HEALTHY FORESTS: COASTAL REDWOOD

This brief is part of the Healthy Forests series, authored by the [Science Advisory Panel of the California Governor's Forest Management Task Force] in collaboration with the USDA Climate Hubs and USGS Climate Adaptation Science Centers. The series is intended to characterize healthy forest attributes, their ecological function, and key stressors.

Photos: National Park Service (NPS; left) and Save the Redwoods League (center and right)

REDWOOD FORESTS AND DISTRIBUTION IN CALIFORNIA

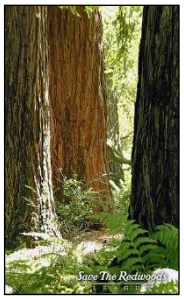
WHAT DO HEALTHY REDWOOD FORESTS LOOK LIKE?

Redwood forests support the largest trees on the planet and are among the state's most iconic natural treasures. These cool and wet forests occur in a narrow and fog-dependent region along the Pacific coast. Mature treetops soar out of view while the branches of younger, middle-aged, and dead trees form a multilayered canopy. In this second brief of the Healthy Forest series, we describe the physical nature, key features, and stressors of redwood forests.

Fog is a critical component of a redwood forest's water supply. The canopy architecture is designed to intercept moisture from fog, which can be absorbed directly by the foliage[1]. Intercepted fog will also collect and drip down to moisten the forest floor and soil and water redwoods' shallow, but expansive, root systems.

In the northern part of their range, redwoods intermingle with grand fir, Sitka spruce, and western cedar and Douglas-fir; farther south, the forest includes tan oak, madrone, and pine species. Below the towering trees, a shady understory supports huckleberry, ferns, mosses, and other vegetation[2]. Beneath it all lie loamy soils with a rich mixture of leaf litter and wood that support diverse fungi and invertebrate decomposers.

Individual trees are not evenly spaced; rather, redwoods naturally grow in clumps, reflecting their unique ability to sprout from their trunks, burls, and roots. Second-growth forests grow rapidly and, as a result of post-logging reforestation planting practices, are typically dominated by overly dense stands of Douglas-fir and small trees. As these second-growth forests mature, tree densities decline from over 250 to less than 80 trees per acre, and redwoods continue to increase in size and dominance[3]. In old-growth forests, at least five trees per acre will be over 60" in diameter in addition to denser stands of smaller trees (on average 26 trees per acre that are less than 10" in diameter)[2].



Benefits of a healthy redwood forest

- Integral to the culture of over a dozen Indigenous Peoples.
- Home to diverse and unique species, including spotted owls, endangered marbled murrelets, red-legged frogs, Humboldt marten, fishers, and hundreds of fungi.
- Among the most productive ecosystems on the planet in terms of carbon storage.
- Generate millions of dollars per year in local economies from recreation alone.
- Highly productive and economically valuable commercial timber species.

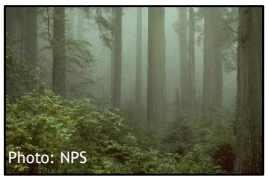
Keeping Redwood Forests Healthy

Fire

Redwood trees are adapted to fire and the forests should experience low severity fire as frequently as every ten years[4]. The thick bark insulates the living tissue from the heat of a fire, their ability to shed lower branches ("self-pruning") makes it difficult for a fire to transition to the canopy, and redwoods can sprout even after complete crown loss. However, despite these adaptations, severe fires in old-growth stands do result in losses of key habitat characteristics, such as the presence of old-growth Douglas-firs and of required habitat for the endangered marbled murrelet. Since only 5% of original old-growth redwood forests remain[5], it is critical to reduce risk of severe fires. Additionally, second-growth forests are often dense, putting the forest at greater risk of severe fire. Use of mechanical thinning and prescribed fire can help restore these forests to more resilient conditions, by promoting lower stand densities and uneven tree spacing.

Climate Change

Due to climate change, coastal fog is expected to become less common; the resulting moisture and temperature stress could reduce seedling regeneration and growth, creating a forest with fewer young redwoods. Such changes may constrain the southern and eastern edges of the range of redwood forest. Longer and more extreme dry periods may further stress redwoods, which are not drought-tolerant[6].



Additional Resources

For more information, visit: Save the Redwoods League, UCANR Forest Research and Outreach

Citations:

[1]Limm, E., K. Simonin, T. Dawson. 2012. Foliar uptake of fog in the coast redwood ecosystem: a novel drought-alleviation strategy shared by most redwood forest plants. In: Standiford, Richard B.; Weller, Theodore J.; Piirto, Douglas D.; Stuart, John D., tech. coords. Proceedings of coast redwood forests in a changing California: A symposium for scientists and managers. Gen. Tech. Rep. PSW-GTR-238. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station; p. 273-281

[2]Giusti, G.A. 2007. Structural characteristics of an old-growth coast redwood stand in Mendocino county, California. In: Standiford, Richard B.; Giusti, Gregory A.; Valachovic, Yana; Zielinski, William J.; Furniss, Michael J., technical editors. 2007. Proceedings of the redwood region forest science symposium: What does the future hold? Gen. Tech. Rep. PSW-GTR-194. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station; p. 161-168

[3]Iberle, B.J., R. Van Pelt, S.C. Sillett. 2020. Development of mature second-growth Sequoia sempervirens forests. Forest Ecology and Management 459. 14 p.

[4]Lorimer, C.G., D.J. Porter, M.A. Madej, J.D. Stuart, S.D. Veirs, S.P. Norman, K.L. O'Hara, W.J. Libby. Presettlement and modern disturbance regimes in coast redwood forests: Implications for the conservation of old-growth stands. Forest Ecology and Management 258:1038 – 1054.

[5]Burns, E., R. Campbell, P. Cowan. 2018. State of Redwoods Conservation Report. San Francisco, CA: Save the Redwoods League. 52 p.

[6]Fettig, C., A. Wuenschel, J. Balachowski, R. Butz, A. Jacobsen, M. North, S. Ostoja, R. Pratt, R. Standiford. 2019. Managing effects of drought in California. In: Vose, J., D. Peterson, C. Luce, T. Patel-Weynand, eds. Effects of drought on forests and rangelands in the United States: translating science into management responses. Gen. Tech. Rep. WO-98. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. p 71-93.