

Carnivorous Pitcher Plants in the Longleaf Ecosystems

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Longleaf pine savannas are unique coastal habitats that have a close association with fire. In many of these habitats, the indigenous and very diverse flora and fauna are threatened by loss of habitat and from fire suppression (e.g., Platt 1999, Gilliam & Platt 2006). Longleaf pine ecosystem is a pine dominant habitat. This ecosystem hosts broad spectrum of plants and animal species. These ecosystems are mostly found in the southeastern United States. Southern Louisiana is rich in longleaf pine ecosystem. These tall trees are not affected by fire. They can withstand harsh climates and live for hundreds of years. As an Ecologist myself, I am deeply interested in longleaf pine ecosystem, and I am currently teaching Ecology to my middle school students as an elective. One of my goals of this academic year is to take my students to a field trip to one of these ecosystems and study the area.

Many unusual plants are endemic to pine savannas. Pitcher plants are carnivorous plants that obtain their nitrogen and other nutrients from capture of insect prey. These unique plants occur primarily in local edaphic wetland habitats called seeps (or sometimes bogs) imbedded at low elevations within longleaf pine savannas (Bridges & Orzell 1989; Drewa et al. 2002). Such low-elevation coastal wetlands should contain plant species that can withstand short-term flooding and sediment deposition by fresh water, but the effects of storm surges comprised of saline water might be much more negative on seep plants. Pine savannas are the natural habitat of this carnivorous plants. Pitcher plants have a fascinating ecology. These plants always fascinated me ever since I was a child. When I was a child, I read somewhere that the 'tube' of pitcher plant holds almost 800 different species of microorganisms, and those microbes resemble the ones that humans have in their digestive tract. This made me very curious about the morphophysiology of these carnivorous plants. Unfortunately, there hasn't been much work done

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to study these plants at the cellular level, but I strongly believe that study of these plants with dual mode of nutrition could answer plethora of questions regarding evolution. Carnivorous plants are ideal organisms with which to study the ecology and evolution of plant-animal interactions in heterogenous environments, because these plants depend upon animals in several different ways (Givnish, 1989; Juniper et al., 1989). Carnivorous plants have fascinated evolutionary ecologists, botanists, and horticulturists for centuries (Ellison et al., 2003). “Darwin (1875) provided the first detailed experimental evidence for carnivory in several plant genera, and established once and for all that true heterotrophy existed in an autotrophic kingdom” (Ellison et al., 2003).

Pitcher plants use the nutrients from the organisms that are trapped inside their body. The plant uses digestive enzymes to break down and extract the nutrients. Waterlogged areas of pine savannas serve as the best habitat for these carnivorous plants. The soil beneath such land is very dense and water is stored for a long period of time. Such areas are very poor in nutrients. These pitcher plants have a tubular leaf that contains bacteria which produce digestive enzymes so that the plants are able to obtain nitrogen by digesting insects. The plant seems to contribute very little to the digestive process, so the trapping of ants can be important to the digestion process as well. A flat flange lies along the outer edge of the leaf and provides a trail of a sweet, nectar-like substance leading to the opening of the pitcher. The nectar acts as a narcotic causing insect to fall inside of the pitcher where rows of downward pointing hairs line the walls of the pitcher tube, preventing insects from crawling out. Once inside the pitcher the ant dies and decays, thus releasing the formic acid produced by the ant to cause painful stings, further contributing to the digestive process by making the pH as low as 2.0. Many insects are found to complete their life cycle inside the tube. According to Botanical Society of America, the blowfly, *Sarcophaga*

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serraceniae, spends its larval life deep at the bottom of the pitcher tube where it enjoys the decaying parts of captured prey. When it matures to form the pupa stage, it likewise leaves the pitcher to pupate among the surrounding moss. As an adult, the blowfly returns to the pitcher plant, but this time to steal nectar from the flower, and also to pollinate it. Pitcher plants, like other species that are associated with longleaf pine savannas, are threatened by loss of habitat and changes in the environment, such as those resulting from fire suppression. Further, global climate change is resulting in sea level rise that will threaten these unique coastal species over coming decades.

Outcalt (2000) states that “Longleaf pine (*Pinus palustris* P. Mill. [Pinaceae]) was the most prevalent pine type in the southern US. Stands of longleaf were also habitat for a vast array of plant species. Decades of timber harvest followed by conversion to agriculture, urban development, or to other pine species, have reduced longleaf dominated areas to less than 5% of its original range”(p.1). Longleaf pine ecosystems, the habits of these carnivorous plants, are being impacted by several environmental and human factors. Coastal pine savannas also are threatened by rising sea levels caused by global climate change. Although located above high tide lines, the low-lying coastlines of the southeastern United States result in large areas of coastal habitats being affected by sea level rise and hurricane storm surges. For example, along the northern Gulf of Mexico coast, storm surges extended as much as 20 km inland during the landfall of Hurricane Katrina (FEMA 2005, Knabb et al. 2005). Flooding associated with storm surges introduces saline water, deposits wrack (plant debris and associated human artifacts), and potentially changes sediments (Emanuel 2005); coastal savannas are among those habitats most greatly affected (Platt et al. 2013). Further, as rises in sea level continue, effects of hurricane

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storm surges should extend further inland over coming decades, threatening unique coastal pine savannas and their diverse endemic species.

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