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Plants, Drought, and Hurricanes

When Eric Menges, Program Director of the Plant Ecology Program, started working at Archbold Biological Station in 1988, it seemed to him like an ideal job combining two of his main research interests. It allowed him to study an ecosystem with many rare plants, and it was a landscape where events such as fire and hurricanes (as we all know) were common. Working previously in the Midwest, Menges had spent many hours studying prairie fire and how a particular rare plant responded. Menges recalls “While I discovered a lot about this one plant species, my conclusions about the role of fire on rare prairie plants were limited”.

Fire in the Florida scrub was quite different than in the prairie, Menges discovered. Menges explains, “Prairie fires moved rapidly, burned completely, and left a rather blank canvas of burned vegetation. In contrast, fires in the Florida scrub often included much higher, more intense flames, patches of vegetation that were burned intensely or not at all.” Menges set out to learn more about how scrub plants dealt with this variability in fire.

The Lake Wales Ridge is a sandy upland that runs down the middle of Florida in Highlands, Polk, and Lake Counties. Here, there were many rare plants to study. Menges says, “Several analyses have shown that the Lake Wales Ridge is a hotspot for endemic plants and animals, those found only in a limited geographical area. To find other places with similar

concentrations of endemic plants in a small area in the United States, one would have to travel to Hawaii or California.”

The first rare plant he studied, *Dicerandra frutescens*, or the Scrub Balm (a partly-woody, small shrub in the mint family), is found only in southern Highlands County near Lake Placid. Menges states, “When I first started studying this mint, the only protected site at the time was at Archbold Biological Station.” Menges set out to study the Scrub Balm, marking individuals, conducting experiments, and watching pollinators. At the outset, Menges had an idea to conduct a long-term study. “From my projects in the Midwest, I realized that insights gained from a few years of study might be incorrect, and different conditions in the next year could cause plants to respond in a surprising way”.

Why study the same organisms for many decades? Menges explains, “In the Midwest, I had used computer models to project likely scenarios for plant populations, and had seen that results based on limited data were often not dependable. Therefore, I set out to begin long-term studies on rare plants.” Because Archbold Biological Station has a history and culture of long-term, field-based studies, this approach was feasible and encouraged.

This project has continued to this day, with September 2017 marking the 30th annual census of the Scrub Balm. At Archbold, Menges and his colleagues collected data on plant size, survival, flowering, and seedling recruitment at regular intervals. He discovered that plants were killed by fire, but populations showed dramatic increases after fire as dormant seeds stored in the soil were stimulated to germinate. “The post-fire populations were like a different plant”, Menges stated. “There was more germination, faster growth, and flowering at younger ages in the burned areas than in areas not burned”.

Building population models from these data, Menges and his collaborators (including Professor Pedro Quintana-Ascencio of the University of Central Florida) predicted that if fires occurred too frequently or not frequently enough Scrub Balm populations would go extinct. In earlier publications, he suggested that fires should occur every 5-12 years in the type of Florida scrub where Scrub Balm grows.

However, continuing studies over the decade have modified the story. Menges and his colleagues found that long-unburned Scrub Balm populations did not disappear as predicted by the models. “The few plants that remain when fire is absent are often in persistent gaps, or open sandy areas; these few plants in favorable gaps allow the population to hold on longer than the models first predicted”. Seeds produced by these plants can also remain dormant in the soil for many years, allowing populations to recover once an area burns, even if plants have not existed for a few years.

You may be wondering how the latest hurricane affected the Scrub Balm and the Florida scrub. In regularly burned Florida scrub, the effects of hurricanes are more subtle than you might imagine. Occasional pine trees are tipped over, but the low, dense shrubby cover is little affected by wind and, usually, lies above the elevations that are flooded.

As far as the Scrub Balm is concerned, the last year was not a good one. The species experienced unprecedented declines between 2016 and 2017, as the September 2017 datasheets were full of “zeroes”, indicating plants that had died. However, this high mortality was not due to hurricanes. “In 2017, the drought produced effects that we had not seen in 30 years of study” reports Menges. “Nearly all seedlings died and few new plants seen. However, adult plants still persist and could produce seeds that may germinate and grow in wetter future years”.

Even after studying one plant for 30 years, there are surprises in store. Long-term studies like the Scrub Balm project provide a context to consider unusual events and climate change effects on organisms. Field stations like Archbold are set up to provide the opportunity for studies on plants, birds, insects, reptiles, and other organisms that are provide this important perspective.

Photo 1: Scrub Balm flowers open as cream colored flowers with red marks. The flowers fade to white after a few hours. Photo by Steve Long.



Photo 2: Intern Katherine Charton counts flowering branch tips on a flagged Scrub Balm plant during the September 2017 census. Photo by Eric Menges.



Photo 3: Eric Menges discusses Florida scrub plants to visiting scientists to Archbold, 2014. Photo by Archbold Biological Station.

