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Backyard Endangerment; the Bunched Arrowhead

The Bunched Arrowhead is an exceedingly rare plant species that is in danger of vanishing from the planet. It is not generally a stunningly beautiful plant, nor is it very resilient. During the fall, the plant looks a little like crab grass, but in the spring it blossoms into a tall leafy plant with a small white flower. It grows in groups in a delicate wetland habitat, and is threatened by invasive weeds, water flow, silt deposition, and human land development. Although federally protected, the Bunched Arrowhead is not only endangered but also unheard of to most of the American population. Students at Furman University are exceptionally fortunate to have the Bunched Arrowhead right on campus. However, the Furman population reflects the rest of the country by being ignorant about our local treasure. The purpose of this research project is to better acquaint ourselves with the Bunched Arrowhead and its habitat in order to develop an appropriate appreciation for this endangered species in our local environment. Included in the report is a description of the bunched arrowhead and its habitat, an investigation of threats and relevant laws, and a discussion of Furman specific issues concerning this endangered species.

The Sagittaria fasciculate, otherwise known as the Bunched Arrowhead, is a small emergent aquatic phototrophic angiosperm which grows from six to thirteen inches tall. (Bunched) The life cycle of the bunched arrowhead is perennial, and it reproduces sexually. The dates for germination are unknown, however leafing occurs in March and April, and budding occurs in April and May. The methods by which pollen is disseminated are unknown; however seed is disseminated by animals and water. Its leaves are on average twelve inches long and two centimeters wide, and are attached to the base of the plant. (U.S., Endangered) The flowering stalk sticks straight up from the base. Bunched Arrowhead is monoecious; the upper flowers of the stock are male while the lower flowers are female. Each male and female flower grows upward separately on its own stem from the main stalk in spirals of two to three along the stalk. The plant

flowers in May and June and fruits in June and July. Each flower has three petals and three sepals; the males have three reflexed sepals, three white petals 0.2-0.7 inches long, and numerous stamens with pubescent, dilated filaments; the females have three spreading or reflexed sepals, three white petals 0.2-0.7 inches long, and numerous separate carpels. (Bunched)

According to Taxonomy of seven species of Sagittaria from Eastern North America by J.W. Wooten, "Bunched Arrowhead is the only Sagittaria species in the Southern Appalachians with non-sagittate leaves." This means that the leaves of the bunched arrowhead are not shaped like an arrowhead at all. The emergent leaves are actually spatulate (looking like a spatula) or oblanceolate (looking like a lance). Winter rosette leaves and submergent leaves are linear shaped. (Beal) Wooten suggests that the bunched arrowhead diverged genetically from other species of the sagittaria graminea group during a period of long geographic isolation because the saggittaria fasciculate exhibits low crossability with varieties of sagittaria graminea.

People generally associate the term "plant" with gardens or fields; however the Bunched Arrowhead enjoys a habitat immersed in shallow bodies of water. Likened to a finicky eater, the Bunched Arrowhead requires an environment found in very few places around the southeast, and is extremely sensitive to any environmental changes. These bodies of water range from small streams to swampy bogs with an underlying kaolinite clay layer. (Wooten) The natural habitat for the species is in forested seepages; however, there are several colonies in the open. "The seepage wetland headwaters of some local rivers […]" found in North Carolina and the South Carolina upstate provide the ideal environment and for this reason remain home to the last known populations of the Bunched Arrowhead. (Gaynor) These muck-filled seepage areas are usually on quaternary alluvial floodplains, or occasionally on small sandbars in streams. The Bunched Arrowhead populations are located on gneiss with the dominate minerals being plagioclase and quartz, with some muscovite and biotite mica. Humus comprises much of the organic matter in the muck, and serves to increase the porosity and water holding capacity of the soil, as well as providing a buffer against rapid changes in acidity. It also assists in retention of plant nutrients. The seepages may be related to a long, linear fault which occurs in the four northwestern South Carolina counties. (Snipes) Little is known

of the precise habitat requirements for bunched arrowhead; however the most common environmental conditions for the plant occur in the continuous flow of unconfined ground water with temperatures between 57 and 67 degrees Fahrenheit in nutrient poor soil. Nitrogen, phosphorus, and potassium are usually present in low amounts with wet pH varying between 5.0 and 7.1. The species survives best in sites with little competition with other species. Adjacent to the seepage areas are often red maple, tupelo, sweet gum, Virginia pine, Juncus, Cecumaria, Pettandra, Iris, Alnus serrulata, Sparagnium, Rhus, Impatiens, and Lycopus. The major competitor for the bunched arrowhead is Alneilema keisak. (U.S., Endangered)

Although these habitat characteristics may seem bountiful, the number of living Bunched Arrowhead plants is dwindling to endemic levels. A plant that once thrived in many areas across the southeast is now limited to a mere seven populations located in North and South Carolinas. The North Carolina population is found in Henderson County near East Flat Rock. Bent Fork Creek plays refuge to this struggling plant, and is the last of many sites in North Carolina. The Bunched Arrowhead could be found in several historical preservation sites all over North Carolina, but development and pollution have led to its disappearance in these areas. The current population was nearly wiped out during the late 1970's when maintenance was performed on a nearby railroad bed causing much of the population to be destroyed. (U.S., Endangered) Unfortunately this population remains in a vulnerable location, positioned under a highway overpass adjacent to the same railroad bed responsible for much of its destruction. (Gaynor) The South Carolina populations are in slightly better condition, but they are by no means safe from harm or even extinction. These populations are all located within a few miles of Furman University campus, outside the town of Traveler's Rest. The Tyger and Enoree rivers provide the combination of fresh water and mild current in which the Bunched Arrowhead thrives. (Gaynor) However, similar to the populations in North Carolina, the number of plants found in South Carolina is declining due to not only development and pollution, but fluctuations in water flow, exotic weeds, and "the plant's naturally limited range and small size." (U.S., Bunched)

Both North and South Carolina provide the combination of environmental factors required for the Bunched Arrowhead to sustain life and flourish. The fact that North and

South Carolina are the only states in which the Bunched Arrowhead is found is far more than a coincidence. Instead, it is an environmental relation provided by the Southern Appalachians, which run through the western part of both states. This "mountain range, from the moist bottom lands to the rugged peaks, lends itself to a tremendous diversity as altitude climate zones, rainfall distribution, and a host of other more subtle factors lead to a multitude of microclimates." (Gaynor) Found within a few of these many microclimates are the small sedimentary seepage environments needed to sustain the plant. Coupled with shade and tranquility, these areas create the only habitat in which the Bunched Arrowhead can sustain life. (U.S., Endangered)

The bunched arrowhead was designated an endangered species by the Endangered Species Act of 1973. The federal agency responsible for the upkeep and protection of the plant is the United States Fish and Wildlife Service. The primary threat to the bunched arrowhead is the destruction or alteration of its habitat. Specifically, this includes: wetland filling for residential, industrial, highway, agricultural, or grazing purposes; altering stream paths; trampling by livestock; the dumping of fill from a road project; pollutants; and the development of the upland areas adjacent to the plants' habitat. (Taxonomy)

The South Carolina Heritage Trust Program is a group dedicated to the protection of the bunched arrowhead. They follow the Recovery Plan implemented by the United States Fish and Wildlife Service and strive to protect an adequate number of Bunched Arrowhead colonies and populations to ensure the continued survival of the species. Their efforts include protecting the existing populations with their essential habitat, studying the species and monitoring the population, and enforcing laws and regulations protecting the plant. They educate landowners with the Bunched Arrowhead on their property about caring for the endangered plant, and purchase plots of land where the Bunched Arrowhead grows naturally. They also transplant colonies of the plant to locations where it can flourish. These colonies are protected by the Nature Conservatory and are overseen by members of the United States Fish and Wildlife Service. (U.S. Bunched) Some counties are protecting the bunched arrowhead by restricting the use of pesticides in and around areas of the plant growth. These small steps will make a difference in the population growth of this precious plant species. (Field Operations)

Furman University contains the aforementioned necessary seepage habitat with its sandy substrate for the Bunched Arrowhead and is fortunate to have this endangered species right on the campus. Because it is so ecologically sensitive, and so dependent on its unique habitat, any alteration to the Furman Bunched Arrowhead habitat would be devastating. Unfortunately, the campus is not as safe for the plant as one might imagine. Behind the Furman University campus is a childcare center. Near this center, there is a large piece of undeveloped land. Furman is considering selling this land to a firm that builds retirement communities. This causes a great concern to environmentalists; the construction may change the water table and runoff patterns. If the unsaturated zone of the ground becomes saturated with an increase in runoff, the groundwater table will rise. The new asphalt could easily cause flooding, killing the Bunched Arrowhead with far too much water. Development would alter the recharge area for the seeps and could affect the flow and quality of water in the habitat. Urbanization also interferes with natural dispersal patterns of the plant. If this construction were to take place, there is a very real chance of this plant becoming extinct. Unfortunately, Furman University is a private University, and the plant dwells on private land. Although it is a federally protected species, Furman can do anything they want with their land. At the moment, however, the plant is safe. Furman has entered into an agreement with Parks, Recreation, and Tourism to protect the population. In fact, the Bunched Arrowhead area on the campus is a heritage site. Currently, Furman University student Charlotte Matthews is conducting a study on the effect of an introduced Asian species of plant on the bunched arrowhead. This will monitor the precarious position of this intrusive plant and hopefully prevent the death of the Bunched Arrowhead. (Worthen)

Why save the Bunched Arrowhead? Many people take a utilitarian view of nature and recognize that humans should protect things that are useful. Unfortunately, no one has really studied this species yet. No one knows whether it produces useful pharmaceutically active compounds, if the stability of this habitat is dependent on this species, or if the Bunched Arrowhead has important pollinators that depend on it. Essentially, the use and ecological value of this species is unknown. A conservative approach would dictate that the Bunched Arrowhead is saved at least until it has been studied more thoroughly so that we do not discard a potentially valuable or important

species. Another reason to preserve this plant refers to an aesthetic view of nature. Natural diversity and complexity continue to enrich both lives and spirits. The human race is connected to nature in an emotional and genetic way. The health and integrity of ecosystems are important for food, clean air, and clean water. Although this one little species may not contribute in a meaningful way to personal welfare, it is a living piece of the biological diversity that sustains people. Therefore, Furman has a responsibility to care for this plant; extinction is forever. (Worthen)

The Furman University Environmental Action Group is currently raising money for the construction of an observation deck and educational signs to educate the Furman community and the public on this endangered plant. Raising awareness is crucial; if the public is ignorant concerning the existence of this plant, no one will be upset if it disappears. Three fundraising projects are currently in place: (1) The selling of ornamental plants in the University Center; (2) The selling of organic winter produce planted recently on a faculty members' farm; and, (3) A donation competition among Furman's Greek organizations. Furman University President Dr. Shi avidly supports this project and has issued a challenge to the Greek organizations, stating that his office will match their donations dollar for dollar up to one thousand dollars. Any organization donating money will be recognized on a plaque that will be placed on the observation deck, and the Greek organization that donates the most money will receive the Environmental Action Group Community Service Award. (Perry)

In conclusion, the small flowering Bunched Arrowhead retains a questionable future. Just as North and South Carolina provide the rare environment for the plant, they also provide the elements that have lead to the rapid destruction of numerous populations. Luckily, the destruction of the Bunched Arrowhead appears to have hit a roadblock thanks to recent efforts by the United States Fish and Wildlife Services, the South Carolina Heritage Trust Program, and the Furman University Environmental Action Group, among others. Here at Furman University, we have an obligation to protect this treasure in our backyard. The best tools are knowledge and preservation; accept the challenge of saving an endangered species and prevent the extinction of the Bunched Arrowhead.

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