A Rare Plant Survey of Atlantic White-Cedar , ***Chamaecyparis thyoides*** (L.) B.S.P., Habitats of the Georgia Westcentral Fall Line Sandhills

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Abstract

The Georgia Westcentral Fall Line Sandhills are known for their local occurrences of rare and disjunct plant populations. Isolated stands of Atlantic white-cedar along clear, cool, sand-bottomed, spring-fed creeks associate with longleaf pine uplands. Together these two keystone species form the nucleus of a unique ecosystem in westcentral Georgia. During 1998 and 1999 a rare plant survey of Atlantic white-cedar habitats was performed. Typical rare plant species found with Atlantic white-cedar include *Carex collinsii, Carex venusta, Fothergilla gardenii Helenium brevifolium*, *Kalmia carolina, Myriophyllum laxum, Pinguicula primuliflora*, *Sarracenia rubra,* and *Schoenoplectus etuberculatus*. Noteworthy discoveries included *Utricularia floridana,* which has only been reported from Georgia in the Lake Seminole region, and a range extension for *Macbridea caroliniana*. The discovery of *Chamaecyparis thyoides* on a tributary formerly containing a population of *Sarracenia oreophila* represents a previously unrecognized plant association for this federally endangered pitcher plant species. New drainages containing *Chamaecyparis thyoides* were discovered on tributaries of Patsiliga, Beaver, and Horse creeks in Taylor County, Beaver Creek in Crawford County, Black Creek in Talbot County, and Shoal Creek in Marion County. Taken together these discoveries represent significant additions to the distributional knowledge of Atlantic white-cedar in westcentral Georgia.

Introduction

The Georgia Westcentral Fall Line Sandhills are known for their local occurrences of rare and disjunct plant populations (Lane, 1976; Sheridan et al., 1997, 1999; Wharton,1978). Atlantic white-cedar communities along clear, cool, sand-bottomed, spring-fed creeks associate with longleaf pine uplands. The association of longleaf pine and Atlantic white-cedar communities form a unique ecosystem in westcentral Georgia. The significance of this ecosystem is underscored by the disjunction and isolation of the Atlantic white-cedar community in the Georgia Westcentral Fall Line Sandhills. The nearest Atlantic white-cedar communities are 175 kilometers to the east in Richmond County, Georgia and 225 kilometers to the south in the panhandle of Florida.

As population pressure and associated development continue to increase in westcentral Georgia concerns have been raised about the fate of the rare Atlantic white-cedar ecosystem. Atlantic white-cedar ecosystems are unusually vulnerable to the hydrological, chemical, and mechanical insults attendant with development. In particular, alterations in stream flow and sediment loading caused by both point and non-point sources can be especially devastating

(Ehrenfeld and Schneider 1991, 1993). This project was therefore initiated to search for additional rare plants and significant natural areas in the Georgia Westcentral Fall Line Sandhills as part of phase 1 of the Fall Line Sandhills Conservation Plan (Cammack et al. 2000).

Materials and Methods

The geographic area of this survey was confined to the Fall Line Sandhills of Westcentral Georgia including Bibb, Crawford, Macon, Marion, Peach, Schley, Talbot, Taylor and Twiggs counties. Priority habitats for investigation were longleaf pine sandhills, Atlantic white-cedar swamps, clearwater ponds, sand springs, and riparian and hillside seepage communities.

Sites for investigation were determined by consulting the literature, aerial helicopter flights (June 1998 and March 1999), personal reports, and USGS 7.5' topographic maps. An effort was made to find new sites with intact natural communities and rare plants rather than revisit sites previously identified by Sheridan et al. (1997, 1999). Field research was conducted from May 17 - August 13, 1998 and March 9 - 13, 1999. Potential rare plant occurrences for the region were determined by consulting Patrick et al. (1995). The local newspaper (Butler Herald) was also used to inform citizens of the survey, rare plants being sought, and to ask the public to report any sightings of such rare plants.

Rare plants were documented by voucher specimens provided the population size warranted a collection. All sites visited were located on USGS 7.5-minute topographic maps, populations of rare plants mapped, and a special plant data sheet prepared. In addition each collection site received an alpha-numeric identifier and a natural features data form was initiated. Past studies (Sheridan et al. 1997, 1999) were consulted and used similar data collecting procedures. Data forms from all field surveys are on file with the Georgia Natural Heritage Program, Social Circle, Georgia. Vouchers are to be deposited at the University of Georgia Herbarium, Athens.

Results

At least 89 sites have been investigated in the Fall Line Sandhills of Westcentral Georgia for rare plant occurrences by the senior author. This represents a conservative enumeration of total sites visited since many botanically unproductive areas were not assigned an alpha-numeric identifier during field work in the late 1980s and early 1990s. Important previous discoveries have been discussed (Sheridan et al. 1997, 1999). Forty-four sites were found in this survey which contained rare, threatened, or endangered plant species (Table 1). The association of rare plant species found was rather predictable within the context of the upper reaches of Whitewater Creek in Taylor County and Juniper Creek in Marion County consisting of *Carex collinsii* Nuttall, *Carex venusta* Dewey var. venusta, *Chamaecyparis thyoides* (L.) B.S.P., *Helenium brevifolium* (Nutt.) Wood, *Pinguicula primuliflora* Wood & Godfrey, *Sarracenia rubra* Walt.and *Schoenoplectus etuberculatus* (Steudel) J. Sojak. Depending on site quality and geographic setting these were the typical rare plant occurrences found within the Atlantic white-cedar ecosystem of westcentral Georgia

Both *Fothergilla gardenii* Murray and *Kalmia carolina* Small are strictly local in westcentral Georgia. *Kalmia carolina* is only found on the upper reaches of the Whitewater Creek drainage. All other sites are in the bog habitats of the Blue Ridge Mountains in northeast Georgia. A historical site was rediscovered for *Fothergilla gardenii* (GATAYL034) while no new sites were found for *Kalmia carolina* despite extensive field investigation. A range extension was recorded for *Macbridea caroliniana* (Walter) Blake on Juniper Creek in Marion County (GAMARI007). This species is recorded as G2G3S1 (i.e., globally rare and known in Georgia from less than five stations) by the Georgia Natural Heritage program and represents a significant westward range extension into the Chattahoochee River watershed. A noteworthy discovery of the survey was *Utricularia floridana* Nash (Fig. 1). This bladderwort species has only been reported from extreme southwest Georgia in the Lake Seminole region. The documentation of this species as a disjunct in numerous sites in the Fall Line Sandhills further demonstrates the unique ecology of this region. Although the senior author has made an intense effort over the past ten years to find the federally endangered green pitcher plant, *Sarracenia oreophila* (Kearney) Wherry, no populations were discovered. A possible former occurrence for this species (GATAYL039) was recorded on the piedmont/fall line interface.

A number of new drainages containing *Chamaecyparis thyoides* were discovered through both ground and aerial surveys. Of particular significance were occurrences on tributaries of Patsiliga, Beaver, and Horse creeks in Taylor County, Beaver Creek in Crawford County, Black Creek in Talbot County, and Shoal Creek in Marion County (Fig. 2). Taken together these discoveries represent significant additions to the distributional knowledge of Atlantic white-cedar in western Georgia. The discovery of *Chamaecyparis thyoides* (GATAYL028) on Beaver Creek in Taylor County (Fig. 3) represents a previously unrecognized plant association between Atlantic white-cedar and the green pitcher plant, *S. oreophila*. Additional investigation of these new Atlantic white-cedar sites may considerably expand the extent of rare plant occurrences in westcentral Georgia.

Discussion

Physiogeographic limitations of the Fall Line Sandhills vegetation

The Westcentral Georgia Fall Line Sandhills are chiefly confined to Crawford, Marion, Talbot, and Taylor counties. Fragments of sandhills and sandhill vegetation are found in Bibb and Peach County but the sand is not as extensive, or as deep, and kaolin and sandy clay deposits are closer to the surface altering the vegetative composition. Extensive searches have been conducted east of the sandhills in Jones, Twiggs, and Wilkinson counties, but these efforts failed to locate the same suite of rare plant species that are routinely found in the sandhills to the west. This suggests an underlying geological reason for the restriction of the rare plant species in the westcentral Georgia sandhills. Further work, however, is warranted along the Boggy Branch drainage in Bibb County (BIBB001) to rediscover *Sarracenia oreophila* and *S. rubra* previously reported for this degraded longleaf pine sandhill area (Troup and McDaniel 1980; Sheridan 1998).

The sandhills are limited to the south in Macon and Schley counties by the emergence of the Red Hills soils and to the west in Muscogee and Chattahoochee counties by the dissected terrain associated with the Chattahoochee River. Investigations were conducted in August 1998 along tributaries feeding the Red Hills region including Trip Up Branch and Coon, Usry, Camp, Buck, and Little Muckalee creeks. The diagnostic rare plant species found in the sandhills were not found in these tributaries of the Red Hills. One of the best indications of both vegetative and edaphic changes was the disappearance of *Utricularia floridana* from aquatic habitats. *Utricularia floridana* seems to require the spring-fed, slightly tannic, clearwater ponds that are found in the sandhills. Ponds in the Red Hills apparently have more clay and sediments suspended in the water with a subsequent change in water chemistry.

Distribution of Atlantic white-cedar

Prior to this survey only four drainages were known to contain Atlantic white-cedar in the westcentral Georgia sandhills: Juniper Creek in Marion County, Whitewater Creek in Taylor County, Cedar Creek in Schley and Taylor counties, and Juniper Creek in Peach County (Sheridan et al. 1999). Additions to this known distribution were made by the discovery of several drainages containing Atlantic white-cedar north and east of Butler in Taylor County, along Beaver Creek in Crawford County, the headwaters of Black Creek in Talbot County, along Whitewater Creek in Macon County, and on Shoal Creek in Marion County.

The Crawford County Atlantic white-cedar population (GACRAW006) fills a gap in the range between the Peach County occurrence at Camp Benjamin Hawkins (GAPEAC001) and the Taylor County populations. Although this millpond site contains only a few individuals of Atlantic white-cedar it does suggest that winter aerial surveys in this region may be able to disclose additional populations that could harbor rare plant occurrences. The previous discovery of *Sarracenia rubra* and other rare plant associates in Crawford County (Sheridan et al. 1997) implied the presence nearby of Atlantic white-cedar and this discovery further highlights the strong plant associations within the Atlantic white-cedar community in westcentral Georgia.

The Atlantic white-cedar stands discovered on Patsiliga, Beaver, and Horse creeks have several implications. The Patsiliga Creek site (GATAYL031) was reported by a logger who called the branch this site is located on Juniper Branch. He also reported that Atlantic white-cedar he had cut from this site was different from other Atlantic white-cedar he had cut in the area and he called it Red Juniper. Apparently mature trees from this stand have a unique coloration to the heartwood which may prove worthy of investigation. This site is rather difficult to traverse due to its location adjacent to Patsiliga Creek and swamp. Aerial surveys found this site to harbor an extensive colony of mature Atlantic white-cedar. The exact position and acreage of this stand within the Patsiliga Creek drainage remains to be resolved.

The discovery of Atlantic white-cedar on a tributary of Beaver Creek (GATAYL028) is particularly significant since this is the reputed drainage for Neisler's collection of *Sarracenia oreophila* (Troup and McDaniel 1980). The association of these two species has not previously been documented. In addition, a colony of Atlantic white-cedar was also found nearby at Suggs Millpond with *Sarracenia rubra*. The association of both these pitcher plants with

Chamaecyparis thyoides may therefore need to be considered in future botanical work in the fall line sandhills of Georgia.

The Horse Creek (GATAYL027) Atlantic white-cedar population appears to be particularly robust and contains several associated rare plant species. In addition, some very large diameter wetland longleaf pine (*Pinus palustris* Miller) were also found in this community in the March 1999 survey. The Atlantic white-cedar population occurs along approximately one mile of this watershed.

The March 1999 aerial survey resulted in the discovery of Atlantic white-cedar on Shoal Creek in Marion County, Black Creek in Talbot County, and into Macon County on Whitewater Creek. The Shoal Creek record is particularly important due to the association with *Taxodium distichum* (L.) Richard. Although Atlantic white-cedar may be sympatric with *Taxodium* elsewhere in its range, this is the only site in westcentral Georgia where this association was recorded. *Taxodium* tends to be very local in the westcentral fall line sandhills and further exploration of the Shoal Creek drainage may uncover additional, significant floristic records in this unique association.

Search for *Sarracenia oreophila*

Despite a decade of work by the senior author, and additional field work by other investigators (Troup and McDaniel 1980), there is no extant fall line sandhills site for the federally endangered green pitcher plant *Sarracenia oreophila*. Principally a plant of the Cumberland Plateau, Blue Ridge, and Ridge and Valley provinces, *Sarracenia oreophila* has only been documented from a maximum of five sites (four counties) within the fall line of Alabama and Georgia (Fig. 4) (Troup and McDaniel 1980, Sheridan 1998). All of these stations were small and in some cases consisted of a single plant (Randy Troup, pers. comm.). What was the nature of the Taylor County population of *S. oreophila* and can any inferences be made about an association with Atlantic white-cedar?

Fortunately, the discoverer of *S. oreophila* in Taylor County, Georgia was the physician Dr. Hugh Neisler. Dr. Neisler had extensive communication with the noted botanist Asa Gray. Dr. Neisler had settled along Beaver Creek near Butler in Taylor County soon after the eviction of the local American Indians (mostly Muscogee Creeks). His writings provide a first hand glimpse of a rare plant population at settlement. Dr. Neisler's communications with Asa Gray have never been published and contain significant information about the pitcher plants in his area.

Dr. Neisler's Observations

On June 10th 1857 Neisler wrote about finding *Sarracenia rubra* on his property. "I am again sometimes pestered by finding peculiarities in plants unnoticed in the books, as for instance the leaf of a *Sarracenia* which I enclose, which is a young leaf of *S. rubra* – I found them growing in tufts on a spot of ground that had been burned over early in the spring. I was much puzzled in determining to what species it belonged, indeed I never should have found out if chance had not showed me a tuft – in which the fire had spared the central part consisting of a few last years leaves and the scape in flower – these were surronded at base by numerous young

leaves of this form – which I never could have thought would change so much in becoming grown". On June 27th 1857 he further commented "The trouble with me about the leaf of the *Sarracenia* was the very small tube and the broad lanceolate appendage in the full grown leaf you know, the appendage is very narrow and linear changing its form altogether, I have a dried specimen, in flower with both forms of leaves growing from it. I will try and save it for you."

On June 2nd 1858 Neisler wrote about his recent discovery of an unidentified pitcher plant "Since writing last I have come up with a *Sarracenia* that I have not before seen – I found only the leaves. I am inclined to believe that it has not yet flowered. The leaves are small and slender till near the summit it enlarges to two or more inches in diameter wing linear, narrow; lamina much compressed below, sides reflected and arched over the opening of the tube – it and the throat internally streaked with purple – it is neither the *rubra*, *purpurea*, nor *flava* if the recollections of the last species are correct; some of the leaves are twenty five inches long – There is the same marked difference between the young and full grown leaves as in the <u>*rubra*</u> – in the latter you no doubt remember I mentioned this great difference to you and sent a young leaf that you might see for yourself – I have put up some half dozen leaves for you and will get the flowers if I can. I omitted to mention that the leaves of the *Sarracenia* above mentioned are so strongly nerved that a transverse section forms a polygon rather than a circle."

There are several significant aspects to Neisler's June 2nd letter. First, he comments that the throat of the unknown pitcher plant is streaked with purple and unlike *S. flava* which he was familiar with. Typically *S. flava* in Georgia either lacks purple pigment in the throat or has a disctinctive purple splotch in that area. In contrast *S. oreophila* can have a throat streaked with purple. Also of significance is the presence of both *S. rubra* and the unidentified (*S. oreophila*) pitcher plant in the same general collecting area. *Sarracenia oreophila* rarely occurs within the range of any other pitcher plant species. The one documented co-occurrence was in the extirpated colony in the fall line of Alabama in Elmore County with *S. rubra* ssp. *alabamensis* and potentially in Bibb County, Georgia also within the range of *S. rubra*. Second, he comments on the distinctive strong nerving on the leaf of the pitcher plant which is also suggestive of *S. oreophila*.

He then wrote on June 18th 1858 (dots indicate where part of letter cut off) "I went out this morning to look up my *Sarracenia* that I told you …. a while since. It is a litte singular that I can find … but in the one spot and there, nine feet square will …. the whole space occupied by them and six or eight …includes the whole number of plants. I can yet find … trace of a scape, either past, present or to come. Yet in searching for it, I have found something much more curious to me than the young leaves of the *S. rubra*, which I sent you a year or more ago. Around the bases of the phyllodia there are clusters of young leaves, that bear no trace or resemblance to them that I can see. And if they are ever changed into the … Nature does it by some hocus pocus that I cannot comprehend, as yet at least. I send you some of them. Also a young and tender phyllodium, scarcely longer than one of the strange leaves. Also another fully grown but dwarfed by disease or accident. It will give you an idea of the coloration and pubescence of the throat and lamina. Remember though that the perfect and fully grown phyllodia are entirely straight, two feet or more high, slender, enlarging gradually upwards, until near the summit they abruptly enlarge so that the throat may be often three or four inches across – the nerves too, are much more decidedly and equally developed . can you form an idea which

of the species, it will, most likely, prove to be? I would observe lest - I forget – that the specimen may not give an exactly correct idea of the lamina in the phyllodia of the *Sarracenia*, its sides are reflected below and it is arched completely over the throat." The "strange leaves" that Neisler refers to are the flattened, non-pitchered leaves produced by *S. flava*, *S. oreophila*, and *S. leucophylla*. Ironically these flattened leaves are now called phyllodia while the "phyllodia" that Neisler referred to are actually the pitchered leaves.

On July 22nd 1858 he writes "Since I wrote last, I have found the *Sarracenia* so often spoken of, in another spot, five or six plants, and an old scape with a rotten seed vessel, I think, of last year. This years flowers were probably destroyed by a late frost we had in April. The phyllodia are now all decaying and young leaves are springing up from the roots, these I now think will by winter be transformed into phyllodia, which surviving the period of flowering and fruiting next season will in their turn wither and be succeeded by others. If I am correct in my conjecture the difference between the young and full grown phyllodia in this plant is very remarkable and will form an interesting chapter in its history. I enclose another leaf to let you see the gradual change that has taken place since the one I sent you in my case, was gathered – You see that the thickened, concave margin of the leaf has changed its form somewhat and that the minute point at its extremity has bent over assuming very exactly the position of the future lamina! I also enclose a young phyllodium of *S. rubra* in which the lamina is well developed as also the tube a little more than half way down – but the remainder is precisely in the condition of the whole concave margin of the other leaf! What begins to look a little like a demonstration I think. I fear the *Sarracenia* may become a bore, so we will drop it for a time at least."

On August 18th 1858 he wrote "No change in *Sarracenia* since my last visit. In the *S. rubra* I find tube and lamina fully formed in the bud! Still I sometimes find a leaf several inches long, without either. In the undetermined species – in the bud, as yet, leaves but no phyllodia! I now, know not what to make of it."

On April 28th 1859 he wrote "These are the leaves and flowers of the *Sarracenia* I have so often mentioned to you. I discovered it twelve months since and have been able to find but two clusters of plants, as yet, a few hundred yards apart. One cluster on the edge of a swamp – the other on tussocks in a swamp – all together not a dozen plants. This year the leaves began to spring from the ground about the middle of March. At first the hood is erect and folded together and the mouth of the tube is closed. When they have arrived at their full height the hood slowly expands and the mouth of the tube opens and in the end the hood becomes beautifully arched over it. The scape appears when the leaves are up to some height – but the latter are fully grown before the flowers unfold. The flowers are of a pale greenish yellow entirely without odor.

The large tubular leaves wither and die in the fall but in the mean while those small leaves come forth and are persistent during the winter, towards spring they begin to die – and at this time (28 April) scarcely one perfect one is to be found – the upper part of all of them to a greater or lesser degree being withered and dead – Thus the plant has an altogether different foliage in the winter and the summer. To me this is remarkable, to you it may not be new – Something similar is also found in the *S. rubra* – You will find a note of it with the specimens of that plant. I send three flowers, all that there were, several full grown leaves – some young ones as well as many of the winter leaves – I find nothing in my books by which I have been able to

identify the plants and have come to the conclusion that it is undescribed – Let us know – As it is not as obvious in a dried as in a fresh and living leaf it may be as well to observe that the tube of every leaf has about four (counting that to which the wing is attached as one) principal and as many secondary nerves giving the tube a ribbed appearance and rendering a cross section somewhat octagonal"

In his April 28th 1859 letter Neisler recognizes that he has an undescribed species of pitcher plant. Another seventy-four years would pass before *Sarracenia oreophila* was officially described as a new species (Wherry 1933). Neisler also mentions the lack of flower odor and full development of the pitchers before the flowers open in his undescribed species, morphological traits which are unique to *S. oreophila*. His herbarium specimen to Asa Gray included the flattened, non-pitchered "strange leaves", now known as phyllodia. These leaves are diagnostic for *S. oreophila* since they are short, recurved and ensiform. Clearly Dr. Hugh Neisler was the first botanist to recognize the unique traits of *S. oreophila* and documented its occurrence in the fall line sand hills of westcentral Georgia. That this species occurred near his home in the sand hills along Beaver Creek is supported by his June 18th 1858 letter where he states "I went out this morning to look up my *Sarracenia…*". For Dr. Neisler to go out in the morning and collect leaves for herbarium specimens means that the plant had to grow within a relatively short distance, since transportation at that time was by horse or on foot.

In November 1859 he wrote "The *Sarracenia flava* does not grow with us as far as I yet know. I have been familiar with it in the low country of the Carolinas – years ago – and my recollection of it differs from the plant I have talked so much about. But your knowledge of and familiarity with the matter of course enables you to determine with little difficulty. Still it seems to me strange that the angular outline of a transverse section of the phyllodia so different from anything seen in the *purpurea* the *rubra* or *variolaris*, which I have frequent opportunities of seeing in their season, should be entirely overlooked in all the descriptions I have met with. If you wish it I can send you roots of this plant any day – as well as those of any other of our plants and shrubs – that you would like to add to your collection of living plants – it is much easier to me than to gather seed which is a much more difficult matter than I anticipated." Of significance in the November correspondence is that Neisler indicates "frequent opportunities" of seeing *S. purpurea* and *S. variolaris* (now *S. minor*). *Sarracenia purpurea* is extremely rare in Georgia (having been extirpated from the few sites in southwest Georgia) and has never been documented from the west central fall line sandhills of Georgia. Did Neisler know of stations for this rare pitcher plant in western Georgia? Likely not, based on his earlier residence in the "low country of the Carolina's" where *S. purpurea*, *S. minor* and *S. flava* are still to be found (McDaniel 1971, Radford et al. 1968).

Neisler's descriptions of *S. oreophila* provide a unique look at the population biology of this federally endangered pitcher plant species at settlement. The population was small, extremely localized, and sparse in reproductive events. A possible inference is that the clearing activities and burning that Dr. Neisler performed in 1858 may have helped expose this population along a shrubby swamp edge. The reference to the clump on tussocks also infers that the plants were migrating locally via water to new sites for establishment. Interestingly, Dr. Neisler's home was along Beaver Creek which implies beaver activity along this stream system. Was beaver disturbance, including associated successional events, important to the dispersal of

S. oreophila in Taylor County, Georgia? Tussocks in beaver ponds are actively colonized by *S. rubra* today in Taylor County. An extensive colony (200 stems) of young pitcher plants occurs among clumps of various grasses and sedges (*Andropogon glomeratus*, *Rhynchospora* spp., *Carex* spp.) in an abandoned beaver pond along Black Creek. This site occupies nearly an acre and has recently been shown by the junior author to contain an additional rarity, namely tawny cotton-grass (*Eriophorum virginicum*). Curiously, the closest occurrence of *Eriophorum* may be with *S. oreophila* at one of its few Blue Ridge sites in Clay Co., North Carolina! A similar colonization strategy could have been exercised by *S. oreophila* in Taylor County and argues for further exploration of these habitats today for *S. oreophila*.

Intensive field work has resulted in the discovery of numerous *S. rubra* populations in the fall line sand hills of west central Georgia. What is the problem in locating an extant *S. oreophila* fall line population? Conceivably *S. oreophila* has gone extinct in the fall line and a restoration effort will be needed to reintroduce this species. Given the limited historical population size of *S. oreophila* in the fall line an extinction vortex may have occurred through the combined effects of inbreeding depression (Sheridan and Karowe 2000) and land use changes. In an extinction vortex the negative fitness effects of limited effective population size are amplified by negative land use changes (e.g. lack of fire) to the point that a species is driven to extinction.

Another possibility is that searches for *S. oreophila* in the fall line sandhills are mis-directed and should be focused more on the piedmont/fall line transition zone. *Sarracenia oreophila* was very local in the fall line sandhills of Georgia and Alabama and only reported, but not collected, from the Piedmont Province of Georgia (Wherry 1933, Troup and McDaniel 1980). Perhaps this species occurred locally in a narrow band in the transition zone between the piedmont and coastal plains. Some support for this hypothesis is offered by the location of historical records and personal reports (GATAYL039).

The occurrence of *S. rubra* as the only extant pitcher plant in seepage wetlands of the Georgia Westcentral Fall Line Sandhills is also rather remarkable. Although *Sarracenia* pitcher plants are known to occur as only a single species in a physiogeographic province (e.g. *S. alata* in Texas) the occurrence of *S. rubra* without the association of another pitcher plant species in an ecosystem is rare. Perhaps there is a subtle habitat difference on the piedmont/inner coastal plain transition that meets the habitat requirements of fall line *S. oreophila*. Further field work in this transition zone is necessary to test this hypothesis and to search for any remaining colonies of *S. oreophila*.

Conclusion

Our botanical surveys of rare plant occurrences within the Atlantic white-cedar ecosystem of westcentral Georgia have demonstrated the biological significance of this region. Additional investigations will undoubtedly add more significant elements to this flora and provide insights for biogeographers to consider. However, over the past ten years we have slowly seen the land start to be developed and suffer degradation. This trend has accelerated and may only get worse with the completion of the several high speed roads through the region. One of the greatest dangers to the Atlantic white-cedar community is the siltation of streams caused by clearing of land on adjacent slopes and the increased velocity and temperature of stormwater.

Excessive siltation within the Atlantic white-cedar ecosystems in westcentral Georgia may have catastrophic effects on the riparian rare plant communities. Increased stream flows influence water quality. Removal of forested buffers increases silt deposition. The rare plant community (especially *Myriophyllum, Pinguicula, Sarracenia, Utricularia*.) is not tolerant of this kind of disturbance and can be lost as a result of such drastic habitat alterations. Effective long-term protection of this ecosystem will require an integrated ecosystem approach which successfully addresses the social, political, and environmental challenges of modern conservation biology.

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Table 1. TNC Rarity ranks for selected Georgia Fall Line Sandhills Plants*

Species	Common Name	State Status	Global Rank	Georgia Rank
Carex collinsii	Narrow-fruit Swamp Sedge	N	G4	S2
Carex venusta	Dark Green Sedge	N	G4	S2?
Chamaecyparis thyoides	Atlantic White-cedar	N	G4	S2
Eriophorum virginicum	Tawny Cotton-grass	N	G5	S1
Fothergilla gardenii	Dwarf Witch-alder	N	G3G4	S2
Helenium brevifolium	Bog Sneezeweed	N	G3G4	S1
Kalmia carolina	Carolina	N	G4	S1

	Bog Myrtle			
Macbridea caroliniana	Carolina Bog Mint	N	G2G3	S1
Myriophyllum laxum	Lax Water-milfoil	T	G3	S2
Pinguicula primuliflora	Clearwater Butterwort	T	G3G4	S1
Sarracenia oreophila	Green Pitcher Plant	E	G2	S1
Sarracenia rubra	Sweet Pitcher Plant	E	G3	S2
Schoenoplectus etuberculatus	Canby's Club-rush	N	G3G4	S1S2
Utricularia floridana	Florida Bladderwort	N	G3G5	S2S3

*Based on July 2001 rarity rankings.

State Status: N = none, E = state endangered in Georgia, T = state threatened in Georgia.

Global rank: G2 = globally imperiled, 6-20 populations; G3 = very rare and local throughout its range or found locally in a restricted range, or because of other factors vulnerable to extinction, 21-100 populations; G4 = apparently secure globally although it may be rare in parts of its range, 100-1000 populations; G5 = demonstrably secure globally, though it may be quite rare in parts of its range, 1000+ populations.

? = rank is uncertain

State rank: S1 = critically imperiled in the state, 1-5 populations; S2 = imperiled in the state, 6-20 populations; S3 = rare or uncommon in the state, 21-100 populations.

List of Figures

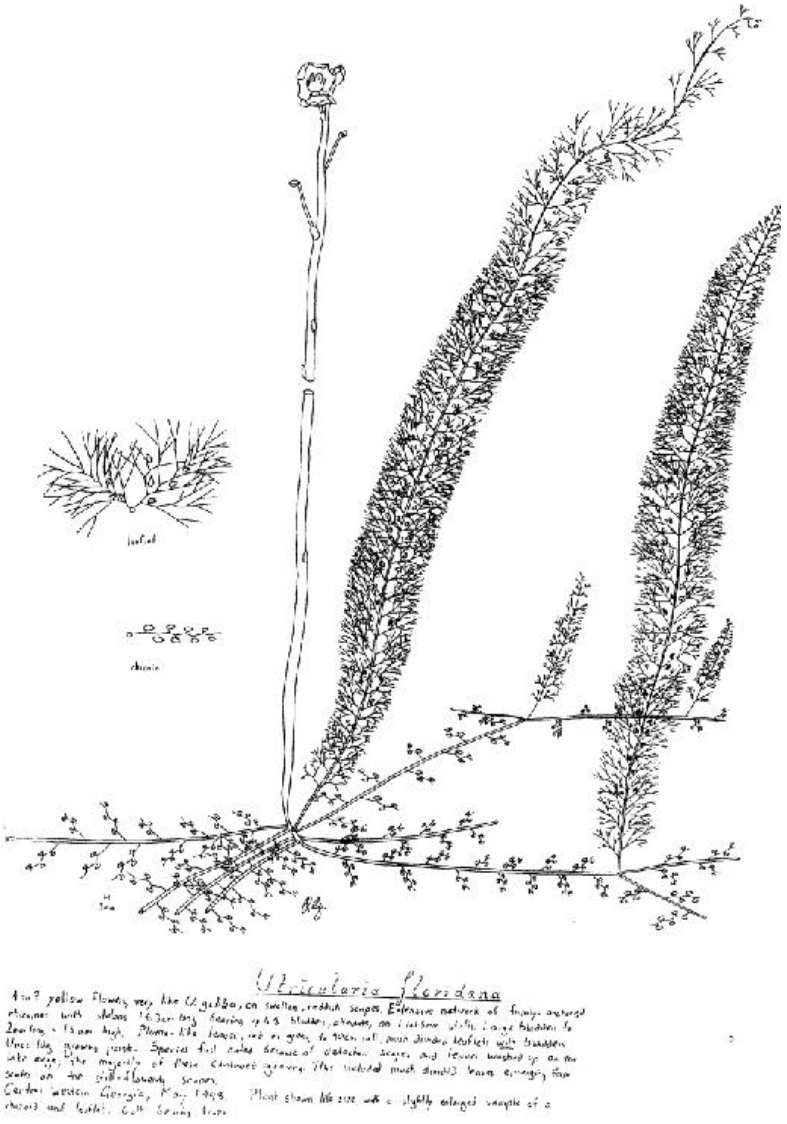

Fig. 1. Diagnostic line drawing of *Utricularia floridana*. Illustration by Robert Gibson.

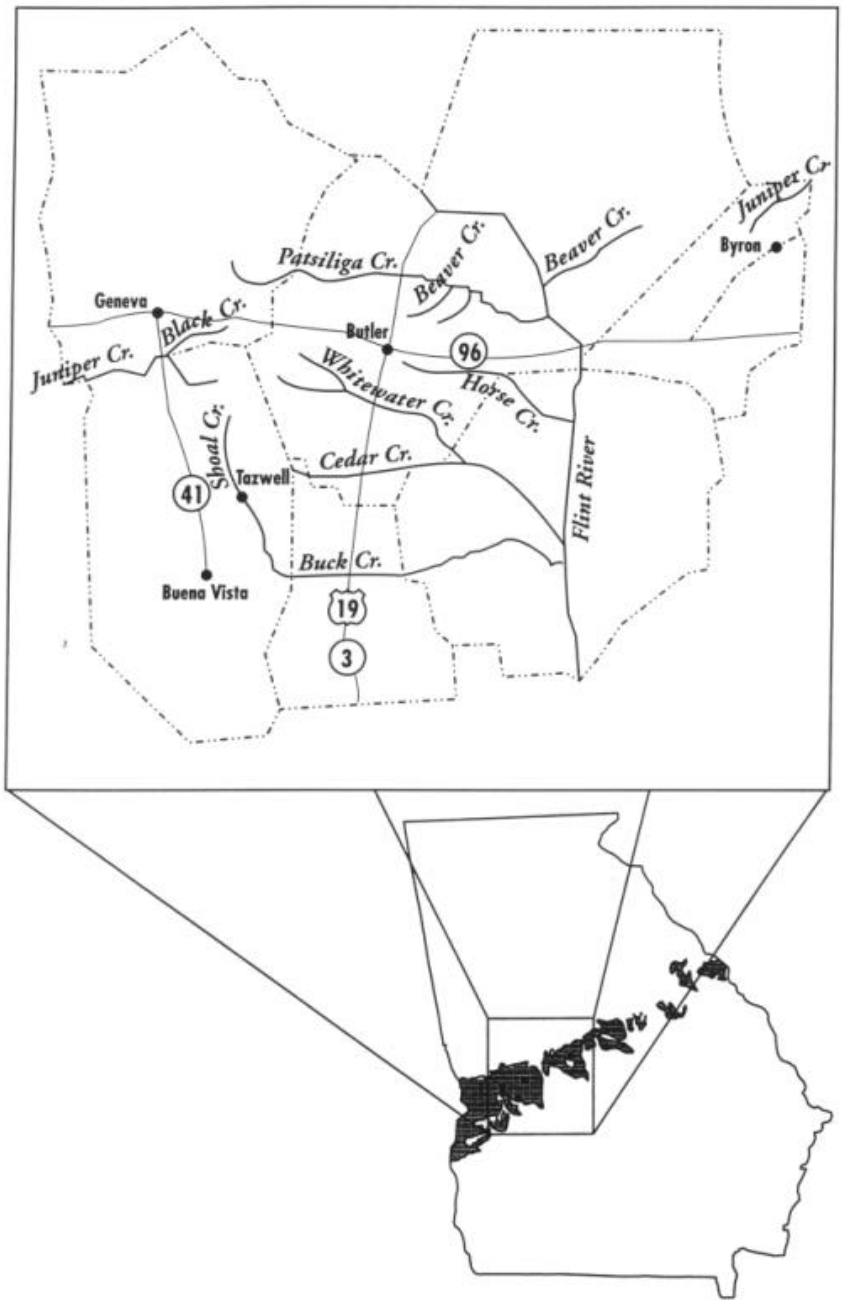

Fig. 2. Distribution of Atlantic white-cedar in the Fall Line Sandhills of Westcentral Georgia. The shaded region represents the sandhills. Detailed section of map delineates specific stream systems in westcentral Georgia where Atlantic white-cedar occurs.

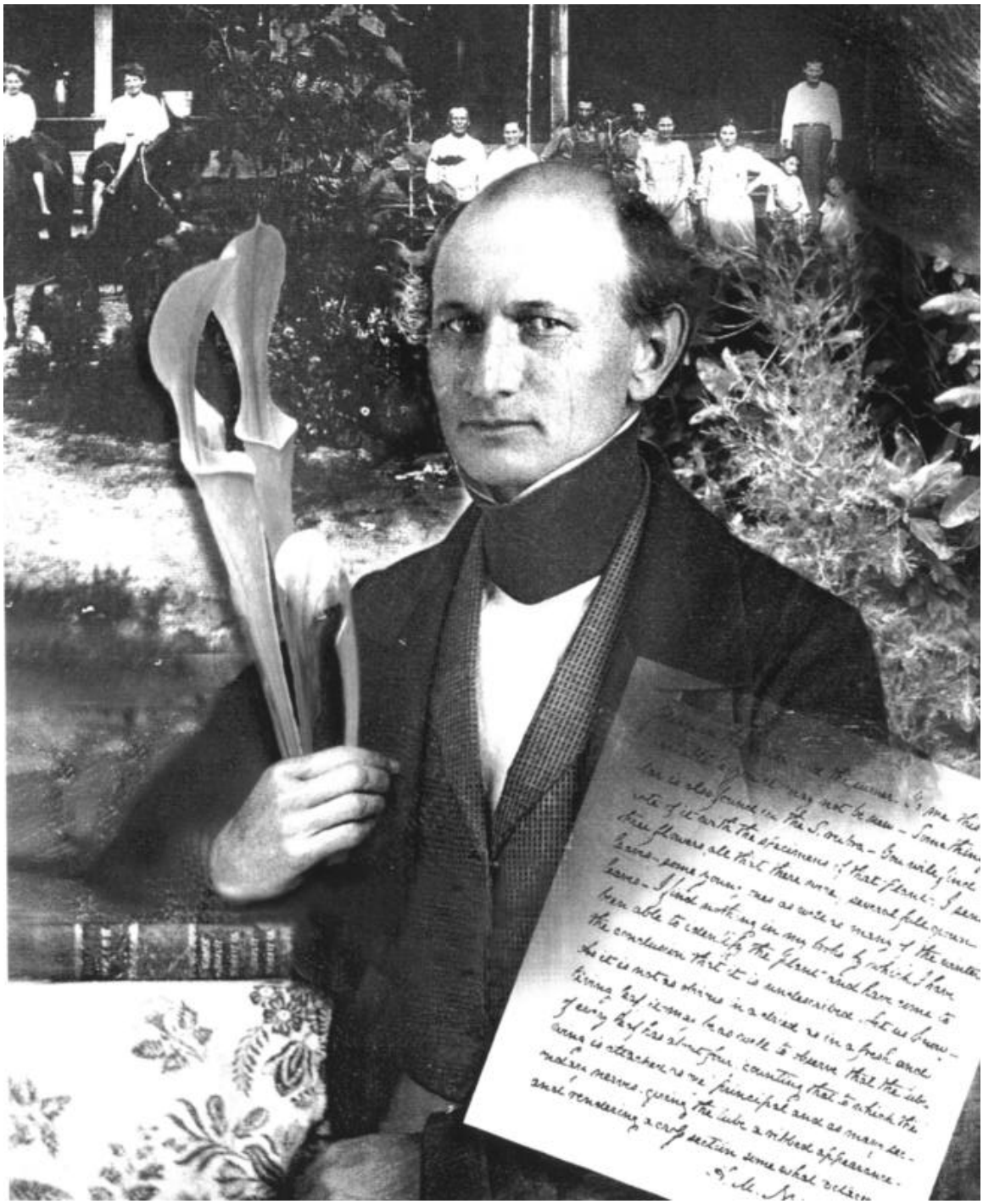

Fig. 3. Recreation of the discovery of *S. oreophila* by Dr. Hugh Neisler in 1859 at Beaver Creek. Photographs of Dr. Neisler and family homestead are authentic and provided for publication by Marilyn Neisler Windham. Although the association of *S. oreophila* with *S. rubra* was documented by Dr. Neisler, the affiliation with Atlantic white-cedar is hypothetical and based on the discovery of this tree species on the same watershed.

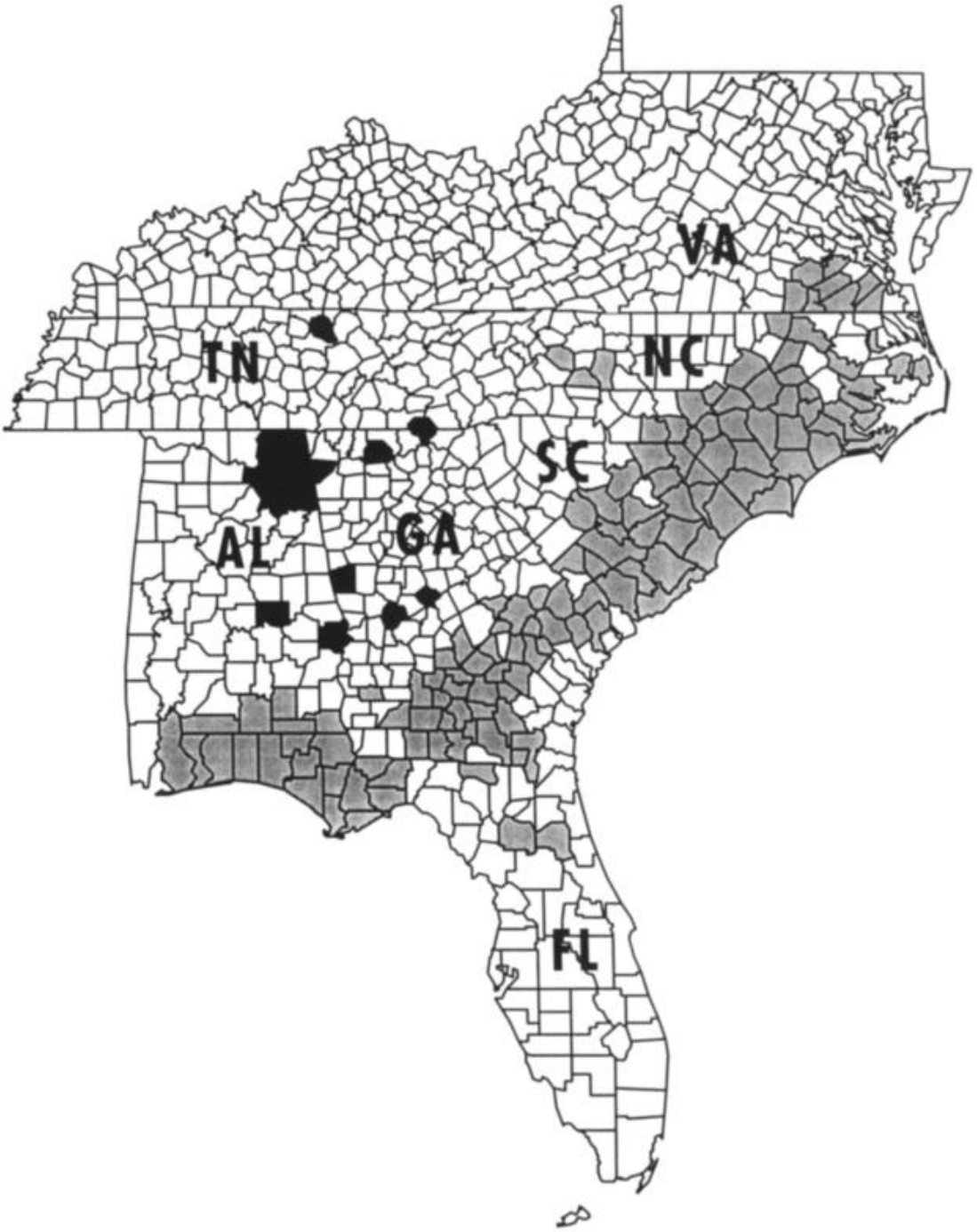

Fig. 4. Distribution of the green pitcher plant (dark shade), *Sarracenia oreophila*, and the yellow pitcher plant (light shade), *Sarracenia flava.*