CHERAW STATE PARK
ENVIRONMENTAL ASSESSMENT

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CHERAW STATE PARK

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Cheraw State Park

Red-Cockaded Woodpecker Survey and Floristic Inventory

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I. Introduction:

The Cheraw State Park is located in Chesterfield County, South Carolina. Geologically this area is the north-western edge of the Inner Coastal Plain refered to as the Sandhills. The Sandhills area is a small but interesting habitat and extends south-westerly from south-central North Carolina (Fayetteville area) through South Carolina (Cheraw, Columbia, Aiken) and Georgia. Historically, this area represents the upper limit of the Atlantic Ocean during the Tertiary Period (70 million years before present) of geological history and was formed from a combination of sand dunes and a buildup of eroded mountain sediments from the Southern Appalachians. As a result of these factors the topography and soil structure is a deep, coarse, excessively drained sands layed down in low, rolling hills with steep, deep cut valleys resulting from stream action. One additional natural factor has shaped the Sandhills: fire. Before settlement by Europeans, the entire Southeast was subject to regular and reoccurant fires resulting from both lightning and more recently the hunting methods of the American Indians. As a result of all of these factors of formation, topography, soil composition, stream action and fire, the Sandhills has evolved into a unique area inhabited by a particular assemblage of plants and animals. These organisms have evolved to cope (and even thrive and promote) with these harsh environmental factors; especially with the burning.

Since European colonization, large tracts of property have been put under the plow, cities have been built, and the supposed enemy, fire, has been eliminated. All of these activities have begun to change the natural maintenance of this area. The vegetation that evolved to withstand and promote fire so as to limit competion from other species are now being outcompeted. The animals that relied on the original fire maintained plant species for forage and reproduction are inturn outcompeted by the new assemblage of animals utilizing the newer vegetation. Many of these organisms (both plant and animal) can no longer survive or their habitats are becomming more restricted. As a result, many wide spread and common species are now extinct, endangered, or threatened. The population numbers of these species that still exist will continue to dwindle unless steps are taken to revert their habitats back into it's natural form.

The Cheraw State Park, being a natural area, still has much of it's area in marginal natural habitat. Since its development in the 1930's, minimal human activity has retained it's natural aspect. However, the very important factor of fire has been eliminated and much of the park has been allowed to succeed into Oak-scrub terrestrial communities or Bay Forest Type Wetland communities. Within the "un-succeeded" areas many of the important endangered and threatened species still exist. This study was done to locate, document, map, and inventory these species and communities and also to recommend measures that will help their proliferation.

II. Methods:

The Ecological study entailed two distinctive projects on the Cheraw State Park: Red-Cockaded Nest Site Survey and a Floristic and Habitat Inventory. The two studies were conducted independently and coordinated differently.

The Red-Cockaded Survey used both student and personal time for observation and documentation. Student input consisted of 75 person-days of 6-8 hours each; exclusive of transportation time to and from the park. Total personal time consisted of 12 field days and 4 lab days. A total of 9 field trips were taken with these students where the group size per trip ranged between 8-10. All students used were Biology Majors at St. Andrews Presbyterian College and all were members of Tri-Beta National Biological Honor Society.

The survey strategy was to locate, identify, mark, and map Red-Cockaded nest cavities within the park. The park was divided into quadrants, upland vs wetland habitats were identified, and finally potential habitats were determined. This data was derived from aerial-photo maps (scale; 1" = 400). Once done a crew of students (along with me) surveyed the areas. All habitats were searched including pine dominated wetlands; however, upland pine-wire grass areas received the most attention. The field search procedure followed the U.S Fish and Wildlife Service recommendations by stretching a line of people in a North and South direction and traveling on a compass heading of East and West. Students were spaced at different intervals depending upon the density of the understory vegetation.

The second aspect of this Ecological study was to prepare a complete floristic and habitat analysis of the Cheraw State Park. Personal time consisted of a total of 81 days divided between field and lab time. Work in the lab consisted of pressing/drying plant materials, identifying and labelling specimens, and preparing herbarium material. All material (when possible) was collected in duplicate and one set will be sent to the University of South Carolina Herbarium (USC) and the other set will remain at the St. Andrews Herbarium (SAPCL) serving as voucher specimens. Each species was also analyzed as to its distributional range and its status with respect to Federal and State regulations concerning endangered, threatened, rare, or of concern. A complete listing of species is appendixed to this report. Field recognizance for collection and habitat analysis spanned a time from March 1 - Oct. 1, 1989 which is the entire growing season. This frame was used so that all species could be recorded including the very early Spring Flora/Winter annuals and the Fall flora.

By using aerial-photos, all possible habitats were identified and each was visited several times throughout the season. Several areas proved richer in species diversity than others and these were visited regularly. Aquatic (lake) habitats were surveyed by canoe and terrestrial areas by foot. In addition to the species list, the data in the results section of this report encapsulate the diversity.

Species nomenclature primarilly follows Radford et. al. (1968), but also Godfery and Wooten (1979 and 1981), Cronquest (1980), Gleason (1963), and Hitchcock (1971). Community nomenclature follows Nelson (1986).

III. Results:

A. The results of the Red-Cockaded Woodpecker survey yielded a total of 42 nest trees of which 1 was enlarged and occupied by a piliated woodpecker, 3 were starter holes (2 of these were in pond-pine), and 3 were inactive. Several trees had multiple holes. The most interesting observation was that the majority (90%)were found in disturbed habitats and areas of intense human activity (road sides, areas of pine straw digging, and front yards). Analysis of this observation has lead to an understanding of their habitat needs which involves the removal of scrub and understory vegetation. Attached to this report are guidelines for habitat maintenance for the Cheraw State Park which has been developed in response to the forest management practices now being done on the park.

B. Cheraw State Park Floristic Diversity

Total Species Identified----------389
Total Species Considered New to Chesterfield County (Co. Records)------91
Total Species Considered New to the State of South Carolina----------2
Total endangered, threatened or rare.----------10

Specific species and status	
1. Pityopsis barbulata	endangered (Federal)
2. Solidago verna	threatened (Federal)
3. Hudsonia ericoides	threatened (Regional)
4. Chrysoma pauciflosculosa	threatened (Statewide)
5. Lygodium palmatum	threatened (Statewide)
6. Lycopodium obscurum	rare*
7. Paronychia herniarioides	rare*
8. Ruellia ciliosa	rare*
9. Sarracenia rubra	rare*
10. Scirpus etuberculatus	rare*

* (Rare category as cited in Radford et. al., 1968)

IV. Discussion:

A. Red-Cockaded Woodpecker Analysis

Cheraw State Park does contain a fair number of Red-Cockaded Woodpeckers as indicated by the survey where a total of 42 nest trees were found (including 1 enlarged and 3 inactive trees). This number of nesting sites does not translate directly into the total number of birds since they have only one mating pair per clan and the clan size is variable. What this data does suggest is that the population of these endangered species in the park is high. It does not suggest that the potential numbers could (and should) be much higher given the vegetational composition and character of the park.

The habitat of the Red-Cockaded Woodpecker consists of mature (>60 years), open, long leaf pine forests with little to no shrub layer and a forest floor in grasses (Aristida) and forbes. Prior to European settlement of the Southeast this entire area was in that vegetational form resulting from periodic burning. Burning promotes the thick-barked pines and the grasses but removes the shrubs and hardwoods. Since colonization, fire has been eliminated and the Sourheastern pine forests have been allowed to succeed into hardwood forests. Within the Sandhills region the hardwood species are predominately scrub oaks (sandhills white, post, black jack, turkey, blue-jack oaks) and hickories. These trees prevent reproduction of pines and also offer food sources to flying squirrels and piliated woodpeckers which can outcompete the Red-Cockaded Woodpecker for their nest sites. With existing nest sites occupied by other species and the pines not reproducing, the Red-Cockaded Woodpecker is gradually becomming extinct. Proper management practices by burning will remove the scrub oaks and shrub layer both forcing out Red-Cockaded Woodpecker competitors and promoting the grouth of new nest trees of Long Leaf Pine. Current PRT park maintenance procedures do not include burn maintenance. As a result, there are a few areas left with the park capable of supporting the woodpeckers or promoting their spread. From the map data on the nest sites it can be seen that the highest concentrations of woodpecker activity is in areas of human activity; roadsides, picnic areas, front yards, and areas of pine straw digging. Each of these activities removes scrub oaks and shrubs and promotes grasses and pine trees. These activities, as a result are the sole reasons Cheraw State Park has Red-Cockaded Woodpeckers within its' boundries! Human disturbance of habitat is not normally considered in the best interest of wildlife species. But in the absence of natural factors, human activity that results in similar effects should be invited. The development of the proposed golf course percisely fits this model where the human impact will not only insure the survival of the existing woodpecker colonies but also promote species expansion as long as mature trees for nest sites and foraging habitat are protected.

Attached in the appendix of this report are guidelines for pine forest and woodpecker habitat management. It should be noted that other endangered and rare plant species would benefit from these procedures.

B. Habitat Analysis

Upland Pine-Wiregrass Woodland, Pine-Oak Scrub, and Xeric Sandhill Scrub Communities:

The most predominant terrestrial vegetational types on the Cheraw State Park are the Sandhills Communities: Upland Pine-Wiregrass Woodland, Pine-Scrub Oak Sandhill, and Xeric Sandhill Scrub. All of these communities are related via the two factors of hydrology and fire. From a hydrological view, these communities have been listed (above) in order from the more xeric (first) to the most xeric (last) with respect to percolation and watertable level. Successionally, the dominant vegetational association in any of these areas will develop into the Xeric Sandhill Scrub, regardless of hydrology, when fire is excluded. But when fire is recurrent and regular (Pyric Clima) all will be maintained in the Upland Pine-Wiregrass Upland. In a successional sequence, hardwoods follow pines in the Southeast. The hardwoods are shade tolerant but the Pines are not. As hardwoods invade the pine woodlands they can survive under the shade of the pine canopy. Once the hardwood canopy closes the reproduction of pine species is prevented since the pine seedlings need full sun to survive. Through time the pines die from old age and all that remains are the hardwoods. In our area the scrub oak species which dominate are Quercus laevis (Turkey Oak), Q. incana (Blue Oak) Q. margaretta(Sandhills White Oak), Q. marilandica (Black Jack Oak), and Q. stellata (Post Oak). In the driest of areas, only the Q. laevis (Turkey Oak) may exist.

Historically, in pre-settlement times, the entire southeast coastal plain was subject to reoccuring fire. The species have evolved in such a way that they have been able to withstand fire, often need fire for growth and reproduction, and even promote fire to exclude competition. The thick bark on Pinus palustrus (Long Leaf Pine), the volital saps, and the long needles are all evolved fire adaptations. The health of most all of the Sandhills Communities on the Cheraw State Park are in need of pyric maintenance for their survival. Since fire has been excluded these natural communities face two major problems. First, the natural pyric climaxes have been allowed to succeed into scrub forests. Second, the layers of leaf litter (fuel) has become dangerously deep. If a fire does get started, it would cause severe damage and crownfires which will kill all the vegetation including the pines. Hot fires also alter the soil structure and prevent rapid reforestation (disclimax). There are two such areas on the park which have suffered from hot fires, only one of which is in a terrestrial sandhills area. Maps are included with this report which locate these Sandhills Communities. It is essential that these areas be managed properly so they can revert back to their natural state and reduce the risk of severe damage if a fire does occur. Also included with this report are management recommendations for these communities.

Location of Hot Burn Area:

Island peninsula on the south side of Eureka Lake approximately 0.5km NE of Camp Forest beach. This area is almost directly across the lake from the park headquarters and swimming area. This area has a soil surface of coarse loose sand which is underlain (0.5cm) by a fine layer of charcoal. Below this charcoal layer is finer grained sand. The charcoal layer absorbs nutrients and prevents percolation of water into the soil. The vegetation consists of a few widely spaced Quercus laevis (Turkey Oak) individuals with a ground cover of Cladonia sp, (Reindeer Lichen). It is an area of soil sterility with respect to nutrient availability and organic material and sparce vegetation. Succession back to the forested area will be very difficult. This area is physiognomically similar to the registered Hudsonia Flats. It shoud be possible to transplant several of the endangered and threatened species from Hudsonia flats to this area. The species are Chrysoma pauciflosculosa (Woody Goldenrod), Solidago verna (Spring Flowering Goldenrod), and Hudsonia ericoides (Hudsonia).

Pine Flatwoods Community:

By definition, a Pine Flatwoods Community is similar to a Pine-Wiregrass Upland Community except that the watertable is closer to the surface in the Flatwoods. This higher watertable leads to an increased forb flora and more diverse canopy although Pinus palustrus (Long Leaf Pine) still dominates. Both communities are maintained by fire. For both of these communitites, if the pyric climas is not maintained they will succeed into a hardwood forest; however, the climaxed reached by each of these will differ in species composition resulting from the hydrological differences. In the Pine Flatwoods Community, the successional climax should develop into an Oak-Hickory Forest whereas the Pine-Wiregrass Upland will become a Pine Scrub Oak Sandhill.

On the Cheraw State Park there does not appear to be any areas that could be called a Pine Flatwoods Community. However, within the Park's boundary is the US Fish Hatchery at the junction of US 1 and SC 20. A 5-10 acre tract of the Fish Hatchery property is an excellent example of this Flatwoods Community.

Location:

Pine Flatwoods Community: US Fish Hatchery property, located between the public parking area/aquarium and US 1. Area consists of low, hilly topography with young and mature, widely spaced P. palustrus (Long Leaf Pine) canopy. Along seepage areas, where open, occurs Pine Savannah habitat including several Sarracenia species. Within this small tract exist 9 Red-Cockaded Woodpecker nest trees...the largest colony with the boundries of the Park.

Oak-Hickory Forest Community:

The Oak-Hickory Forest Community is the typical standard vegetational climax expected in the mesic to dry-mesic habitats of the Southeast where fire is rare or occasional. Characteristically, this community is dominated by a variety of hardwoods and the conifer composition is low. As the name implies, these areas in Cheraw State Park are dominated by Oaks ((Quercus velutina, Q. ruba, Q. marilandica, Q falcata, Q. stellata)(Black, Red, Black-Jack, Southern-Red, Post Oaks respectively)) and Hickories ((Carya tomentosa and C. glabra)(Mockernut and Pignut Hickories) but they also contain other hardwoods such as Liriodendron tulipifera (Tulip Tree), Acer rubrum (Red Maple), Cornus florida (Dogwood), Oxydendron arboreum (Sourwood) and Liquidambar styraciflua (Sweetgum). Cheraw State Park is not pyricly maintained. One would expect large tracts of these communities throughout the park; however, their occurance is rare and of little significance to the park's vegetationaly composition.

The Sandhills (and obviously Cheraw State Park) is typified by rolling hills and deep, coarse, sandy soils. This soil composition and topography permits rapid percolation and drainage of surface water leaving dry uplands (Pine Scrub-Oak Sandhills Communities) and hydric valleys (Bay Forest Type Communities). Literally, an elevation difference of 0.5-1.0meter (and often less) separates these two communities with little or no mesic ecotonal area with respect to hydrology. Within Cheraw State Park there are many areas exhibiting the vegetational composition of the Oak-Hickory Forest; however, there are no large and continuous tracts. Instead, one finds narrow bands of Oak-Hickory Forest sandwiched between the xyric and hydric communities when the topography is of low slope. Within the park, areas West of SC 20 do exhibit more gentile sloping and the incidence of floristic elements characteristic of the Oak-Hickory Forest are more common; especially the areas on either side of SR 232 between Juniper Creek and the Southern Park boundry. One accessable area East of SC 20 is as follows: Area 0.1 mi. NE of Jct. US 1 and SC 20 on US

1. A tributary or seepage area of Juniper creek flows under US 1 and feeds into the US Fish Hatchery pond system. On the NW side of US 1 exhibits a wide belt of Oak-Hickory Forest elements.

Bay Forest Type Communities: including Pocosins, Streamhead Pocosins, Small Stream Forest, and Hillside Herb Bog.

The Bay Forest Community has been defined by Nelson (1986) as "Heavily forested wet sites(saturated seasonally or intermittently) on the coastal plain, dominated by bay species" (Pg. 4), which are Gordonia lasianthus (Loblolly Bay), Magnolia virginiana (Sweet Bay), and Persea borbonia (Red Bay). Also in association with these "bay species" are Cyrilla racemiflora (ti-ti), Ilex glabra (Inkberry), Lyonia lucida (Fetther bush), Clethra alnifolia (Sweet Pepper Bush), and Myrica cerifera (Bayberry). This community-type occurs throughout the Sandhills and Coastal Plain along stream banks, slopes, and depressions. It appears that the Bay Forest Community is a successional end (Climax) for non-alluvial wetlands in these geographical areas where fire (Pyric Climax) is excluded. Pocosins, Streamhead Pocosins, Small Stream Forests, and Hillside Herb Bogs are all wetland communities variably dependent on fire for maintenance. If these communitites are protected from fire, they will succeed into Bay Forest Vegetation (Pyric post climax) and can only be distinguished by their physical location in reference to their proximity to streams or drainage patterns. On Cheraw State Park prescribed maintenance by fire is NOT done and as a result, these communities are indistinguishable floristically. They are all; therefore, refered to here as Bay Forest Type Communities.

Except for the alluvial or open standing water communities of Atlantic White Cedar Swamps, Pond Pine Woodlands, and Pond Cypress Ponds, virtually 100% of the wetland areas on Cheraw State Park fit the Bay Forest Type Communiy. Floristically, these areas are the most diverse; approximately 65% of the species on the plant inventory list were collected from these wetland areas. When an opening in the canopy and shrub layer has been made (small fires or power-cut) the diversity of the herb flora increases and several significant finds have been recorded: Lygodium palmatum (Climbing Fern) (Statewide concern) Lycopodium obscurum (Ground pine) (200mi. out of range), Sarracenia rubra (Red Pitcher Plant)(Rare), and many species never before recorded as existing in Chesterfield Co., S.C. Below are listed several significant sites of diversity.

1) Powerline cut parallelling SC 20 beginning at the Hudsonia Flats area (0.3 mi. SE of US 1 on SC 20) and extending 0.4 miles across a ridge.

2) Same location as No. 1 but adjacent (east) to the ridge tops is a 1 acre burn area. The east side of the burn area is open and dominated by many savannah species.

3) Power cut at West end of Camp Forest and extending 0.5 miles along the edges of a Bay Forest Type Community.

4) North side of Cherokee Lake. A recent burn (less than 5 years) has opened a small area producing Hillside Herb Bay.

5) Most all areas around the Cherokee Lake nature trail are sufficiently open with hillside seepage to permit savannah vegetation.

6) US Fish Hatchery property between the aquarium parking lot and US 1.

7) Randomly along SR 232 are small patches of open canopy with seepage creating may small patches (<0.3 acres) of savannah vegetation.

8) Park interior: 0.3 mi. SE on US 1 after Jct. US 1 and SC 20, then 1 .0mi. South into park interior, ca 0.1m N. of Juniper creek. Area refered to as Sarracenia Flats. The area is a broad, flat, spindle shaped area devoid of canopy cover and dominated by grasses and Sarracenia rubra and Sarracenia flora.

Pond Cypress Pond Community:

Pond Cypress Pond Communities are well represented on Cheraw State Park and constitute essentially all of the open water paulustrine communities in the upper (Southwestern) 1/3 - 1/4 of Eureka Lake. There are, in addition, extensive areas in the lower (north eastern) end of the lake exibiting this community where the shallows extend 20-30m into the water and also upstream and along Juniper Creek approximately 1.2km until the creek channelizes near the U. S. Fish Hatchery.

Within the Park the largest tract extends almost continuously across the upper 1/5 of Eureka Lake and upstream Juniper Creek 0.4Km from its junction with the lake at the Old US 1 bridge.

This partiacular community characteristically is dominated by Taxodium ascendens (Pond Cypress) and Nyssa sylvatica var. biflora (Black Gum) with shrubs and herbs rooted in the bark of the swollen bases of these trees ("Cypress Butt Communities"). Since the water is shallow, large numbers of floating aquatics also exist. The Pond Cypress Pond Community is tied to regular (although very infreguent) drought. The canopy species cannot reproduce (seed germination) in standing water; although they can grow and mature in it. Therefore, periodic drought is necessary for community regeneration. If drought conditions are severe or prolonged this community will succeed into Pone Pine Woodlands, Atlantic White Cedar Swamps, or Bay Forest Type Communities.

At the Cheraw State Park the Pond Cypress Pond Communities vary from this ideal. The presence of Nyssa sylvatica var. biflora is of minor importance and the Taxodium ascendens are basically even aged. When the Park was developed, the damn built, and the Eureka Lake formed in the 1930's periodic drought was halted. As a result, this community is not reproducing and most of the trees are even aged. It currently is at the age of maturity where it is the most important to wildlife species (both plant diversity and animal utilization) and in aesthetic quality from a human standpoint.

With respect to animal wildlife utilization, this community serves as an important breeding habitat for water foul and perching birds. It also serves as a water foul stop-over for migration and in 1988 a green heron rookery was sighted. Plant species diversity in these areas is also high which can be attributed to the openness of the canopy and variation in water depth from shallows to deeper water.

In the shallows the vegetation resembles a Pond Cypress Savannah with the presence of species such as Xyris spp. (Yellow Eyed Grass), Sarracenia spp. (Pitcher Plants), Utricularia spp. (Blatterwort), Drosera spp. (Sundew), and Mayaca aubletii. In deeper water floating aquatics and emergents dominate, for example Nuphar luteum (Cow Lilly), Nymphaea odorata(Water Lilly), Myriophyllym heterophyl-lyum (Pond weed), Scirpus eturberculatus (Scirpus), and most dominantly Nymphoides cordata (Banana Plant). One of the more interesting vegetational associations within the community are the "Cypress Butt Communities". Physically rooted in the bank of the swollen Cypress bases are a regular grouping of shrubs which include: Zenobia pulverulenta (Zenbia), Leucothoe racemosa (Fetter-Bush), Lyonia lucida (Fetter-Bush), Cassandra calyculata (Leather Leaf), Clethra alnifolia (Sweet Pepper Bush), Itea virginica (Virginia willow), and Cyrilla racemiflora (Ti-Ti)..

The aesthetic quality of this vegetational community has been noted by the South Carolina PRT. Through Park literature PRT has used the Pond Cypress Pond Community as a major drawing card for park visitation. Currently accessability to these communities are only by boat. The site of the proposed golf course, club house, and lodge will surround these areas. As a result, these communities will be managed, improved, and opened for appreciation by the general public.

Pond Pine Woodland and Atlantic White Cedar Communities

Pinus serotina (Pond Pine) is extremely abundant in the wetland (non-aquatic palustrine areas) areas of Cheraw State Park. It generally serves as the dominant coniferous species in these areas and is associated with the typical shrub species prevalent in Bay Forest Type Communities. This type of vegetation composition constitutes a community type refered to as the Pond Pine Woodland; however, on the Cheraw State Park there is little acreage that actually fits the definition for this community despite the species occurances and associations. The Pond Pine Woodland is a community whose existance is dependent upon fire. Pinus serotina produces cones which stay closed for years until fire burns through the habitat. Fire causes the cones to open and the seeds germinate in the ash.

On Cheraw State Park, the absence of this maintenance technique has produced non-reproducing, even aged P. serotina Woodland acres. As a result these areas have succeeded into other communities tied to the particular hydrology of the specific area. Most of these areas are succeeding in one of the Bay Forest Type Communities or the Atlantic White Cedar Swamp Communities.

According to Radford et. al (1968) Chamaecyparis thyoides (Atlantic White Cedar) is restricted in it's distribution in South Carolina to the Sandhills portion of the state. There are several large stands of this species on the Cheraw State Park which constitutes areas large enough and with the proper association of other plant species to form Atlantic White Cedar Communities. This community, as is the Pond Pine Woodland, is dependent on fire for its maintanence; however, the occurance of fire is much rarer and infrequent. Within the Cheraw State Park are two good examples of the Atlantic White Cedar Community.

1. Thin edge of Eureka Lake extending SW along the southern shore from an area just NE of Camp Forest to the headwaters of the Lake. Also on the northern shore southeastward starting just south of the park headquarters and continuing SW to the lake headwaters. There are scattered individuals of Chamaecyparis in other locations along the lake shore; however, not existing in continuous stands. As Eureka Lake narrows towards it's Juniper Creek source the number and density of Chamaecyparis increases, particularly up broad, shallow, swampy/boggy tributaries on the sourhern shore south of Camp Juniper (proposed club house site "C"). These areas represent small (but true) communities.

2. The largest continuous Atlantic White Cedar Community on the park exists west of SC 20 and between US 1 and SR 232. Just west of SC 20, Juniper Creek bends South and a large tributary joins from the North. From this juncture and extending southward approximately 2km exists a large community composed of both open and partially open Sphagnum and Sarracenia rubra flats as well as closed pocosins with a heavy (4-6m tall) understory of Cyrilla racemiflora (Ti-ti), Itea virginica (Virginia willow), Persea borbonia (Red Bay), Myrica ceriferea (Bay Berry), and Rhus vernix (Poison Sumac). This area is also the only site in the park with a known collection of the endangered Hyla andersonii (Pine Barrens Tree Frog). Within the middle of this complex exists a spindle shaped open area approximately 20m by 400m (which I refer to as Sarracenia Flats) in which several hundred clumps of Sarracenia rubra exists. This flat is rapidly succeeding into an evergreen pocosin and should be maintained as an open area. Throughout this habitat considerable numbers of Pinus serotina exist and essentially co-dominate the area. It is believed this is an example of a wetland area that has succeeded from a Pond Pine Woodland to an Atlantic White Cedar Community resulting from a lack of pyric maintenance.

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3) Lycopodiaceae

Lycopodium appressum (Chapman) Lloyd & Underwood
Lycopodium flabelliforme (Fernald) Blanchard
cr Lycopodium obscurum L.

4) Selaginellaceae

Selaginella rupestris (L.) Spring

6) Ophioglossaceae

Botrichium dissectum Sprengel

7) Osmundaceae

Osmunda cinnamomea L.
Osmunda regalis var. spectabilis (Willd.) Gray

8) Schizaeaceae

cr Lygodium palmatum (Bernh.) Swartz

10) Pteridiaceae

Pteridium aquilinum (L.) Kuhn.

11) Aspidiaceae

Athyrium asplenioides (Michaux) A.A. Eaton

12) Blechnaceae

Woodwardia areolata (L.) Moore
Woodwardia virginica (L.) Smith

13) Aspleniaceae

Asplenium platyneuron (L.) Oaks

14) Polypodiaceae

cr Polypodium polypodioides (L.) Watt

16) Pinaceae

cr	Pinus echinata Miller
	Pinus elliottii Engelm.
	Pinus palustrus Miller
	Pinus serotina Michaux
	Pinus taeda L.
cr	Pinus virginiana Miller

17) Taxodiaceae

	Taxodium ascendens Brongn.
	Taxodium distichum (L.) Richard

18) Cupressaceae

	Chamaecyparis thyoides (L.) BSP
cr	Juniperus virginiana L.

19) Typhaceae

	Typha latifolia L.

29) Poaceae

	Andropogon scoparius Michaux
	Andropogon ternarius Michaux
	Andropogon virginicus L.
	Anthaenamtia villosa
	Aristida stricta Michaux
	Arundinaria gigantea (Walter) Muhl.
	Cenchrus longispinus (Hackel) Fernald.
	Chasmanthium laxum (L.) Yates
	Ctenium aromaticum (Walter) Wood
	Cynodon dactylon (L.) Persoon
	Dactylis glomerata L.
	Danthonia cericea var. cericea Nuttall
	Digitaria sanguinalis (L.) Scopoli
	Erianthus giganteus (Walter) Muhl.
	Festuca octoflora Walter
	Hordeum pusillum Nuttall
	Lolium multiflorum Lam.
cr	Paspalum floridanum Michaux
	Paspalum notatum var. saurae Parodi
	Paspalum urvillei Steudel
	Poa annua L.
	Setaria geniculata (Lam.) Beauvois
	Sorghum halepense (L.) Persoon
cr	Tridens flavus var. flavus (L.) Hitchcock

30) Cyperaceae

Carex albolutescens Schweinitz
Carex folliculata var. australis Bailey
Cares glaucescens Ell.
Carex grayi Carey
Carex lurida Wahlenberg
Dulichium arundinaceum (L.) Britt.
Eleocharis equisetoides (Ell.) Torrey
Eleocharis microcarpa Torr.
cr Rhynchospora cephalantha Gray
cr Rhynchospora macrostachya Torrey
Scirpus etuberculatus (Steudel) Kuntze
Scleria triglomerata Michaux

32) Araceae

Orontium aquaticum L.
Peltandra virginica (L.) Kunth.

34) Mayaceae

Mayaca aubletii Michaux

35) Xyridaceae

Xyris ambigua Beyrich
Xyris caroliniana Walter
Xyris difformis Chapman

36) Eriocaulaceae

cr Eriocaulon compressum Lam.
cr Eriocaulon decangulare L.
Lactocaulon anceps (Walter) Morong

38) Commelinaceae

Tradescantia rosea var. graminea (Small) Anderson & Woodson

40) Juncaceae

Juncus effusus L.
Juncus biflorus Ell.
Juncus tenuis Willd.
cr Luzula bulbosa (Wood) Rydberg

41. Liliaceae

	Aletris aurea Walter
	Allium vineale L.
cr	Medeola virginica L.
	Smilax bona-nox L.
cr	Smilax glauca Walter
	Smilax laurifolia Pursh
	Smilax rotundifolia L.
	Tofieldia racemosa (Walter) BSP
	Uvularia pudica (Walter) Fernald
cr	Yucca filamentosa var. filamentosa L.
cr	Zigadenus glaberrimus Michaux

43. Dioscoreaceae

	Dioscorea villosa var. villosa L.

44. Amaryllidaceae

	Hypoxis hirsuta var. hirsuita (L.) Coville
	Zepharanthes atamasco (L.) Herbert

45. Haemodoraceae

	Lachnanthes caroliniana (Lam.) Dandy

46. Iridaceae

	Iris verna var. verna L.
cr	Iris virginica L.

49. Orchidaceae

cr	Cypripedium acuale Aiton
cr	Goodyera pubescens (Willd.) R. Brown
cr	Habenaria ciliaris (L.) R. Brown
cr	Habenaria cristata (Michaux) R. Brown
cr	Malaxis unifolia Michaux
	Pagonia ophioglossoides (L.) Ker
cr	Tipularia discolor (Pursh) Nuttall

50. Saururaceae

	Saururus cernuus L.

52) Myricaceae

cr	Myrica cerifera var. cerifera L.
	Myrica heterophylla Raf.

53) Juglandaceae

cr	Carya glabra (Miller) Sweet
	Carya tomentosa (Poiret) Nuttall
cr	Juglans nigra L.

54) Betulaceae

	Alnus serrulata (Aiton) Willd.

55) Fagaceae

cr	Fagus grandifolia Ehrhart
cr	Quercus falcata var falcata Michaux
	Quercus incana Bartram
	Quercus laevis Walter
cr	Quercus laurifolia Michaux
	Quercus margaretta Ashe
	Quercus marilandica Muenchh
	Quercus nigra L.
cr	Quercus phellos L.
	Quercus stellata Wang
	Quercus velutina Lam
	Quercus virginiana Miller

56) Ulmaceae

	Celtis laevigata Willd.

61) Loranthaceae

	Phoradendron serotinum (Raf.) M.C. Johnston

62) Aristolochiaceae

	Hexastylis arifolia (Michaux) Small
cr	Hexastylis virginica (L.) Small

53) Polygonaceae

	Polygonum pensylvanicum L.
cr	Polygonella polygama (Vent.) Engelm. & Gray
cr	Rumex acetocella L.
	Rumex crispus L.
	Rumex hastatulus Baldwin ex Ell.

66) Amaranthaceae

	Froelichia floridana (Nutall) Moq.

68) Phytolaccaceae

	Phytolacca americana L.

71) Caryophyllaceae

	Arenaria caroliniana Walter
cr	Paronychia herniarioides Nuttall
cr	Saponaria officinalis L.
	Stellaria media (L.) Cyrillo
	Stipulicida setacea Michaux

73) Nymphaeaceae

	Nuphar luteum ssp. macrophyllum (Small) E.O.Beal
cr	Nymphaea odorata Aiton

75) Cabombaceae

cr	Brasenia schreberi Gmelin.

80) Magnoliaceae

	Liriodendron tulipfera L.
cr	Magnolia virginiana L.

81) Annoniaceae

	Asimina triloba (L.) Dunal

84) Lauraceae

Persea borbonia (L.) Sprengel
Sassafras albidum (Nuttall) Nees

88) Brassicaceae

Cardamine hirsuta L.
Lepidium virginicum L.
cr Teesdalia nudicaulis R. Brown

89) Sarraceniaceae

Sarracenia flava L.
Sarracenia purpurea L.
cr Sarracenia rubra Walter

92) Droseraceae

Drosera intermedia Hayne

94) Saxifragaceae

Itea virginica L.

95) Hamamelidaceae

Hamamelis virginiana L.
Liquidambar styraciflua L.

97) Rosaceae

cr Alchemilla microcarpa Boissier & Reuter
Amelanchier canadensis (L.) Medicus
Amelanchier obovalis (Michaux) Ashe
Crataegus uniflora Muenchh.
cr Crataegus marshallii Eggl.
Duchesnea indica (Andrz.) Foche
Malus angustfolia (Aiton) Michaux
Potentilla canadensis L.
cr Prunus angustifolia Marshall
Prunus serotina var. virginiana Ehrhart
Rosa sp.; escape, trailing CV.
Sorbus arbutifolia var. arbutifolia (L.) Heynhold

98) Fabaceae

	Albizia julibrissin Durazzini
	Apios americana Medicus
	Baptisia alba (L.) R. Brown
	Baptisia cinerea (Raf.) Fernald & Schubert
	Baptisia tinctoria (L.) R. Brown
	Cassia fasciculata Michaux
	Cassia nictitans L.
	Cassia obtusifolia L.
	Centrosema virginianum (L.) Bentham
	Cercis canadensis L.
cr	Clitoria mariana L.
	Crotalaria angulata Miller
	Galactia regularis (L.) BSP
	Indigofera caroliniana Miller
	Lespedeza procumbens Michaux
	Lespedeza repens (L.) Britton
	Lespedeza virginica (L.) Britton
	Lupinus diffusus Nuttall
	Psoralea psoralioides var. psoralioides (Walter) Cory
	Pueraria lobata (Willd.) Ohwi
	Rhynchosia reniformus DC.
cr	Robinia pseudo-acacia L.
	Schrankia microphylla (Solander ex Smith) Macbride
	Stylosanthes biflora (L.) BSP.
	Tephrosia florida (Dietrich) C.E. Wood
	Tephrosia virginica (L.) Persoon
	Trifolium arvense L.
cr	Trifolium dubium Sibthorp
cr	Trifolium repens L.
	Wisteria sinensis (Sims) Sweet

99) Linaceae

	Linum striatum Walter

101) Geraniaceae

cr	Geranium carolinianum L.

104) Simaroubaceae

Ailanthus altissima (Miller) Swingle

105) Meliaceae

cr Melia azedarach L.

106) Polygalaceae

Polygala cruciata L.
Polygala lutea L.
Polygala mariana Miller
Polygala ramosa Ell.

107) Euphorbiaceae

Acalypha gracilens Gray
Acalypha rhomboidea Raf.
Cnidoscolus stimulosus (Michaux) Engelm. & Gray
Euphorbia curtisii Engelm.
Euphorbia gracilior Cronquest
Euphorbia ipecacuanhae L.
Stillingia sylvatica Garden

110) Anacardiaceae

Rhus copallina L.
Rhus glabra L.
cr Rhus radicans L.
Rhus toxicodendron L.
Rhus vernix L.

111) Cyrillaceae

Cyrilla racemiflora L.

112) Aquifoliaceae

Ilex coriacea (Pursh) Chapman
Ilex decidua Walter
Ilex glabra (L.) Gray
Ilex opaca Aiton

113)	Celastraceae	
	cr	Euonymus americanus L.
115)	Aceraceae	
		Acer rubrum L.
119)	Rhamnaceae	
		Ceanothus americanus L.
120)	Vitaceae	
	cr	Ampelopsis arborea (L.) Koehne
	cr	Parthenocissus quinquefolia (L.) Planchon
		Vitis rotundifolia Michaux
126)	Hypericaceae	
		Hypericum gentianoides (L.) BSP
	cr	Hypericum hypericoides (L.) Crantz
		Hypericum mutilum L.
		Hypericum setosum L.
		Hypericum stans (Michaux) P. Adams & Robson
129)	Cistaceae	
		Hudsonia ericoides L.
130)	Violaceae	
	cr	Viola lanceolata L.
		Viola pedata L.
	cr	Viola rafinesquii Greene

131) Passifloraceae

Passiflora incarnata L.

132) Cactaceae

Opuntia compressa (Salisbury) MacBride

136) Melastomaceae

Rhexia alifanus Walter
cr Rhexia mariana var. exalbida Michaux
Rhexia mariana var. mariana L.
Rhexia virginica L.

137) Onagraceae

Oenothera fruticosa L.
Oenothera laciniata var. laciniata Hill
Ludwigia decurrens Walter

138) Haloragaceae

Myriophyllum heterophyllum Michaux

140) Apiaceae

Eryngium yuccifolium var. yuccifolium Michaux
cr Hydrocotyle umbellata L.
Ptilimnium capillaceum (Michaux) Raf.
Zizia aptera (Gray) Fernald.

141) Nyssaceae

Nyssa sylvatica var biflora (Walter) Sargent

142) Cornaceae

Cornus florida L.

143) Clethraceae

Clethra alnifolia var alnifolia L.

145) Ericaceae

(State Record)

cr	Cassandra calyculatta (L.) D. Don
	Chimaphila maculata (L.) Pursh
	Epigaea repens L.
	Gaylussacia dumosa (Andrz.) T. & G.
	Gaylussacia frondosa var. frondosa (L.) T. & G.
	Kalmia latifolia L.
cr	Leiophyllum buxifolium var. buxifolium (Bergius) Ell.
	Leucothoe axillaris (Lam.) D. Don
	Leucothoe racemosa (L.) Gray
	Lyonia lucida (Lam.) D. Don
	Lyonia ligustrina (L.) DC.
	Lyonia mariana (L.) D. Don
cr	Monotropa hypopithys L.
cr	Monotropa uniflora L.
	Oxydendron arboreum (L.) DC.
cr	Rhododendron atlanticum (Ashe) Rehder
	Rhododendron minus Michaux
	Rhododendron viscosum (L.) Torrey
	Vaccinium arboreum Marshall
cr	Vaccinium corymbosum L.
	Vaccinum crassifolium Andrews
	Vaccinium elliottii Chapman
cr	Vaccinium staminium L.
	Vaccinium vacillans Torrey
cr	Zenobia pulverulenta (Bartram) Pollard

146) Diapensiaceae

Pyxidanthera barbulata Michaux

149) Sapotaceae

cr Bumelia lycioides (L.) Persoon

150) **Ebenaceae**

Diospyros virginiana L.

151) Symplocaceae

Symplocos tinctoria (L.) L Her.

152) Styracaceae

Styrax americana Lam.

153) Oleaceae

Ligustrum sinense Lour.

154) Loganiaceae

Cynoctonum sessifolium Walter ex J.F. Gmelin
Gelsemium sempervirens (L.) Aiton f.
Polypremum procumbens L.

155) Gentianaceae

Gentiana catesbaeia Walter
Sabatia brachiata Ell.
Sabatia difformis (L.) Druce
cr Sabatia quadrangula Wilbur

155.1) Menyanthaceae

Nymphoides cordata (Ell.) Fernald

156) Apocynaceae

Amsonia ciliata Walter

157) Asclepiadaceae

Asclepias amplexicaulis Smith
Asclepias rubra L.
Asclepias tuberosa var. tuberosa L.

158) Convolvulaceae

Bonamia patens var. patens (Desr.) Shinners
cr Ipomoea heteracea var. heteracea (L.) Jacqin
Ipomoea pandurata (L.) G.F.W. Meyer
Ipomoea purpurea (L.) Roth

162) Verbenaceae

Callicarpa americana L.
cr Verbena brasiliensis Vellozo

164) Lamiaceae

Lycopus virginicus L.
Macbridea caroliniana (Walter) Blake
cr Prunella vulgaris L.
Pycnanthemum flexuosum (Walter) BSP
Scutellaria integrifolia var. integrifolia L.

165) Solanaceae

Physalis virginiana var. virginiana Miller
Solanum carolinense L.

166) Scrophulariaceae

cr Agalinis fasciculata (Ell.) Raf.
Agalinis purpurea (L.) Pennell
Agalinis setacea (J.F. Gmelin) Raf.
Aureolaria pectinata (Nuttall) Pennell
Gratola pilosa Michaux
Linaria canadensis (L.) Dumont
Penstemon australis Small
cr Verbascum thapsus L.
cr Verbascum virgatum Stokes

167) Bignoniaceae

cr Anisostrichus capreolata (L.) Bureau
cr Campsis radicans (L.) Seemann
Catalpa speciosa Warder ex Engelm

170) Lentibulariaceae

cr	Utricularia biflora Lam.
	Utricularia juncea Vahl.
	Utricularia purpurea Walter
	Utricularia subulata L.

171) Acanthaceae

cr	Ruellia ciliosa Pursh

172) Plantaginaceae

	Plantago aristata Michaux
	Plantago hookeriana var. nuda (Gray) Poe
	Plantago lanceolata L.
	Plantago rugelii Dcne.
	Plantago virginica L.

173) Rubiaceae

	Cephalanthus occidentalis L.
	Diodia teres Walter
	Diodia virginiana L.
	Galium pilosum Aiton
	Galium tinctorium L.
	Houstonia pusilla Schopef.
cr	Houstonia tenuifolia Nuttall
cr	Mitchella repens L.
	Richardia brasiliensis (Moq.) Gomez.
	Richardia scabra L.

174) Caprifoliaceae

	Lonicera japonica Thunberg
cr	Lonicera sempervirens L.
	Sambucus canadensis L.
	Viburnum nudum L.

178) Campanulaceae

Lobelia nuttallii R. & S.
Specularia biflora (R & P) F & M
Specularia perfoliata (L.) A. DC.
Wahlenbergia marginata (Thunberg) DC.

179) Asteraceae

Achillea millefolium L.
cr Ambrosia artemisiifolia L.
Aster concolor L.
Aster novi-belgii L.
Aster linariifolius L.
Aster pilosus var. pilosus Willd.
Aster solidagineus Michaux
cr Aster squarrosus Walter
Aster tortifolius Michaux
Berlandiera pumila (Michaux) Nuttall
Bidens frondosa L.
Carduus repandus (Michaux) Persoon
Carphephorus bellidifolius (Michaux) T. & G.
cr Chrysoma pauciflosculosa (Michaux) Greene
Coreopsis major var. stellata (Nuttall) Robinson
Elephantopus nudatus Gray
Elephantopus tomentosus L.
cr Erechtites hieracifolia (L.) Raf.
cr Erigeron canadensis var. canadensis L.
Erigeron canadensis var. pusillus (Nuttall) Ahles
Erigeron strigosus Muhl. ex Willd.
Eupatorium album L.
Eupatorium capillifolium var. capillifolium (Lam.) Small
cr Facelis retusa (Lam.) Sch-Bip.
Gnaphalium obtusifolium L.
Gnaphalium purpureum var. purpureum L.
Haplopappus divaricatus (Nuttall) Gray
Helenium autumnale L.
Helianthus atrorubens L.
Heterotheca graminifolia (Michaux) Shinners
Hieracium gronovii L.
Krigia virginica (L.) Willd
Latuca canadensis L.
Liatris spicata var. resinosa (Nuttall) Glaiser
cr Liatris squarrosa (L.) Michaux
cr Marchallia graminifolia (Walter) Small
Marshallia obovata var. scaposa Channell

Mikania scandens (L.) Willd.
Parthenium integrifolium var. integrifolium L.
Pyrrhopappus carolinianus var. carolinianus (Walter) DC.
Senecio smallii Britton
Silphum compositum var. compositum Michaux
Solidago arguta Aiton
Solidago nemoralis Aiton
Solidago stricta Aiton
Sonchus asper (L.) Hill
cr Solidago verna M. A. Curtis
cr Taraxacum officinale Wiggers
Tetragonotheca helianthoides L.
Trilisa odoratissima (Walter) Cassini
Vernonia acaulis (Walter) Gleason
Vernonia angustifolia var. angustifolia Michaux

B. *Solidago verna* maintenance

Solidago verna

The existing population of approximately 100 plants exists on the roadside berm of SR 20, along the west side of the road and extending 150 meters south from the southern edge of Hudsonia Flats. One additional plant of this species has been found along a powerline cut paralleling SC 20 adjacent to the roadside population. *Solidago verna* appears to have the habitat requirement of moderate moisture, full sunlight, and shallow leaf litter. The roadside popoulation thrives since mowing removes the cover and litter. The powerline cut is managed in a similar way albeit less frequently, and, as a result, lower vitality.

Although roadside mowing improves the success of established individuals, it eliminates the chances for the population to increase and disperse by destruction of the flower and seed source. In 1989 somewhere between May 23 and June 8 this section of roadside was mowed. *Solidago verna* was in full anthesis during this time. It is recommended that this 150 meter section of roadside not be mowed until July 1 each year in order to promote the existing population. The powerline cut area should be mowed or burned during the winter every 2-3 years to promote the spread of the establishing population. The importance of the winter maintenance of the powercut results from the existance of another endangered species, *Sarracenia rubra* in that area. Both plants are perennial and dorment during the winter so winter maintenance would not harm them.

C. *Sarracenia* species maintenance

Sarracenia rubra, S.purpurea, S.flava

Only *Sarracenia flava* is well represented on Cheraw State Park but is included here because of similar habitat needs. *Sarracenia rubra* is located in two closely distributed areas. Site one: along powerline cut parallel to SC 20, 0.1 mi South of Southern edge of *Hudsonia* Flats. Site two: approximately 0.2 miles E. of powerline cut. This second site includes the occurance of *S.purpurea*.

These species require hydric, peaty shallows/depressions and full sun. The powerline population thrives resulting from periodic mowing; however, the wetland population is rapidly declining. In this area the canopy is closing and other aquatic species are out-competing them. *Sarracenia* species are perennial and dormant in the winter months, burning the interior of the open wetland should open the canopy and reduce competition. As with most burn maintenance, once each 3-5 years is adequate.

These species are conducive to transplanting. Should the populations increase in number, some individuals could be transplanted in wetter golfcourse areas or other places throughout the park.