Forest Diseases and Birds

Exotic diseases that can devastate entire populations of trees continue to threaten forest birds

By Walt Koenig

Just as the health community is perpetually concerned about the possibility of exotic diseases sweeping the country and infecting millions of unprepared and nonresistant people, forest pathologists and conservation biologists worry about diseases destroying entire forests and indelibly altering entire ecosystems in their wake. There are ample historical precedents for such events, both for humans (consider the 1918 Spanish flu epidemic) and for forest trees, which in the United States alone have been decimated by several major exotic diseases within the past century.

One of these, the chestnut blight, is a fungus from Asia that was unwittingly imported into New York City in 1904. It quickly spread throughout the range of the American chestnut and within the next 40 years functionally wiped out what had once been one of the most important forest trees east of the Mississippi River. Mature chestnuts remain all but extinct, although new advances have led to the production of blight-resistant trees that could pave the way for a partial comeback in the future.

A second major exotic forest pathogen is Dutch elm disease, a fungus spread by the European elm bark beetle. It was discovered in Cleveland in 1930 and spread throughout the range of American elms--most of the entire eastern half of North America--over the next half-century. As with the chestnut, elms have virtually disappeared because of the disease, transforming both natural landscapes and cities, including Ithaca, New York, where the Cornell Lab of Ornithology is located, and innumerable towns like Elmhurst, Illinois, where I grew up.

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Unfortunately, comparably devastating sweeps of forest disease appear all too likely to occur in the future. One of current concern is the fungus--like Phytophthora ramorum (actually known as a "water mold"), another exotic that was first found in the Santa Cruz mountains of California in 1995 after it starting killing tanoaks, a species whose tannin-laden bark was used extensively for tanning in the 19th century, and coast live oaks, one of the most common oaks species in central and southern coastal California. Infected trees develop bleeding bark cankers and foliar pigment degeneration and may die within a period of a few weeks, hence giving the disease the ominous name of "sudden oak death," or SOD.

So far the evidence suggests that SOD may have been introduced from ornamental rhododendrons imported from Germany by a commercial nursery. Related to the case of the famous potato blight that caused the Great Irish Famine of the 1840s, SOD has since been found in 13 central coastal California counties and extreme southwestern Oregon. As it has spread geographically, better molecular methods have been devised to detect it and it is now known to infect 32 genera, including coast redwoods and Douglas--firs, two of the most commercially important and spectacularly majestic trees on the West Coast.

Fortunately, SOD does not usually kill either of these species, instead inflicting minor foliar and twig damage. However, two other native California oaks are potentially killed by SOD, including
California black oak and canyon live oak, and studies indicate that the disease is capable of killing other related oak species outside SOD's current range as well, including widespread eastern species such as red oak and black oak.

Forest diseases such as chestnut blight and Dutch elm disease transformed the American landscape in ways that have gone almost completely unmeasured. There are few studies of how wildlife communities present in eastern hardwood forests in the 19th century were altered by the loss of chestnuts or elms, although what data there are indicate that the effects were considerable.

Although our current state of knowledge provides few clues as to how to stop the spread of SOD, researchers are at least documenting the changes that take place among the forests currently composed of the most susceptible species. For example, along the Big Sur coast of central California, where SOD is widespread, researchers have been studying how mortality of tanoaks decreases acorn production, a major forest resource on which numerous species of wildlife depend. My own work, in collaboration with graduate student Bill Monahan, has used a combination of citizen science, knowledge of tree distributions, and information on the climatic correlates of current SOD distribution to estimate how SOD might influence oak–dependent birds in the future both as the disease spreads and the California climate changes due to global warming.

The foundation of these analyses are the North American Breeding Bird Survey and the Audubon Christmas Bird Count, which provide unparalleled data on North American birds during the breeding season and the winter, respectively. Using these databases, we can determine how the distribution and abundance of various bird species map onto the distribution of California oaks. Five bird species stand out as being particularly dependent on oak species diversity within California oak woodlands: the Acorn Woodpecker, Nuttall's Woodpecker, Hutton's Vireo, Western Scrub–Jay, and Oak Titmouse.

Exactly what will happen to populations of these species if SOD expands throughout the state depends on several assumptions, but as one extreme, we estimated the effects of SOD eliminating coast live oaks, one of the two major tree species that is particularly susceptible to the disease. Especially hard hit under this scenario are the two woodpecker species and the Oak Titmouse, whose populations throughout the current range of coast live oaks would likely decline 52–68 percent, while the other two species, Hutton's Vireo and Western Scrub–Jay, would suffer considerable but lesser declines. One of the main reasons for this large effect is that coast live oaks are frequently found in areas with low oak diversity to begin with, particularly near the coast itself, where it is often the only native oak species present. Loss of coast live oaks in such areas would effectively eliminate oak habitat, taking the oak–dependent bird species along with them.

Although the effects within the current range of coast live oaks would be dramatic, the good news is that there are several widespread species of California oaks that SOD does not appear to significantly affect. As a result the overall impact on the populations of oak dependent birds within California is likely to be modest, ranging from a 4 percent statewide decline in the Hutton's Vireo and Western Scrub–Jay to a 10 percent decline in the Oak Titmouse.

The other good news is that the current geographical extent of SOD, combined with climate projections for the next 50 years, indicate that the disease is likely to spread through northwestern California and parts of the Sierra Nevada, but at least within this time frame should impact only a modest fraction of California oak woodlands and their attendant oak–dependent birds. Taken together, these aspects of our predictions are relatively reassuring, at least with respect to species that are not specifically dependent on the SOD susceptible tree species. If it weren't for other threats to California oaks, including widespread habitat conversion, lack of oak regeneration, and the potential effects of future climate change on oak distributions, it might be possible to breathe a sigh of relief concerning the future of California's oak–dependent wildlife.
Of course, it's also possible that the ultimate extent of SOD may be considerably greater than we currently expect, either because our predictions are wrong or because of evolutionary changes in the pathogen that make it more virulent and extend over a wider geographic range than we currently expect. Either way, it is citizen-science projects—-not only those used in our study but also the Great Backyard Bird Count, Project FeederWatch, eBird, and others run by the Cornell Lab of Ornithology and Audubon—-that will provide not only the understanding to allow us to predict the changes that are likely to occur but the data to test the accuracy of those predictions as they take place.

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