Volume 30: Number 4 > Fall 2013

The Quarterly Journal of the Florida Native Plant Society

FLORIDA NATIVE PLANT SOCIETY
serenoa repens

Palmetto

Swamp Fern Experimental Hammock ● Mockernuts ● Tarkiln Bayou ● *Carex*

Swamp Fern Experimental Hammock:

past disturbances, present challenges, and a hopeful future

Wesley R. Brooks and Rebecca C. Jordan

Florida's native landscapes have come under enormous pressures over the last century. In particular, agricultural expansion and development have been the primary drivers of the habitat destruction and fragmentation that threatens the long-term prospects of Florida's unique floristic communities. While the many worthwhile preservation and conservation initiatives ongoing in the state are a key piece of maintaining Florida's ecological heritage, it is unclear whether these actions alone are sufficient to overcome the damages incurred in the past, ongoing in the present, and those yet to come, especially when the underlying factors promoting these outcomes are unlikely to wane anytime soon.

Ecological restoration has been touted for its potential to not just stem the tide of damages, but potentially reverse them. However, there are major uncertainties surrounding our ability to use ecological restoration effectively. Perhaps the most important is the realization that ecosystems and communities are not the static entities we often believe they are, and as we subsequently try to manage them to be. The fact is that all ecological systems are incredibly dynamic, each reacting to multiple biotic and abiotic influences and a host of short- and long-term feedback loops that make predicting future changes difficult. The actions of humans can short-cut or exacerbate these influences and make understanding ecosystem behavior that much more challenging. Additionally, political and socioeconomic considerations may also have tremendous consequences for the success of individual restoration initiatives, impacting both what restoration outcomes are desired and even what criteria will be used to evaluate success.

Typical scene from Swamp Fern Experimental Hammock early in the restoration effort with air potato (*Dioscorea bulbifera*) climbing on chemically-treated Brazilian pepper (*Schinus terebinthifolia*) snags.

In light of these arduous challenges, it makes sense to question the traditional motive of ecological restoration – to return a site or community to its previous "natural" condition – for densely populated areas, just try to imagine how well a return to the natural hydroperiods or fire regimes necessary to support many of Florida's historical plant communities would be received in your neighborhood! Recognizing that traditional restoration is often at loggerheads with modern human civilization, new paradigms of restoration ecology, including Rosenzweig's (2003) "Reconciliation Ecology", are beginning to be developed. We too, like Rosenzweig, believe that the only way

Swamp Fern Experimental Hammock after two years of restoration efforts. Note outplanted pigeonplum (*Coccoloba diversifolia*) in foreground.

Restored (left) and unrestored (right) areas of Swamp Fern Experimental Hammock. Note the thick cover of Asian sword fern (*Nephrolepis brownii*) in unrestored areas as opposed to the sparse cover of the native swamp fern (*Blechnum serrulatum*) after restoration treatments.

Outplanted Florida fiddlewood (*Citharexylum spinosum*) in bloom.

to preserve Earth's breathtaking biological diversity lies not in "asking [people] to stop earning a living or making a profit", but rather by "sharing our habitats deliberately with other species" (Rosenzweig, 2003). Thus, we sought to develop a new model to allow the benefits of ecological restoration to be realized in human-dominated landscapes. Our "Novel Native" model aims to pragmatically select natives from the larger region – rather than just from a site or community's historical pool – that are adapted to the existing conditions at degraded sites when historical conditions cannot be re-created (Brooks & Jordan, 2014). Ultimately, we hoped that our approach would allow for increased biodiversity in metropolitan areas, and provide land managers with an additional means to conserve rare species by expanding potential habitat, as well as a potential tool to reduce the invasibility of public lands by noxious exotics. We sought to test the potential for this model of restoration to accomplish these goals by establishing Swamp Fern Experimental Hammock (SFEH) in 2008.

Continued on page 6

Outplanted chiggery grapes (*Tournefortia hirsutissima*), a rare, state-listed endangered species.

From left: outplanted West Indian lilac (*Tetrazygia bicolor*) in bloom; new recruit from outplanted lancewood (*Ocotea coriacea*) populations.

Site History

Conditions at this site have changed dramatically since Miami's first population boom over one hundred years ago, and as a result, so have the plant communities. Modern geological maps and old aerial photographs from as early as 1938 show that SFEH was located on the northern edge of a limestone outcrop island along the Miami Rock Ridge, a fact that is corroborated by evidence of surface water flow and erosion in small areas of exposed limestone substrate of the site. The aerial photos also show a slough winding around the northern edge of the outcrop island and a few areas of hardwoods in small scattered mesic and hydric hammocks along the slough to the east and a few others more than a mile to the northwest of present day SFEH. Encroaching development, including the construction of roadways and clearing of land for agriculture and other development is evident even 75 years ago. After these initial disturbances, the fairly frequent fires that would have affected this area were excluded, and as a result, the site was slowly colonized by hardwoods from the nearest hammocks, leading to the mesic hammock character of the site today.

Several decades after this development-induced fire exclusion began, the whole of South Florida's landscape was altered by the Central and South Florida Project (for an excellent historical account of the politics surrounding this project and the Everglades as a whole, see Grunwald 2006): a massive series of water control structures and canals that ultimately succeeded in lowering the water table along the Miami Rock Ridge by several feet or more. The SFEH site that had slowly been succeeding from marl prairie / pine rockland towards mesic hammock, was now faced with shorter hydroperiods and considerably drier soils than the majority of hardwood colonizers were adapted to withstand. Relatively drought-tolerant species such as live oak (*Quercus virginiana*), cabbage palm (*Sabal palmetto*), and cocoplum (*Chrysobalanus icaco*) are ubiquitous on the site today as a result, while wetter-loving species such as swamp bay (*Persea palustris*), laurel oak (*Quercus laurifolia*), and dahoon holly (*Ilex cassine*) exist today as only a few rare reproductively mature specimens unable to recruit, with the end result being a relatively low diversity mesic hammock.

Aerial map of the area in 1938 (USDA 1938). The black box indicates the modern boundaries of Swamp Fern Experimental Hammock.

More recently, SFEH has had to contend with two additional disturbances that have shaped the character of the site: species invasions and Hurricane Andrew. Invasive species have gradually been accumulating at the site for many decades, but the changing nature of the surrounding region from mainly agricultural to residential by the 1980s meant many more opportunities for exotic species to establish on the site after dispersing from neighborhood lawns and landscapes. Once there, these invaders found lots of opportunities to thrive with only a few of the extant native hardwoods being able to successfully recruit on the site. In 1992, Hurricane Andrew wreaked havoc on Miami-Dade County and SFEH was no exception; the existing canopy was razed, further tilting the balance in favor of fast-growing exotics over most natives. Noxious trees like Brazilian pepper (*Schinus terebinthifolia*) and Australian umbrellatree (*Schefflera actinophylla*) grew to prominent roles in the newly developing canopy, shoebutton ardisia (*Ardisia elliptica*) would become the most numerous and prolific woody plant on the site, and vines including rosary pea (*Abrus precatorius*), air potato (*Dioscorea bulbifera*), and velvet bean (*Mucuna pruriens*) would limit the potential of native canopy to recover. Further inhibiting the recruitment of young native trees and shrubs was the rapid spread of Asian sword fern (*Nephrolepis brownii*), the most abundant ground cover prior to site restoration in 2008.

Restoration

The primary goal of the restoration was to change the character of the site from that of a relictual mesic hammock to a tropical hardwood hammock more typical of the Miami Rock Ridge. We hypothesized that such a community might be more sustainable on the site given that tropical hardwood hammock species are typically more drought tolerant than mesic hammock species, and thus better able to thrive given the modern hydrology of the region. We also hypothesized that a more complete and thriving plant community on SFEH might be more successful at resisting invasion by exotic plants.

Miami-Dade County's Department of Environmental Resources Management and Department of Parks and Recreation's Natural Areas Management Division provided the requisite permissions and access to the approximately 3-acre highly disturbed woodlot in suburban Southwest Miami-Dade County. We also worked with the Miami-Dade County Chapter of the Florida Native Plant Society to obtain a Conservation Grant from FNPS to fund the purchase of novel native plantings to be used in the restoration experiment. Within the interior of SFEH, we established 150 experimental quadrats measuring 15 square meters each. In March of 2008, we began data collection by recording all plant species present in each quadrat along with floristic composition and forest structure variables including species richness, tree density, canopy cover, etc. After consulting with FNPS' own Steve Woodmansee, as well as John Lawson of Silent Natives Nursery, we selected 26 species of tropical hardwood hammock woody plants that were absent from our earlier survey for outplanting into SFEH; including chiggery grapes (*Tournefortia hirsutissima*), an endangered tropical liana, only known in Florida from 12 conservation areas (Gann *et al.* 2013). We used varying combinations of species richness and density of outplantings to augment the flora of individual quadrats, being sure to leave some quadrats unplanted. Using this experimental approach we were able to detect whether potential changes in community composition and forest structure variables at SFEH were related to the species richness or density of outplanting treatments used in the restoration. In June 2009, we outplanted 540 individuals throughout our experimental quadrats and also began clearing exotics by physical removal and chemical treatment within the experimental area. We returned regularly over the next two and a half years to check the health of our outplantings, collect data on the progress of the restoration, and manage exotics.

By January of 2012, we were able to label our restoration a tentative success. First, our outplantings experienced low mortality (only 15.7% of outplanted individuals died) and positive growth (individuals grew nearly a centimeter per month on average between June 2009 and December 2011) suggesting that we successfully matched our introduced species with the abiotic conditions at the site. This accomplishment is even more impressive considering that we provided no supplemental water whatsoever to outplanted individuals. As a result of these successful introductions, the number of natives on the site increased from 36 to 58, and the number of threatened or endangered species increased from four to 10 (Brooks & Jordan, 2014). There is also evidence that three of our outplanted species have begun to recruit on the site, along with several others that flowered and produced fruit.

Secondly, our exotic management was also successful. Exotic cover was decimated on the site as a result of our actions, though continuing invasions mean that we have not eliminated all exotics. We did, however, reduce the total number of exotic species on the site from 26 to 14, including the elimination of six noxious species listed by the Florida Exotic Pest Plant Council (Brooks & Jordan, 2014). While we found no evidence that introducing natives reduced the invasibility of the site by exotics, we did find multiple lines of evidence suggesting that a reduction in exotics was beneficial to natives. In particular, canopy cover and basal area (a measure of productivity and size of trees in a forest), declined directly as a result of our exotic removals, but surpassed 2009 levels in under two years as a result of strong native growth (Brooks & Jordan, 2014).

What's next for Swamp Fern Experimental Hammock?

We continue to monitor our outplantings at SFEH. Ultimately, we hope that these new species will expand their populations naturally across the rest of the site, demonstrating the sustainability and cost-effectiveness of these kinds of projects. Additionally, we have reduced our management pressure on exotics and are interested to see how these species respond given the ongoing success of our outplantings and other native hammock components. We also have several plans in the works to solidify the future of this site as an important conservation and educational tool in Miami-Dade County. First, we are trying to approach the county to increase the level of legal protection currently afforded the site. Upon achieving a more permanent conservation status, the Fairchild Tropical Botanic Garden's South Florida Conservation Team has expressed some interest in using the site for reintroducing other rare plant populations. Second, a STEM-focused magnet school opened adjacent to the site in 2009, the TERRA Environmental Research Institute, and may provide a potential partnership whereby students can directly engage in ecological monitoring and research. We hope that SFEH may provide a workable model for the Novel Native approach to restoring native communities in metropolitan areas that can be applied at other sites through Florida and beyond. ✪

References Cited

Brooks, W.R., and R.C. Jordan. 2014. Restoring tropical dry forest communities: effects of habitat management and outplantings on composition and structure. Set to be published in the March issue of Restoration Ecology.

Gann, G.D., K.A. Bradley, and S.W. Woodmansee. 2013. Floristic Inventory of South Florida. The Institute for Regional Conservation, Miami, Florida, USA. Available at: www.regionalconservation.org

Grunwald, M. 2006. The Swamp: the Everglades, Florida, and the Politics of Paradise. Simon & Schuster, New York, New York.

Rosenzweig, M.L. 2003. Win-Win Ecology: How the Earth's species can survive in the midst of human enterprise. Oxford University Press, New York, New York.

United States Department of Agriculture (USDA). 1938. Aerial photographs of Dade County Flight 2. Map and Imagery Library, George A. Smathers Libraries, University of Florida. Gainesville, Florida, USA. Available at: http://ufdc.ufl.edu/UF00071738/00002/12j

About the Authors

Dr. Wesley R. Brooks is a native of Miami and has researched species invasions in fish and plant communities of South Florida as well as the community structure and ecological restoration of tropical hardwood hammocks along the Miami Rock Ridge. He is now a member of Rep. Ileana Ros-Lehtinen's (FL-27) Washington, DC-based professional staff at the U.S. House of Representatives, following a Science, Technology, Engineering, and Mathematics Fellowship awarded by the Congressional Hispanic Caucus Institute. wrbrooks@gmail.com

Dr. Rebecca C. Jordan is the Director of the Program in Science Learning at Rutgers University in New Brunswick, NJ. She devotes most of her research efforts to investigating public learning of science through environmental education and citizen science. jordan@aesop.rutgers.edu

The Florida Native Plant Society
PO Box 278
Melbourne FL 32902-0278

The Palmetto
(ISSN 0276-4164) *The Palmetto* is published four times a year by the Florida Native Plant Society (FNPS) as a benefit to members.

Editorial Content
We welcome articles on native plant species and related conservation topics, as well as high-quality botanical illustrations and photographs. Contact the editor for guidelines, deadlines and other information.
Editor: Marjorie Shropshire, Visual Key Creative, Inc. palmetto@fnps.org • (772) 285-4286 • 1876 NW Fork Road, Stuart, FL 34994

The purpose of the Florida Native Plant Society is to conserve, preserve, and restore the native plants and native plant communities of Florida.

Official definition of native plant:
For most purposes, the phrase Florida native plant refers to those species occurring within the state boundaries prior to European contact, according to the best available scientific and historical documentation. More specifically, it includes those species understood as indigenous, occurring in natural associations in habitats that existed prior to significant human impacts and alterations of the landscape.

For more Information:
http://fnps.org

To become a member, contact your local Chapter Representative, call, write, or e-mail FNPS, or join online at www.fnps.org/join

Follow FNPS online:
Blog: http://fnpsblog.blogspot.com/
Facebook: www.facebook.com/FNPSfans
Twitter: twitter.com/FNPSonline
LinkedIn: Groups, Florida Native Plant Society