Lightning Talks

In 2012, at the 7th International Oak Society Conference in Bordeaux (France) we introduced field trips during the Conference. In 2015, in Lisle (United States), workshops made their appearance. This Conference saw yet another innovation integrate our triennial event: lightning talks.

The first recorded practice of lightning talks dates from 1997, though this appellation only appears in the year 2000, coined by Mark Jason Dominus.

The ingredients? An interesting subject, five minutes, fifteen slides that advance automatically every twenty seconds, a dynamic moderator – in this case, Taylor Lewis of the UC Davis Arboretum and Public Garden – and a good pinch or two of adrenaline.

On your mark, get set, go!

Julianne Skai Arbor (TreeGirl)

Intimate Encounters with Wild Oaks

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Ancient oaks are ecological treasures, but we do not appreciate them often enough for their aesthetic beauty and as living beings with which we can mindfully connect and interact physically. As a certified arborist, naturalist, forest ecotherapist, and photographer in quest of meeting the world's most amazing trees, I capture women intertwined nude in intimate connection with some of the world's most fantastic, famous, and ancient trees, including oaks. My TreeGirl photography aims to remind people that "we are nature" and that being in the physical presence of charismatic trees brings us feelings of awe, connection, and biophilia (affinity for life) – a state of being quercophiles might call "oakgasmia" – a necessary part of mending the modern disconnection between humans and nature that is causing ecological collapse.

Photo 1/ ***The Bowthorpe Oak Nest***

While being fully unclothed is obviously not necessary in order to connect with trees, intimate contact can be – potential hazards aside – a pleasurable experience when done safely. Simply climbing a tree or resting in its presence is healing for the mind, body, and spirit, and provides information from direct experience about a tree that may not otherwise be attainable.

Conservation barriers such as fences, signs, and surveillance cameras, such as those at the famous Angel Oak (*Quercus virginiana*) in South Carolina (U.S.A.), while being well-intended, can ultimately prohibit people from having a personal connection with trees that could help their preservation, as well as create great fine art!

My photographs include these charismatic species from California: *Q. agrifolia* (coast live oak), *Q. chrysolepis* (canyon live oak), *Q. garryana* (Oregon white oak), as well as England's famous millennial *Q. robur* (the Bowthorpe Oak, the Major Oak, the Majesty Oak, and the Wyndham Oak) and *Q. petraea* (the Quarry Oak and the Queen Elizabeth Oak).

Jen Bayer and Hilary Bayer*

Addressing the Roots of Threats to Oaks

Magic, Inc., PO Box 15894, Stanford, CA 94309, USA / *corresponding author: *hilarymetta@gmail.com*

For 40 years Magic has engaged in oak habitat stewardship on 1,000+ acres of Stanford University lands. We began with an eye to sustaining existing California native oak populations by planting acorns and seedlings where natural regeneration was failing. Soon we realized that more was necessary.

We defended oaks against cattle, rodents, vandals, weeds, and fire. We advocated preventing their removal to make way for roads and buildings. We irrigated them through punishing droughts – at first, worse than any in the prior 800 years, and afterwards, worse than any in the prior 1,200 – exacerbated by record heat. We've watched helplessly as an introduced pathogen (*Phytophthora ramorum*) took its toll.

Having come to see the forest for the trees, we've increasingly seen the globe for the forest. In response we've shifted emphasis from what we do on the land to what we do with the human hearts and minds which are driving global ecosystem disruption.

Twenty thousand volunteers have learned with us to work for

Photo 2/ We started by planting acorns. We learned that to grow oaks on the land we also grow valuescience in hearts and minds.

the common good. Through oaks they've reconnected to a natural world increasingly concealed and mediated by technology. They've been motivated to think ecologically about everything from daily habits to underlying questions of value. While we take satisfaction in having established thousands of trees, hundreds of which now tower over us, we know that only by altering ideas about what humans want and how we can get it – and the actions we generate from those ideas – have we any hope of securing the future for oaks and for ourselves.

Adam Black

An Alternative to Seeds for Ex-Situ Conservation

Peckerwood Garden, Hempstead, Texas 77445, USA / *adam@peckerwoodgarden.org*

Photo 3/ Examples of *Quercus hinckleyi* root-sucker cuttings suitable for propagation.

Many of the dwarf, suckering oak species have restricted ranges and face various threats due to their often highly specific habitat requirements, resulting in many being of great conservation concern. Infrequent seed production or consistently non-reproductive populations hinder the development of ex-situ germplasm collections from wild-collected material. We have found that propagation of these species by establishing root suckers excised from plants in situ is remarkably easy compared to conventional rooting of branch cuttings, with nearly a 100% yield when adequate material is available.

A small, vigorous sucker preferably under 20 cm tall, is carefully severed from the periphery of the parent plant with a segment of at least 6-10 cm of the subterranean stolon, and the foliage reduced to minimize transpiration. The cut end of the stolon is dipped in 0.01% IBA. For rooting media, 100% coarse grade perlite or 100% Profile™ Greens Grade™ has proven successful under intermittent mist combined with adequate air circulation. In most cases, root initiation readily occurs in 3-5 months, after which the rooted plants are transplanted into suitable

potting media. This method has worked equally well with suckers collected in late summer (with hardened current-season growth) as with dormant material collected in mid-winter. This propagation technique enhances Peckerwood Garden's conservation efforts with species from West Texas including *Quercus intricata*, *Q. hinckleyi*, *Q. toumeyi*, and *Q. fusiformis* as well as sandhill scrub species from the Southeastern U.S. including *Q. minima*, *Q. chapmanii*, *Q. inopina*, *Q. pumila*, *Q. myrtifolia*, and *Q. margarettae*.

Roderick Cameron

The Problem with Spanish Oak Names

Grigadale Arboretum, Lobería, Prov. de Buenos Aires, Argentina / *roderick@grigadale.org*

Most Western European languages have a name that can be applied to any tree in the genus *Quercus*, one that can be traced to an ancient root that meant "oak" or "tree". The Germanic languages of Northern Europe all have names derived from a common ancestor: oak, *eik*, *Eiche*, etc. As there are few native oaks species in that region, common names use a modifier to distinguish different oaks, e.g., common oak and sessile oak. The Italic languages have more oaks to name and so common names are numerous, but in most cases one name still covers all oaks: *quercia* in Italian, *chêne* in French, and *carvalho* in Portuguese, all descended from a common ancestor.

PIE	Basque / Latin / Arabic	Folk genus	Folk species	Scientifc name
*$h_1$rewd^h-	robur	roble		*Q. robur/canariensis/faginea*
		rebollo		*Q. faginea/pyrenaica*
		roulilla		*Q. lusitanica*
		roble	robledilla	*Q. lusitanica*
			roble albar/albero/del invierno	*Q. petraea*
			roble albar/pedunculado	*Q. robur*
			roble andaluz	*Q. canariensis*
			roble carrasqueño/enciniego/valenciano	*Q. faginea*
			roble negro/negral	*Q. pyrenaica*
			roble pubescente	*Q. pubescens*
*perkw *kar	quercus alqurnúq	alcornoque		*Q. suber*
		corcoxu/corcu/cuerco/curco villano		*Q. pyrenaica*
	quercus?	cajiga		*Q. canariensis*
		cagiga/cajiga		*Q. robur*
		quejigo		*Q. canariensis/pyrenaica*
		quejigo/cajiga		*Q. faginea*
		quejigo	quejigueta	*Q. lusitanica*
			quejigo andaluz	*Q. canariensis*
	cassnus?	carba		*Q. petraea*
		carballo/carvallo		*Q. robur*
		carballo	carballo enano	*Q. lusitanica*
		carrasca		*Q. ilex*
		carrasca	carrasca negra/clofolluda	*Q. ilex*
		carrasca(o)/carrasquilla/carrasquizo		*Q. coccifera*
		coscoja/coscoll		*Q. coccifera*
*dorw		tocorno/tozo/tocio(a)/tociu		*Q. pyrenaica*
?	ilex	encina(o)		*Q. ilex/rotundifolia*
		encina	encina dulce	*Q. rotundifolia*
?	suber	suro		*Q. suber*
	malum folium	marojo/melojo		*Q. pyrenaica*
	matta	mata parda		*Q. rotundifolia*
		matarrubia		*Q. coccifera*
	txapar	chaparra(o)		*Q. ilex/coccifera/suber*
	mufidah	moheda		*Q. suber*

Figure 1/ Common names in Spanish are numerous and derive from several roots in Latin, as well as Basque and Arabic. Due perhaps to this variety, there is no clear generic name for oaks in Spanish.

In Spanish, however, there is not a clear generic name for oaks. The one that comes closest is *roble*, derived from the Latin *robur* and ultimately from a root meaning "red". But *roble* is understood to refer only to deciduous species and is not universally accepted by Spanish speakers as a generic name.

As far as oaks are concerned, Spanish speakers are divided by a common language. Spain and South America use *roble* as the generic name for oak, whereas Mexico and Central America use *encino*, a variant of *encina*, the common name for *Quercus ilex*. These names lack good roots: they do not derive from an ancient word meaning "oak".

Spanish needs a new name for oaks. So let's take the Latin *quercus* and convert it to Spanish, which is how many other Spanish tree names were formed (e.g., *pino*, derived from *pinus*). The ending "-us" becomes "-o", and the initial "qu" is pronounced as a hard "k" sound, following the standard evolution from Latin to Spanish: *querco* (ker-ko). This new name has sound etymological roots and can be used to refer to all oaks by Spanish speakers the world over.

Christina Carrero,* Diana Jerome, and Murphy Westwood

Using the IUCN Red List to Assess the Global Status of Oaks

The Morton Arboretum, 4100 Illinois Route 53, Lisle, IL 60532-1293, USA / *corresponding author: *ccarrero@mortonarb.org*

The International Union for Conservation of Nature (IUCN) Red List is a globally recognized, objective system for assessing the extinction risk of plant and animal species based on past, present, and projected threats. The risk-extinction evaluations that have been completed for a certain number of oak species are based on conducting literature reviews, analyzing species ranges, and conferring with local experts. These assessments serve as a baseline for our current understanding of the state of the world's oak species

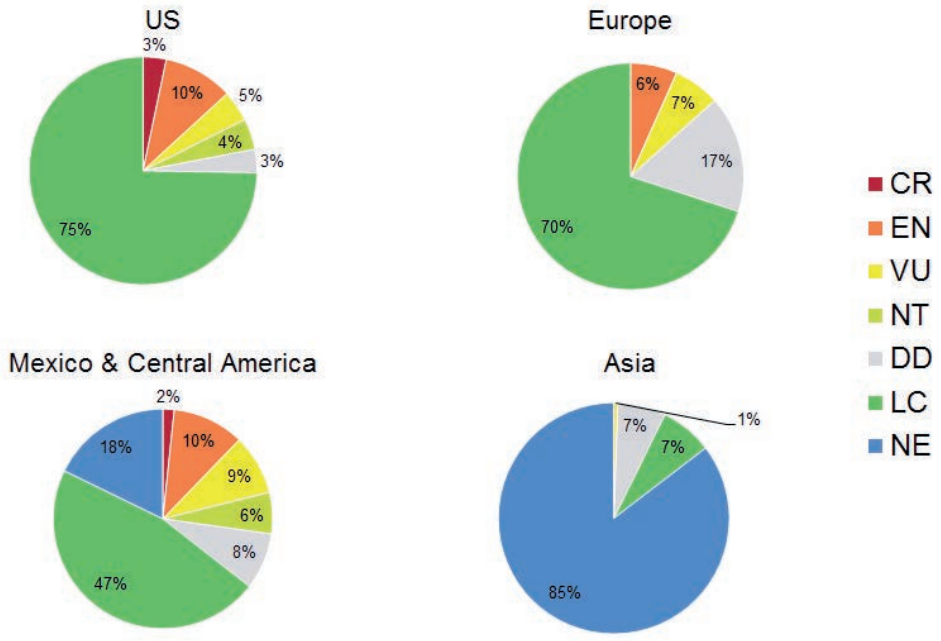

Figure 2/ Percentage of oaks in each Red List assessment category.

and an authoritative guide for future conservation action.

Our goal is to assess all of the world's roughly 450 oak species. In 2017, we completed assessments for all 91 native species of United States oaks and published *The Red List of US Oaks** that details the distributions, population trends, and threats facing these species. We have now focused on assessing the rest of the oaks of the Americas (~180 species) and the oaks of Asia (~178 species). The assessments for the oaks of Asia will be done in collaboration with Joeri S. Strijk. There are over 30 species that are likely Data Deficient, meaning we do not have sufficient information to assign them to a threatened or a non-threatened category. Collaboration with oak experts is needed to complete their assessment and more accurately determine their threat status and need for future conservation.

* Jerome, D., E. Beckman, L. Kenny, K. Wenzell, C.-S. Kua, and M. Westwood. 2017. *The Red List of US Oaks*. Lisle, IL: The Morton Arboretum.

Fang K. Du,* Jia Lyu, Jia Song, Yuan Liu, Yuyao Wang, and Junqing Li

Species Boundaries Between Three Sympatric Oak Species in China

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Oaks are important timber trees with wide distributions in China, but few genetic studies have been conducted on a fine scale. In this presentation, I introduce the genetic diversity and differentiation of three sympatric oak species (*Quercus aliena* and *Q.*

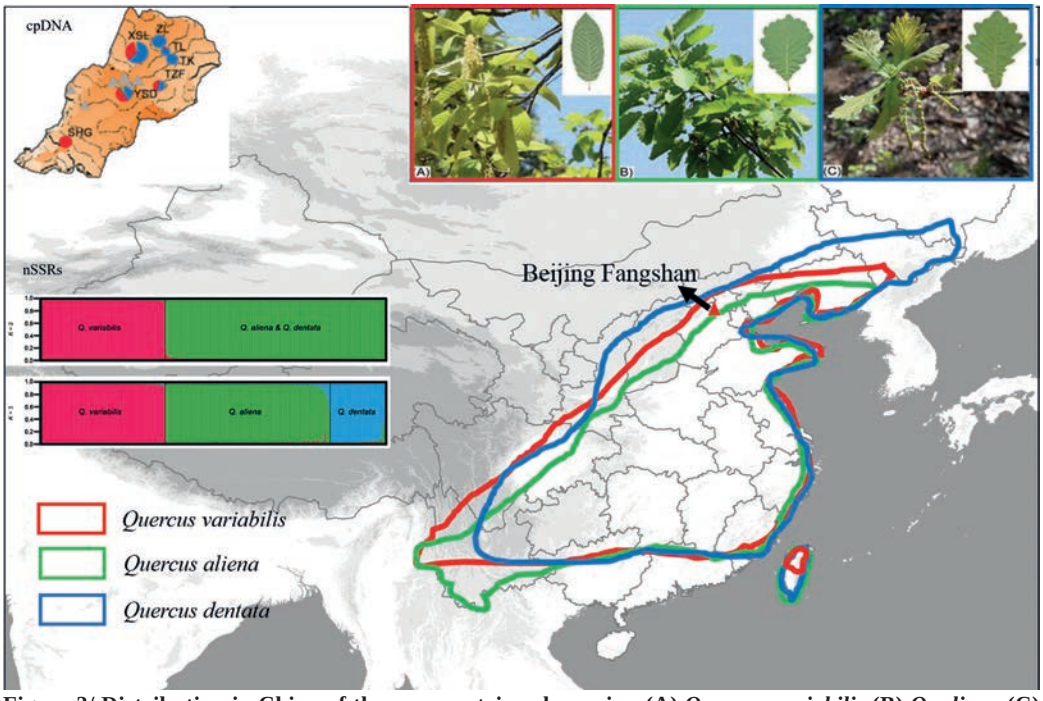

Figure 3/ Distribution in China of three sympatric oak species. (A) *Quercus variabilis* (B) *Q. aliena* (C) *Q. dentata*.

dentata from section *Quercus*, and *Q. variabilis* from section *Cerris*) in their northern distribution in China using 17 bi-parentally inherited nSSRs markers and 5 maternally inherited chloroplast DNA (cpDNA) fragments.

Both the cpDNA and the nSSRs show a high level of genetic differentiation between the two different sections. The chloroplast haplotypes are clustered into two lineages. Clear species boundaries are detected between *Q. variabilis* and either *Q. aliena* or *Q. dentata*. The sharing of chloroplast haplotype H1 between *Q. aliena* and *Q. dentata* suggests very recent speciation and incomplete lineage sorting or introgression of H1 from one species to another. The nSSRs data indicate a complete fixation of variation within sites for all three oak species. They also indicate that extensive gene flow occurs within species whereas only limited gene flow is detected between *Q. aliena* and *Q. dentata*, and nearly no gene flow can be detected between *Q. aliena* and *Q. variabilis* or between *Q. dentata* and *Q. variabilis*. Prezygotic isolation may have contributed to the species boundaries of these three sympatric oak species.

Damien D. Hinsinger[1,2*] and Joeri S. Strijk[1,2,3]

Combining Molecular Data to Reconstruct Oak Evolution

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Oaks were one of the first groups described by Linnaeus, but both their diversity and their broader evolutionary history remain largely unknown, especially in understudied regions like Asia.

Despite recent advances in our understanding of North American and Asian oak evolution, major questions remain, notably concerning both the divergence and the relationships between and within the different currently recognized subgenera and sections.

Here we investigate the diversity and evolution of the genus *Quercus* using low-coverage whole-genome shotgun sequencing (WGS). We recovered both complete chloroplasts and nuclear ribosomal cistrons (NRC) by a genome-skimming approach. We also analyzed genotyping-by-sequencing (GBS) data, as well as the k-mer phylogenetic signal using the AAF (assembly and alignment-free) method for representative subsets of species from each section.

The incongruence between both AAF and GBS analyses versus the assembled plastomes and NRC showed that hybridization patterns are common at various levels in different sections, with sections *Ilex* and *Cerris* being the most affected.

We estimated that the divergence and diversification of oaks occurred during the mid-Eocene climatic optimum. This suggests that global cooling experienced by oaks since the end of the Eocene triggered their diversification by isolating continental flora previously connected through the boreotropical forest biome.

This study highlights the potential of low-coverage WGS for reconstructing the evolutionary history of oaks (and other genera in the family Fagaceae), as well as the complex history of the genus, tightly linked to past changes in climate. In combination

with previous and ongoing more detailed studies focusing on specific lineages (like sections *Quercus* and *Lobatae* in North America), it is likely that we will soon be able to delineate the global history of oaks. Finally, our results allow for the first phylogenomic analysis at the family level including the most speciose genera, combining hundreds of taxa with either thousands of loci (GBS, AAF) or dozens of thousands of basepairs.

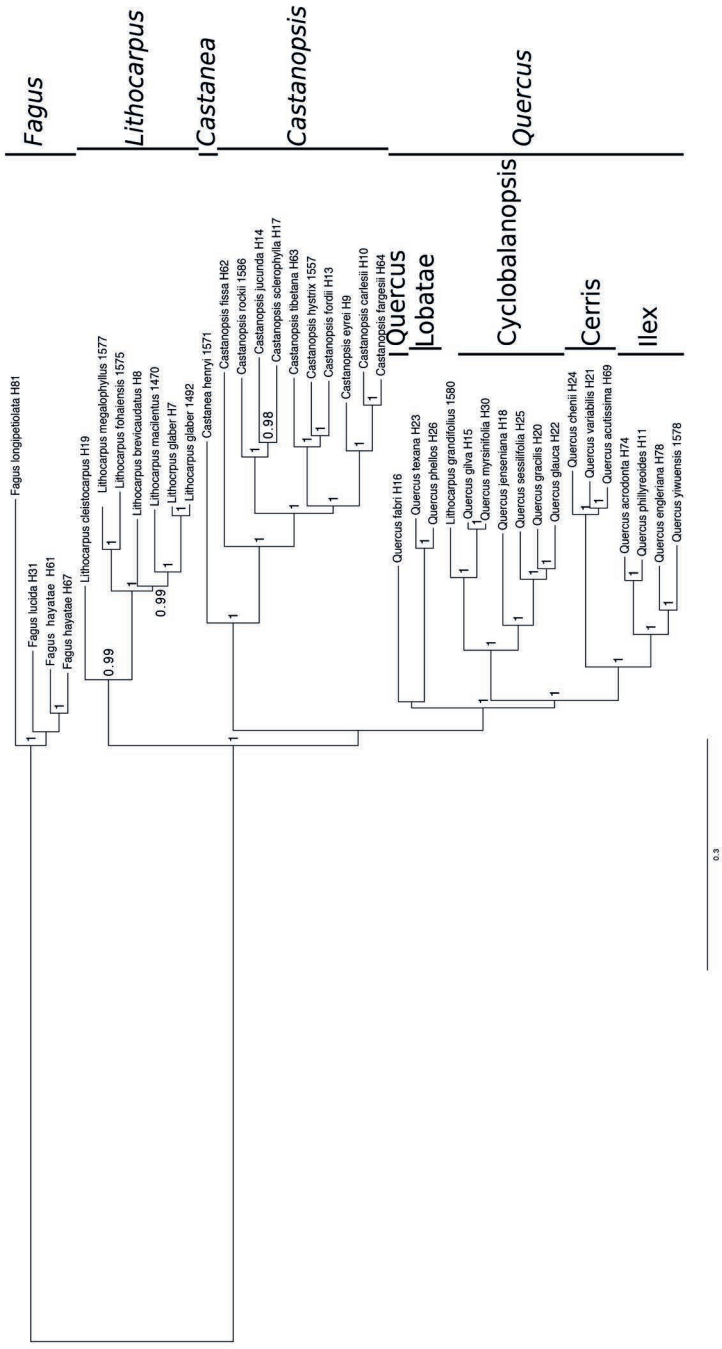

Figure 4/ Maximum likelihood phylogenomic tree built from genotyping-by-sequencing (GBS) data. Values at nodes are SH-like values; scale in substitutions per site.

Jonathan W. Long,[1]* Andrew Gray,[2] and Frank K. Lake[3]

Recent Trends in Large Hardwoods in the Pacific Northwest

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Several hardwood species can form large trees in the Pacific Northwest of the United States: *Quercus kelloggii*, *Q. garryana*, *Q. chrysolepis*, *Notholithocarpus densiflorus*, *Chrysolepis chrysophylla*, *Acer macrophyllum*, *Umbellularia californica*, and *Arbutus menziesii*. These species provide fruits or other benefits important to Native American tribes, and they form large cavities that are important to rare wildlife. However, shifts in fire regimes resulting from fire suppression have allowed conifers to encroach and limit the development of full-crowned hardwoods, while also contributing to high mortality of mature trees when wildfires do occur.

To evaluate potential declines, we examined data from nearly 4,000 Forest Inventory and Analysis plots. We restricted the study areas to those that historically had a frequent fire regime and that were suitable habitat for *Pekania pennanti* (Pacific fisher), a rare forest carnivore that needs large live hardwoods. At different periods from 1991 to 2016, we examined conditions across public and private ownerships within six ecoregions.

Results suggest that the hardwood species are stable or increasing, which is consistent

Photo 4/ Severe wildfires threaten ecosystem services provided by large hardwoods, such as this *Notholithocarpus densiflorus* used by animals to cache acorns within a fire scar.

with expectations for changing climate in the region. However, *Q. kelloggii* tended to experience declines, especially on national forest lands and in three ecoregions – the Sierra Nevada, California Coast Range, and Klamath – which collectively contained 92% of the *Q. kelloggii* basal area and which have had increasing amounts of high-severity fire. We also found substantial decreases, over 40%, in the basal area of open-grown and dominant trees that were medium sized or larger.

Continued analysis of these indicators as more inventories are completed will increase the power to detect significant trends, and to evaluate whether conservation efforts are sustaining large, full-crowned trees and their associated benefits.

Diane Pepetone

Twenty-two Years of Oak Woodland Conservation

L'Monte Information Services, 1190 N State St # 378, Ukiah, CA 95482, USA / *diane@lmonte.com*

An estimated 80% of California oak woodlands are privately owned. The presenter and her partner became part of that number in August 1994 when they moved to a small 20-acre parcel in Northern California.

From the beginning they appreciated the oak woodland as a vital force provisioning the local ecosystem with food in various forms and providing less visible services, such as sequestering of carbon and attenuating local weather extremes. During the first year on the land, they took an informal inventory of oaks on the property and found many mature oaks with diameter at breast height (DBH) between 25 inches to more than 65 inches, fewer oaks with a DBH of 8 inches to less than 25 inches and no trees with a DBH of less than 8 inches. Their concern about the lack of young oaks crystalized into an oak conservation project.

Over the next 22 years they developed a simple protocol, requiring few resources, that has succeeded in adding over 150 young oak trees ranging from 2 to 30 feet in height. This talk described their experiences and the benefits and disadvantages of each method they experimented with for planting, protecting, and inventorying young oaks. Their hope is that sharing experiences in oak conservation will inspire and inform other landowners to become involved in oak conservation.

Devii Rao,[1*] Bill Tietje,[2] Luke Macaulay,[1] and Judi Young[3]

Sharing Oak Woodland Research through a Popular Website

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Since its creation in 1995, the University of California Oak Woodland Management website has been a valuable educational resource. Based on Google Analytics data from 2011 to 2017, the website receives an average of 45,000 users annually. It is a repository

of nearly 30 years of research and outreach data on the ecology, management, and conservation of California's eight million acres of oak woodlands.

Recent staff retirements and changes in website standards created a need for an update and redesign. To accomplish this, the University of California Cooperative Extension received a Renewable Resources Extension Act Capacity Grant in 2017. The grant allowed us to reformat the website for mobile devices (which about half of our visitors are using), make the website more functional and visually appealing, add the latest research, and promote the website to groups who have not historically used it, in particular the ranching community. The new website (oaks.cnr.berkeley.edu) is expected to go live in Spring 2019.

To increase user friendliness, we developed links at the top of the home page for the three primary target audiences: homeowners, land-use planners, and ranchers. On the home page, we also highlighted five topics that receive the most hits: species identification and ecology, oak regeneration and restoration, economic and ecological values of woodland stands, threats to oak woodlands, and woodland wildlife.

Our new flexible website design will allow us to continuously meet the needs of our clientele. With our new look and expanded reach, we hope that the website will be a one-stop shop for everything people need to know about oak woodland conservation and management.

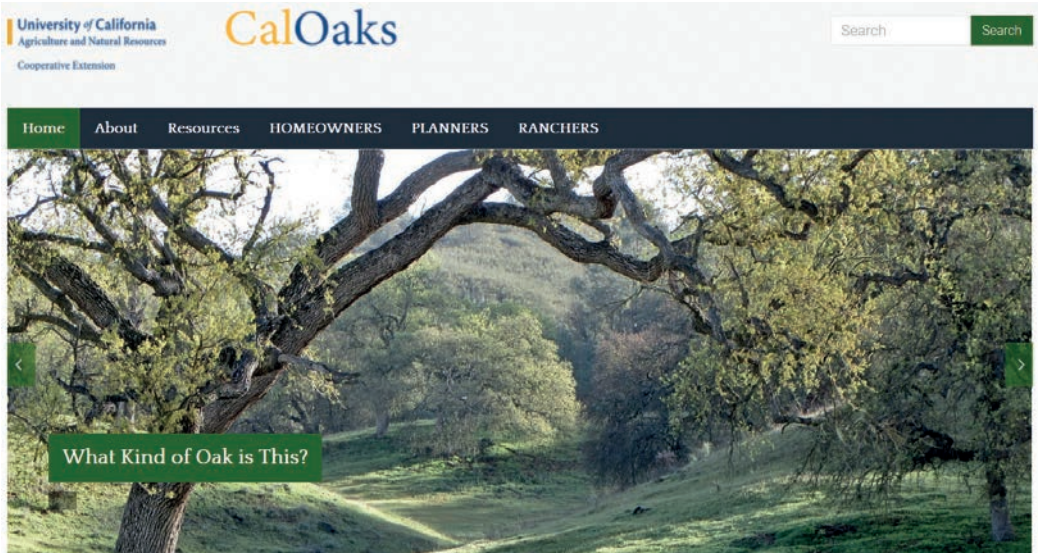

Figure 5/ New website home page.

Shyamali Roy

Evaluating Impact of Disease on Microbial and Insect Populations

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The two native oak species in the UK, *Quercus robur* and *Q. petraea*, are in decline due to the emergence of new pests and pathogens. Acute oak decline (AOD) is one such

disease that is likely to have not only a devastating effect on the oak tree populations but also a consequent impact on the many important organisms dependent on them.

To begin with, the composition and abundance of insect herbivores and microbial endophytes associated with healthy oak trees in the UK were determined. Phenological and morphological measurements of the host trees were taken, insect herbivore species were recorded, and microbial endophytes were identified using next-generation sequencing.

Date of budburst in the spring was a major determining factor in the abundance of leaf-chewing and galling insects – something to be considered when moving trees in assisted migration. Many insect herbivores showed a preference for either *Q. robur* or *Q. petraea*. It appears that the same community of bacterial and fungal endophytes is present in *Q. robur* and *Q. petraea*, but the overall abundance of endophytes is higher in *Q. robur*.

Photo 5/ Insect herbivores associated with oak trees in Earth Trust's Paradise Wood, Oxfordshire, UK. From top left to bottom right: *Andricus curvator*, leaf roller (unknown species), *Orchestes avellanae*, *O. quercus*.

To understand how AOD may be influencing these endophytic microbial communities, oak trees from various affected woodlands in the UK were sampled, including seemingly "healthy" trees and trees displaying the characteristic stem bleeds of AOD. Bacterial and fungal endophytes within the leaves and inner bark were determined using next-generation sequencing. The results, expected shortly, should indicate how AOD is influencing the wider oak community and may identify beneficial microbes that could either reduce disease or promote tree growth.

It is hoped that the information collected here will enable us to better understand oak communities and help us to predict the possible impact of climate change on oak woodlands in the UK.

Steven Swain

Managing Sudden Oak Death: What Works and What Doesn't

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Photo 6/ Horizontal measurement of a backup inoculation point (marked B). Original inoculation was 10 mm in diameter. Negative controls typically showed associated necrosis to be about 12-15 mm in diameter, which is the approximate size of the blackened area in this image. The remaining darkened area inside of the disease margin represents pathogen growth since time zero.

Many treatment methodologies have been proposed to both prevent and cure oaks infected with *Phytophthora ramorum*, the causal agent of sudden oak death. Bark scribing, a treatment technique listed by the University of California Integrated Pest Management program to therapeutically treat *Phytophthora*-infected citrus trees with a treatment history going back nearly 100 years, seemed to show promise, especially after uncontrolled pilot studies on *Phytophthora*-infected oaks seemed to show that treated trees had a survival rate higher than 80% in the field. However, controlled, replicated studies done on branches of mature oaks show that the situation is much more complicated than expected.

Of the approximately 60 trees used in the study, about one third resisted the pathogen so effectively that no growth occurred in either the treatment inoculations, the control inoculations, or both, and in most of these cases no living isolate of the

pathogen could be recovered (though residual pathogen DNA could be detected via PCR in many of these lesions). Another sixth or so of the trees were killed by the inoculation, and therefore could not be used for this study. The remaining half of the oaks showed no significant difference between treatments and controls, even at the 95% confidence level.

Our interpretation of the results is that oaks are surprisingly good at killing *P. ramorum*, even if they do not always survive infection. Our findings have been corroborated by researchers using different field techniques. Thus, when practitioners utilize tools such as bark scribing to treat infections, results cannot be reliably interpreted from the survival rates of treated trees alone. Furthermore, our results cast doubt upon the purported efficacy of bark scribing as a treatment technique, even in such "proven" systems as citrus.

I would like to acknowledge Matteo Garbelotto and Doug Schmidt of UC Berkeley, coauthors of this study.

Elise Willis

The Great Oak Count and the OakWell Survey

Canopy, 3921 East Bayshore Rd., Palo Alto, CA 94303, USA / *elise@canopy.org*

In the area known since 1971 as Silicon Valley, the last two centuries have seen oak woodlands become largely eliminated, first by agricultural conversion and later by rapid development and urbanization. Twenty years ago, a dedicated group of volunteers conducted The OakWell Survey, a citywide inventory of *Quercus agrifolia*, *Q. lobata*, *Q. douglasii*, and *Q. kelloggii*, in order to create a baseline for future evaluation of changes in Palo Alto's native oak population.

Today, there is increasing recognition that reintegrating oaks in our parks and urban landscapes promises a host of benefits, both for wildlife and for people. As a first step, Canopy and partners have revived The Great Oak Count, a comprehensive survey of native oaks in Palo Alto. We actively educate the community about the importance of native oak trees and how to properly care for them. By engaging residents to use our new

Photo 7/ A volunteer in The Great Oak Count in Palo Alto.

Tree Plotter tool and inviting citizen scientists to gather data on the number, size, and locations of oaks in Palo Alto, we gain community support and valuable data collection.

This effort will reveal the changes that have occurred in the native oak population and help inform urban forest managers and re-oaking efforts for the coming decades. The last wave of urban tree plantings 50-75 years ago needs to be continued today and we now have the chance to shape our environment once again. With hundreds of years behind us, we move forward to the new generation of oak plantings and oak advocates.

Photographers. Photo 1: Julianne Skai Arbor. Photo 2: Phil Robertson. Photos in Fig. 3: Fang Du. Photo 4: Frank K. Lake. Photo 5: Shyamali Roy. Photo 6: Steven Swain. Photo 7: Elise Willis.