The Conservation and Display of Southeastern U.S. Pitcher Plant Bogs at The Crosby Arboretum

Robert F. Brzuszek • The Crosby Arboretum • Mississippi State University Extension • P.O. Box 1639 • Picayune, MS 39466 USA • crosbyar@datastar.net

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With increasing value being placed on our natural heritage, The Crosby Arboretum, Mississippi State University Extension, is the premier native plant education facility of the Gulf Coastal Plain. The Arboretum allows us to study and learn about indigenous plants and plant products so that we may use them to their best advantage and ensure their continuous propagation in the future. Through the Crosby Arboretum, aesthetic, agricultural, scientific, and industrial contributions of native plant species and ecosystems can be examined in a real-life setting.

The Arboretum began as a living memorial to L.O. Crosby, Jr. in 1978. It has expanded to become a resource for education in the region and the world. The Arboretum provides for the protection of the region's biological diversity as well as a place for the public's enjoyment of regional native plant species.

The Setting

Arboretum lands lie within a diverse floral portion along the Gulf of Mexico known as coastal meadows. Coastal meadows comprise a low-lying generally flat area extending from the Gulf of Mexico shoreline from five to thirty miles inland. Elevations in this area do not exceed thirty feet above sea level. Occasional swamps and marshes mark the land, as well as sand ridges, where beach dunes once existed. The soil, dating from Eocene to Holocene in age, is sandy and grayish in the higher parts and black, peaty, and acid in the low-lying areas where water sometimes stands. The movement of water through the soil in lower areas is slow, and soils are strongly acidic, ranging in pH from 3.5 to pH 5.0. An open growth of pine savanna covers the area; and on the wet, acid soils there exists undergrowth similar to that of northern bogs.

Fire is an important part of the natural history of the pine woodlands, predating the coming of man around 20,000 years ago. In the past, lightning was responsible for fires approximately 5 out of 10 years in both the longleaf pine forests and in the more open bogs and savannas. This long association of the plant communities of the Piney Woods with fire has resulted in many adaptations now evident. Early land uses for agriculture and forestry has continued the use of prescribed fire for land management, until recent times with increasing land use changes. It is estimated that less than 3% of the Gulf Coast's original pitcher plant bog habitat remain. This staggering loss is certainly attributed to agriculture and grazing, and filling in for development; but primarily lost to the cessation of regular fire intervals.

The coastal meadows have a humid, warm temperate to sub-tropical climate. Annual precipitation averages 170 cm (66 inches) per year, with the heaviest rainfalls occurring in late spring to summer months. Torrential rains and strong winds—often with drastic effects upon vegetation—accompany the occasional hurricanes that cross the land. The mean temperature is 20.5°C (69°F) and the annual mean relative humidity is 76 percent.

This unique setting of our region gives birth to the conservation efforts, research, and educational exhibits of the Crosby Arboretum. The Arboretum is composed of seven different natural areas, totaling nearly 400 ha (1,000 acres), and is managed for conservation and research efforts. This vast assemblage of carefully selected and protected lands nurtures over 700 species of indigenous trees, shrubs, wildflowers, and grasses found along the Gulf Coast. The major veg-

Figure 1: The author conducting a prescribed burn. Photograph by L. Pardue.

Figure 2: Raised boardwalk through the bog. Photograph by R. Brzuszek.

Figure 3: Volunteers assisting with a bog rescue. Photograph by R. Brzuszek.

etation types, based upon a continuous interplay of fire and moisture regimes, include: longleaf pine, longleaf pine-scrub oak, slash pine, slash pine-hardwoods, sweetbay-tupelo-swampbay, beech-magnolia, baldcypress-tupelo, bottomland hardwoods, and shrub bogs, hillside bogs, and savannas (McDaniel, 1986).

The Flora

Shrub bogs, hillside bogs, and savannas are three closely related vegetation types and similar in species composition. Moreover, all three types frequently include large numbers of pitcher plants. Generally the shrub bogs and hillside bogs are somewhat wetter than savannas. In fact, occasionally they may be so wet that they shake when walked upon.

A shrub bog may be defined as an area with bog vegetation, especially pitcher plants, surrounded or broken by areas of shrubs or small trees. The shrubs or small trees are mostly evergreen or at least tardily deciduous. One of the rarest woody plants of the Gulf Coast region, bog spicebush (*Lindera subcoriacea*), was discovered in an Arboretum shrub bog about twenty years ago.

Hillside bogs are similar to shrub bogs but, lacking the break of intervening shrubs, are more open. They also have greater changes in elevation than shrub bogs or savannas. Hillside Bog Natural Area, a 28 ha (70 acres) section of Crosby Arboretum, is a spectacular sight espe-

cially after a winter burn, with literally hundreds of thousands of pitcher plants. In addition to pitcher plants, hillside bogs are quite diverse in herbaceous species including orchids, sedges, grasses, yellow-eyed grass (*Xyris* spp.), lady's hatpins (*Eriocaulon* spp.), and other herbs.

Savannas in our area are flat, frequently wet, with scattered slash or longleaf pine present. As a result of frequent fires and abundant sunlight, savannas have a rich herbaceous flora including several species of pitcher plants and other carnivorous plants, orchids, diverse sedges, and numerous grasses. Many of the plants are restricted to this environment.

Few places in the world can rival the diversity of carnivorous species than in southeastern U.S. pitcher plant bogs. According to noted biologist, George W. Folkerts, over half of the approximately forty-five North American carnivorous species occur along the Gulf Coast (Folkerts, 1982). Similarly, these pitcher plant bogs are equally diverse in many plant genera. Research conducted on Crosby Arboretum lands have documented in excess of 40 plant species per square meter.

The carnivorous plants of Gulf Coastal bogs include species of sundews (*Drosera*: Droseraceae), bladderworts (*Utricularia*: Lentibulariaceae), butterworts (*Pinguicula*: Lentibulariaceae), and pitcher plants (*Sarracenia*: Sarraceniaceae). Species recorded on Arboretum lands include *Drosera capillaris*, *D. intermedia*, *D. brevifolia*, *Pinguicula lutea*, *P. primuliflora*, *Sarracenia alata*, *S. psittacina*, *Utricularia cornuta*, *U. gibba*, *U. juncea*, and *U. subulata*. Prescribed fire is routinely conducted for management purposes in Arboretum natural area bogs every 5 out of 10 years.

A Novel Idea

In addition to the preservation of local plant communities in its natural areas, The Crosby Arboretum has an additional public center site, located in Picayune, Mississippi. Pinecote, as the center is known, is a 42 ha (104 acre) native plant facility and serves as the focus of activities and development. Unique in the garden world, the Arboretum features native plants exclusively in *in situ* environments.

Pinecote is a land of many changes. Originally a wet pine flatwood, the site was clear-cut of its longleaf and slash pine in the early 1900s. Experimental crops such as strawberries were grown on the land in the 1930s, and resulted in a network of roads and ditches to help the site. Pines were replanted in the 1940s and maintained by prescribed fire until the early 1980s.

The concept for Pinecote was to create and manage native plant communities that that reflect the flora of our region. It was decided to exhibit three main environments—aquatic, woodland, and savanna ecosystems. The savanna ecosystem was fairly easy, since the site was already maintained by fire. Twenty-four hectares (60 acres) of savanna were designated for this purpose. The woodland exhibit was to develop over the course of time by allowing 16 ha (40 acres) of savanna to transform by natural succession. Species missing from the site would be added as part of the restoration program. The aquatic exhibit was constructed in 1986, and features a 1 ha (2 acre) beaver pond and a 0.2 ha (0.5 acre) slough exhibit.

Next came the task of determining which plant communities would be displayed, restored, and managed within each of the three environments. Botanists from Mississippi State University established a 30 m × 30 m (100' × 100') grid system over the entire Arboretum site. From this they noted the existing plants and elevation changes within each of the grid systems. Research monitoring is conducted at periodic intervals to determine the species changes over time.

In the Savanna Exhibit, under the influence of fire, the higher elevations evidenced an emerging longleaf pine forest. These zones were designated for the management and restoration of longleaf pine and associated herbaceous species. In the lower wet areas, it was surmised that an existing pitcher plant bog had once occurred on the site, and was lost due to past agricultural use. These wet zones were designated for pitcher plant restoration. Other developing savanna community exhibits include *Sphagnum* moss flats, Slash pine lowlands, Baygalls, and other transitional communities.

From research and observation in our natural areas, restoration efforts were then initiated in each of the exhibits. The relative frequencies, dominance, and spatial characteristics of plant species were evaluated and compared to natural area sites. Longleaf pines were replanted to reflect natural groupings. Associated missing herbaceous species found in natural areas but not on the Arboretum site were directly seeded or planted in. All plantings were selected from plants of local genotype by purchasing from local native plant nurseries. Prescribed fire is introduced to all Savanna and Bog Exhibits on a regular basis.

The Pitcher Plant Bog Exhibit is approximately 1.6 ha (4 acres). Many wetland herbaceous plants such as spikerush (*Eleocharis* spp.), giant plumegrass (*Erianthus gigantea*), blazing star (*Liatris* spp.) and swamp sunflowers (*Helianthus angustifolia*) were already present, but no carnivorous species were in the site. To reflect the majesty of our regional bogs, both species of pitcher plants found in our county (*Sarracenia psittacina* and *S. alata*) were introduced, *en masse*.

We obtained the majority of our pitcher plants and other bog plants from rescues at local development sites. Unfortunately, privately owned small bogs (under 0.4 ha, 1 acre) are not protected by federal wetland laws and are frequently converted to fish ponds and other uses. When we learn about these events, we first try to educate the landowner about preserving the sites. If this does not work, we obtain permission from the landowner to conduct an emergency rescue, and then assemble volunteers to save as many plants as possible.

Over the course of ten years, thousands of pitcher plants have been relocated to the Pitcher Plant Bog Exhibit. We have had nearly 100% success in transplanting, even during an extreme drought in 2000. A wooden boardwalk 370 m (1200 feet) long traverses the bog and allows visitors a close view without trampling the tender ecosystem.

The result of this public display area has been an extraordinary opportunity to teach people about the magical workings and wonders of the southeastern U.S. pitcher plant bogs. Our goal is to have an enlightened public and help foster their conservation and preservation of this disappearing habitat. To achieve this, the Crosby Arboretum regularly conducts public programs on prescribed burning, pitcher plant bog tours, and plant sales of propagated bog plants.

For more information on the Crosby Arboretum, please visit our website at http://msstate.edu/dept/crec/camain.html.

References:

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