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RESEARCH RENDEZVOUS

"Rendezvous" is the new method for outdoor education

In 2017 we held the first Rendezvous, the Bristlecone Rendezvous in the California White Mountains.

The Rendezvous is a coming together of arborists, and scientists and others to explore remote tree populations in natural habitats. These retreat-like meetings combine camping, hiking, and wilderness exploration with study of trees. The goal is to explore native trees in natural settings to better understand tree adaptation, biology and ecology. This allows a deeper perception of how trees function and adapt to soils, climate, and other living organisms. In the case of the Bristlcone pine, we observed their critical reliance on the Clark's nutcracker for dispersal and colonization of seed into young poorly developed soils in the White Mountains. Bristlecone pines are very long lived, but do not grow to great height and in many cases survive because of their ability to sector themselves into ribbons of long lived tissues. Their needles live over 40 years and the tree would likely survive even longer than 4000 years if it were not for erosion that undermines their roots and eventually creates susceptibility to insect pests and root disease. At Grandview campground "campfires" we had two guest lectures, one on the history of the White Mountains and another on white pine blister rust, a disease of five needled pines. The days were spent hiking and studying pine stands in both the Schulman and Patriarch groves as well as exploring the high meadows of the White Mountains and examining the unique flora found there with CNPS rare plant specialist David Magney. For many of the thirty plus attendees, this was their first exposure to these unique trees and chance to study plant adaptations in one of nature's harshest environments.

Chiracahua Rendevous, 2018

Working from the success of the recent Bristlecone Rendezvous, I am proposing Trees of the Chiracahua Mountains for the next Rendezvous. This Rendezvous will be hosted by the Southwestern Research Station (SWRS) a field station of the American Museum of Natural History. For more information on SWRS please visit their page at (https://www.amnh.org/our-research/southwestern-research-station). The SWRS is located near Portal, Arizona and is the gateway to the Sky islands of Southeastern Arizona. These isolated mountains are biodiversity hot spots and centers of endemic plants and animals. They are interesting because they mix tropical, mountain and desert environments. Monsoonal rains are typical here, and the rhyolite-based geology is unique. The SWRS offers a compelling place to visit this unique region and study its natural history. SWRS is a research station with lodging, meals, and conference facilities in the "sky islands" setting at 5400 feet elevation. The Chiracahua Rendezvous will occur October 8-12, 2018.

The course will be 5 days and will cost less than most hotel stays for the same period. We will cover the natural history of trees in the Chiracahua Mountains as well as topics on tree adaptations, tree physiology, ecology, soils, and general biology. The Rendezvous will be joined by Dr. Kevin Smith from USFS in New Hampshire as well as local authorities from the University of Arizona and others. There will be daily hikes and seminars. The Chiracahua Rendezvous will focus on tree adaptations to warming arid climates. I want to gauge potential attendance at this Rendevous, so please email me at ajdowner@ucanr.edu to express your interest. Pricing, details and a flyer will follow early this summer.

Pruning Climate Ready Trees

Greg MacPherson (USFS) and Alison Berry (UC Davis) started a research project a few years back to test the suitability of selected trees to withstand hotter and drier climates. They established trees at test sites in Davis, Riverside and Irvine, and at parks in Sacramento, and Los Angeles. I put in a similar test in Santa Paula. The goal is to provide minimal inputs (water, maintenance costs, pruning etc.) and then measure the outputs (tree growth, quality, etc.) over a number of years with reduced water, no fertilization, and minimal pruning. Dr. Berry and I have pruned the trees in Davis two times and I have pruned all the other trees at the other control sites once. Control sites have four replications of each species. Taxa vary between inland coastal, northern and southern California sites, but some species are found in all the sites. Trees in all sites are now well established. We find some of the taxa have specific structural pruning needs.

Since all of study trees are nursery grown, there are structural issues such as multiple trunks, codominant leaders, lack of a single leader, or too many branches arising from one point. Some species are shrubby in habit and will require pruning to “create” a tree form. Over the last one to two years, Dr. Berry and I devised a pruning protocol which is minimal, but attempts to provide structural guidance necessary to ensure a successful long term evaluation of these trees in urban landscapes and parks. The pruning system is simple: make only three-four cuts per year. Pruning cuts optimize structure by removing branch faults or retarding growth of competing branches or leaders. Suckers or other basal growth are exempt from the three cut minimum. Each year three to four corrections are made and no more. In these early years, structural pruning only requires minutes per tree. As trees enlarge, we will attempt to maintain the pruning paradigm, although cuts may increase in size or number.

All trees are subject to nursery induced branching problems such as when multiple stems or branches form from the leader where it was headed back. However, trees also develop their own constitutive branching or architectural anomalies. Some trees grow so fast that the minimal approach to structural pruning is not adequate for correcting these anomalies. Palo Verde and Maverick Mesquite (in Southern California) trees failed before they could be structurally pruned (figure 1 & 2). In Palo Verde planted at a later date we were able to prune before tree branches or leaders became too large and their failure was prevented so far. Some species such as Tecate cypress, Mulga, Arizona Madrone, and Ghost Gum need almost no pruning to maintain structure (Figure 3). In these taxa (especially Mulga) removing some lower branches encouraged a more tree-like stature, which would otherwise look like a large shrub. Rosewood and hackberry seem to overproduce branches in general, so removal of temporary laterals is necessary. Hackberry tends to grow in a large low-to-the-ground tangle, so removing branches in order to thin the clutter helps to begin formation of tree-like form (figure 4). Red Push Pistache produces clusters of branches arising from the same place on the stem that require thinning cuts to remove impending branch faults (Figures 5 & 6). So far, Ghost Gum has needed very little pruning. Catalina cherry requires removal of some competing leaders or retarding growth of leaders so they slow in growth. Some species such as island oak and Texas Ebony have not grown enough to prune much but encouraging a central leader is the main goal. The escarpment oak required removing competing leaders and little else. Desert Willow requires little pruning except for heading cuts to retard growth of competing leaders. Palo Verde (in all locations) requires drop-crotching competing leaders or branches to slow their growth relative to the main leader.

Table 1. First Year Pruning results on Climate Ready Trees in Four locations

Taxon	Common Name	Biomass removed [1]	n[2]	Location[3]	Mortality[4] /failure
Acacia aneura	Mulga	14.9	12	1,2,3	0
Acacia Stenophylla	Shoestring Acacia	1.2	4	1	0
Acacia willardiana	Palo Blanco	5.2	12	2,3,4	0
Arbutus arizonica	Arizona Madrone	0	4	4	1 (replanted)
Celtis reticulata	Netleaf Hackberry	22.6	16	1,2,3,4	0
Chilopsis linearis 'Bubba'	Desert Willow	9.2	8	1,2	0
Corymbia papuana	Ghost Gum	3.0	16	1,2,3,4	0
Dalbergia sissoo	Rosewood	12.3	16	1,2,3,4	0
Ebenopsis ebano	Texas Ebony	0.60	4	1	0
Hesperocyparis forbesii	Tecate Cypress	0.30	10	2,3,4	2
Parkinsonia x 'Desert Museum'	Desert Museum Palo Verde	21.0	7	1,2	1 (trunk failure damage)
Maclura pomifera cv White Shield	White Shield osage orange	0.40	4	1	0
Prosopis glandulosa 'Maverick'	Maverick Mesquite	23.2	12	1,2,3	0
Quercus Canbyi	Canby's Oak	4.19	4	1	0
Quercus fusiformis	Escarpment Oak	17.1	8	2,3	0
Quercus tomentella	Island Oak	5.0	12	2,3,4	0
Pistacia chinensis 'Red Push'	Red Push Pistache	17.6	12	2,3,4	0
Prunus ilicifolia subsp. *lyonii*	Catalina Cherry	6.5	8	3,4	0
Ulmus Propinqua	Emerald Sunshine Elm	1.2	4	1	0

[1]The average fresh weight removed.. clippings averaged over all plots from the first years pruning
[2] n= the number of trees in the sample
[3] Sites: 1= UC Davis; 2 = UC Riverside Field Station; 3 = South Coast Research and Extension Center, Irvine; 4; Hansen Research and Extension Center, Santa Paula.
[4] Mortality is the number of trees died by the time of the first pruning.

Tree Genetics Regulate Biomass Output and thus Pruning Needs

Our preliminary data (Table 1) indicate some trees generate very low biomass (based on our pruning protocol) suggesting less need of structural pruning (Tecate Cypress) or that they just have not grown enough to generate much waste (Palo Blanco). Trees that grow rapidly such as Palo Verde, Red Push Pistache, and Hackberry generate much larger volumes of pruning waste. Hackberry and Rosewood are so "branchy" that it can take longer to decide which three cuts to make. Some species such as Island oak have not grown enough to evaluate pruning needs. The study is a good reminder that tree genetics determine site adaptation, pruning needs and biomass output. Genetics determine inherent branch faults and the need for structural pruning of certain taxa. Multiple branches from one point seems to be a genetic predetermination for Red Push Pistache—without structural pruning, it will likely have branch failures. For Texas Ebony, Hackberry, Palo Blanco and even Island Oak pruning seems necessary to develop a tree shape early in their lives, otherwise some sort of large shrub will dominate for many years until the mature tree form emerges.

Tree Adaptations Affect Pruning Requirements and Survival in Landscape

The purpose of this study is to trial drought and heat tolerant species in California landscapes. Trees were selected from hot and hostile climates, such as those in Asia, Australia, Southwestern United States, etc. Trees are adapted to not only hot or dry landscapes but also to the soils that occur in their native ranges. Well drained desert soils with low moisture holding content and reachable surface aquifers are where Palo Verde grow. When Palo Verde is grown in hot inland valleys with deep loam or clay soils the abundant soil moisture stimulates fast growth and wood that is not strong enough to prevent structural failure. Tectate Cypress and Ghost Gum perished in multiple test sites, from *Phytophthora* infection likely trees were predisposed by high moisture content soils, which are not such a problem in the native range of Tecate Cypress (Santa Anna Mountains of Orange and San Diego Counties in California) (Figures 7 & 8). Some difficulties were observed in the transition from nursery culture to landscape culture. Many of the desert species are grown in the nursery with multiple stems. These taxa may function well in a dry climate, but both Palo Verde and Mexican mesquite failed in California landscapes due to poorly attached competing leaders that became too large to sustain. Field dug Escarpment oaks failed to come out of dormancy in multiple park sites but established in control sites. As the study moves out of the establishment phase, water inputs will be reduced to test tree responses to drought.

Figure 1. Palo Verde failed due to rapid growth and insufficient structural pruning.

Figure 2. The Mulgas developed stable structure and needed little structural pruning.

Figure 3. Hackberry grows in a tangle with too many temporary branches.

Figure 4. Ghose Gum died of *Phytophthora* spp.

Figure 5. Canker on Ghost Gum Eucalyptus caused by *Phytophthora* spp.

Figure 6. Maverik Mesquite failure is due to nursery culture as a multiple trunked tree.

Red Push Pistache has a genetic tendency to produce many branches at the same stem location. The tree on the top had branches removed from stem clusters and branches headed back to reduce their growth rates.