

Status of the *Phytophthora ramorum* Epidemic across Forests of the East Bay Regional Park District, San Francisco Bay Area, California

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The East Bay Regional Park District, the largest urban park network in the United States, includes extensive coast live oak (*Quercus agrifolia*)-dominated forests at the urban-wildland interface. Parks that encompass chaparral, grasslands, riparian habitats, and hardwood and conifer forests are adjacent to one of the most heavily-populated urban regions in the country. From 2008 to 2011, we placed 535 randomly assigned, 10 m radius fixed plots in coast live oak-bay laurel (*Umbellularia californica*) stands in each of five parks to establish baseline disease conditions. The random design permits extrapolation to landscape scales. Baseline data included diameter at breast height (DBH) for all woody stems >2.5-cm, disease status of coast live oaks, and woody plant regeneration. Plots were re-assessed between 2015 and 2018 to quantify change and to develop projections for future change.

All parks exhibited increases in infection and mortality levels, with annual infection rates as high as 7.7%. Infections increased markedly following the cessation of the 2011-2015 drought. Despite general similarities in species composition, 2011 infection levels varied from 6.3% (Anthony Chabot) to 14.4% (Wildcat Canyon) and mortality varied from 4.1% (Wildcat Canyon) to 8.7% (Redwood Park). The 2015-2018 evaluations found infection levels between 8.7% (Anthony Chabot) and 27.7% (Wildcat Canyon) and mortality levels from 8.7% (Anthony Chabot) to 29.9% (Wildcat Canyon). Within-park variation in disease and mortality may reflect stand level differences in mean coast live oak DBH, but land-use history also probably affects disease levels. Larger coast live oaks show much higher levels of infection and mortality than the more abundant smaller size classes. The disproportionate loss of the largest mast-bearing trees in these forests will affect wildlife in ways we yet do not understand. In addition, the increase in fuels in these evergreen forests increases the risks of catastrophic wildfire in stands that lie to the east of large population centers.

We also conducted surveys of three more inland parks; Diablo Foothills and Pleasanton Ridge Regional Parks and Las Trampas Regional Wilderness. Diablo Foothills was assessed using randomly placed plots. Despite having much less coast live oak than blue oak (*Q. douglasii*, not a known host), 34% of the coast live oaks (N = 259) in Diablo Foothills were symptomatic in 2016. The other two parks were surveyed, but not randomly, for presence of symptomatic coast live oaks in 2018. In Las Trampas, 30.6% of coast live oaks (N = 98) were symptomatic, with 10% dead. Pleasanton Ridge showed 10% symptomatic (N = 211), with less than 1% dead.

The continuing epidemic is leading to permanent changes in landscape composition and environmental services, which will require attention to management of these forests adjacent to large populations centers.