becoming established. Later, the scientists will visit the sites monthly to check the wasps' impact on the whitefly population. Bellows says that in about a year scientists will know the wasps' long-term prospects for success.

In the meantime, gardeners can remove infested leaves from plants. Infested plant material should be sealed in plastic bags and removed to prevent migration of the whiteflies to other plants, Bellows says.

San Diego farm advisor Karen Robb also recommends "syringing," blasting the undersides of infested leaves with a stream of water. It improves the plant's appearance and, unlike insecticides, doesn't disrupt biocontrol programs, she says. — *Kathy Barton*

Replacing vegetation may remedy Pierce's disease

Jack Kelly Clark

The 1/4-inch long blue-green sharpshooter *(above)* transmits Pierce's disease to grapevines. The bacterial disease *(below)* is ravaging some vineyards in Napa and Sonoma counties.

Jack Kelly Clark

Early results in a 5-year study suggest that managing riverbank vegetation near vineyards may be a potent control of Pierce's disease, a bacterial scourge of grapevines now ravaging some prized vineyards in Napa and Sonoma counties.

Transmitted by the blue-green sharpshooter, the bacteria *(Xylelle fastidiosa)* multiply in the plant xylem, blocking this vital water conducting system and causing leaves and fruit clusters to dry up and die, often within 2 years. There are no effective treatments or resistant rootstocks.

The sharpshooter overwinters and breeds in riparian (river bank) areas; it transmits the bacteria to grapevines from a wide array of wild plants, all symptomless carriers. UC Berkeley entomologist Alexander Purcell and forest ecologist Joe McBride are running experiments in Napa Valley to see if they can reduce sharpshooter by changing riparian habitat.

"The early results are very encouraging: we have seen a 70% to 99% reduction in insect activity," says Purcell, who is an international authority on Pierce's disease. "We have removed the main breeding hosts of the insect such as blackberry, elderberry and wild grape, and replaced them with native riparian species that are not breeding hosts — such as California bay, black walnut and ash. In most cases we are increasing plant diversity."

The investigators have planted saplings in two locations and recorded sharpshooter activity for 1 and 2 years; a third location was added this year.

"The results are still preliminary," Purcell cautions. "Before we could recommend this as a control method, we would need to determine if reductions can be maintained over several years as the planted trees mature, and if there will be any adverse effects on wildlife and stream ecology. Wildlife effects are now under study by UC Berkeley entomologist Don Dahlsten."

While the removal and replanting of riparian vegetation is expensive, it is less costly than Pierce's disease losses in many North Coast vineyards near riparian habitats, says Purcell.

"A UC Berkeley study of the economics of Pierce's disease showed that growers were losing money trying to grow grapes within 150 to 200 feet of riparian woodlands," Purcell notes. "This raises the possibility that buffer planting of other crops might be used to protect grapes in extremely high risk areas."

In a related study by Purcell, McBride and UC Davis scientists Bruce Kirkpatrick and Roy Sachs, conifers and hardwoods are being planted to create 20-foot-wide buffers between the riparian habitat and vineyards. Earlier studies in the Santa Cruz Mountains showed sharpshooters didn't feed in or penetrate conifer stands.

Pierce's disease has damaged the state's vineyards since 1880, decimating Southern California vineyards in the 1880s, and Central Valley vineyards in the 1930s. In more recent decades it has been a "quiet" disease, causing occasional outbreaks across the state. However, since 1991 its incidence has been rising rapidly in the North Bay counties. It has recently spread at an epidemic rate in Napa Valley and has appeared for the first time in Mendocino County and parts of Sonoma County.

"Conservatively, it took a $24 million toll in Napa County in 1996, based on a grower survey by the Pierce's Disease Task Force," says Purcell. The task force was organized by the wine industry and provides research funding and educational efforts.

"Pierce's disease has always occurred at hot spots close to riparian areas," says Ed Weber, viticulture farm advisor in Napa County. "The news is that we are seeing the disease striking farther and farther away from riparian areas. Usually the disease goes through epidemic

cycles, increasing for a few years then returning to normal levels. In Napa, we've been waiting for 6 years for Pierce's disease to return to normal levels, but it seems to just keep getting worse."

Why is the incidence of Pierce's disease on the rise? Weber speculates there are five possible reasons: more vineyards, planted to meet rising demand for quality wines; more habitat for sharpshooters, such as ornamental landscapes; inadvertent spread of infected insects by workers or managers; reduced insecticide use, and more young vines, which are more susceptible to the disease. Napa growers have recently replanted many vineyards on rootstock resistant to phylloxera, a vine-destroying insect that also posed grave threats to North Coast vineyards.

Napa's recent warm winters may be contributing to the epidemic. The disease does not occur in areas with cold winter climates.

Current control methods include pesticide spraying of riparian vegetation bordering vineyards, and the vineyards themselves. Dimethoate insecticide can only be applied with a special permit. Imidacloprid is registered for use on grapes but is not specifically approved for use against Pierce's disease vectors. *–Ed.*

Research update

Oak woodlands harbor greatest biodiversity

UC and other research in the last decade has shown that oak woodlands, which cover almost 10% of California's 100 million acres, harbor the richest biological diversity of any major habitat in the state. They are home to some 2,000 species of plants, 170 birds, 100 mammals, 60 amphibians and reptiles and 4,000 species of insects. In addition to their values for wildlife, oak trees and associated vegetation improve water quality, control soil erosion, and provide outdoor recreation and aesthetic values.

In this issue, UC researchers report on biological diversity in oak woodland at Camp Roberts, a military facility overlapping San Luis Obispo and Monterey counties (see p. 8). The base encompasses certain oak woodlands that are unusual for their numerous oak snags, a flourishing understory of oak saplings and shrubs, and ground cover that includes many native forbs and downed woody material — an intact habitat structure that provides homes for many vertebrate species. In many oak woodlands, these habitat components have been altered or removed by intensive burning, development, agriculture, wood cutting or road building. The scientists will use their data as a baseline for evaluating the effects of such disturbances on animals in oak woodland.

In October, the researchers, in cooperation with the California Department of Forestry and Fire Protection and Camp Roberts Fire Department, conducted prescribed burning treatments on some of their study plots and are now assessing the responses of the animals they have monitored.

Landowners, developers and local planners also play important roles in the management of the state's oak woodlands. More than 80% of California oak woodlands are in private ownership, and most land-use planning is done at the local level. UC's Integrated Hardwood Range Management Program (IHRMP) is working with UC Extension advisors and faculty and state agencies to help landowners and land-use planners maintain old and new enterprises in oak woodlands, while sustaining wildlife and other natural resources.

Recent, unprecedented demand for California wine grapes has led to increasing development of vineyards on oak woodland upslopes, historically considered marginal for intensive agriculture. Removal of native trees, conversion of riparian areas, and establishment of large monocultures all pose threats to biological diversity. To promote sustainable development and management of California vineyards, IHRMP has developed a new extension curriculum for grape growers: "Vineyards in an Oak Landscape." The curriculum is coordinated by IHRMP director Richard Standiford, graduate student Julia Crawford, and extension specialist Adina Merenlender.

For more information, call Adina Merenlender, (707) 744-1424. *–Ed.*

Dave Rizzo, UC Davis plant pathologist, gives a training session on protecting oak woodlands.