

Sudden Oak Death Dispatches

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Decay is Their Business

Author: Christopher A. Lee

Wednesday July 29 2009

At the end of the day on Monday, as we finished up looking at and measuring trees in our plots, the 104-degree heat in the north coast interior was a bit distracting. But I noticed this guy growing on a black oak and wanted to take his picture (sorry for the blurriness) before he gets old and dried-out.



This is a fresh fruiting body of *Phellinus gilvus*. The black oak on which it was growing has for several years displayed bleeding cankers that are probably caused by *P. ramorum*. (I haven't sampled and tested them, but several other black oaks in the immediate vicinity have been infected.) In their book *A Field Guide to Insects and Pathogens of California Oaks*, Ted Swiecki and Elizabeth Bernhardt note that this fungus decays the sapwood of trees infected with *P. ramorum* and also often decays dead trees.

Most people interested in ecology already know this, but you can't mention it too often: some of the most valuable members of our forest communities are the ones that decay others, recycling nutrients through the greater ecosystem and basically cleaning up the messes--like accumulations of dead branches and trees that could serve as fuel for fires--attendant on the normal processes of animal and plant death.

Plus, fungi are simply interesting in their own right. They have myriad strategies for inhabiting and digesting other living and dead things, and they come in a variety of fascinating shapes and colors. Here is a mini-salute to some of the other decay fungi we sometimes come across in the Douglas-fir/hardwood forest up here in the north coast.



Fomitopsis pinicola, the "red belt fungus": it decays Douglas-fir and other conifers.



Trametes versicolor, "turkey tails": it decays hardwoods such as tanoak.



Lenzites betulina (no common name): it generally decays hardwoods. Notice the white decay it causes.

Unfortunately, some of the fungi that decay hardwoods are much more obvious now that *P. ramorum* has killed so many trees in our region.

Tags: California black oak (1), decay (1), fungi (1), oak health (4), Phytophthora ramorum (20)

Phytophthora in Streams Redux

Author: Christopher A. Lee

Sunday July 26 2009

A few weeks ago I wrote about *Phytophthora* in stream water. I mentioned that monitoring streams provides a good early detection strategy for *P. ramorum* and that the ecology of this pathogen in streams is still somewhat mysterious.

On Friday, the San Francisco Chronicle published a [story](#) about Sudden Oak Death and the spread of *P. ramorum* in waterways. It mentioned that ten streams, ditches, or ponds in six states have now been found infested with *P. ramorum*. Many of these are states that are officially considered uninfested because the pathogen has not been found in the forest environment. In all these cases, the pathogen has been linked to nearby nurseries that have at one time or another carried infested ornamental plants.

The article points out that the most mysterious case is right here in Humboldt County. Two streams in McKinleyville, north of Arcata, are infested with *P. ramorum*. Although both streams run through heavily developed residential neighborhoods, we from UC Cooperative Extension have teamed up with Humboldt County Ag Department and Redwood National Park personnel to try to find the source of the spores in the stream by walking as much of the streambanks as possible to find symptomatic plants--and so far, we have found nothing in two seasons of looking.

Near both streams, there is very little host material for *P. ramorum* to infect.

There are very few ornamental hosts and almost no bay or tanoak. The bright side may be that this paucity of host material means little chance of the pathogen's escaping the stream and spreading further. Another positive is that at the point where *P. ramorum* has been recovered in each stream, the waterways empty into the ocean in short order.

Although a nearby nursery in McKinleyville has had infected plants at various times in the past, there is no definite link between the nursery and the streams--the streams are too far away for water from the nursery to easily make its way to the streams--unlike in other states, where it's obvious how infested runoff exited each nursery and made its way to each nearby waterway.

The mysterious cases of persistent spores in these streams highlight the troubling difficulty of definitively ridding infested nurseries and forests of *P. ramorum*.



Monitoring Rock Creek in Del Norte County for *Phytophthora ramorum* using rhododendron leaf baits.

Tags: nursery (2), *Phytophthora ramorum* (20), stream monitoring (1), sudden oak death (31)

News of Another Invasive

Author: Christopher A. Lee

Monday July 20 2009

In a way, Emerald Ash Borer (*Agrilus planipennis*) is the "sister" invasive species to *Phytophthora ramorum*. It's a problem in the midwest rather than

the far west. Its epidemic developed over roughly the same time span as *P. ramorum*. Its mortality impacts are focused on one tree genus (*Fraxinus*, ash trees), in much the same way *P. ramorum* kills trees in two closely related genera (*Quercus*, true oaks, and *Lithocarpus*, tanoak).

One difference is that *P. ramorum* mortality is episodic, depending on climate, whereas the spread of EAB is less dependent on climatic cycles. Indeed, just last month the state of New York announced that the beetle has now been detected there, near Randolph in Cattaraugus County. Along with its recent move over to the Wisconsin/Iowa border, and recent finds in Kentucky and Minnesota, it's looking like EAB is on the march!

More EAB news is developing: researchers are investigating the possibility of using a biological control for the beetle, a parasitic wasp that lays its eggs in EAB eggs and larvae and kills them. Like any efforts to investigate and develop control of a pest, success, if it comes, will probably be many years down the road. Read one part of the story here.

And for more information about EAB in general, visit www.emeraldashborer.info.



Emerald ash borer feeding galleries, which have destroyed the entire cambium. Photo courtesy Daniel Herms, The Ohio State University, bugwood.org

The Woodland Star

Author: Christopher A. Lee

Friday July 17 2009

A couple of months ago, I was on a large ranch near Boonville in Mendocino County, walking back from a plot where we have been counting and measuring trees killed by *P. ramorum*. As I came out of the drainage where most of the dead trees were, I was suddenly walking through a white oak woodland.

Here the trees were statelier, they were widely spaced, and everything felt drier. Besides the white oaks, huge bay laurels shaded the leaf litter and flowering plants in the understory. I looked down and saw this:



This is *Lithophragma*, aka the "woodland star." It was waving in the breeze, so I didn't get a very clear picture. I'm a sucker for all those delicate-looking flowers with complicated petals so often found in oak woodlands. Here's another one, *Silene*:



One of the interesting things about our oak woodlands is the variety to be found among them, even in just the northern part of the state. In Humboldt County, many of our coastal ridges and "bald hills" are crowned by open stands of white oaks. Driving past Laytonville in Mendocino County, one passes majestic stands of long-limbed valley oaks. Along Highway 20 from Lake into Colusa County, blue oak savanna with golden grass and plenty of other oak species carpets the tall rolling hills. On the way into the Bay Area from the north, the driver can't miss the coast live oaks lining the ridges near the road, heavy branches dipping down to the ground. In all these habitats, oaks have evolved to take advantage of relatively little water and thin soils, factors that make these places dicey, at best, for Douglas-fir or other conifer survival.

But Douglas-firs will try to survive there if they can get a foothold. In the eras of Native American use and European settlement, fires were either started or allowed to burn through many of these woodlands to maintain their open character. This kept conifers out. But beginning in the twentieth century, fires were kept out, and the conifers started to come in.

In the north coast, we are losing many oak woodlands and historically open prairie areas to Douglas-fir encroachment--and also to encroachment by some hardwood species that like the increased shade, such as bay laurel.

Interestingly, in many of these places it's easy to tell that the Douglas-firs don't really like it there. Here's a picture of one of the sites where we have installed some experimental silvicultural treatments to try to limit slow the spread of *P. ramorum*. It's an old prairie that has been under Douglas-fir invasion for a very long time. Note the crowded conditions and sickly-looking conifers. The Douglas-firs here are suffering from heavy infestations of two root diseases, *Phaeolus schweinitzii* (the velvet-top fungus) and *Armillaria*.



Bay laurel, though, is not as particular as Douglas-fir. If it can get established, it can grow surprisingly well even in places that seem as though they should be too dry. And in an area where *P. ramorum* has also become established, it will find the bay laurel--the tree is like a *P. ramorum* magnet.

Ch-ch-ch-changes

Author: Janice M Alexander

Monday July 13 2009

Mountain biking through China Camp State Park a few days ago, I was struck

by all of the different signs of change in the forest around me. First, I rode through the area that recently burned along the southeast corner of the park. The air still smells of charcoal and the ground is black, but I know that come winter and spring, new green shoots will burst forth, adding to the mosaic of plants and habitats in the grassland. All along that trail, I saw another sign of change - the seasonal coloring of everyone's favorite plant, poison oak. At least the deepening red of the leaves makes the dreaded plant more visible and easier to avoid.



Further along the trail, I moved out of the warm sun of the oak woodlands and into damp and shaded canyons, dim under the canopies of redwood and bay trees. Here the change was not only marked by the shift in temperature and tree species but also by the amount of Sudden Oak Death mortality visible. Immediately upon entering one such spot, I saw a full tanoak canopy down on the hillside next to the trail, leaves brown and dry. While I had seen plenty of dead and dying coast live oaks along other, earlier parts of the trail, the sense of mortality was somehow greater here.

The overall change that Sudden Oak Death will bring to this forest, and other similar forests in California and Oregon, is still largely unknown. Over the past decade, we've seen the trees go and mourned their immediate loss - but once those skeletal reminders are gone, will we recognize the changes that have occurred in these woods?

Finally, a note on changes on a personal level. Due to the financial constraints currently affecting the state and the UC system, my fellow blogger Nicole Palkovsky will no longer be working on Sudden Oak Death outreach. We wish Nicole the best and look forward to a time we can work with her again. Chris Lee and I will continue to post to this blog on a regular basis and welcome your input as well. That said, I'm off for a couple weeks of vacation, so keep Chris busy with your comments and thoughts in the meantime, and I'll be writing here again in August.

Tags: China Camp State Park (1), fire (3), oak mortality (1), poison oak (1)

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Wilting Trees

Author: Christopher A. Lee

Friday July 10 2009

When most of us think about the word "wilt," we don't picture trees. Instead, we think about green shrubs and flowering plants losing all their support and flopping over, usually from lack of water.

But many diseases of forest and urban trees are classified as wilts. The pathogens that cause these diseases grow into the water-conducting vessel elements and tracheids in the sapwood of the tree, clogging them up and stopping the flow of water. Some of the better-known tree diseases that do this include Dutch elm disease, oak wilt, blackstain root disease, and . . . Sudden Oak Death!



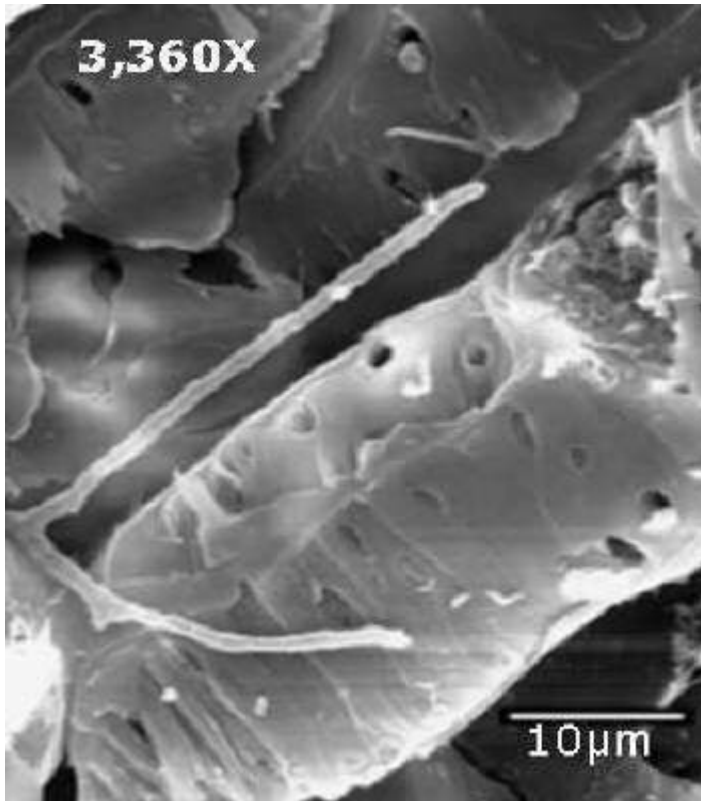
Douglas-fir killed by blackstain root disease in southern Humboldt County

Well, Sudden Oak Death is *partly* a wilt. Scientists haven't completely determined all the steps involved in pathogen infection and death of tanoak and true oak trees. For a long time, it was assumed that *P. ramorum* killed trees solely by consuming the cambium underneath the bark. When the pathogen had done this all the way around the circumference of the tree, the tree died because it could not produce new phloem to carry organic compounds or new xylem to carry water and mineral nutrients.

But within the past couple of years, a team led by Jennifer Parke at Oregon State University determined, with the aid of electron microscopy, that *P. ramorum* does grow into the vessel elements and tracheids in the sapwood of tanoak trees (read the abstract [here](#)). This invasion stimulates the tree to

produce hard structures called *tyloses*, which are like little hardened embolisms that protrude into the vessels. These tyloses may help slow pathogen growth, but they also slow water transport.

Thus, *P. ramorum*'s mode of killing trees appears to be a multifaceted one. The OSU team continues to investigate exactly how this works, while other scientists are investigating whether *P. ramorum* also produces toxic substances that help to kill plant tissue in its path. This variety of ways to survive and grow inside the tree is matched by a variety of movement and survival strategies on the part of the pathogen in the outside world, again demonstrating how tough and versatile *P. ramorum* is--truly a supremely difficult forest problem to tackle.



P. ramorum hyphae in tanoak xylem. Photo courtesy of Dr. Edwin Florence.

Attack of the Citizen Scientists!

Author: Janice M Alexander

Monday July 6 2009



The encroaching army leaves mayhem in its wake, spreading from hillside to hillside, county to county, with alarming speed and determination. Only the strong and brave can stare into the gaping maw: educated school children.

This is one great example of citizen science at work - the [AntWeb database](#) sponsored by the California Academy of Science, one of many such projects through the Academy's [Naturalist Center](#). More than 800 citizen scientists have participated thus far in the project, submitting ant specimens from around the Bay Area. From these submissions, the Cal Academy has indentified 34 distinct ant species, and is gaining a better understanding of how the invasive Argentine ant is affecting native ant populations.

Closer to our Sudden Oak Death roots, students at the Mount Madonna school in Watsonville are monitoring local *P. ramorum* infections and tree mortality as part of their own citizen science initiative. Here in Marin, the Marin Municipal Water District uses visiting student groups to track SOD on their land. I know that there is interest from other students and teachers in using Sudden Oak Death in their classrooms and during field trips - what other projects are going on out there?

Send me information on any citizen science projects that deal with SOD, or wishes for projects that might get started, and I'll post the highlights in an upcoming blog.

Tags: AntWeb (1), citizen science (1), MMWD (1), Mount Madonna (1), Sudden Oak Death (31)

Sudden Oak Death and Management Fatigue

Author: Christopher A. Lee

Sunday July 5 2009

On Friday, I was at the Trinity River in eastern Humboldt County, watching my son splash his way through water as clear as the sky above. One hundred feet upstream, a helicopter repeatedly dipped its bucket into the river, rising up each time to carry its load to one of the fourteen fires that broke out in our county and neighboring counties last week, the results of lightning strikes. As the helicopter passed over our heads, it trailed a stream of water from the bucket, and about three minutes later, it would be raining on us very gently for a minute or two.

This got me thinking, of course, about fire hazard and the toils of keeping

cleared, defensible space around one's home when one lives in the country (which I do not). This in turn evoked thoughts of a local NGO in our north coast area, the Mattole Restoration Council (MRC), which is working to encourage homeowners in the Mattole River watershed to provide that defensible space by distributing grant money to help the homeowners get the work done. When each household maintains that magical 100-foot clearance, it benefits the entirety of this remote watershed, where it's often extremely difficult for firefighters to get quick entrance and egress on steep, narrow roads in scattered neighborhoods. With less flammable space around homes (and fewer homes that are themselves flammable--but that's another subject), firefighters can concentrate on attacking the flames in the wildland area rather than spending all their time worrying about defending structures.

This led to thoughts of other worthy MRC work: the organization is working on writing a Program Timberland Environmental Impact Report, a document designed to apply to owners throughout the watershed who want to practice sustainable forestry designed to return Mattole forestlands, many of which were highly degraded by mid-20th-century timber harvest practices, to healthy productivity while protecting water quality and other important values. Having a program document like this (i.e., an already-written "checklist"-type document) will make responsible forestry, which can be an expensive proposition for a small landowner, a real possibility for many watershed residents.

Which brought me to Sudden Oak Death. *P. ramorum* has moved to the very eastern edges of the Mattole River watershed. Soon, the disease could be one more thing for Mattole valley residents to worry about. Along with the MRC, UC Cooperative Extension has been holding informational workshops about SOD, but concern hasn't built as high here as in some areas of coastal California. This could partly be the result of a few dry years during which the pathogen has become less visible in southern Humboldt County because it has caused less tanoak mortality. On another level, though, it's understandable that many Mattole residents may have "wildland management fatigue" from worrying for so many years about fire, fish, and forestry.

Since Sudden Oak Death has not yet impacted the Mattole, there's a real chance that, given funding and political will, residents could do something to limit the spread throughout the watershed. But the disease is tagging along behind all those other equally important concerns. The question that occurs to me at this point, then, is this: Is there a way to unite these seemingly disparate domains? Given the realities of funding, in which each relatively narrow environmental issue attracts its own funding, scientific study, and advocacy groups, could some kind of comprehensive wildland management assistance ever materialize for rural landowners who need it, like the ones in the Mattole?

When our president talks about creating jobs to help our environment, this is what I see: an army of forest management experts and helpers, working in places like the Mattole to address all these wildland management concerns in a comprehensive manner. On any given property, these folks, organized into teams perhaps, would work on fuel hazard reduction *and* riparian restoration

and erosion remediation *and* sustainable timber production *and* weed control *and* habitat protection *and* protection from insects and diseases. Considering how each of these management activities can often interact synergistically with the other activities, it remains a wonder to me that this hasn't already happened. It may just be that a vision like this, to come to fruition, will require a collective societal decision that wildland management is worth an investment.



The Mattole River: good for many uses.

Tags: fire (3), forestry (2), management (2), *Phytophthora ramorum* (20), sudden oak death (31)

Bay's Miracle

Author: Christopher A. Lee

Wednesday July 1 2009

I'll be upfront: I stole the title of this post from my supervisor at UC Extension in Eureka, Yana Valachovic, who also took the pictures. She has talked about this subject several times to various audiences, and I think it's so interesting I wanted to post it.

Below are two pictures of the same California bay laurel (*Umbellularia californica*) tree, one from a distance and one up close. Bay laurel (also called pepperwood, Oregon myrtlewood, or just plain bay) is the main transmitting host of *Phytophthora ramorum*. The pathogen produces loads of spores on the

leaves of bay laurel, and the spores are then blown or splashed onto other trees. If those trees happen to be tanoaks, coast live oaks, Shreve oaks, California black oaks, or--maybe--canyon live oaks, they can be killed. (The bay laurels, meanwhile, remain completely unharmed.)

Because of this, some of the management activities aimed at controlling Sudden Oak Death focus on strategic removal of some bay laurels to reduce disease risks for particular important oaks and tanoaks. As part of our management experiments in the north coast, we decided to try cost-effective ways of killing large bay laurels. It's very expensive for crews to cut them down, remove the limbs, and burn the small limbs and foliage. So we decided to try girdling some trees to see how rapidly they would die in place. Even though the standing trunk and limbs would still be there, the foliage, which is the part of the tree that carries *P. ramorum*, would be gone.

To make a long story short: nothing doing. Those girdled bays are not interested in dying. The girdle on the tree below was made by one of the landowners with whom we are collaborating. And boy, did he ever girdle it! The "beaver cut" he made goes at least six inches deep into the sapwood.

The top picture gives you a good look at this beaver cut. But if you look at the bottom picture, you'll see that the tree is trying to heal itself.





The roughened area of bark-like tissue in the center of the trunk is an area where the tree is trying to grow a new "bridge" of cambial tissue over the girdled area to heal itself. The crown of this tree is still green and healthy-looking, over two years after it was girdled, despite the tree's inability to move food between crown and roots.

Obviously, bay laurels are amazingly resourceful trees! Maybe this is one reason why several ecologists have speculated that as tanoaks decline in coastal California because of the effects of Sudden Oak Death, bay laurels will increase in dominance in many areas.

Tags: bay laurel (1), management (2), Phytophthora ramorum (20), sudden oak death (31)

Prevention is the best medicine

Author: Janice M Alexander

Monday June 29 2009

One of the biggest problems in dealing with invasive, non-native species is that it is rarely possible to exterminate them once you've seen the mess they've made, and you often don't even know to be concerned until the problem is too large to deal with. Preventative actions to limit their introduction in the first place and aggressive actions to control early infestations seem to be the best course of action, but has its obvious limitations. How many of us know to floss regularly to prevent tooth decay but still end up with a root canal anyway?

One issue with preventative measures is measuring success. With a control effort, you can say "we had X and now it's gone." With a preventative measure, such as limiting importations or strictly regulating the movement of plant material, all you can say is "X didn't happen" and there are many questions then of whether "X" would have happened at all and whether your draconian measures did more harm than good in the meantime.

This exact topic came up at the SOD Science Symposium a couple of weeks ago, and it seems to come up with every new pest that grabs our attention. When will we stop reinventing the wheel on this topic? If stricter across-the-board regulations aren't the answer, how will we get all interested parties to agree which pests are important to stop, when, and how? Will there have to be another Sudden Oak Death - or Chestnut blight, or Dutch elm disease - to resonate with the nation as a whole?



chestnut blight



dutch elm disease

Tags: Chestnut blight (2), prevention (1), regulation (1), Sudden Oak Death (31)

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Site Specific

Author: Christopher A. Lee

Friday June 26 2009

Since Nicole has been weighing in on the Sudden Oak Death Science Symposium IV held last week in Santa Cruz, I may as well do the same. Of all the creative ideas and new thoughts stimulated by the assemblage of scientists, ecologists, and land managers gathered together to discuss what they've learned about this disease, the one that strikes me most right now is the idea of the importance of *site specificity*.

As we took a field trip to the Santa Lucia Preserve on June 15 to look at the proactive management that Preserve owners and Santa Lucia Conservancy scientists are doing, it was clear that this management is possible because of the unique neighborhood structure and financial circumstances of the Preserve. People here are taking responsibility, making the most of their resources to battle Sudden Oak Death. Ownership, resources, and attitudes are quite different in many other parts of the state, which is why it's important for educators and researchers to continue to elevate awareness among the public and policy-makers alike.

The presentations about fire and Sudden Oak Death contained some information that appears superficially contradictory. Whereas fire suppression personnel reported that Sudden Oak Death apparently contributed a lot of fuel on the forest floor to feed the Basin Complex and Chalk Fires, field research on the north coast has so far not seen an unusual amount of fuel buildup in areas affected by the disease. Keeping in mind that this research has just begun and a lot more data will be collected soon, this contradiction can be accounted for by remembering that fire regimes, fire histories, and fire ecology in the north coast are quite different from the central coast. As a matter of fact, these things vary from site to site even within each of these regions: fire regimes in the Santa Cruz Mountains, for example, differ dramatically from those in the Santa Lucia Mountains. Read [this book](#) to find out more.

And in a panel discussing the social impacts of Sudden Oak Death, Chuck Striplen of [UC Berkeley](#) and the [San Francisco Estuary Institute](#) reminded us that forest management in California is often hampered by an unclear

understanding of what the "baseline" conditions of our wildland areas are. What was going on in these forests 100, 200, 500 years ago? What should be our template for management? The answers will vary from site to site throughout the state.

"Site specificity" is a common mantra of professional foresters, who know that forest management activities that work on one site won't necessarily work on others. It's also a good thing to keep in mind when thinking about how to protect wildlands against, or alleviate the impacts of, Sudden Oak Death.



A view from inside a redwood stump in Mendocino County reveals site history: this "window" began as the notch to support the springboard that loggers stood on to get above the "buttswell" when felling the tree. Current management practices in this stand are oriented toward restoring the stand to conifer dominance.

Battling Brush Fires in China Camp

Author: Nicole Palkovsky

Wednesday June 24 2009

A wind-driven, grass fire burned through chaparral in China Camp State Park in Marin County yesterday. The park, heavily impacted by Sudden Oak Death, has many dead or dying trees which prompted an all out response - 79 local

firefighters, two Cal Fire air tankers and a helicopter quickly contained the blaze.



Photo of China Camp showing many dead (red and grey) oak

The full effects of Sudden Oak Death on wildfire are not yet fully understood but firefighters and researchers alike suspect that dead and dying trees increase fire severity.

Research results presented at the Fourth Sudden Oak Death Science Symposium last week, provided some additional insight into the relationship.



Air tanker dropping retardant on Big Sur Basin Fire (Andrew Molero State Park)
Photo by Kevin Hulsey www.khulsey.com Copyright © 2009

Margaret Metz, a member of the Rizzo Lab, worked on the Big Sur fire

analyzing burn severity in areas heavily impacted by Sudden Oak Death. Though she expected to find a direct correlation between impacts of Sudden Oak Death and fire severity, the relationship was not so clear-cut. Her results actually showed fire severity could be predicted by how long Sudden Oak Death had been in a stand. Newly dead trees still have leaves and stands with this material had greater fire intensity. The more of this material, the greater the fire severity.

For more information on Margaret Metz's research and other fire studies, check the [COMTF website](#) in July. We'll be posting all of the presentations from the symposium online.

Tags: Big Sur Basin (1), China Camp Fire (1), Fire (3), Sudden Oak Death (31)

Stars of another kind

Author: Nicole Palkovsky

Monday June 22 2009

When stars make an appearance in Hollywood the paparazzi are sure to follow, cameras in tow. In Santa Cruz it seems that is not the case, not unless you count the handycam my fellow blogger, Janice Alexander, set-up. Though we had the world's best and brightest the only fanfare was a round of applause after the celebrities gave their presentations. Who were these cynosures you ask? World leaders in the field of *Phytophthora*.

In the coming weeks, I'll be working to digitize, edit and post the talks from the Fourth Sudden Oak Death Science Symposium, but until that work is complete, I'd like to highlight a few of the informative and inspirational presentations.

The first-up on my Top 10 list is a talk given by [Dr. Jennifer Parke](#), plant pathologist at Oregon State University.



Dr. Parke presented her lab's work, done in collaboration with [Dr. Nik Grünwald's lab](#) at USDA-ARS Corvallis, on a systems approach to detecting sources of *Phytophthora* contamination in nurseries. The system, modeled after the food industries Hazard Analysis Critical Control Points (HACCP) which ensures food products are not contaminated during processing, focuses on Critical Control Points (CCPs) that is points at which a serious hazard of *Phytophthora* contamination can be controlled.

Over the last 3 years, Parke and Grünwald have worked with four nurseries on identifying the CCPs in nursery production and developing best management practices to mitigate contamination. Though the study focuses on *Phytophthora*, a closer look at the best management practices quickly reveals its application to controlling other pathogens.

The icing on the cake? The researchers have designed a [free online course](#) for nursery growers to help them identify and learn to manage *Phytophthora* diseases in their operations.

Tags: Critical Control Points (1), Fourth Sudden Oak Death Science Symposium (2), Grunwald (1), Jennifer Parke (1), Nik Gruenwald (1), nursery (2), Phytophthora course (1), Phytophthora (4), Sudden Oak Death Blog (1)

Impacts around the world....

Author: Nicole Palkovsky

Wednesday June 10 2009

As next week nears, and researchers, regulators, land managers and industry representatives from around the world start their migration to Santa Cruz for the Fourth Sudden Oak Death Science Symposium, I thought we might take a "flight" to look at the impacts of the disease in other parts of the world.

In the spotlight for this post is Clyne Gardens, a botanical garden in Swansea, Wales, known internationally for its collection of Rhododendrons, Pieris and Enkianthus. The last two years has seen the park heavily hit by *Phytophthora ramorum* and *P. kernoviae* which killed all but four of the parks Pieris.



Rhododendrons and azaleas fill the garden with colour in May.



The ill-fated Pieris is center in this photo.



Clyne Gardens

The science of Sudden Oak Death

Author: Janice M Alexander

Monday June 8 2009

This time next week, researchers, regulators, land managers, and industry representatives from throughout the world working on *Phytophthora ramorum*, Sudden Oak Death, other *Phytophthora* species, and related pests will gather in Santa Cruz for the [Fourth Sudden Oak Death Science Symposium](#). The Symposium will include 59 talks and 46 posters from top researchers around the globe, as well as a field trip to infested Santa Lucia Preserve in Carmel. In addition to several big-picture and emerging issue talks, presentations will provide information on the status of *P. ramorum* worldwide as well as on the latest research findings and management

activities.

This bi- or tri-annual conference is like a big family reunion for those of us working in the *P. ramorum* world. We are a far-flung bunch, even those of us who work closely together through the [Ca. Oak Mortality Task Force](#). I'm lucky that I work in Marin with my fellow blogger, Nicole, and see her a few times a week. But my blogger-in-arms Chris in Eureka is another story, as is our Public Information Officer, Katie Palmieri, who works all the way out in the Sierra foothills.

Not only is it nice to see these friendly people face-to-face, but the conference also allows us to re-engage with each other professionally, and build some new ideas together. Conducting outreach on a disease as cyclical and finicky as Sudden Oak Death can be a challenge - is it a "good" year for the disease? - has it appeared anywhere new? - who's paying attention and why? These are the types of questions that drive a lot of our work and they are almost impossible to predict or plan for.

Luckily, the wealth of information that over 100 presentations will provide over the course of the next week should keep us busy for some time to come, as well as supply a new wave of blog posts. Stay tuned!



FOP 3

Tags: Oak Mortality Task Force (1), outreach (1), Santa Cruz (1), Science Symposium (1), Sudden Oak Death (31)

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Moisture Management

Author: Christopher A. Lee

Friday June 5 2009

My neighbor is re-doing a large part of the house she owns and rents out on our street. Her father, who left the house to her, had never been overly concerned with home maintenance, so when the previous tenant moved out, she decided to investigate the structure's health. What she found was discouraging. She estimates that if she hadn't intervened, the house would have collapsed because of rot in three or four years. She found dry rot in the framing, in the wood sheathing under all the windows, in various spots under the eaves--all around the place, in short. So she is replacing much of the framing and sheathing, has demolished the old carport, and is completely re-siding the house.

When I mention this to locals, they shake their heads and talk about how you really have to stay on top of "moisture management" around here. The north coast area sits where California's Mediterranean climate transitions into wetter Pacific Northwest conditions. Without adequate heating and ventilation, dry rot (the fungi *Meruliporia incrassata* and/or *Serpula lacrymans*) will attack even the wood in the highest portions of houses in this area--especially in post-war houses built mainly out of Douglas-fir.

And when I think of water and fungal organisms, I also think of water and *Phytophthora*. *Phytophthora* species aren't fungi, but they are very similar. The common name often used for them, "water mold," shows that they are even more dependent on water than fungi are. All *Phytophthoras* have a swimming stage, which Nicole has discussed before in her post on the amazing zoospore. Without the presence of standing water at some point in the year, *Phytophthora* reproduction and movement is impossible.

Many *Phytophthora* species like to hang out in free-flowing streams. If plants are infected with these *Phytophthora* species somewhere on the landscape, the zoospores will find their way somehow to the stream. From there, these zoospores can be baited out of the stream with rhododendron leaves or other plant parts that are suspended in the water column for a short period of time and then removed. The zoospores infect the leaves and cause lesions that can be plated in growth medium and examined under the microscope for presence

of the particular *Phytophthora* species that caused them. This is one of our most reliable early detection techniques for the presence of *P. ramorum* in a landscape; often, we detect spores in the stream even before we have noticed tanoaks or true oaks dying in a particular watershed.

If *P. ramorum* is infecting ornamental plants in a nursery, the pathogen will often escape the nursery grounds and end up in nearby streams (kind of like when your pet snake escapes and you know to look for it under the stove). [The California Oak Mortality Task Force June 2009 newsletter](#) reports that so far in 2009, six nurseries in five states have reported detecting *P. ramorum* in nearby water bodies.

With some *Phytophthora* species, scientists understand what happens once the zoospores enter the stream. For example, in the case of *P. lateralis*, which causes Port Orford-cedar root disease, the spores float downstream until they are chemically attracted to fine roots of Port Orford-cedar extending into the stream from a tree growing on the bank. They enter the roots and eventually kill the tree. This leads to a characteristic pattern of dead trees lining the watercourse.



P. lateralis-killed Port Orford-cedar along the Sacramento River. Photo courtesy of Don Owen, California Dept of Forestry and Fire Protection

In contrast, no one fully understands the dynamics of *P. ramorum* in streams. These dynamics must surely vary from those of *P. lateralis*, since *P. ramorum* mostly does not infect roots. Is there a way for *P. ramorum* to escape the watercourse to infect upland plants, such as in floodwater or on animals? Or are the zoospores passively washed out to sea?

We do, however, understand that this issue carries implications for management of irrigation water in nurseries, since water drafted for irrigation can carry spores to the plants on which it lands (read examples of research [here](#), [here](#) and [here](#)). Because of this, a good deal of effort has gone into investigating effective ways to filter nursery irrigation water and developing best management practices that emphasize ground-level, rather than overhead, irrigation. There is also an ongoing conversation about whether and how to treat water that is drafted to fight wildfires. This research and conversation adds yet another dimension to the concept of "moisture management" in coastal California.

Tags: dry rot (1), Phytophthora lateralis (1), Phytophthora ramorum (20), Port Orford-cedar root disease (1), water (1), watercourse monitoring (1)

Going Native....

Author: Nicole Palkovsky

Wednesday June 3 2009

Unless you are planning an outdoor activity, rain in June in our neck of the woods is considered a blessing. The pitter patter of rain drops last night meant we could skip our early morning watering of tomatoes, basil, and all other things edible that grow in our garden and leave the water in the reservoir.

With the drought these past few years, water use in gardens is a constant consideration. We've addressed it by going native. We have a few edibles that require regular watering, but the bulk of our yard is planted with xerophytic plants and natives which require almost no watering.

In addition to saving water (and therefore money), planting with natives has many advantages: they provide habitat connectors for native wildlife from insects to larger mammals, because they are well adapted to local conditions plants thrive with little care, planting natives in the garden in lieu of exotics decreases the risk of introducing invasive species which in turn decreases fire risk.



My plug for naturescaping, as I've heard it called, is not meant to suggest one exclusively plant with native species. I like a mix of edibles, showy flowers, exotic xerophytics and natives just as much as the next gardener, but the benefits of adding even a few natives is great.

If you are a regular reader of this blog, you'll know that all of our posts (must) relate back to Sudden Oak Death in some way. Though in this case it is secondary, one consideration when going native is whether to plant species that are susceptible to *Phytophthora ramorum*? The consensus among those I have spoken to on this issue is, yes, with the possible exception of California bay laurel, an efficient vector for the pathogen. Though introduced pathogens will always be a concern, natives, planted in the right location and adequately neglected, should do well and in general be quite resistant to most pathogens. Another advantage of going native!

To get started on your *gardening with natives* check out the [Las Pilitas Nursery Guide](#). Happy gardening!

How do you say "Sudden Oak Death" in Italian?

Author: Janice M Alexander

Monday June 1 2009

The most obvious connection between Sudden Oak Death and Italy would be the sound of Matteo Garbelotto's accent as he delivers another presentation on

the disease. (*This fulfills my personal requirement of mentioning Matteo in all of my blog posts.*) However, there is an even more unlikely connection coming up this fall in Sonoma County: [Levi Leipheimer's King Ridge GranFondo](#).

For those of you who follow professional cycling, you know that Levi Leipheimer is one of the - or just *the* - best pro cyclists racing these days. He happens to call Santa Rosa, California home and is a big fan of riding the twisty, hilly roads in western Sonoma county. He brought Lance Armstrong and the rest of his team out to train on those roads this past spring, and now he wants the rest of us to join along.

To that aim, he is instituting a cycling event based on the Italian model of a long-distance, mass-participation ride that is not a race - a Gran Fondo. There's the Italian part, but where's the Sudden Oak Death connection? It's on King Ridge - literally - and along the other forested hillsides that a contingent of international and local riders will pass through as part of this organized ride in October 2009. Check out a photo taken from Kings Ridge Road, albeit from 2005:



I've been in contact with the event organizers about doing some sort of outreach and education on Sudden Oak Death as part of this ride. I'm curious, are any blog readers out there also riders? Do you, like me, pay attention to flowers and trees as you ride by them? Are you also going so slowly up the hill that you can identify grasses next to the road? (*I'm sadly totally serious.*)

Let's use this blog for some good (and to help me do my job): Send me your ideas about what kind of educational materials you think someone who will be going on a bike ride would pay attention to: brochures in your registration packet, displays at a rest stop, sponsorship logos on a website? I'll post the best responses in an upcoming blog.

Tags: King Ridge Gran Fondo (1), Levi Leipheimer (1), Sonoma cycling (1), Sudden Oak Death (31)

Rainy-day Symptoms: A Follow-up

Author: Christopher A. Lee

Saturday May 30 2009

A couple of weeks ago I wrote about the rain events early this month, when many locations on the north coast saw 3-5 inches of rainfall within a few days. I speculated that since this rain coincided with relatively warm conditions, we might soon see symptoms of *P. ramorum* infection on a wide variety of host plants.

As a follow-up, here are some photos of symptoms I saw the week after that post.



On Douglas-fir



On evergreen huckleberry



On western starflower

Several of these samples did yield *P. ramorum* in the laboratory (the huckleberry wasn't sampled, but the other two here were, as well as several other species on the site).

A couple of cautionary notes: First, this is a site with exceptionally high levels of the pathogen. The UC Davis Rizzo Lab consistently recovers the pathogen from the soil on this particular site year after year. I haven't seen these kinds of symptoms at other sites yet, so there is hope that this big rain event did not contribute to a new, large-scale spread event for *P. ramorum*.

Second, even if this rain event did contribute to the spread of spores to the pathogen's tree hosts (oaks and tanoaks), we probably won't see the results for a year or two. It often takes at least that long for the pathogen to kill trees.

I just thought it would be interesting to share some new photos of symptoms, even if they are not very consequential. Here in the north coast, we haven't entirely escaped the rainy season yet. This could be good news for many animals and plants, but bad news for tanoaks if we have another big, windy rain event.

Tags: Douglas-fir (2), huckleberry (1), *Phytophthora ramorum* (20), rain (2), starflower (1), sudden oak death (31), symptoms (2), tanoak (5)

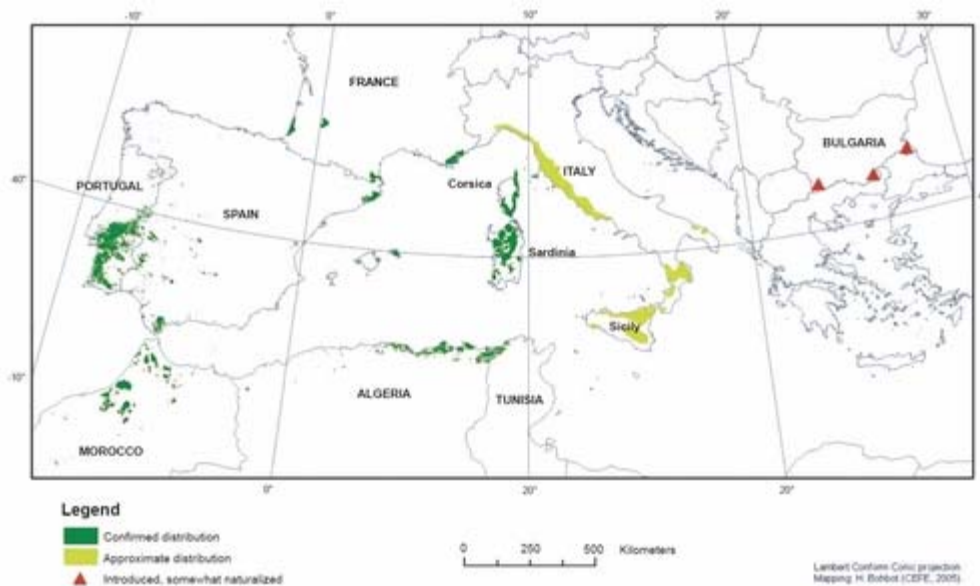
To cork or not to cork?

Author: Nicole Palkovsky

Wednesday May 27 2009

While at a dinner party over the weekend, we sampled a few lovely local wines. After the popping of corks and clinking of glasses, a lively discussion ensued about the use of cork in wines. To cork or not to cork? That was the question.

The cork popping sound we in North America (and many other parts of the world) associate with the sound of celebration is made possible by the cork oak (*Quercus suber*). Cork oaks are native to the Mediterranean and are found in large numbers in Portugal, Spain, Algeria, Morocco, Italy, Tunisia, and France (see map below). While the geographic range is quite broad, cork production is concentrated with 70% of all commercial cork coming from Portugal.



Cork, for use as wine stoppers, flooring, fly rods or otherwise, is harvested from the outer bark of cork oaks and is considered a renewable product as the outer bark regrows. This is a unique feature of *Q. suber*. The first harvest occurs 20yrs after a sapling is planted and the tree's outer bark is reharvested approximately every 10yrs (max age is ~ 200yrs).

In recent years there has been a switch from cork wine stoppers to screw caps or plastic that many believed was due to a worldwide cork shortage. The research I did for this post indicates that alternative caps were actually developed to address 2,4,6-trichloroanisole (TCA), which can cause cork-taint problems destroying the wine. As for the shortage a few sources suggest the cause is mainly due to the lack of demand – decreased revenues are causing cork producers to sell off their woodlands which are readily converted to real estate.

While the real estate explanation may be true for the *current* lack of cork, cork producers did have a few bad years due to decline disease (caused in part by *Phytophthora cinnamomi* a close relative of *P. ramorum*) and the disease is an ongoing problem. Additionally there is concern that cork oaks, an evergreen species in the section *Cerris*, are at risk of developing Sudden Oak Death, the disease ravaging California's oaks, which would further their decline*.

It would seem, anyway you cut it, whether it be pathogenic forces or a vicious cycle of supply and demand, less cork on the market has contributed to the switch to alternative wine stoppers.



Punching out wine corks. Photo courtesy of <http://jelinekcork.blogspot.com/>

To cork or not to cork? A question I will leave unanswered, but certainly something I will ponder the next time I hear that celebratory pop!

* Assay results of inner bark inoculations on *Q. suber* indicate "less" susceptibility which is good news for cork oaks and the cork industry.

Tags: cork (1), decline disease (1), Phytophthora cinnamomi (1), Phytophthora ramorum (20), Quercus suber (1), sudden oak death (31), wine stoppers (1)

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In Memoriam: Chestnut Blight

Author: Christopher A. Lee

Friday May 22 2009

As we slide into Memorial Day weekend, I thought it would be worthwhile to look back at an earlier forest disease epidemic that galvanized foresters and forest pathologists for half a century and changed the look, makeup, and function of forests in the eastern U.S. for perpetuity: chestnut blight.

This disease, caused by the fungus *Cryphonectria parasitica*, practically eliminated the American chestnut, *Castanea dentata*, from the eastern forests to which it is native. In these forests, the chestnut tree was a stately dominant that provided an important mast crop for wildlife and also durable, rot-resistant lumber. Its abundant tannins were used for tanning leather. Because of these qualities, you could think of chestnut trees as having been analogous in different ways to both the redwoods (stateliness, wood quality) and tanoaks (tannins, wildlife food) of our western forests. It was a very important tree that has now been replaced in dominance throughout much of its range by oak species.



Canker on chestnut stem caused by *C. parasitica* (photo courtesy of Linda Haugen, USDA Forest Service, bugwood.org)

Two particular features of chestnut blight are interesting to me in relation to Sudden Oak Death: (1) its spread was both fast *and* slow, and (2) it changed the ecological niche of the American chestnut tree without eliminating it entirely.

Chestnut blight was discovered in 1904 and had taken out most mature American chestnut trees by 1940. Looking back, this is swift work! But if we

look at it from the perspective of someone learning about chestnut blight in, say, 1913, it might not command the same sense of urgency. At that point, one could not predict its ultimate effects on the east's hardwood forests. This is roughly the same point we are at today with *P. ramorum* and Sudden Oak Death. *P. ramorum* was named nine years ago, and we are trying to learn more about it, wondering what its ultimate effects will be. If it does eventually eliminate a majority of its primary host, tanoak, from western forests, this too could take several decades. This is slow according to a human perspective, but from a forest perspective, even a couple of centuries is the blink of an eye.

Above, I said that *C. parasitica* practically eliminated the American chestnut from its former range. I inserted that "practically" because plenty of American chestnut trees still exist. Their root collars and root systems are fairly resistant to the fungus, and the chestnut can resprout (again, like tanoaks). But before the sprouts can mature, the fungus kills them. Thus, chestnut is maintained as an understory plant rather than as the mature tree it once was. This bears interesting resemblances to the case of tanoak and *P. ramorum*, in which *P. ramorum* can kill the main stem and then somehow hang around and continue to cause problems to the new sprouts that re-emerge from the old root system. Whether it does this in every case, or even in a majority of cases, is yet to be seen. Perhaps this won't be as big a problem for tanoak as it was for chestnut. But if it is, tanoak, too, could be reduced to an understory plant that never grows large enough to produce the mast crop that so many wildlife species depend on.

There's a lot more that could be said about chestnut blight--for example, about hopeful [efforts to breed resistant trees](#) (this link has a great picture of a historic chestnut stand) and [provide biological control of *C. parasitica*](#)--but for this Memorial Day weekend, thinking about what it has done so far is enough for me. Looking at this historical case through the lens of our uncertainty about the possible future effects of *P. ramorum* is enough to inspire some thoughtfulness about the future of our coastal Western forests.

Tags: American chestnut (1), chestnut blight (2), Phytophthora ramorum (20), sudden oak death (31), tanoak (5)

Art and the Invasives

Author: Nicole Palkovsky

Wednesday May 20 2009

While Janice was writing her [Monday's post](#) on [O OAK OH!](#), an arts event celebrating oaks in the context of Sudden Oak Death, I was listening to an NPR programme on the University of Wisconsin Cooperative Extension's music campaign against aquatic invasives. In Wisconsin too, it seems scientists and artists have come together to get their message across.

[Bret Shaw](#), Environmental Communication Specialist for [UW Extension](#) and Assistant Professor in the [Department of Life Sciences Communication](#), worked

with a group of singer/songwriters to produce a series of songs addressing the spread of aquatic invasives in Wisconsin's waterways. Shaw, a musician and a scientist, says, "Research shows music can influence how people respond to messages, influencing memory and recall, emotion, information processing, attitudes, and even behavior."



STOP AQUATIC HITCHHIKERS!™

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Not only are the tunes catchy, they send an important message to anglers that Shaw is hoping will pluck a chord (forgive the pun), and get anglers to start doing their part in stopping the spread of VHS fish disease (viral hemorrhagic septicemia) and other aquatic hitchhikers.

It is true, scientists don't often engage the arts in their outreach efforts, but when they do, the results can be inspiring. Here is a link to my favourite song, enjoy! I'll be looking for some oak ballads soon....

Song: **One Bait, One Lake**

Singer/Songwriter: Andrew Isham

Description: This rock tune proclaims the importance of not moving bait minnows from one lake to another if water has already been added from the first lake to the minnow bucket. This simple act helps prevent VHS fish disease (viral hemorrhagic septicemia) from spreading from an infected to a non-infected lake. [Listen to the song and read the lyrics](#)

Talkin' in Georgia

Author: Nicole Palkovsky

Tuesday May 19 2009

For those of our readers in Athens, Georgia, today is your chance to hear one of the world's leading researchers on Sudden Oak Death. [Dr. David Rizzo](#) of the University of California Davis, will discuss "Emerging plant diseases in natural ecosystems: biological invasions and microbial diversity" at the University of Georgia - Warnell School of Forestry and Natural Resources at 3pm today(details below).



The major focus of the Rizzo Lab is studying *Phytophthora ramorum*, from basic studies on the biology and ecology of the pathogen to numerous management related issues. The Rizzo lab is also collaborating on the [Teakettle Ecosystem Experiment](#), where they are looking at the spatial distribution of pathogens and insects and their impact on plant community development in mixed-conifer forests in the Sierra Nevada.

Dr. Rizzo's lecture is set for Room 2401 in the Miller Plant Sciences Building. *For more information, contact Sandi Martin at 706.542.2079 or smartin@warnell.uga.edu*

Tags: Dave Rizzo (1), Phytophthora ramorum (20), Sudden Oak Death (31), Teakettle Ecosystem Experiment (1), University of Georgia (1), Warnell (1)

Unseen Connections: Art in the Forest

Author: Janice M Alexander

Monday May 18 2009

Last week, in a very rare event for me, I was surrounded not by scientists, but by artists. While I tend to take great care to follow and support the scientific method and speak in carefully chosen words about what we do and do not know, this was not the case with a group of passionate and engaged artists stricken with the calamity of Sudden Oak Death in their forest.

The forest in question is part of the [Montalvo Arts Center](#) in Saratoga. Its 5 acres of performance spaces, artist workshops, and manicured gardens is surrounded by 170 acres of oak woodlands which have become infested with *Phytophthora ramorum*. The Center did not even realize they had Sudden Oak

Death until an artist visiting from New York ventured into the forest in exploration for a performance piece on interdependence and saw the dead and bleeding oaks.

Deeply moved by what she saw, [Mierle Laderman Ukeles](#) came up with an art piece that would address the health of Monalvo's land and focus on its local oak trees. On July 21 and again in October 2009, people will come together to learn about and celebrate oaks in the context of the threat that Sudden Oak Death poses to the Center's forest and to the larger California oak ecosystem: [O OAK OH!](#)

Since 1977, when she became the official Artist In Residence at the New York City Department of Sanitation – a position she still holds – Ukeles has created art that deals with the endless maintenance and service work that “keeps the city alive,” urban waste flows, recycling, and ecology.



For my part, we talked about the interdependence and ecology of California's oak ecosystems and the people that live among them. It may not seem surprising for the inhabitants of New York City to not see the connections that they have with the many levels of people and "stuff" in that mega-metropolis, the unseen ecology of the social organism they are a part of. In "green," eco-minded California though I would expect that these connections would be more obvious and understood by our communities. Still it seems that people often do not fully understand the role they play in the larger environment and how they can affect the forests and landscapes they may largely take for granted.

These connections are biological, economic, and also very emotional. While I, as a scientist, do my part to engage the intellectual and rational side of people to help them make decisions that will support their love for their trees and forests, artists can go straight for the heart and gut - pure emotional responses to what these trees and landscapes mean to us. I can see the interdependence there, too.

Tags: interdependence (1), Mierle Laderman Ukeles (1), Motalvo Arts Center (1), Sudden Oak Death (31)

Armillaria: A Pathogen to Admire

Author: Christopher A. Lee

Thursday May 14 2009

Well, OK, maybe that's a little much. Admire a forest pathogen? But bear with me.

Armillaria is the genus name for a group of fungi that are found in forests worldwide. Some species of *Armillaria* are virulent tree-killers, while others mostly play a role in forest recycling by decaying dead wood. In coastal California, the most common species of *Armillaria* can produce bleeding symptoms on hardwood trees that look exactly like the symptoms caused by *P. ramorum*.



Armillaria (white) beneath bark, with typical bleeding symptoms above (photo courtesy of Jack Marshall)

So what is there to admire? Well, for one thing, *Armillaria* is native to California. Researchers from UC Davis sampled *Armillaria* species throughout California and found four species. The overwhelming majority of their samples, though, consisted of only two of these species: *A. mellea* and *A. gallica*.

A. mellea is primarily found in developed areas. It causes a root rot that kills trees, although it rarely kills large numbers of trees at a time. *A. gallica* is found throughout coastal forests and is the species of *Armillaria* that I most commonly come across. (At least, I think that it is the species I most commonly come across. Definite identification of *Armillaria* to the species level requires DNA analysis and/or sophisticated morphological diagnostic skills that I don't have.)

In any case, *A. gallica* causes a heart rot that slowly develops inside the tree, causes bleeding lesions that show up on the bark, and eventually produces a more or less open column of rot within the tree. It can also decay tree roots and butts, but not as swiftly or commonly as *A. mellea*.

Since it is a native fungus, *A. gallica* behaves much as we would expect something to behave when it has evolved over thousands of years in the same environment with its hosts. It is ubiquitous in the forest environment, surviving on what dead woody material it can and picking off the occasional small tree that is stressed because of having to grow under a dense canopy with insufficient light. Healthy, mature hardwood trees apparently resist it easily.

In other words, *A. gallica* is one of nature's cull and decay agents. Not like *P. ramorum* at all! Since *P. ramorum* is not native, its host trees have not evolved defenses adequate to resist infection. This enables the rapid epidemic spread of *P. ramorum* in our coastal forests.

In other areas with different forest stresses, *Armillaria* species, even though native, can cause far greater problems. *A. ostoyae*, for example, kills large numbers of trees in the high-elevation forests on the east side of the Cascades and up into Canada. In these areas, trees have to compete for much more limited water resources and are much more susceptible to a variety of insect and disease problems. Our coastal forests have it easy in comparison.

So far, I have admired *Armillaria* for (1) being a native member of our Western forests and (2) for being a versatile survivor that plays an important role in forest nutrient cycling. I also admire the fact that the mycelium (main fungal body) of many *Armillaria* species glows in the dark--i.e., it's "bioluminescent." Pretty cool, huh? And there are plenty of other nifty things about this fungus--material for another blog entry someday.



California black oak with *Armillaria* mycelium (below left); symptoms at top right could be caused by *Armillaria* or *P. ramorum* (photo courtesy of Jack Marshall)

Tags: [Armillaria](#) (2), [bleeding](#) (2), [forest health](#) (1), [native pathogen](#) (1), [oak health](#) (4), [Phytophthora ramorum](#) (20), [sudden oak death](#) (31)

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Looking back....

Author: Nicole Palkovsky

Wednesday May 13 2009

"Despite all of this wonderful work, we still don't have all of the answers we need to effectively control and manage Sudden Oak Death in our forests and yards." When I read this ending to Janice's blog on Monday it reminded me of all the work that still needs to be done, but more importantly all the work that has been done.

Someone sent me a link to a YouTube video recently and watching it felt like I had discovered an artifact in a time machine. The video, simply titled "[Sudden Oak Death](#)", is a UC Television production that I believe was filmed in 2001. If you have time, listening to the Quest program juxtaposed to watching (even a small part of) this video makes you realize how much has been discovered in the last 8 years.



Photo courtesy of MauroTaborelli

Researchers, many of whom will be at the upcoming [Fourth Sudden Oak Death](#)

Science Symposium, have been working extremely hard to understand the biology and management of *Phytophthora ramorum*. The tag-line for the Quest show likened Sudden Oak Death to the Swine Flu, another infective agent getting a lot of attention these days. *P. ramorum* is infecting (and killing) a large number of trees, but the life, and therefore biology, of oaks is measured in years, if not decades. The study of *P. ramorum* is a relatively slow and, I imagine, sometimes frustrating process. But on this early morning, looking back, I wanted to say thanks to all those that work so tirelessly to give us answers.

Tags: Fourth Sudden Oak Death Science Symposium (2), Quest (2), sudden oak death (31), swine flu (1), UC television (1)

On a QUEST for Sudden Oak Death

Author: Janice M Alexander

Monday May 11 2009

Warning: *The following blog post contains shameless self- and cross-promotions!*

Early this morning, my husband gingerly worked his way down the stairs to grab his bike for work, leaving me in the rare state of having two sleeping children and quiet in the early dawn. I heard the quiet murmurs of the garage radio click on below me, and then a bounding of steps and a flinging of doors as he leapt back upstairs and switched on the radio in the bedroom. Soon, both kids were up, too. Such is the effect that hearing Matteo Garbelotto's voice broadcast on the airwaves will have on our household.

Being true NPR-philes, we have all of our radios tuned to local station KQED. Their environmental program QUEST, for the second time now, has highlighted Sudden Oak Death and the researchers who are working to understand and control it. Two years ago, they brought a film crew out to Sonoma County to do a video story on the impacts of the disease; this morning they aired a radio story on recent management efforts in Marin and the Peninsula. You can hear the full story here: www.kqed.org/quest/radio/sudden-oak-death.

What I loved about today's radio story was the focus on the tough work that researchers and land managers are doing to deal with Sudden Oak Death in our yards and forests. The COMTF newsletter recently highlighted the same story from the MidPeninsula Regional Open Space District project on genetic resistance in tanoaks (see photo below).



Despite all of this wonderful work, we still don't have all of the answers we need to effectively control and manage Sudden Oak Death in our forests and yards. With continued funding - and your support - researchers can continue to work toward more answers. And public radio can continue to report on their progress.

Tags: KOED (1), Quest (2), Sudden Oak Death (31)

Rainy-day Symptoms

Author: Christopher A. Lee

Friday May 8 2009

Janice mentioned on Monday that the rainy weather last weekend and this week may encourage new *P. ramorum* infections in our coastal forests. I guess we'll have to wait and see how the rest of the rainy season shapes up to get an idea of just how extensive or damaging this pathogen activity might be. But since the rain this week was long-lasting, windy, and wet (we got 3.5 inches in southern Humboldt County over the past few days), I will be keeping my eyes open as I go out in the field for some of the interesting non-lethal symptoms that show up on plant foliage during wet springs.

Two hosts of particular interest to me are tanoak and Douglas-fir. This is because in southern Mendocino and southern Humboldt Counties, these two species have just begun to put out new foliage. The level of development varies between sites--in southern Mendocino County, for example, new, succulent tanoak leaves were bursting out at the beginning of last week,

whereas in southern Humboldt County the buds were still at the point of opening up.

Although *P. ramorum* only kills tanoaks and selected oaks in our West Coast forests, and its ability to infect other plant tissues varies wildly from species to species, it seems to be pretty good at infecting and blighting brand-new, succulent tissues of most any plant that its sporangia or zoospores fall on. So when we get a lot of rain over the course of a winter, or particularly late rains, I look for these kinds of symptoms:



On Douglas-fir



On tanoak



On redwood



On canyon live oak

None of these symptoms is lethal. On the two conifers pictured above and on canyon live oak, the pathogen apparently simply kills the new growth and is unable to penetrate into older tissue. It may cause a minor growth slowdown, but this is probably little more than an inconvenience to the plant. The important exception to this statement is in the case of conifer plantations where tree form is very important, as in the case of Christmas tree farms. If such plantations are surrounded by symptomatic bay laurel trees, rainy winds can blow spores onto the emerging leaders of the growing fir or Douglas-fir trees below. If the leader is killed, the tree's growth form may be compromised, leading to a bushier tree or one with lower branches competing to become the new leader. Obviously, the timing of infection has to be just right for this scenario to occur.

And what about tanoak? We're still not completely sure what role pathogen persistence on tanoak branches and foliage plays in continued branch or twig dieback, inhibition of sprout growth, or pathogen sporulation in forests containing tanoak. A subject for more research!

Tags: California rain (2), canyon live oak (1), Douglas-fir (2), foliar blight (1), *Phytophthora ramorum* (20), redwood (1), sudden oak death (31), symptoms (2), tanoak (5)

Phytophthora siskiyouensis

Author: Nicole Palkovsky

Wednesday May 6 2009

While out on a trail run with Tomas Pastalka last week, he mentioned the discovery of *Phytophthora siskiyounsis* in a grove of Italian alder (*Alnus cordata*) in Foster City, CA. The discovery and isolation of this pathogen from a commercial landscape is outlined by authors Suzanne Rooney-Latham, Cheryl Blomquist, Tomas Pastalka and Larry Costello in, "[Collar Rot on Italian Alder Trees in California Caused by *Phytophthora siskiyounsis*](#)", recently published online at Plant Management Network.



Sporangia and zoospores of *P.siskiyounsis*
(photo from <http://www.plantmanagementnetwork.org/sub/php/research/2009/alder/>)

This is the first identification of *P.siskiyounsis* in California and the first documented case of the pathogen causing collar rot on Italian alder.



Close-up of margin area
(photo from <http://www.plantmanagementnetwork.org/sub/php/research/2009/alder/>)

P.siskiyounsis, thought to be endemic to the forests of southwestern Oregon, was first found in Siskiyou County while researchers were baiting for *P.ramorum* (Reeser *et al.* 2007 *Mycologia* 99: 639-643.) Whether the pathogen is endemic or introduced in California is not yet known, and there is concern about it becoming established in our forests (*Alnus rubra* and *A. rhombifolia* are both susceptible). As a precaution all of the alders infected with the pathogen were removed from the Foster City site.

The similarity of this pathogen to *P.ramorum* (and other *Phytophthora spp.*) allowed for quick identification and management of *P.siskiyounsis* here in California- the researchers were involved in work on *P.ramorum* from its early infancy.

Contemplating the possible introduction of this pathogen, and the many others I have been reading about this past week ([white-nose syndrome in bats](#), [swine flu in humans](#)) I am reminded of the necessity of collaboration between governments, agencies, businesses and the general public in addressing potential "outbreaks". Though all of these infectious agents are seemingly disparate on the surface, addressing introductions or aggressive pathogens often requires a similar approach (greatly simplified: identification of cause and spread, collaboration to limit spread, education and management/eradication) and when there is cross-over and collaboration between agencies we can address things in a timely and hopefully *effective* fashion.

For those interested in learning more about the collaboration that takes place in addressing *Phytophthora ramorum* worldwide, the [Fourth Sudden Oak Death Science Symposium](#) will be held June 15-18, 2009 in Santa Cruz, California.

Storm clouds ahead

Author: Janice M Alexander

Monday May 4 2009

Hosting a field trip in May, at least in the Bay Area, usually doesn't require a back-up plan due to bad weather. Such was not the case last Friday, as I stood outside with 20 folks in varying states of water-resistance.

The farmers we were with that day relished the rain, even as the wind picked up and turned the drops horizontal. The lack of water this spring, as well as the past few springs, helps water keep its status as "liquid gold" here in semi-arid California. While there is no doubt that we can use every drop, the timing of that rain can make a big difference in overall water availability – and in the spread and impact of Sudden Oak Death.



During cyclical El Nino years, we can expect lots of precipitation all the way through late spring. It has typically been these years that have also led to the most *Phytophthora ramorum* infections in our forests. Anytime that abundant water and mild spring temperatures overlap, it is a recipe for fungus and mold, and *P. ramorum* is no exception. Mortality due to Sudden Oak Death usually follows 1-3 years later, or longer, depending on the species of tree infected.

Thus, this week caused me to shift my own predictions of how prominent Sudden Oak Death may be in the coming year. Given the weather up to last week, I was ready to write 2008-2009 off as a "bad year" (or a "good year" depending on your perspective) for the pathogen. Now, with warm rains and healthy winds all up and down the north and central coasts, I'm wondering if this weather will be just enough to create a new round of infections. While we likely won't see the kind of tree mortality that El Nino years typically bring, there's no doubt that we'll still be dealing with Sudden Oak Death for the next few years to come.

Tags: California rain (2), El Nino (1), Phytophthora ramorum (20), Sudden Oak Death (31)

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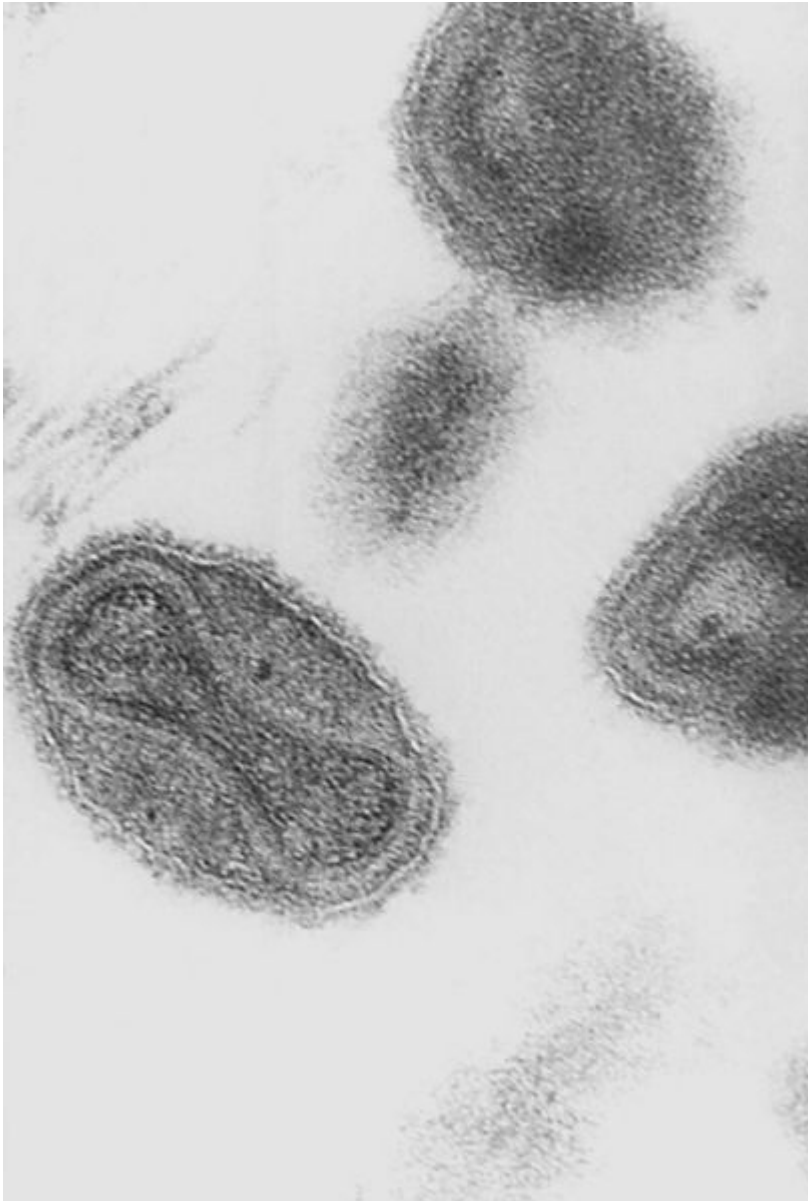
Invasives R Us

Author: Christopher A. Lee

Friday May 1 2009

Everybody's thinking green these days. Among other things, that means that people are re-assessing some of the hidden costs of our world's interconnectedness: fossils fuels burned for travel; the complexities of job outsourcing, trade imbalances, and linked economies; and the flattening of cultural distinctiveness. We can add to this list the continual threat of invasive species. On the news this week, we can see that the swine flu virus has spread from New Zealand to Canada, from Mexico to Scotland. The global economy, which has no doubt brought us many good things, has also helped bring pythons to the Everglades (see Nicole's post from last week) and *Phytophthora ramorum* to California, Oregon, and Europe.

I came upon a [review](#) of what looks to me like a very interesting book (maybe I'll read it soon) about one of the ultimate invasions prompted by world exploration and commerce. Charles C. Mann's book *1491: New Revelations of the Americas before Columbus* maintains that the common picture of pre-European-settlement America--as a mostly empty wilderness filled with small numbers of natives who lived "in tune" with their environment in a low-impact way--is incorrect. He gathers together recent scholarship that is building an understanding of these native societies as populous, technologically advanced, and sophisticated at manipulating the natural environment to provide food and material goods. According to this understanding, diseases brought by the first European settlers quickly decimated these societies, giving "wilderness" plenty of time to re-occupy North and South American landscapes before the Europeans arrived *en masse* to view what looked like an idyllic garden of Eden. This view is, of course, highly controversial, with anthropologists, archaeologists, sociologists, and historians slugging away on both sides.



The smallpox virus. Photo courtesy of CDC/Dr. Fred Murphy and Sylvia Whitfield.

There is no dispute, though, about the devastating nature of the diseases that settlers brought with them, whether they wiped out a quarter of the native population or ninety percent. No matter how different any given invasive species are from each other, their epidemiology can be quite similar when they are introduced into non-resistant host pools. In this respect, our coast live oak and tanoak populations are much like these native people exposed to foreign diseases.

Janice's post on Wednesday spotlighted some effective ways in which local education and citizen science can be leveraged for efforts against individual invasives. That post, along with some of Nicole's recent posts, inspires me to revisit some questions I raised a couple of weeks ago about invasive species. Are case-by-case reactions to these invasions the best way to deal with them, or do we need to develop a globally coordinated approach? Among the many

environmental problems that beset us, should we place the threat of invasive species, and their potential to change our landscapes, high on the list? (To its credit, the USDA Forest Service [did this](#) in 2004, but now its list of emphasis areas has [changed](#).) Is this threat a high enough priority to receive the same kinds of national coordination and policy-making that clean air and water, endangered species, climate change, and other major environmental problems receive?

Tags: invasive species (2), natural resources policy (1), Phytophthora ramorum (20), sudden oak death (31)

Doctor my tree is bleeding!

Author: Nicole Palkovsky

Wednesday April 29 2009

We urban dwellers have a complicated relationship with nature. We seek solace in the *wild*, putting shoe to trail or fly to water, escaping urban jungles for nights spent under the stars. But too much of good thing can leave us feeling out of sorts.

Wells Tower, author of "Everything Ravaged, Everything Burned" comically describes his urban escape to the wilds in "Felled Wood" (4.19.09 New York Times Magazine). His retreat from the concrete jungle of a large American city, to a heavily wooded lot in North Carolina turned out to have more (tree) bounty than he bargained for. The trees were so thick they crowded every corner of his lot, hung on gutters, leaned over porches and blocked windows, Towers decided it time for some to go. He was content with the removals, save one, an oak.

"One of the few trees whose company I did enjoy was a large pin oak shading my front door, but in early fall it developed a weird problem: an arboreal form of chronic diarrhea. A terrible fluid leaked out of its bark, an acrid amber gunk that smelled awful and attracted hornets the size of my thumb. The tree surgeons materialized and brought the oak to earth."

Ironically, this tree may not have required removal. Without seeing the oak I can't say exactly what was causing the ooze (our horticultural advisor probably could), but my guess would be [wetwood](#). Wetwood, as the name implies, is a wetting of the wood in the branches or trunk due to a bacterial infection. As bacterial fermentation of the sap occurs, the pressure from building gases causes the sap to ooze out of the tree (usually through cracks or wounds). Though wetwood smells horribly and attracts insects that feed on the exudate, in and of itself, it does not weaken the wood. As is the case with sudden oak death, the bleeding seen on trees is usually the first evidence of infection. Unlike sudden oak death, trees rarely die from wetwood.



Bacterial wetwood on pin oak (top), bleeding on coast live oak infected with *P. ramorum* (bottom)

This brings me to the point of my post, how do you know when bleeding means it is terminal?

Bleeding on oaks infected with *Phytophthora ramorum* is the result of the trees defense mechanisms. It is quite thick, smells nicely and tastes horribly. Wetwood exudate is due to the bacterial fermentation, it is watery, smells horribly and tastes quite good. I am not recommending you go tasting the exudate from your trees, I am however recommending you carefully consider the source of the bleeding before bringing your oak to earth.

Tags: bacterial wetwood (1), bleeding (2), oak (1), Phytophthora ramorum (20), pin oak (1), sudden oak death (31)

Citizen Scientists

Author: Janice M Alexander

Monday April 27 2009

As federal stimulus funds begin to work their way down through our state and local governments and non-profit groups, some of my professional and personal associates are in the enviable and challenging position of deciding how to best make use of this new financial resource. In a much, much smaller way, I too am challenged with how best to use a sometimes bountiful resource - though in my case, the capital is human.

The notoriety of sudden oak death and the large impact it can have on individual properties and lives gives it a place in people's minds and hearts unusual for most forest diseases. Time and again, people contact me about a school research project they want to undertake, a treatment trial they're willing to host on their land, and unsolicited personal donations of time and money. I wish I could say that we've put that passion to the best use, but the truth is that it can be difficult to match volunteer resources with particular projects and tasks.

This [recent news story](#) highlights some of the national efforts that are taking place to make better use of volunteers in combating invasive species. As Nicole mentioned in a recent post, the monster pythons in the Everglades get a fair amount of attention, but even our local *P. ramorum* infestation warrants a mention. In terms of sudden oak death, the most relevant and successful use of citizen scientists so far has come from U.C. Berkeley professor Matteo Garbelotto and his "[SOD-Blitzes](#)." These events start with educating a local community, who then go out into their forests to collect samples and GPS coordinates. These new data points are then used to expand our knowledge of exactly where the pathogen is in a localized area and inform management decisions for that community. There are other examples as well, such as the [OakMapper](#) website and the work of UC Master Gardeners in counties around the state, but there is still much room for expansion in this realm.



There are any number of reasons to engage citizen scientists for this kind of work: stretching reduced agency budgets, increasing people's science literacy, data and management plans tailored to the local level, etc. The best reason for me, though, may be emotional – the personal connection that people have to the land they learn about and help to take care of through this kind of work will last far longer than any individual disease outbreak might. Indeed, the initial work on sudden oak death might not have happened had not a dedicated cadre of citizens demanded to know what was killing their beloved oak trees. In the face of uncertain budgets and emerging threats to our forests and wildlands, that kind of stewardship may be the best chance for our remaining natural places.

Tags: citizen scientist (1), SOD-Blitz (1), stewardship (1), volunteer (1)

California's Changing Landscape

Author: Christopher A. Lee

Friday April 24 2009

Since *Phytophthora ramorum* is most active in the late winter and early spring, this part of the year is when we spend the most time out in the field sampling and monitoring for the pathogen. Here are some of the signs of spring I've seen in the past few weeks en route to our field plots:



Calypso orchid (*Calypso bulbosa*)



Shooting star (*Dodecatheon hendersonii*)



Minor cicada (*Platypedia minor*)

In the north coast, *P. ramorum* shows up primarily in two forest types: (1) redwood forests with a secondary story of tanoaks and other scattered hardwood trees and (2) Douglas-fir / tanoak-madrone forests, also with other hardwood trees. Some people call this second type the "north coast mixed evergreen" forest, but this label can also encompass many other combinations of evergreen trees.

I've seen the most prolific wildflower growth on sites where the forest gives way to more open landscapes. In Sonoma, Mendocino, Humboldt, and Del Norte counties, these open places are often historic prairies or oak woodlands being slowly invaded by conifers. The woodlands and prairies stayed open in the past through frequent wildfires, many of which were set by Native Americans for a variety of reasons such as hunting, travel, maintenance of plants important for food and basketweaving, or clearing of habitable sites. Some land managers, such as Redwood National and State Parks, have begun ambitious programs of prescribed burning on these sites to clear out the invading Douglas-fir saplings and keep the sites open.

In some areas, historically open spaces are being invaded not by conifers, but by the primary sporulation/transmission host of *P. ramorum*: California bay laurel. By comparing historic aerial photographs to current ones, researchers from UC Davis, Sonoma State University, and the University of North Carolina at Charlotte determined that over the past half-century, open spaces in some areas of Sonoma County are shrinking and that most of these spaces are being filled by bay laurel (read the article [here](#)). This has implications for the spread of Sudden Oak Death in these areas, both because of a more continuous area

of host trees and a more humid environment in the newly forested spaces.

In contrast, *California Agriculture reports* in its latest issue that climate change can be expected to alter the distribution of many plants native to California--and the issue spotlights bay laurel, predicting that its overall distribution will shrink. However, this may be true mostly for hotter and drier locations like the Sierra foothills, where *P. ramorum* has not been found.

Studies like these illustrate the dynamic nature of Western forests. They also show that our decisions, actions, or lack of action make a difference. There is no natural balance point that forests will reach if we leave them alone; rather, we have to decide collectively whether we are comfortable with our forests' changing from what the Native Americans and the first European settlers saw when they lived here. Left unchecked, forest succession, natural disturbances such as wildfire, and introduced disturbances such as *P. ramorum* will all ensure that these changes will be large ones.

Snakes and other Uninvited Guests

Author: Nicole Palkovsky

Wednesday April 22 2009

In hot weather people tend to seek shade and restful activities during the day, waiting for the cooler nights to increase their movement; so too for snakes, at least that is my conclusion after multiple snake sightings last night.

As we made our way on Coastal Fire Road to Pantoll Station in Mt. Tamalpais Park, sitting squarely in the center of the road was a juvenile coastal rattlesnake. It seemed stunned, rather than energized, not even giving a small warning as I nearly stepped on the seemingly inert brown *clump*. As the clump transformed before my eyes into a beautiful snake, I made a mental note to watch the trail(side) more closely.



Coastal Rattlesnake (courtesy of <http://www.californiaherps.com>)

The extra attention paid-off as we were treated to two more snake sightings that night: a rubber boa and a ring necked snake. Afterward we reveled in our good fortune, as these natives are not commonly seen.



Rubber Boa (courtesy of <http://www.californiaherps.com>)



Ring-necked snake (<http://www.californiaherps.com>)

The recent sightings of Burmese pythons in the Everglades National Park have not been as celebrated. In the latest issue of the New Yorker Burkhard Bilger spends time with wildlife biologist Skip Snow, the python hunter, discussing how Everglades National Park came to have an unwanted, breeding population of pythons. As Burkhard explains in *Swamp Things: Florida's uninvited predators*, Snow has been trying, for years, to get officials to notice these pet shop escapees (likely dumped by owners), but there weren't enough sightings to generate any real interest. The general consensus was that spottings were isolated inoculations and the snakes would not become established. In 2003 when some unsuspecting tourists came across an adult alligator battling a full grown python and drew the world's attention to the snakes, Snow was called in to investigate. He discovered an established breeding population- more than 900 snakes have been found to date.

When one reads a story like the above, it may seem obvious what should have been done, but in reality dealing with introductions is rarely clear-cut. Knowing how, if and when to deal with an invasive species has challenged biologists, natural resource managers, and regulators for decades. Even when *immediate* responses are mounted, management can be difficult.

Take *Phytophthora ramorum* for example. By the time Sudden Oak Death was noticed in Marin *P.ramorum*, was already well-established. Due to its microscopic nature it had avoided detection and because it was a new pathogen, it was initially difficult to identify. Despite the uncertainty (the exact cause was unknown when efforts began) Marin County mounted an immediate response, working to localize and minimize the impacts. California moved quickly to create a task force to ensure a collaborated effort -working with other states and countries to minimize spread. Management strategies vary with levels of infection - small pockets call for eradication, where it is not yet detected prevention - and these differing management efforts must all be made in parallel with an increasing and changing understanding of the

pathogen; not very clear-cut.

So what do introductions, be it pythons or *P.ramorum*, have in common?

There is one commonality worth noting: the human role. Intentionally or unintentionally, we humans move species from their native habitats to new geographic locations where they can quickly become uninvited guests, overstaying their welcome, almost impossible to send home. Given the challenges we face in addressing invasive species once they are established, it seems a reasonable first step would be ensuring we, as individuals, minimize our role in introductions. A thought worth considering on Earth Day?

Tags: Everglades (1), invasive species (2), pythons (1), Phytophthora ramorum (20), snakes (1), sudden oak death (31)

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The Garden

Author: Christopher A. Lee

Monday April 20 2009

In 16th and 17th-century England, courtiers and writers regarded nature as most beautiful when combined with human artifice and ingenuity. They didn't have quite the same concept of the beauty of wilderness that so many of us have today. Here's an example of an idealized nature from "The Garden," a famous poem by Andrew Marvell (1621-1678):

What wondrous life in this I lead!
Ripe apples drop about my head;
The luscious clusters of the vine
Upon my mouth do crush their wine;
The nectarine and curious peach
Into my hands themselves do reach;
Stumbling on melons as I pass,
Insnared with flowers, I fall on grass.

(By the way, to bring things back around to *P. ramorum* territory: oaks, laurels, and "bays" show up in Marvell's poem, too, all as part of a carefully sculpted landscape that figures the poet's idea of a well-manicured Eden.)

These days, we still strive for those beautiful, perfect gardens. As part of this effort, invasive insects and diseases often hitch a ride in on plants coming from foreign countries, as other writers in this blog have already mentioned. Then those pests often spread through other kinds of human-directed activity. I read this week that the [emerald ash borer](#) has been found in western Wisconsin and is strongly suspected to be present across the border in eastern Iowa as well. This is one of those surprises that shouldn't be a surprise to those who follow invasive insect issues. This beetle, responsible for killing millions of ash trees in ten states and two Canadian provinces, appears to have hopscotched across nearly the entire state of Wisconsin, where it was until now observed only in the eastern part. Pests have a way of doing this. [Entomologists think](#) that the beetle traveled across the state in infested firewood carried by some unsuspecting person.



Emerald ash borer. Photo courtesy of David Cappaerts, Michigan State University

Reading this made me think about how many forest disturbances have their origins in urban or suburban settings and then radiate outward into wild environments. In some cases, this is because we're not all that different from those Early Modern folks--always busy planting flowerbeds, selecting trees, digging ditches, laying out gardens, putting down compost, all that stuff to make our immediate environment more perfect. Sometimes a pest finds its way from foreign shores to our own and wreaks havoc. Of course, there are also human-influenced disturbances associated with the wildland-urban interface--such as wildfires and ozone damage to trees--that don't have quite as direct a connection to our landscaping activities.

It's a huge challenge, almost overwhelming, to think about how our gardening, and the rest of our varied lifestyles for that matter, fit into the bigger picture of how our forests are changing. I know I'm not very good at it. Part of the problem is that it's not always very clear what needs to be done on a large scale to safeguard landscapes from invasive species introductions.

On the individual level, and for individual insects and pathogens, we often know what to do; [here](#), for example, are some things you can do to avoid spreading *P. ramorum*. But collectively, as trade in plants (and everything else) around the world increases, perhaps we need a list of clear recommendations that apply to invasive species as a whole so that we can contact our elected officials and voice support for their implementation.

Does such a list exist? I'm in the information-providing business, not the policy-formation one, so I admit my ignorance. If you know of one, please let me know, and I will pass it on to our blog readers. When I look at web sites such as [this one](#), I have to admit it looks daunting, technical, and very case-by-case (this regulation for ballast water, that regulation for weed seeds, and so on). As far as invasive species go, where is the unified machinery that has enabled ordinary people to understand, say, the threat of global climate change so well?

Maybe, like Marvell and his contemporaries, we are as a society comfortable with the notion that change is OK. If so, it will be interesting to see what our

wild forests look like a couple of centuries from now. Very different, I would think.

The Amazing Zoospore!

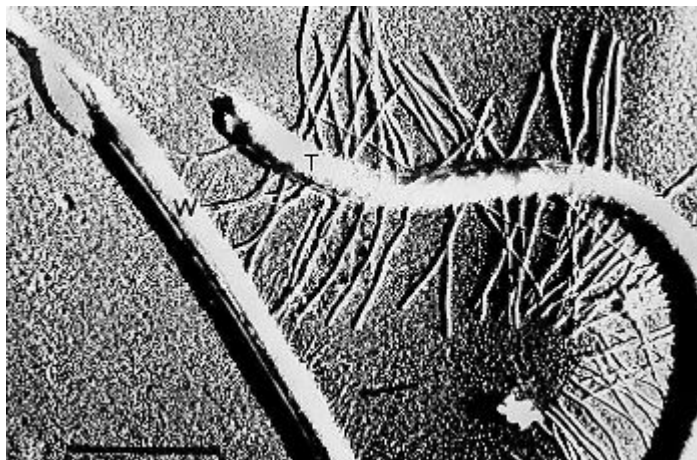
Author: Nicole Palkovsky

Friday April 17 2009

If my last blog was not enough to make you think *Phytophthora* are incredible, perhaps today's post will convince you.

In talking with Steven Swain, our Horticultural Advisor about *Phytophthora* he shared what he what he called, "The *coolest* things about *Phytophthora*: the zoospores." Here are the highlights, with some additions from yours truly.

For starters the zoospores accomplish movement in a unique way. If you are familiar with single celled organisms, you'll know that many of them "swim" by use of cilia or flagella that often stick out the back and accomplish movement by a series of twists and turns. *Phytophthora* zoospores actually have two flagella: a whiplash flagellum that sticks out the back and pushes the zoospore along and a tinsel flagellum that protrudes out the front. The tinsel flagellum has protrusions like branches on a tree, that open and close, thereby pulling the zoospore along.



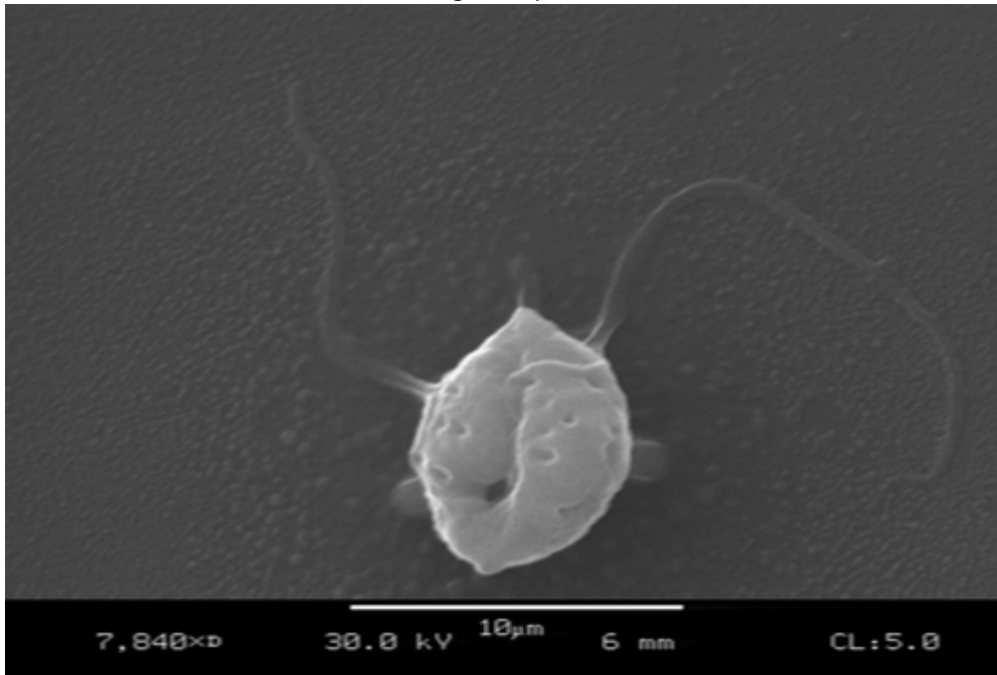
Tinsel flagellum of *Phytophthora infestans* source unkown

The flagellum also doubles as an "antennae", so to speak, guiding the zoospore through the world. It uses different taxes, pronounced tæk-si-z, to accomplish this feat. Taxis is simply (or not so simply), an innate behavioural reponse to a directional stimulus. *Phytophthora* flagella exhibit several: phototaxis (attraction to light), chemotaxis (response to chemical gradients), geotaxis (attraction due to gravity), and electrotaxis (response to a electrical field).

What all this means is, the zoospores can detect light and swim toward or away from it, they can sense chemical gradients and react accordingly, they can detect gravity and swim up, and they can detect unique electrical fields. In

the case of *P. sojae*, it swims along through the soil until it senses the distinct electrical field of soy plants. Once detected it makes its move. Any other plant's field will *repel* the zoospores.

This single celled organism is capable of experiencing the world in so many dimensions it is incredible. Amazing zoospores!



Micrograph of zoospores (courtesy of wikimedia)

Tags: chemotaxis (1), geotaxis (1), phototaxis (1), Phytophthora (4), taxes (1), taxis (1), zoospores (1)

Beauty in the Beast?

Author: Nicole Palkovsky

Wednesday April 15 2009

Education and outreach on sudden oak death often address the *beastly* aspects of *Phytophthora ramorum* - namely the mortality it causes and the long term impacts. This is to be expected with an introduced pathogen as its effects can be devastating.

There is another side of course - the beauty of this beast. While looking at micrographs of *P. ramorum* sporangia, I was reminded of the beauty and complexity of this oomycete.



Micrograph of sporangia courtesy of Dave Rizzo

Unlike other *Phytophthora* species that you may be familiar with - which infest roots and are primarily soil and water borne - it is thought that *P. ramorum* mainly spreads aerially and tends to infest the above soil parts of plants. It does this by producing sporangia (pictured above) which contain zoospores. The sporangia themselves can be airborne, and when they land on a suitable host, they either germinate directly or release their bounty of tiny zoospores (8-10 on average). When conditions are right (wet and/or optimally 18 -20°C)

the zoospores then readily infect the host.

According to work done by the Garbelloto Lab, it may take as many as 10, 000 sporangia to infect an oak! This seems astounding, until you consider that most of these sporangia are formed on nearby foliar hosts, like California bay laurel (*Umbellularia californica*), where a small amount of infected tissue can contain thousands of these spore producing bodies. If you are a susceptible oak within 10m of a bay tree, consider yourself in trouble. In a strong, wind-rain event, sporangia can travel up to 1/2 a mile!



P. ramorum's biology is fascinating and complex and though it may be easier to focus on the beastly qualities of this oomycete, every now and then, I like to pause and admire its beauty.

Tags: micrograph (1), Phytophthora (4), sudden oak death (31)

Recreational Hazards

Author: Janice M Alexander

Monday April 13 2009

It seems like the biggest hazard in recreating in California's many national, state, and regional parks is not making a campground reservation early enough. Last night, my family finally found a summer spot at a state parks campground in Mendocino - but not until mid August. That's the price we pay for such wonderful, inexpensive recreation within a few hours drive. That, and dirty, dirty clothes.



Of course, there are other issues to consider when we're out in California's forests. In the past week, I've noted three separate recreation-and-Sudden-Oak-Death mentions in local media: [avoiding irritating pests \(and SOD\)](#); [campfire restrictions because of fire hazards \(due to SOD\)](#); and [trail closures \(due to SOD\)](#). On top of that, the question of whether and how recreational visitors might spread the pathogen to new areas is one I get regularly. (Not to mention, it's already been a previous blog post of mine.)

Recreational users of our forests can spread *Phytophthora ramorum* - researchers have shown that they can carry clumps of infested mud along trails and back to their cars and homes ([read the details here](#)). The issue is how this level of spread compares to that of natural spread from the leaves of hosts in the forest, or from infected nursery plants trading around the globe. In any case, there are some [simple sanitation steps](#) that forest visitors can take to ease their minds and reduce their chance of spreading disease.

Ultimately, the recreation question is one I never get tired of because it shows me that people are concerned about our forests and our impacts on them. Any step individuals can take to protect our forests - from Sudden Oak Death or other threats - creates a sense of stewardship and connection that is larger than that single action. We owe it to ourselves and our forests to foster that sense of stewardship as much and as often as we can.

Make your camping reservations now!

Tags: California camping (1), recreation (1), sanitation (2), sudden oak death (31)

Tomatoes and Tanoaks

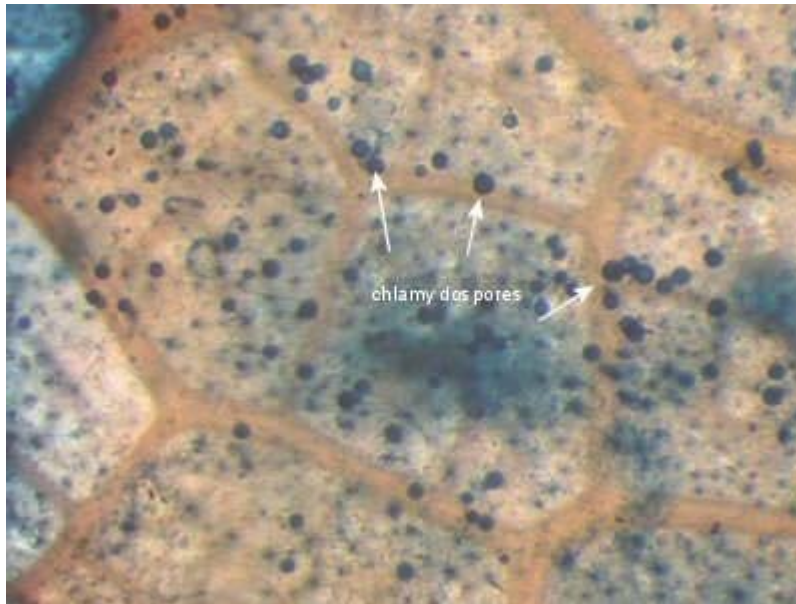
Author: Christopher A. Lee

Friday April 10 2009

Nicole's last blog entry about tomato late blight, caused by *Phytophthora infestans*, was pretty interesting, and it inspired me to look up some more information about the disease and its management. Given that both tomato late blight and sudden oak death are caused by members of the *Phytophthora* genus, one might expect some common themes to show up. And they do. Following are what I think are some of the more interesting parallels, with quotes about late blight (in italics) from the [University of California Integrated Pest Management Program](#):

"Late blight is found when humid conditions coincide with mild temperatures for prolonged periods. When humidity is above 90% and the average temperature is in the range of 60° to 78°F, infection occurs in about 10 hours." As I noted in an earlier blog post, researchers at UC Davis have observed that the greatest quantities of *P. ramorum* spores are detected in the field when we have rains during April, May, and June. (Incidentally, these conditions can also promote tree infection by a variety of other fungi.)

"The fungus overwinters in potatoes, tomatoes, hairy nightshade, and possibly in the soil. Spores of the fungus are easily spread by wind to other plants Remove any nearby volunteer tomato and potato plants and nightshades Disc tomato fields in fall to eliminate a winter reservoir for the fungus." The resemblance between late blight and the diseases caused by *P. ramorum* is pretty striking here. Whereas *P. infestans* overwinters in the members of the nightshade family mentioned here, *P. ramorum* appears to overwinter—and, perhaps more importantly, *oversummer*—mostly in leaves of the California bay laurel. Because of this, experiments on controlling *P. ramorum* at a larger scale in the field have primarily involved removing the hosts that play the largest role in harboring and transmitting the pathogen (bay laurel and tanoak). Note that this doesn't necessarily entail the removal of *all* of these hosts in a given area—rather, *strategic* removal of the ones near tanoaks or true oaks, within the distance that spores can be expected to fly in rainy weather, is warranted.



P. ramorum survival structures (chlamydospores) in bay laurel leaf (chlamydospores are blue). Photo courtesy of Jennifer Parke, Oregon State University

"Apply a protectant fungicide before disease development begins; once an outbreak occurs in a field, it is important to apply additional applications at regular intervals. Coverage must be thorough for applications to be effective."

In both the nursery and forest situations, fungicides are also primarily useful as prophylactics, rather than cures, for *P. ramorum* infection. When applied to nursery plants that are already infected with *P. ramorum*, most of the common contact fungicides (such as mefenoxam or metalaxyl) will suppress symptoms but not eliminate the pathogen from the plant. Similarly, the systemic fungicide phosphonate, which is useful as a preventative, is usually ineffective after oak or tanoak trees are infected with *P. ramorum*. Only in cases of extremely small infections on coast live oaks can phosphonate sometimes slow down the course of infection.



Doug Schmidt from UC Berkeley injecting tanoak tree with phosphonate fungicide. Photo courtesy of Radek Glebocki, UCCE

"Tomato varieties resistant to certain races of the late blight fungus are grown where the disease occurs regularly." Nicole mentioned the availability of these resistant varieties in the case of tomatoes. The concept of growing resistant trees is one that has also occurred to people who research *P. ramorum*. However, since our understanding of this particular *Phytophthora* is still

young, there is a long way to go. Because of the multiple steps required to identify the genetics behind resistance and to breed and test seedlings for resistance both in the greenhouse and in the field—complicated by the longevity of trees as compared to field crops—the identification of tanoak and oak individuals that are resistant to *P. ramorum* could easily be 15-30 years away.

Not that this is meant to strike a note of helplessness or doom. Rather, it just goes to show that versatility, toughness, and adaptability seem to be traits that many species of *Phytophthora* share—imperiling tomatoes and tanoaks alike!



P. infestans infecting a potato sprout touching an already-infected tuber. Photo courtesy of D. Inglis

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Tomato Time

Author: Nicole Palkovsky

Wednesday April 8 2009

The UCCE Marin Master Gardeners' Organic Heirloom & Hybrid Tomato Market will be held on Saturday April 18th and Sunday April 19th. There will be an amazing selection of seedlings on hand.



UCCE MARIN MASTER GARDENERS'

Organic Heirloom & Hybrid Tomato Market

A Plant Sale Supporting Sustainable Garden Education!

Saturday, April 18

9 am - 12 Noon

Pini Ace Hardware - Nave Shopping Center
1535 S. Novato Blvd., Novato

Sunday, April 19

9 am - 12 Noon

Marin Art & Garden Center
30 Sir Francis Drake Blvd., Ross

Yes, it is that time of year - time to choose which tomato varieties to plant. I usually end up planting at least two varieties, and many people plant 6 or more. So how do you choose? With thousands of varieties available -the UCCE Market will have almost 30 for sale- the selection can be difficult. There are small, early ripening tomatoes, larger beefsteaks, slicers, and thick luscious heirlooms not to mention endless colours - green, yellow, pink, light red, deep red, purple and the list goes on. After gastronomic considerations, one must also take microclimate into account and, for many growers, resistance to late blight - a disease that can infect stems, leaves and fruit, dashing all hope of homegrown tomatoes.



Late Blight on Tomatoes Photo Courtesy of UC IPM

Late blight of tomatoes is a disease caused by *Phytophthora infestans*, the same pathogen that caused the Irish potato famine of the 1840's, and a close relative of *P. ramorum*, the pathogen that causes sudden oak death. Unlike *P. ramorum*, which has a broad host range, *P. infestans* usually only infects plants in the nightshade family (Solanaceae). That said, it is likely one of the most infamous members of the *Phytophthora* genus due to the staggering devastation it caused in Ireland.



Juliet F1 Varietal, Photo Courtesy of Garden Stuff

P. infestans is clearly still an important pathogen, though for many of us, the main concern is making sure it does not wreak havoc with our tomatoes. That is where the Master Gardeners can help. At the market you can find Juliet F1 and Legend varieties, both said to resist late blight. There are no guarantees of course, but with the promise of sweet, fresh tomatoes, it is worth a shot.

Bark Beetles in our Forests

Author: Nicole Palkovsky

Monday April 6 2009

The front page of the [Thursday's San Francisco Chronicle](#) had an article on anticipated climate change in California. Unsurprisingly, we are to expect "less water, more frequent and intense wildfires, heat waves and bad-air days".

The article also mentioned that we could see, worst case scenario, temperature increases of up to 3 degrees (F).

Significant temperature changes are not good news for forest health issues and 3 degrees is definitely significant. When temperatures rise, and water is in short supply, forest systems become stressed, and stressed trees are more susceptible to secondary pathogens and insects.

A good example of this is lodgepole pine trees in (my native) British Columbia. The province has experienced several mild winters, and drought-like summers; ideal conditions for Mountain Pine Beetle (*Dendroctonus ponderosae*). This combined with the large, mature stands of lodgepole pine in the interior of British Columbia, has created a bark beetle epidemic.



When Sudden Oak Death was first observed, in 1995, bark and ambrosia beetles (*Pseudopityphthorous pubipennis* and *Monarthum dentiger* and *M. scutellare*) were often found in large numbers in weakened or dead trees. As scientists scrambled to unravel the mystery, one hypothesis put forward was that the bark and ambrosia beetles might play a significant role in disease spread. In fact the beetles were not vectoring *Phytophthora ramorum*, rather just taking advantage of trees already weakened by the pathogen.



In a healthy forest ecosystem, bark beetle populations are kept in check and these "pests", working in concert with native fungal pathogens and fire, play an integral role in natural thinning and nutrient *recycling*. But when things are out of balance (due to abiotic factors, or an introduced pathogen, etc.) their numbers can explode creating an excessive fuel load (i.e. lots of dead trees).



Bark beetles don't just attack in forest systems - as our Master Gardeners can tell you - they also target stressed trees in urban settings. As we head into the warmer months, the oak bark beetles will be taking flight, searching for hospitable (weak) hosts. You can recognize signs of beetle attack on oak trees by the reddish frass they produce (see image below). You may even see some of the beetles (above) though that is unlikely.



If trees on your property are attacked and killed by bark beetles be sure to address their felling/removal/diposal in a timely fashion, as dead trees near your home, like those in the wildland, can increase the risk of fire.

I have greatly oversimplified the biology of these insects for the sake of the blog, but should you be interested in reading more about [mountain pine beetles](#) or [oak bark beetles](#), follow the hyperlinks.

The "Other" Red Oaks

Author: Christopher A. Lee

Thursday April 2 2009

All this blogging about California's oaks has got me thinking about . . . Arkansas' oaks!

Or, as I should say, about oaks of the eastern U.S.--Arkansas just happens to be where I'm from, and where I'm most familiar with oaks. Several kinds of eastern oak species from the red oak subgroup have been found in the laboratory to be susceptible to *Phytophthora ramorum* infection. What this means, of course, is that if the pathogen makes it to that area of the country, sudden oak death could be a major problem there.

Susceptible oak species dominate many eastern forests. Two important species, northern red oak (*Quercus rubra*) and southern red oak (*Quercus falcata*) have already been found infected in natural environments in Europe. These oak species have already been suffering for some time from a decline involving several disease and insect pests, such as the two-lined chestnut borer (*Agrilus bilineatus*), red oak borer (*Enaphalodes rufulus*), *Armillaria* root disease, and the decay fungus *Hypoxylon atopunctatum*. Periodic droughts, as

well as a lack of recurrent fires (allowing more shade-tolerant hardwood trees to compete with the red oak species) have stressed thousands of acres of trees, greatly exacerbating the problem.



Red oak borer. Photo courtesy of Gerald J. Lenhard, bugwood.org

Enter sudden oak death, and it could be curtains for thousands more of these beautiful trees.



Northern red oak. Photo courtesy of Susie Lee

Tags: Armillaria (2), Eastern U.S. (1), Hypoxylon (1), insects (1), oak health (4), sudden oak death (31)

The past, present and future of our oaks

Author: Nicole Palkovsky

Wednesday April 1 2009

Janice's blog on Monday got me to thinking about our historic, present and future relationship with oak trees.

According to "*The Life of and Oak*" the varied etymology of the word oak in northern languages indicates the importance of this plant to past cultures. The English, Dutch and German words *-ac*, *eik* and *Eiche* are related, but other European languages have completely different origins: the Latin *quercus*, *chêne* in French, *roble* or *encino* in Spanish and *deru* in Celtic.

It is easy to understand the historic significance of oaks, a tree that provided abundantly to our ancestors: food for humans and animals (livestock and wild), timberwood, fuel, and quality wood for ships, flooring and furniture.



Oaks still provide so much, I think of them as the "*Giving Tree*" - we climb on their branches, take their acorns, bask in their shade, cut them down for fuel and construction material and finally take rest on their stumps. And, like in the book of the same title(which feautres an apple tree), we love our trees. In the Northern Hemisphere, though oaks are a familiar site, they evoke a strong, emotional response.



Given the decline in oak numbers, in the future our role may be more of the *giver* providing stewardship and protection. Some of that will come in the form of research and management, trying to understand pathogens like *Phytophthora ramorum* that have killed many red oaks in California, some will be out of our control like abiotic factors that contribute to weakening and killing of oaks over time. But human influence, through time, should not be underplayed - clearing for development, pollution effects and mechanical injury have claimed many oaks as well. We will have to decide what the future of this long relationship looks like, for now I'll leave it with a "?"

Tags: historic oak (1), oak etymology (1), oak uses (1), sudden oak death (31)

Why is Sudden Oak Death in California?

Author: Janice M Alexander

Monday March 30 2009

That's a question that I get asked fairly regularly, and there is a simple answer ("the pathogen was introduced on imported nursery plants") and a much more complicated one. Really, the questions that people want answered are "Why does this pathogen kill trees the way that it does? What allows it to establish itself and spread so easily in our forests? Why are so many plants hosts and why do so many susceptible oaks die?" The answers to those questions can be a bit more complicated.

Researchers are still not sure why this organism, contrary to the proper etiquette of a good pathogen, kills some of its hosts outright. Without this fatal (pardon the pun) flaw we might never have noticed or cared that a new *Phytophthora* species was out in our forests and yards. But notice and care we did, so then the second issue - how and why does this pathogen establish itself and spread in our forests - comes to the fore. Now that we recognize the key role that California bay laurel and other foliar hosts play in spreading the pathogen and infecting nearby oak trees, our focus is often directed at the relationship between these bay and oak trees, and whether we can or should change that relationship.

Which brings me to the secret subject of this post - what did California's oak forests look like historically? This came to mind as I read a recent article in the San Francisco Chronicle about an ecologist trying to determine the historical extent of valley oaks in the Silicon Valley. Can you imagine 60,000 oaks blanketing the hills and valleys of the south bay? (see <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/03/27/DD2Q1619AU.DTL>)



What really caught my eye though was a comment posted online suggesting that the presence of Sudden Oak Death makes the possibility of ever restoring or maintaining such a vast oak forest in California completely unattainable. This may or may not prove to be the case - researchers are now looking at genetically resistant tree stock, forest management techniques, various preventions and cures - but it does bring up the questions of how our forests historically looked and functioned and how we want them to look and function in the future. Sudden Oak Death will clearly play a role in the future of California's oak forests, but the extent of that role will partly be up to us.

Tags: [historic extent of oaks \(1\)](#), [oak woodland restoration \(1\)](#), [sudden oak death in California \(1\)](#)

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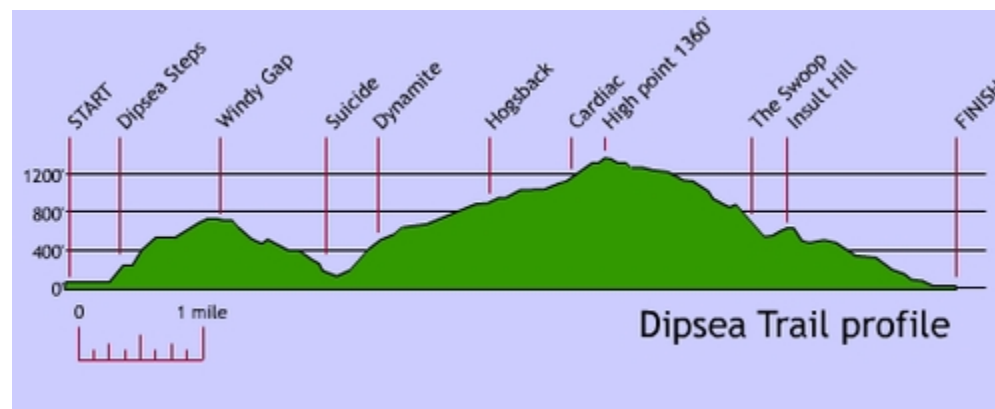
Dipsea Madness

Author: Nicole Palkovsky

Friday March 27 2009

If you are not already in full Dipsea swing then you are likely not affected by Dipsea Madness; a little known and poorly understood affliction with disease hot spots in Marin County. For some this ailment begins in March when applications are due, for others it starts on New Year's and for a select few it is a year-long occurrence. What is Dipsea Madness? A complete obsession with all things Dipsea related.

The Dipsea, first run in 1905, is the oldest American trail race. This year marks the 99th running and with only 78 days until race day, those of us invited back, or hoping to get in, are deep into our training. From now until Sunday June 14th all things will be measured by minutes to the top of Cardiac, the infamous crest of the race where most runners, no matter where they finally finish, feel like they are about to die.



(Photo courtesy of <http://www.dipsea.org>)

The 7.4 mile course, starts in Mill Valley and makes its way through Muir Woods, winding up to Cardiac Hill (near Pantoll Station), finally coming out in Stinson Beach. Some of the more scenic parts of the trail meander through mixed redwood -tanoak stands that have been heavily impacted by Sudden Oak Death.

As I ran the trail yesterday I noticed just how many tanoaks have died and

failed in the last few years - in some areas all the tanoaks from seedling to mature tree have died. One can't help but wonder what the long-term impacts will be on these stands and their inhabitants. Will good luck oak, a coast live oak whose branches reach down on the trail, be there to pat us on the back in years to come? Will the trail become more exposed as large tanoaks fall and open the canopy? What will replace them? And, as the main acorn bearing tree in these forests, how will wildlife be affected? The full extent of the impacts are yet to be realized, but it is clear that the forces of *Phytophthora ramorum* have taken a stronghold along much of this famous trail.



Come race day, 1500 lucky folks, will get to run their hardest on the Dipsea trail. People will come from around the country, hoping to take home a

coveted black shirt, given to the top 35 finishers, or at least a survivors commemorative t-shirt and pin. What they are not planning on taking home is *P. ramorum* – the aggressive pathogen that causes Sudden Oak Death and Ramorum Foliar Blight. So, if you are one of the fortunate to run this year's race, be sure to clean your shoes so that all you take home from Marin and the Dipsea is a great shirt!

For more information on:

sanitation visit suddenoakdeath.org

[nature's hitchhikers](#)

[tanoaks in our forests](#)

Tags: Cardiac (1), Dipsea (1), Marin (1), Muir Woods (1), Phytophthora ramorum (1), Sudden Oak Death (31)

Tanoaks Big and Small

Author: Christopher A. Lee

Thursday March 26 2009

Here on the north coast, *Phytophthora ramorum* kills tanoaks almost exclusively. We don't have coast live oaks, and our California black oak population has steadily been decreasing because of land-use changes accompanied by corresponding changes in forest cover (a topic for another blog entry sometime). This year I've had the opportunity to see more majestic tanoaks than usual because of some projects we've been involved in—projects to save large tanoaks by applying a systemic fungicide that prevents infection by *P. ramorum*.

What we often see in our part of the world are dense thickets of small tanoaks, usually growing in clumps where it is obvious that all the trunks sprouted from the same mass of root tissue. Often these clumps are legacies of cutting in the past, either to clear land or to harvest the trees for the tannin in their bark (most of this occurred around the turn of the 20th century). When tanoaks are cut, the mass of budding root tissue at the base of the tree (called the "burl") is stimulated to produce a multitude of new sprouts to replace the lost trunk. Although they still have the old root system, these areas of young, dense tanoaks haven't established their dominance in the forest yet with expansive crowns, so they usually compete for forest floor space with lots of huckleberry and other shrubs.

Here's an example:



However, here and there on the landscape you can find some groves of “old-growth” tanoak. These specimens easily compete for beauty with any of the true oaks California is famous for. Native Americans valued these groves for their abilities to produce vast quantities of acorns and took care of them to keep them accessible and healthy. Here's a big one:



There's a common misconception out there that foresters and land managers don't value tanoak or think of it as a "weed" tree because it lacks economic value in the wood markets of today. It is true that land managers sometimes try to discourage tanoak growth in certain stands of trees so that they can reforest those areas with conifers such as Douglas-fir. But this doesn't mean that they always think of tanoak as a weed. In these cases, as with all land management activities, it's important to think about management goals for the

land and how best to work with the land to enhance an abundance of values.

In many cases, by attempting to control tanoak, foresters are trying to return to its historic condition land that was cut over years ago and left without any attempt to replant the Douglas-firs that originally grew there. In other cases, the soils, topography, and moisture conditions on the site are perfect for growing Douglas-firs, so the property foresters are trying to maximize the capabilities of that land to grow what is marketable. Tanoak is a beautiful wood with a lot of character, and if people come to value wood with these qualities, industrial forestry attention could shift away from its strong focus on Douglas-fir.

This also fits in with a larger societal picture of trying to take responsibility for our own needs for wood in California by growing and buying local rather than importing all our wood from places like Canada and Brazil that lack California's stringent environmental regulations (check out this [report](#)--thanks to Yana Valachovic for the reference). As we try to puzzle out all the pieces of this complex picture by fitting needs for wood products into just-as-compelling needs for ecosystem stability and connectivity, aesthetic beauty, and wildlife habitat, we come to realize that tanoak is an important piece of the puzzle—and we see the damage that non-native, invasive species can potentially do when they rob us of such pieces.

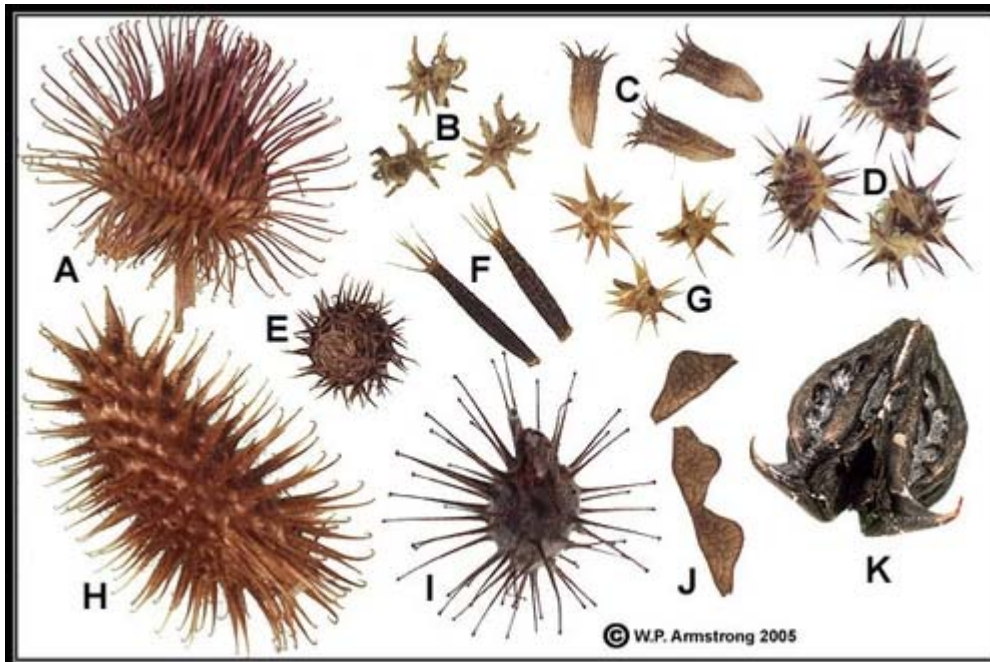
Tags: economic value (2), forestry (2), natural resources (1), Phytophthora ramorum (20), tanoak (5)

Hitchhiker's guide to the universe

Author: Janice M Alexander

Monday March 23 2009

I don't know if hitchhiking is so common anymore in our human communities, but it is a dispersal strategy that is alive and well in the plant world. Take a walk through California's annual grasslands in the summer and check what's left in your boot laces and socks to see what I mean.



(Photo courtesy of <http://waynesword.palomar.edu/plmay98.htm>)

Even organisms that need not rely on animals for dispersal can still benefit from the worldwide movement of plants and animals. Take, for instance, the microscopic water mold *Phytophthora ramorum*, the pathogen that causes Sudden Oak Death and Ramorum foliar blight. Genetic analyses suggest that *P. ramorum* was introduced to California as an unknown, unseen hitchhiker on imported nursery plants. Now, in areas where it is well established in wild forests and landscapes, *P. ramorum* can hitchhike again, on the feet, hooves, paws, and tires of large animals.

As we enter spring, a time of planting in our gardens and venturing back out into our forests, it is good to remember the hitchhikers, seen and unseen, around us. Simple steps can help discourage the unwanted hitchhiking species around us, be they deadly plant pathogens or merely annoying weed seeds.



Tags: dispersal (1), Phytophthora ramorum (20), sanitation (2), weeds (1)

Spring Fever

Author: Nicole Palkovsky

Friday March 20 2009

The first signs of spring have arrived in the hills, with early wildflowers like Blue-Eyed Grass (*Sysirinchium bellum*), Indian Paintbrush (*Castilleja affinis*),

Douglas Irises (*Iris douglasiana*) and Mosquito Shooting Stars (*Dodecatheon hendersonii*) blooming along the trails. As Mother Nature shows her handiwork, my eyes have turned to my own garden, and started me thinking about spring plantings and general landscaping.



Deciding what to plant can be an exciting challenge at best and an arduous task at worst - one has to consider microclimate, drought tolerance, native vs. ornamental, and the list goes on and on. If you are in a *Phytophthora ramorum* infested county there are added considerations.

Fortunately, the Marin Master Gardeners are creating a great web based tool to help homeowners select plants for their yards. It can guide you in determining your microclimate, evaluate your garden site and select water wise plants that will work in your site.

As for Sudden Oak Death, the general consensus is that plants should not be avoided simply because they are known *P. ramorum* hosts; bay laurel may be the exception. Most foliar hosts are not killed and avoiding all these plants would severely limit the number of natives available for planting, not to mention the undesired long-term effects on species diversity.

It is a great time to get back in the garden, and do a little handiwork of our own so happy planting!

Tags: phytophthora ramorum (20), spring planting (1), sudden oak death (31), water wise plant (1), wildflowers (1)

Sudden Oak Death and the California Drought: It's a Complicated Picture

Author: Christopher A. Lee

Wednesday March 18 2009

The Eureka *Times-Standard* reported yesterday morning that the rain we received on the north coast over the last weekend brought our rainfall totals

up to 78% of normal for the water year. As far as water reserves go, this isn't great, but it's better than it was back in February. Still, it would take a whole lot of water over the rest of the spring to boost our levels up to anywhere close to normal.

Phytophthora ramorum, the pathogen that causes Sudden Oak Death, thrives in moist conditions, so the wetter the winter/spring, the more pathogen spread we usually see. After the wet winter of 2005-06, tree infections exploded across the north coast, and we are still seeing the legacy of those infections showing up three years later in the form of newly dead trees. Since the winter/spring periods between then and now have been relatively dry, the mortality has been tapering off.

The total amount of precipitation is not the only factor influencing the level of *P. ramorum* infection, however—*when* the rain comes is just as important. Rainfall that comes late in the season, especially in the relatively warm months of April, May, and June, tends to be followed by higher levels of infection, since the pathogen thrives not only in moist conditions but also in warm ones. It's in those years, when rainfall coincides with budbreak and new leaf development in a variety of plant species that are hosts for *P. ramorum*, that we see the symptoms that many people think of as classic *P. ramorum* symptoms, such as "shepherd's crooking" on the branch tips of host trees such as tanoak.

This year, I suppose, we'll have to cross our fingers that sufficient precipitation will happen before that warm period. We need the rain—it's important to so many parts of our natural and agricultural environments.



rain gauge

Tags: north coast (1), phytophthora ramorum (20), rain (2), sudden oak death (31)

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The true value of our oaks

Author: Janice M Alexander

Monday March 16 2009

I was chatting with our local Agricultural Commissioner, Stacy Carlsen, last week when he casually informed me that fully one third of all pesticide use in Marin County is due to Agri-Fos, the phosphonate compound used to prevent Sudden Oak Death on susceptible oak trees. One third! If we didn't have SOD in Marin County, we'd be saving that much money, labor, and resources on just this one aspect of the disease.



That doesn't even take into account the dollars that homeowners and land managers spend on removing trees once they've been infected and killed, or the other great lengths they may go to in unfounded attempts to cure trees.

I've been working on an economic analysis of Sudden Oak Death in Marin, trying to get a handle on how much money people spend to treat and manage this problem in our forests. Having a dollar figure attached to SOD will hopefully help focus funders and government agencies on a problem that often falls to individual land owners to deal with.

The true value of the oaks, though, can be seen in the heroic attempts that passionate homeowners and tree lovers will make to protect and save their trees, and the devastation when those attempts fail.

Tags: [economic value \(2\)](#), [sudden oak death \(31\)](#)

Where have all the chanterelles gone?

Author: Nicole Palkovsky

Friday March 13 2009

In the late fall through the early spring, hunters can be seen combing the forests, pocket knife and basket at the ready. Their elusive prey? The flavour packed, trumpet shaped, chanterelle mushroom.



(photo courtesy of Andres Tarasco)

Chanterelles usually show up after a big rainstorm and locally, are most easily found under the leaf litter of mature oak trees. Sometimes all that gives away their location is a little bump in the browning leaves. As mycorrhizal fungi they are associated with tree roots; in Marin those of oaks but in other areas pines, douglas fir and assorted hardwood species serve as the main associate. Harvests are cyclical, and affected by many conditions - tree species, stand age, soil moisture and nutrient status, just to name a few.

The harvest this season has been dismal to say the least, which prompts the question, where have all the chanterelles gone? The rains have been noticeably absent, which may have been enough, but I can't help wondering if there is something else going on. Could the presence of *Phytophthora ramorum* be affecting the number of chanterelles we are seeing this year? How might this new pathogen impact mycorrhizal communities in the future?

We don't have answers yet, but it's certainly food for thought.

Tags: chanterelle (1), phytophthora ramorum. mushroom (1), sudden oak death (31)

On the leading edge

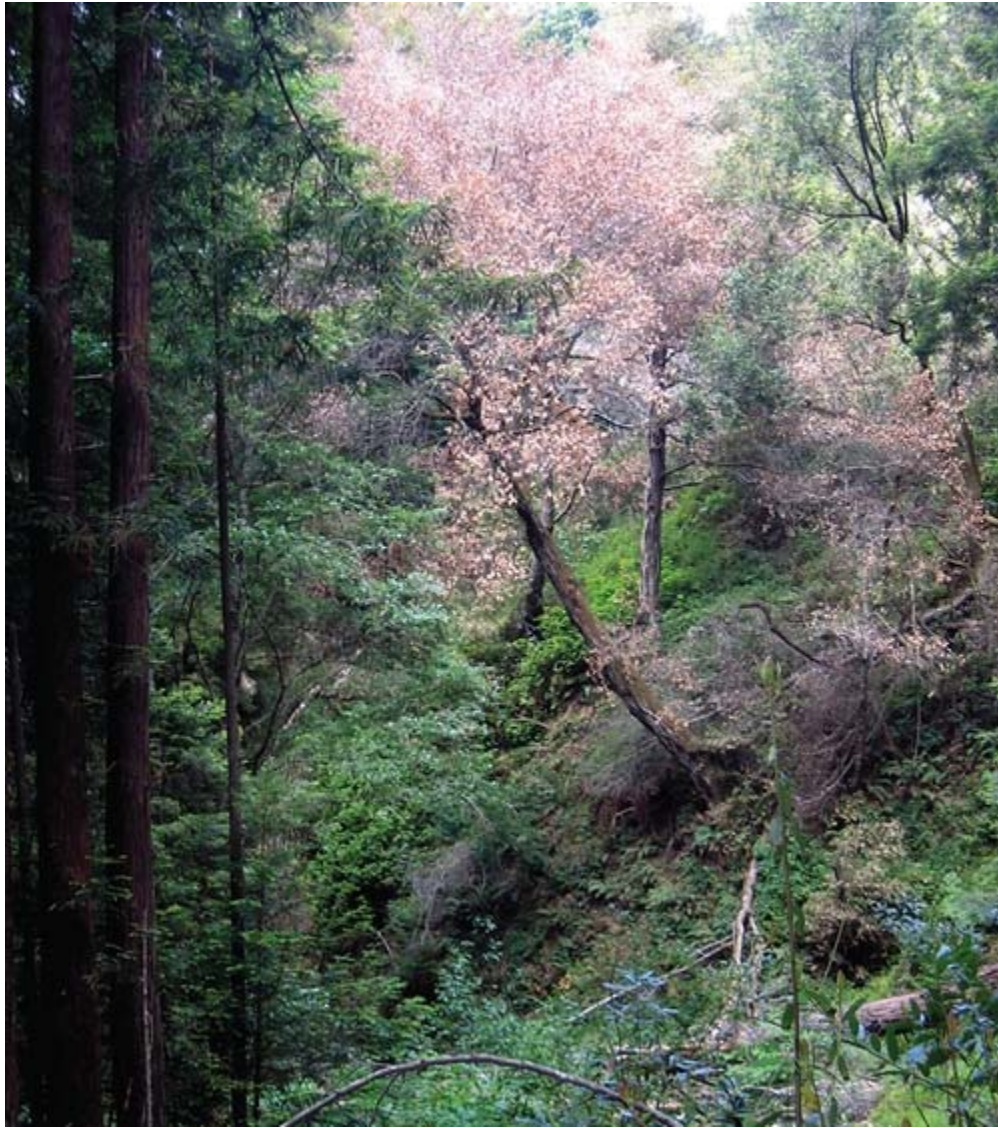
Author: Nicole Palkovsky

Wednesday March 11 2009

Preventative treatments for Sudden Oak Death, and the hard working researchers that discovered them, are prominently featured in the latest edition of [California Agriculture](#).



A misty shot of tanoaks, decorated with spring-loaded injectors, filled with Agri-Fos, the phosphonate compound which protects healthy red oaks from the disease, adorns the cover. Researchers from Matteo Garbelotto's lab are now trying to discover if Agri-Fos can also protect healthy tanoaks. Though much of the attention on Sudden Oak Death has been focused on true oaks killed by *Phytophthora ramorum*- coast live oak, black oak, interior- live oak and shreve oaks - tanoaks have been severely impacted by the disease, with up to 100% of trees dying in some areas. Researchers speculate that this may be due to tanoak being both a foliar host and a bark canker host.



California's drier winters have slowed the spread of Sudden Oak Death and perhaps taken it out of the media spotlight, but outreach specialists - Chris Lee in Humboldt, Janice Alexander and Nicole Palkovsky in Marin and lead researcher Matteo Garbelotto in Berkeley - are trying to stay on top of things so that when the rains come, and *Phytophthora* picks-up, the preventative work will already be in place.

As the CalAg article points out, "One of the biggest challenges in controlling Sudden Oak Death is that prevention is the best treatment, but most efforts begin only after trees are already infected." There is a great deal of science based outreach taking place so that the disease can be addressed before it's a full emergency.

Here are just a few examples of trainings open to professionals and the general public:

Fourth Sudden Oak Death Science Symposium The California Oak Mortality Task Force is organizing its' fourth symposium which brings together scientific and management communities from throughout the world working on *Phytophthora ramorum* and Sudden Oak Death. This forum provides a scientific overview on the state of our knowledge about Sudden Oak Death and *P. ramorum* in forest, woodland,

urban forestry, nursery, and horticultural settings.

Treatment Workshops Matteo Garbelotto offers treatment workshops on the UC Berkeley campus targeting not only tree care professionals and the general public. He makes the information accessible and questions are encouraged. The 2hr sessions, offered monthly during the academic year, cover preventative treatment for the disease. Participants learn which trees to treat, when and how to treat them and are able to see exactly how the treatments are done.

Tags: oak health (4), phytophthora (1), sudden oak death (31), UC Extension (1)

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