quercus agrifolia*), deciduous blue oak (*Q. douglasii*), and valley oak (*Q. lobata*)—facilitated by the native shrub *Baccharis pilularis*. In 2015, we identified 216 coyote brush individuals and assessed the oak saplings

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growing under and around these shrubs. Measurements included sapling height, herbivory damage, and distance from the edge of the nurse plant. The same plants were re-evaluated in 2023 to track changes over time.

FINDINGS AND IMPLICATIONS

Saplings under nurse plants exhibited significantly greater height growth than those in open areas, both in raw length and percentage of change. Evergreen oaks were on average taller than deciduous oaks in both 2015 and 2023. Evergreen saplings also benefited more from nurse plants compared to deciduous species, with no deciduous saplings from 2015 surviving under nurse plants until 2023. Deciduous species required larger nurse plants for effective facilitation, with the threshold size for facilitation increasing from 6.7 m in 2015 to 7.7 m in 2023, though the size remained constant for evergreen oaks at 4.3 m. Saplings under nurse plants in the HHS site were located further from the edge of the shrub compared to those in the LHS site, indicating a protective effect against herbivores. This trend was more pronounced in 2015, suggesting that changes in herbivory pressure can alter the spatial distribution of beneficiary oaks.

Nurse plants significantly enhance the height growth of oak saplings, particularly in high herbivory environments. However, their facilitative effects are more pronounced for evergreen species than for deciduous oaks. The size of the nurse plant and the density of herbivores are critical factors influencing oak sapling survival and growth. These findings underscore the importance of considering species-specific and environmental factors in oak woodland management and restoration efforts. Further research should focus on tailored management strategies for deciduous oaks, given their greater need for facilitation and the higher threshold of nurse plant size required for their regeneration.

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