



## LEADING THE CITIZEN SCIENCE CONTAGION

PHD '96 PLANT PATHOLOGY

## MATTEO GARBELOTTO

By Mackenzie Smith | Photos by Jim Block

Each winter, **Matteo Garbelotto** creates an assembly line in his Mulford Hall lab. To compile hundreds of training kits for volunteers, Garbelotto's team of researchers and students gathers boxes of supplies: pencils, pads, and laminated cards featuring photos of trees infected with sudden oak death (SOD).

"We give volunteers everything they need to be successful citizen scientists," says Garbelotto, a Cooperative Extension specialist and adjunct professor in the Department of Environmental Science, Policy, and Management. "Using a paper and pencil to record data in the field is more time-consuming for my lab to translate into data, but it's also more inclusive—kids, families, and elderly community members alike can participate in SOD Blitz."

The SOD Blitz kits are used to train nearly 1,000 Californians annually to identify the fungus-like tree disease that causes cankers on trunks, foliage dieback, and eventually the death of the infected plants. SOD has killed over one million trees in 14 coastal counties in Central and Northern California, destroying healthy forest ecosystems throughout the state. There is no cure, but if SOD is identified early, its spread can be managed through chemical treatments and the removal of diseased trees.

Scientists first discovered the pathogen that causes SOD, *Phytophthora ramorum*, in California in the 1990s. As reports of the disease became more frequent, Garbelotto began developing treatment strategies and tried to create an accurate

map of infected trees throughout the state, a task that proved nearly impossible. "Even if I had an infinite amount of funding and hired a top-notch research team to survey diseased trees, it just wouldn't work," he says. To prevent SOD from ravaging California's forests, Garbelotto needed the data that only local experts—and concerned community members—could provide.

## Hunting for Healthy Forests

Forests have been a fixture of Garbelotto's life since childhood. He was born in Venice—a city spanning 118 islands and constructed almost entirely of wood—and later moved to the northern Italian village San Martino di Castrozza, where lumber plays an important cultural and economic role. For centuries, spruce trees co-owned by San Martino and communities in the nearby Fiemme Valley have been felled to make world-class stringed musical instruments, including those crafted by Antonio Stradivari. More than 300 years after the luthier's death, Stradivari-made instruments can fetch upwards of \$16 million at auction. "Growing up in this part of the world helped me understand the cultural and personal value of trees," Garbelotto says.

When he arrived at the University of Padua as an undergraduate student, Garbelotto began studying forestry. He was interested in the life cycles of trees, but learned that surveying them is challenging: "To see the full span of a tree's life, I would need to live hundreds of years, in some cases," he says. "But I still wanted to understand how we can keep our forests healthy." Garbelotto ended up combining forestry with his childhood love of mushroom hunting. "When I discovered that the microorganisms that live in forest ecosystems—including fungi—can make or break a tree's health, I knew that forest mycology would be the focal point of my work."

## Citizen Science 2.0

Throughout Garbelotto's 25-plus years at UC Berkeley—first as an international exchange student, then as a graduate student, and now as a researcher—understanding forest health has remained at the core of his research. After a failed two-year attempt to recruit volunteers for a project that he now sees was too "top-down" in design, he began listening more closely to the communities he visited. "People are very connected to their trees," he says. "As SOD spread, there was a feeling of despair among many Californians." They wanted answers and treatment options; Garbelotto needed data and accurate outbreak maps. In 2007, he launched a new SOD-focused citizen science program, SOD Blitz, with these dual needs in mind. This time, the project was driven by locals who wanted to save their forests.

What began with five communities in Northern California—Big Sur, Berkeley, Carmel, Sonoma, and Woodside—has grown into a program spanning 25 areas across the state, including cities, towns, and Native American tribal lands. Garbelotto personally leads the mandatory annual volunteer trainings, and with each year of survey results, the data sets become more powerful and more accessible. He now shares SOD Blitz findings online as soon as they're collected, via a website called SODMAP, whose database has been viewed more than one million times.

## Citizen scientists want answers and treatment options; Garbelotto needs data and accurate outbreak maps.

According to Garbelotto, SODMAP keeps the program robust and active. "If we didn't share the data, people wouldn't keep participating—they need access to this information in real time, or it won't be useful for locating and treating SOD-impacted areas." SODMAP Mobile, the smartphone app Garbelotto and his team developed in 2013, makes it even easier for users to access the database while searching for potential SOD outbreaks in their neighborhoods. When Garbelotto first launched SOD Blitz and sought funding from organizations like the National Science Foundation, he was told that educating the public was important, but that citizen scientist-collected data wouldn't be viable for publication in peer-reviewed journals.

Garbelotto disagreed—a stance supported by his research: a 2015 study in *Frontiers in Ecology and the Environment* demonstrated that data gathered from SOD Blitzes was just as powerful and accurate as the SOD maps created by professional researchers. "The analysis for our paper used seven years of SOD Blitz data and created a complex, predictive model for SOD—the best ever created for the disease," he says. The publication confirmed Garbelotto's belief that community science projects can create the "perfect partnership," providing large-scale data sets for researchers while also meeting a community's need to act.

Garbelotto continues to innovate. A new project launched in February trains professional arborists working with property owners to collect and prepare trunk samples for SOD testing. "This is a socially equitable way to share sampling costs between homeowners, researchers, and arborists, while also giving all parties access to lab results," he says. Garbelotto calls this project "citizen science 2.0": gathering the expertise and passion of local stakeholders, professionals, and scientists to help stomp out a deadly tree disease, while collecting data that benefits researchers and community members alike.



Doug Schmidt, Cameron Chee, and Matteo Garbelotto prepare kits for volunteers who will gather data on infected trees as part of the annual SOD Blitz.