

Appendix H. Plants Technical Team Report

Prepared by Tom Patrick and Mincy Moffett, Team Leaders

Technical Team Members

The Plants Technical Team represents academia, professional and amateur botanical consultants, nursery staff, and personnel from nature centers and botanical gardens.

Marshall Adams, Nurseryman [woody plants]
 Heather Alley, Plant Conservation Program, State Botanical Garden [native plant horticulture, coordinator of Botanical Guardian volunteers]
 Joanne Baggs, Botanist, Chattahoochee/Oconee National Forest [rare plants, monitoring]
 Wilson Baker, Naturalist [plants of the Coastal Plain; surveys]
 Mark Ballard, Botanical Consultant [plants of the Piedmont; surveys]
 Steve Bowling, Conservation Assistant Horticulturist, Atlanta Botanical Garden [discovery, horticulture, surveys]
 Forbes Boyle, Botanist, Okefenokee NWR [Okefenokee Swamp flora]
 Jim Candler, Environmental Supervisor, Georgia Power [powerline management, surveys]
 Jaime Collazo, Ecologist, Georgia Dept. of Transportation [roadside management, mitigation]
 Richard Carter, Professor of Biology, Valdosta State University [sedges; rare plant surveys]
 Jenifer Ceska, Coordinator, Georgia Plant Conservation Alliance, State Botanical Garden
 Linda Chafin, Conservation Botanist, State Botanical Garden of Georgia [general flora]
 Alan Cressler, Hydrologist, U. S. Geologic Survey [discovery, photography]
 Ron Determann, Superintendent, Fuqua Conservatory, Atlanta Botanical Garden [horticulture, discovery, habitat restoration]
 Brian Davis, Ecologist, Georgia Dept. of Transportation [surveys]
 Paul Davison, Professor of Biology, North Alabama University [bryophytes]
 Ben Dickerson, Wildlife Biologist, Georgia Power [powerline management, surveys]
 Jim Drake, Georgia Botanical Society [gentians, lilies, discovery]
 Lee Echols, Botanical Consultant, North American Land Trust [conservation, blackland prairies]
 Debbie Folkerts, Professor of Biology, Auburn University [bog ecology]
 Chick Gaddy, Naturalist [rare plants, discovery, surveys]
 Tom Govus, Botanical Consultant [vegetation classification, rare plants, discovery]
 Malcolm Hodges, Director of Stewardship, The Nature Conservancy of Georgia [natural area management lichens]
 Lisa Kruse, Botanist, Nongame Conservation Section, GADNR [general flora, monitoring, natural area management, Oxypolis canbyi]
 Ron Lance, Land Manager, North American Land Trust [woody plants, Crataegus]
 Eamonn Leonard, Vegetation Ecologist/Botanist, Nongame Conservation Section, GADNR [vegetation classification, invasives, native plant propagation]
 Patrick Lynch, Botanical Assistant, Joseph E. Jones Ecological Research Station [vegetation of limestone forests of the Coastal Plain; general floristics]
 Bob McCartney, Nurseryman [woody plants, surveys, discovery]
 Ed McDowell, Master Gardener [rare plants, monitoring, networking within conservation multiple conservation organizations]

Max Medley, Naturalist [discovery, general flora]
 Mincy Moffett, Botanist, Nongame Conservation Section, GADNR [general flora, natural area management, invasives, mountain bogs, Xyris, safeguarding]
 Tom Patrick, Botanist, Nongame Conservation Section, GADNR [rare plants, Biotics database, Trillium, safeguarding, surveys]
 Rich Reaves, Botanical and Wetlands Consultant [general flora, state land inventories, discovery]
 Matt Richards, Conservation Coordinator, Atlanta Botanical Garden [orchids, horticulture, habitat restoration]
 Frankie Snow, Archaeology Consultant, Science/Computer Lab Technician, South Georgia College [flora of the Altamaha Grit Region, discovery]
 Bruce Sorrie, Botanist (retired), North Carolina Heritage Program [Agalinis, endemics of the Southeast, surveys, flora of the Fall Line Sandhills, Liliium]
 Matthew Stoddard, Wildlife Biologist, Nongame Conservation Section, GADNR [discovery, natural area management]
 Nate Thomas, Wildlife Biologist, Nongame Conservation Section, GADNR [discovery, natural area management, Northwest Georgia rare plant surveys]
 Jacob Thompson, Vegetation Ecologist/Botanist, Nongame Conservation Section, GADNR [flora of the Outer Coastal Plain, monitoring, surveys; vegetation classification]
 Richard Ware, Georgia Botanical Society [Floyd County flora, discovery, woody plants]
 Brad Wilson, Veterinarian, Herpetologist [orchids, carnivorous plants, discovery]
 Wendy Zomlefer, Professor of Plant Science, Director of the Herbarium, University of Georgia [herbarium access, Georgia flora atlas project, advises grad students in floristic and biosystematics projects]

Approach

Primary information sources for this assessment were the files of the Georgia Natural Heritage Program (now within the Nongame Conservation Section), selected publications (especially volumes published to date in the Flora of North America series), and some internet sources such as the NatureServe website (www.natureserve.org). The standard reference for taxonomy and nomenclature for Georgia vascular plants is the 2015 edition of Flora of the Southern and Mid-Atlantic States by Alan Weakley. The electronic version of this 1320-page flora is available at the University of North Carolina Herbarium website. Other information came from specialists in large and difficult groups, such as the two examples described below.

First, consider the purple foxgloves, *Agalinis* spp. In 2012 a call for information on ten-lobed purple foxglove, *Agalinis decemloba*, a name under which no specimens were located at the University of Georgia Herbarium, brought to light several taxonomic issues. Botanists from Mid-Atlantic States and published research determined that federally listed sandplain purple foxglove, *Agalinis acuta*, was synonymous with *Agalinis decemloba*. An early monograph showed *Agalinis decemloba* from the Blue Ridge of Georgia and a recent collection was identified as *Agalinis decemloba* from Catoosa Co. in the Ridge and Valley, plus a published picture in Tipularia showed the plant on Lookout Mountain near Cloudland Canyon. Field observations by Rich Reaves, Tom Govus, Max Medley and Tom Patrick confirmed *Agalinis decemloba* extant in Georgia. Meanwhile, Wilson Baker dutifully rediscovered Georgia purple

foxglove, *Agalinis georgiana*, from pristine longleaf pine-wiregrass habitat in the Southeastern Plains near Thomasville. These observations represent new findings in need of herbarium documentation and conservation actions. Bruce Sorrie assisted with determinations of collections made by various members of the Plants Technical Team.

Another conundrum is represented by the hawthorns, *Crataegus* spp. Fortunately, in 2014 Ron Lance published Haws: A Guide to Hawthorns of the Southeastern United States. This provided enough insight on *Crataegus* to allow for identification of most specimens, and, most importantly, it included detailed range maps and rarity status notes at the state level. Some 75 *Crataegus* taxa are known from Georgia, including 22 listed as rare. We include 5 species as High Priority Plants suitable for effective plant conservation activities, plus one known at present only historically. Attention to *Crataegus* has long been overlooked. With the guidance of Ron Lance we now can determine the significance of the many hawthorns found in woodland and prairie habitats that are of conservation concern. Further additions, however, to our rare plant list await more detailed field surveys.

A two-day team meeting was held at Valdosta State University on 20-21 March 2014 with selected Coastal Plain botanists. At this time team members and other volunteers were introduced to the new Biotics 5 conservation database by our botany intern, Rebecca Pudner. Richard Carter demonstrated the virtual herbarium project now underway at Georgia's two largest herbaria, Valdosta State University and the University of Georgia. Jacob Thompson discussed vegetation classification in the coastal counties. Tom Patrick reviewed other heritage methodology, including recent rare plant surveys and assignment of state rarity ranks. Some botanically significant sites were noted by the group and a preliminary list of rare plants of the Coastal Plain was presented and critiqued. Similar regional sharing of lists among team members will be undertaken.

Results of Initial Assessments and Discussions

Phase I of the assessment process began with the development of a matrix, in the form of an Excel spreadsheet, that featured, as column headers, various ranking factors (abundance, habitat, last observation dates, management needs, etc.), and designated best sites. All plants in the conservation database marked as "Tracked" or "Watched" by the Nongame Conservation Section were reviewed. For SWAP (2005) this initial list contained 996 species, but grew to 1085 species for this revision, including both vascular and nonvascular plants. Nonvascular plants include lichens, mosses, liverworts and hornworts only. There are no data for the fungi of Georgia at present incorporated in the database. Currently, there are ca. 3100 vascular plants and ca. 550 nonvascular plants recorded for Georgia. Roughly 31 percent of all Georgia plants were reviewed for SWAP (2015).

The primary ranking factors identified by the team are listed below. Three in bold print at the end of the list are new criteria based on conservation actions taken through coordination with other agencies, primarily as part of decisions made through the Georgia Plant Conservation Alliance with guidance from GADNR botanists.

- Range-wide (global) abundance
- Federal and State protection status
- Narrowness of range in the state
- State rarity ranking
- Overall perceived species trends
- Degree of demonstrable threat
- Number of already protected occurrences
- Statewide abundance
- Importance of efforts in Georgia to overall status of the species
- **Whether petitioned for listing by Center for Biological Diversity**
- **Safeguarding actions already in place**
- **Urgency of overall conservation needs**

Using the criteria enumerated above, two lists of high priority rare plants were compiled.

First, State Historic (SH) plants, those plants not observed in the wild since the mid-1990s, were compiled in Table 1. The rediscovery of the so-called “Lost Plants” of Georgia is a high priority for SWAP (2015). No conservation actions besides looking for these plants can be undertaken until populations are relocated. There are 49 confirmed “Lost Plants” in addition to the famous Franklin tree (*Franklinia alatamaha*) that is now regarded as extinct in the wild. Of these 49, most were found on the Coastal Plain, especially in areas known as the Dougherty Plain and Tifton Upland primarily in Southwest Georgia on the Southeastern Plains or Inner (Upper) Coastal Plain ecoregion. Several dozen more taxa likely qualify as SH in Georgia, but data are lacking for dates of collection and latest observations of several graminoids, mosses and liverworts. In addition, even basic rarity ranks for nonvascular plants for the most part have yet to be determined.

Table 1. Distribution of "Lost" or Not Recently Seen Plants, by Ecoregion							
Scientific Name	Common Name	Year Last Seen	SA/RV	BR	PD	SP	SCP
<i>Agalinis gattingeri</i>	Gattinger's Purple Foxglove	1976	X				
<i>Agalinis harperi</i>	St. Marks Purple Foxglove	1962				X	X
<i>Agalinis laxa</i>	Spreading Purple Foxglove	1947				X	
<i>Agarista populifolia</i>	Pipe-Stem Fetterbush	Mid 1800s					X
<i>Arabis lyrata</i>	Lyre-Leaf Rockcress	1878	X				
<i>Aristida simplicifolia</i>	Chapman's Three-Awn Grass	1975				X	
<i>Asplenium heterochroum</i>	Bicolored Spleenwort	Early 1900s					X
<i>Calopogon multiflorus</i>	Many-Flowered Grass-Pink	1992				X	
<i>Calopogon oklahomensis</i>	Oklahoma Grass-Pink	1947				X	
<i>Carex brunnescens</i>	Brown Seepage Sedge	1939		X			
<i>Carex buxbaumii</i>	Brown Bog Sedge	1966	X				
<i>Carex triangularis</i>	Fox Sedge	1951	X				
<i>Carphephorus pseudoliatris</i>	Lavender Lady	1949				X	
<i>Cephaloziella obtusilobula</i>	Roundleaf Liverwort	1950		X			
<i>Corallorhiza maculata</i>	Spotted Coralroot	1946		X			
<i>Crataegus brachyacantha</i>	Blueberry Hawthorn	1941					X
<i>Delphinium alabamicum</i>	Alabama Larkspur	1900	X				
<i>Eleocharis bicolor</i>	Two-Tone Spikerush	Pre-1990				X	
<i>Eleocharis erythropoda</i>	Bald Spikerush	1963	X				
<i>Eurybia eryngifolia</i>	Snakeroot-Leaf Aster	1947				X	
<i>Ilex cuthbertii</i>	Cuthbert's Holly	1991			X	X	
<i>Iris prismatica</i>	Slender Blue Flag	1982	X				
<i>Lindernia saxicola</i>	Rock False Pimpernel	1932			X		
<i>Linum sulcatum</i>	Grooved Yellow Flax	1994	X				
<i>Linum harperi</i>	Harper's Grooved Flax	1900				X	
<i>Ludwigia brevipes</i>	Long Beach Seedbox - P	1942					X
<i>Lysimachia loomisii</i>	Carolina Loosestrife	1837				X	
<i>Minuartia godfreyi</i>	Godfrey's Stitchwort - P	1901				X	
<i>Muhlenbergia torreyana</i>	Torrey's Dropseed	1900				X	
<i>Orbexilum virgatum</i>	Slender Leather-Root	1939					X
<i>Paronychia patula</i>	Pineland Nailwort	1947				X	

Scientific Name	Common Name	Year Last Seen	SA/RV	BR	PD	SP	SCP
<i>Pieris floribunda</i>	Evergreen Fetterbush	Pre-1820		X			
<i>Plagiochila sullivanii</i>	Sullivant's Leafy Liverwort	1950s		X			
<i>Polygonum glaucum</i>	Sea-Beach Knotweed	1974					X
<i>Quercus palustris</i>	Pin Oak	1948	X				
<i>Rhexia parviflora</i>	Small-Fld. White Meadowbeauty	1940				X	
<i>Rudbeckia grandiflora</i>	Largeflower Coneflower	1948	X				
<i>Sarracenia rosea</i>	Gulf Purple Pitcherplant	1900				X	
<i>Schoenoplectus hallii</i>	Hall's Bulrush – P	1966				X	
<i>Scutellaria arenicola</i>	Sandhill Skullcap	1950					X
<i>Silphium radula</i>	Rosinweed	1948	X				
<i>Solanum pumilum</i>	Dwarf Horse-Nettle	1836			X		
<i>Solidago porteri</i>	Porter's Goldenrod	1979			X		
<i>Spiranthes brevilabris</i>	Short-Lipped Ladiestresses	Pre-1950				X	
<i>Tofieldia glutinosa</i>	Northern Bog Asphodel	1946		X			
<i>Vaccinium crassifolium</i>	Evergreen Lowbush Blueberry	1958					X
<i>Viburnum lantanoides</i>	Witch-Hobble	1947		X			
<i>Vitis palmata</i>	Riverbank Grape	1991				X	X
<i>Zamia integrifolia</i>	Florida Coontie	1971					X
Total = 49		Subtotals:	10	7	4	19	11

Second, a revised list of high priority plants, excluding “Lost Plants,” was developed. SWAP (2005) listed 435 plants with no other prioritization of urgency. SWAP (2015), Appendix A, lists 290 high priority plants. A deliberate attempt to list the rarer plants only resulted in a more reasonable number of plants that feasibly could be worked into projects over the next 10-year SWAP cycle. The Appendix A list of High Priority Plants was refined further (see Table 2 below) to emphasize the plants most in need of conservation actions. Most plants in Table 2 are known from few sites, usually under one or two, with little if any permanent protection, *in situ* enhancement or *ex situ* safeguarding. Some well-established safeguarding sites may be underway, but unless viable populations have been established, much additional monitoring and care are needed. One example is the American barberry (*Berberis canadensis*) recently outplanted near Sprewell Bluff along the Flint River, Meriwether Co., in a montane longleaf pine woodland. The outplanting site is a few miles from a known historic collection from the same ridge line and habitat. American barberry in Georgia is known from only one extant natural occurrence and is considered at risk of extinction in the wild without site protection and at least two well-managed viable populations. Another critical species is the Carolina windflower (*Anemone caroliniana*), known from a single site, perhaps extant at another not yet relocated.

The known population in the Monticello Glades, Jasper Co., consists of less than 10 small clumps, some of which are infected with a rust disease and subjected to roadside management threats.

Table 2. Plants in Most Critical Need of Conservation Action		
Scientific Name	Common Name	Comment
<i>Amorpha georgiana</i>	Georgia Indigo-Bush	One site, few plants; management agreement needed
<i>Anemone caroliniana</i>	Carolina Windflower	Few plants, rust disease threat
<i>Berberis canadensis</i>	American Barberry	One site; management agreement needed
<i>Clematis fremontii</i>	Fremont's Leatherflower	One site, few plants
<i>Crocanthemum nashii</i>	Florida Scrub Sunrose	One small site; needs formal collaborative agreement
<i>Cypripedium kentuckiense</i>	Kentucky Ladyslipper	One site, few plants; needs formal protection
<i>Eriocaulon koernickianum</i>	Dwarf Pipewort	Few sites, irregular occurrence; ecology study needed
<i>Eriophorum virginicum</i>	Tawny Cottongrass	One protected site, few plants
<i>Isoetes junciformis</i>	Rush Quillwort	One site, irregular appearance; unprotected
<i>Lilium pyrophilum</i>	Pineland Lily	Newly recognized; browsing threat; few mature plants
<i>Lindera subcoriacea</i>	Bog Spicebush	Severe dieback; few sites
<i>Liparis loeselii</i>	Fen Orchid	One small fragile site
<i>Platanthera chapmanii</i>	Chapman's Fringed Orchid	Management issues; needs rigorous monitoring
<i>Platanthera flava</i> var. <i>herbiola</i>	Pale Green Orchid	One site; very few plants
<i>Platanthera integra</i>	Yellow Fringeless Orchid	Severe decline; irregular appearance
<i>Rhynchospora solitaria</i>	Solitary Beakrush	Two sites, critical management issues
<i>Silene regia</i>	Royal Catchfly	One site; development pressure
<i>Thalictrum debile</i>	Trailing Meadowrue	One site in commercial area; land purchase needed
<i>Thaspium pinnatifidum</i>	Cutleaf Meadow-Parsnip	Small populations; global rarity
<i>Trillium pusillum</i>	Least Trillium	Threatened by development; more protection needed
<i>Trillium</i> sp. nov. (unpublished)	Southern Decumbent Trillium	Few sites; severe threats (feral hogs)
Total = 21		

Species Distribution by Ecoregion

Appendix A lists the high priority plants with an indication of the ecoregions in which they occur. Ecoregions are indicated by the following abbreviations designated in the right-hand columns of the table:

- **SA/RV = Southwestern Appalachians/Ridge & Valley** [includes Cumberland Plateau]
- **BR = Blue Ridge**
- **PD = Piedmont**
- **SP = Southeastern Plains** [Upper or Inner Coastal Plain]
- **SCP = Southern Coastal Plain** [Lower or Outer Coastal Plain and Barrier Islands]

Species Conservation Actions

High Priority Plants will require well-planned conservation actions. Conservation actions are divided into four categories, as defined below.

- **Category A – Broad-scale habitat restoration/management**

Criteria include current range, threats, and habitat needs that are well known. The species is considered a habitat indicator, keystone species, or good representative of a plant community of interest. Within appropriate habitat there exist discernible populations that are large enough for monitoring to be feasible. Population size and structure are assumed to be indicators of overall habitat quality. Conservation emphasis will be on broad-scale protection, restoration and management of habitat as well as monitoring of individual populations.

- **Category B – Protection/management of best populations/critical habitats**

Range, threats, and habitat needs are well known, but the species may not be a good indicator of overall habitat quality (e.g., presence and abundance may be better correlated with microhabitat factors, or may be a eurytopic species that ranges widely over many habitats but that depends on discrete areas with specific soil nutrient, light and water requirements. Plants occur in large enough numbers for monitoring to be feasible. Conservation emphasis will be on monitoring and managing existing populations at best sites within range, protecting critical habitat needs (e.g., hydrology, canopy density, etc.), protection against poaching, and dealing with other threats such as overbrowsing, invasives or disease.

- **Category C – Reintroduction/restoration of populations**

The species has suffered catastrophic declines in the state, to the point of extirpation (or near extirpation). Former range, causes of decline, and habitat needs are generally known, but may require some additional research. Existing populations are clearly imperiled and not likely to persist without intervention. Primary conservation emphasis will be on augmenting existing populations and/or establishing new populations through a variety of methods (e.g., propagation, translocation, small-scale habitat manipulation). For plants, this effort is called safeguarding and is undertaken both in botanical gardens (*ex situ* safeguarding) and in natural habitats (*in situ* safeguarding).

- **Category D – Basic research and surveys**

Evidence of rarity or endemism exists, but significant questions remain as to current range, population status, habitat needs, and/or threats. For some groups, this includes species known historically from the state and not observed in recent years. For plants, selected species known historically from the state are included in a separate table (Table 1). Species reported from only a few sites, usually less than 5 to 20 locations, but for which adequate surveys have not yet been conducted meet the criteria for this category. Generally, insufficient information exists to develop a specific conservation strategy at this time. Emphasis will be on conducting basic research to determine current status, habitat needs, and threats.

While the four categories of conservation actions are described separately, in reality, many high priority species have life history characteristics or habitat requirements that necessitate a multi-focal conservation approach. Therefore, more than one conservation action may be necessary for some plants.

In summary, a total of 21 plants are in urgent need of attention within the next one to three growing seasons. The primary reason for urgency is the threat of habitat destruction due to development, especially since each of the 21 plants is known from only one or two unprotected sites. There often is no efficient way to insure permanent protection with adequate management for small natural areas before sites are destroyed. Without safeguarding action several of these rarities will disappear from existence in the wild within Georgia.

About 103 of the 290 High Priority Plants (Appendix A) have best sites identified that need protection and enhancement and/or restoration action. In many cases, additional landowner contacts and permissions are needed, various protection efforts put into place, and safeguarding sites established. Several of the High Priority Plants are found in more than three or four sites and some work on propagation and safeguarding is already underway. Establishment and management of viable populations are imminent and should be accomplished within the next SWAP 10-year cycle. The remaining High Priority Plants require conservation actions but are found in more populations and are not as critically imperiled.

By no means do these lists contain all rare plants in need of conservation action. Listed for SWAP (2015) are 290 High Priority Plants with an additional 49 “Lost Plants” to relocate. Putting these figures in perspective, the current total number of Tracked rare plants in Georgia is 744. Tracked species are mapped and data on occurrences entered into the conservation database (Biotics). Plants on the Watch List number an additional 345. The Watch List plants lack enough distributional data to determine rarity precisely, but are considered likely to have more than 20 or 30 occurrences, have been observed regularly, and are thought to be in no immediate danger of extirpation, allowing time for a more accurate rarity status determination. Therefore, some $290 + 49 = 340$ plants are covered by SWAP (2015) specifically out of a total of $744 + 345 = 1,089$ plants for which records are kept and research undertaken as time permits. SWAP (2015) High Priority Plants account for about one third (31 percent) of the known plants of conservation concern. There are 6,400 rare plant occurrences represented in the conservation database (Biotics); 1,800 were added during the last SWAP cycle (2005-present).

Importance of Collaboration

The Georgia Botanical Society (BotSoc), founded in 1928, continues to make invaluable contributions to plant conservation in Georgia. Some examples that help support and publicize activities supported by the Nongame Conservation Section are briefly summarized here. BotSoc annually publishes *Tipularia*, a botanical magazine with color photos and articles on field botany and current academic research. BotSoc sponsors field trips to explore sites in all physiographic provinces of the state. Several state lands have been inventoried by teams led by BotSoc members. Rare plants discovered during surveys are routinely added to Biotics.

Another botanical group focused on plant conservation is the Georgia Native Plant Society (GNPS), founded in 1994. Of special importance to the Plants Technical Team efforts are the informative newsletters, the annual Native Plant Symposium, and the plant rescue program. Plant rescues are conducted when a new development will impact native plant populations. Plant rescuers are trained in horticulture and plant taxonomy. Protected Plants, officially designated through provisions of the Georgia Wildflower Preservation Act, when encountered during rescues, are reported to the Nongame Conservation Section. Permits for transport and sale of rescued plants are then issued. GNPS rescuers were among the first to propagate Georgia aster (*Symphyotrichum georgianum*) and offer it for sale. A native plant propagation garden at Georgia's Stone Mountain Park serves to promote and make available native plants for landscaping. The plant rescue operation and technical propagation expertise are invaluable services to GADNR whenever coordination or mitigation is required by government agencies and their consultants

Botanists within GADNR are encouraged to participate in some of the activities of these grass root plant conservation organizations. The volunteer efforts undertaken by members of these groups provide a continuous flow of new botanical information, especially about Georgia's rare species of conservation concern. Our very first SWAP Priority Action Item, elaborated upon below, is to mention the importance of collaborative efforts in plant conservation in Georgia. This effort is best exemplified through the role of the Georgia Plant Conservation Alliance (discussed under Priority 1, Part 2, last section of report).

Additional Assessment Results

Following completion of preliminary lists of rare species for the five ecoregions, more comprehensive lists were sent out for review. One issue became evident as lists of 100s of plants appeared too cumbersome to clearly show objectives and priorities concisely in a SWAP plan. Therefore, more attention was placed on the highest priority plants. This resulted in some additional features of the High Priority Plant List, helpful in focusing on projects that needed attention most, yet not neglecting species of importance in which some progress has already been made. The Appendix A table of High Priority Plants contains all plants known from Georgia that are petitioned for federal listing consideration by various groups, including the Center for Biodiversity. Currently, there are 43 plants (1 hornwort, 3 liverworts, 39 vascular plants) so petitioned. Since SWAP (2005), 5 vascular plants were designated as Candidates for federal listing by the U. S. Fish and Wildlife Service. These 5 high priority plants are enumerated below to show most recent developments and needs:

- *Arabis georgiana*, Georgia rockcress – Listed as Threatened in 2014; intensive safeguarding and augmentation efforts underway; needs annual monitoring
- *Dichantheium hirstii*, Hirst Brother's panic grass – more survey needed in Georgia where one large (the largest currently known) population was rediscovered in 2014; safeguarding initiated
- *Helianthus verticillatus*, whorled sunflower – Listed as Threatened in 2014; Georgia sites mostly protected and managed; needs prescribed fire management
- *Platanthera integrilabia*, monkey-face orchid or white-fringeless orchid – likely to be listed in near future due to poaching, few large populations, and continuous management

requirements (protection from browsing, maintaining open understory, herbicide avoidance); augmentation and/or safeguarding efforts being undertaken for all 9 extant Georgia populations; needs annual monitoring and additional safeguarding

- *Symphotrichum georgianum*, Georgia aster– Signed Candidate Conservation Agreement in effect as of 2014; annual survey and monitoring work conducted; needs 10-year commitment

Important discoveries of plants that appear to be state records, or at least are not well-documented with herbarium specimens or literature accounts with specific Georgia localities continue to be found. A few representative discoveries since SWAP (2005) are listed below along with respective ecoregion of occurrence and habitat.

- *Agalinis maritima*, maritime purple foxglove – Southeastern Coastal Plain; tidal marsh of barrier island
- *Calamovilfa arcuata*, Cumberland sandreed – Southwestern Appalachians; boulder gravel bar along high velocity stream
- *Clematis fremontii*, Fremont’s leatherflower –Ridge and Valley; calcareous flatwoods.
- *Coreopsis rosea*, pink tickseed – Blue Ridge; drawdown zone of Lake Chatuge
- *Crocantemum nashi*, Florida sunrose – Southern Coastal Plain; inland aeolian sand dune
- *Euphorbia purpurea*, glade spurge – Blue Ridge; open seep over serpentine
- *Galium virgatum*, limerock bedstraw – Southeastern Plains; blackland prairie
- *Gratiola graniticola*, granite hedge-hyssop – Piedmont; granite outcrop
- *Liparis loeselii*, fen orchid– Blue Ridge; open seep over serpentine
- *Rivina humilis*, rouge-plant – Southern Coastal Plain; edge of tidal marsh hammock
- *Scutellaria drummondii*, Drummond’s skullcap –Southeastern Plains; blackland prairie
- *Solidago arenicola*, Black Warrior goldenrod - Southwestern Appalachians; boulder gravel bar along high velocity stream
- *Tomostima cuneifolia*, limerock draba - Southeastern Plains; blackland prairie

Examples of High Priority Habitats and Species

Southwestern Appalachians & Ridge and Valley Ecoregion

- Limestone glades and barrens

These are open habitats dominated by graminoids and forbs, with scattered eastern redcedars and other trees. These habitats may contain a large number of endemic plant species. Glades occur on thin, rocky soils, and are typically dominated by forbs while barrens are in areas with deeper soils and are dominated by grasses. Although the soil characteristics of remnant prairies retard rapid establishment by trees and shrubs, woody encroachment due to fire suppression must be managed.

- Limerock arrow-wood (*Viburnum bracteatum*) [Legal Status: State Endangered]

The limerock arrow-wood is a deciduous shrub, inhabiting calcareous, rocky bluffs and found in less than six populations in the world. Quarrying operations are one of the primary threats to the species. The only known population in Alabama was destroyed by quarrying and two of the three Georgia populations, including the largest known in the state, were jeopardized by past quarrying. These sites are now protected from active quarrying, protected and safeguarded.

Blue Ridge Ecoregion

- Rich mesic hardwood forests

These include a range of forest habitats, all hosting a diverse groundcover. These forests, particularly those over basic soils or cation-rich soils (e.g., serpentine, mafic, ultramafic), harbor a wide diversity of rare plant species. These habitats have been impacted by incompatible forestry practices, forest conversion, disease, invasive exotic species, and residential development. Protection from disturbance is vital to the health of these habitats and the rare species they support.

- Persistent trillium (*Trillium persistens*) [Legal Status: State Endangered, Federal Endangered]

The persistent trillium is restricted to extreme northeast Georgia and western South Carolina. In Georgia it occurs mostly in Tallulah Gorge and is associated with several rare plants including the Carolina hemlock (*Tsuga caroliniana*), monkeyface orchid (*Platanthera integrilabia*), and sweet pinesap (*Monotropsis odorata*). It was only recently discovered and described (1971). Because it is not a particularly strong competitor, populations are threatened by invasive species, especially in secondary forests, not only aggressive exotics (e.g., English ivy, Japanese honeysuckle, multiflora rose, kudzu, wild hogs), but also natives (e.g., blackberry, black locust). The species forms fruits with few seeds and seems to have a dispersal problem, resulting in its virtual restriction to a narrow gorge with two downstream disjunct occurrences for a total narrow range of 7 miles along the Tallulah-Tugaloo river system. Moreover, due to its showy nature, this species could become the focus of irresponsible collectors. Increased visitation to the gorge by recreationists requires constant monitoring so that populations are not trampled.

Piedmont Ecoregion

- Granite outcrops

Georgia hosts almost 90% of the Piedmont granite outcrops of the Southeast. These habitats host unique microhabitats that are characterized by a granitic substrate with pockets of acidic, nutrient-poor mineral soil. Vernal pools, or solution pits, occurring on the outcrops host high priority species that are severely restricted in their range. Specific threats to these habitats include destruction of proximate habitat or adjacent uplands from quarrying activities, recreational use (e.g., trail bicycles, ORV traffic, littering, vandalism, fire building, unleashed dogs), eutrophication resulting from conversion of habitat to pasture (cattle waste adds

nutrients that favor the growth of competitive aquatic species), pollution (e.g., dumping of trash, airborne deposition of granite dust), invasive exotic species, and shading due to tree growth. The highest priority for management is to preserve the habitat and to avoid disturbance.

Since SWAP (2005), special attention to Lithonia gneiss outcrops, a subset of Piedmont granite outcrops, shows that additional protection efforts are needed to protect selected outcrops in DeKalb, Gwinnett, Rockdale and Walton Cos. A suite of rare taxa have their best populations on the Lithonia gneiss outcrops. Special plants more abundant here than on other granite outcrops include flatrock onion (*Allium speculae*), Louisiana bluestar (*Amsonia ludoviciana*), dwarf hatpins (*Eriocaulon koernickianum*), Wolf's Spikerush (*Eleocharis wolfii*), Alexander's rock aster (*Eurybia avita*), and granite hedge-hyssop (*Gratiola graniticola*).

- Pool sprite or snorkelwort (*Amphianthus pusillus*) [Legal Status: State Threatened, Federal Threatened]

The pool sprite is endemic to granite outcrops of the Piedmont ecoregion in Alabama, Georgia, and South Carolina. It is the only member of the *Amphianthus* genus. Recent studies show the plants to be highly specialized members of *Gratiola* and therein go by the name *Gratiola amphiantha*. One peculiar characteristic is that the small flowers can be found both among the submerged basal rosette leaves and between the paired, floating, emergent leaves. On outcrops, this species is restricted to the shallow flat-bottomed solution pits where rainwater collects. Because its microhabitat is naturally quite stable (very slow to undergo change), the pool sprite is not adapted to withstand any habitat modification. Much of its habitat has been destroyed by quarrying activities or degraded by livestock, vehicular traffic, and eutrophication through sedimentation. Newly discovered populations need protection efforts and further inventory. One such site is along Rocky Comfort Creek, Warren Co. that also harbors high quality pools of federally listed mat-forming quillwort (*Isoetes tegetiformans*).

Southeastern Plains Ecoregion

- Fire-maintained wetlands

Some of the unique wetlands in this ecoregion include wet pine savannas and herb and shrub bogs. Wet savannas are often a matrix of an open tree canopy with high groundcover diversity, interspersed with bogs. Threats to these habitats are numerous, and include altered fire regimes, altered hydrology and water quality, invasive exotic species (e.g., particularly wild hogs), incompatible agricultural and silvicultural practices, ORV and heavy equipment traffic, and road and utility construction. These threats often compound one another. For example, conversion to pine monoculture results in a fragmented landscape, which promotes altered fire regimes, which in turn facilitate increased density of woody plants, and degrades the habitat for sun-loving bog and savanna plants.

- Purple honeycomb head (*Balduina atropurpurea*)
[Legal Status: State Rare, Federal Candidate]

The purple honeycomb head is found primarily in South Georgia and Florida. The genus is endemic to the southern United States. This species thrives in the wetter areas of peaty pitcherplant bogs and pine savannas and is particularly vulnerable to woody encroachment and hydrologic alteration. It is important to maintain an appropriate fire regime through controlled burning and to avoid drainage of the site (i.e., take special care in the placement of firebreaks near these habitats). Controlling the impacts of feral hogs is also critical. *Balduina atropurpurea* is under scrutiny as a petitioned species for federal listing. It has been the object of several studies that demonstrate numerous populations dependent upon appropriate moisture to bloom regularly, as well as prescribed fire or mowing to maintain an appropriate habitat. Due to irregularity of prescribed fire and the sporadic blooming of small populations, the true rarity of *Balduina* is difficult to ascertain. However, where abundant (dozens of clumps or more) in a properly managed wet savanna/seepage bog habitat, the species appears to hold its own. Due to continued habitat destruction or degradation and the lack of a sufficient number of protected sites, especially in the Southeastern Plains ecoregion, much more survey work and protection efforts are needed. This species also occurs in the Southern Coastal Plain, where some of the more robust populations persist on Ft. Stewart. Since ca. 90% of the nearly 80 occurrences are historic, unprotected, unmanaged, and/or extremely small (less than 30-50 flowering stems in a good year of blooming), much remains to be done to adequately conserve this signature plant of the pitcherplant bogs of Georgia's coastal plain.

Southern Coastal Plain Ecoregion

- Longleaf pine-scrub oak woodlands

These habitats occupy the drier portion of the moisture gradient. Drier habitats, such as sand ridges and scrub communities, host several rare plants. The largest threat to these habitats is altered fire regime. This includes fire exclusion, fire suppression, alteration of habitats through unnatural timing, frequency, or intensity of prescribed burns, and other incompatible fire management practices. The result of altered fire regimes includes a shift in species composition (of pines and oaks) and reduced diversity in the groundcover.

- Hairy rattleweed (*Baptisia arachnifera*)
[Legal Status: State Endangered, Federal Endangered]

The hairy rattleweed is only found in two counties in Georgia. This rare endemic is found on sandy soils in open pine flatwoods and sometimes persists on intensively managed slash pine plantations and power line rights-of-way where invading woody plants are kept under control. Maintaining an open condition through prescribed burning is essential to the long-term viability of this species. Avoiding the drainage of the site is also imperative.

Conservation Actions and Research Priorities

In the following accounts progress on priorities listed in SWAP (2005) are briefly highlighted in Part 1. Newly revised actions and research priorities for SWAP (2015) are given subsequently in Part 2. Each of these conservation actions – old and new - requires attention whether an original

SWAP (2005) topic revised and updated, or an additional conservation action with new research priorities. Each represents a broad plant conservation goal.

Part 1

A Review of Old SWAP (2005) Priorities

Old Priority 1. Conduct statewide assessment of significantly rare natural communities.

Assess the status, distribution, and description of significantly rare natural communities. Although there are coarse landcover analyses for Georgia, none have thoroughly assessed many of the rarer (fine-scale) natural community types. Few of these communities have been adequately described using the ecological framework developed by NatureServe. This priority includes GIS coverages, descriptions of natural communities, assessments of threats and status, and addition of community records into Biotics. Also, recommendations for the protection and stewardship of rare natural communities are needed.

Since initiation of SWAP (2005) additional staff hired as vegetation and GIS specialists conducted vegetation surveys, particularly in the coastal and adjoining tier of counties. In addition, several projects beyond the purview of rare plants were completed, such as vegetation of sandhills and monitoring of fire effects. Documentation of occurrences of rare natural communities is now a more prevalent part of Biotics, the conservation database currently used. NatureServe's ecological community classification systems are now integrated into Georgia's vegetation projects. The assessment of rare natural communities now concerns several teams involved with SWAP (2015). Some examples of the Plants Technical Team directly contributing to assessments of rare natural communities are intense mapping and surveys of mountain bogs in the Blue Ridge, investigations of sag ponds and springs in the Ridge and Valley, vegetation and floristic assessments of blackland prairies and limestone forest communities on the Fort Valley Plateau of the Southeastern Plains, oak/pine woodlands on the Piedmont, and inland aeolian sand dunes along the Ochoopee River.

Members of the Plants Technical Team have authored new plant associations approved and now included within the U. S. National Vegetation Classification hierarchy. Examples are the Southern Ridge and Valley Sub-Calcareous Shale Barrens authored by Tom Govus and Max Medley, and the South Atlantic Mixed Oak-Pine Calcareous Flatwoods Forest authored by Jacob Thompson found in the Southern Coastal Plain. Both associations have significant rare plants – Alabama larkspur (*Delphinium alabamicum*) and swamp post oak (*Quercus similis*), respectively.

Old Priority 2. Develop Element Occurrence Rank specifications.

This is particularly important for species that are either endemic to, or primarily within Georgia (plants and animals). Define specifications for ranking the quality of individual element occurrences (i.e., "observation standards" per NatureServe). Element Occurrence Ranks are much needed by the conservation community in order to prioritize conservation efforts.

Numerous metrics (e.g., population size, distribution, reproductive modes, viability, etc.) would have to be field-assessed.

It is standard procedure now to enter an Element Occurrence Rank based on data provided by the observer. There are 100s of older records that have not yet been ranked and are gradually being updated. Approximately 1,800 new plant records have been entered into the Biotics Database during the last SWAP cycle (2005-present). There have also been nearly 900 additional plant records updated (incl. all edits and deletions) during this same period.

Old Priority 3. Develop protocols and procedures for safeguarding rare plants.

In 2008, a policy statement establishing protocols for an integrated plant conservation strategy combining *in situ* and *ex situ* projects and including habitat restoration and plant population safeguarding was developed and signed by 18 members of the Georgia Plant Conservation Alliance (GPCA). The DNR is both a charter member and leading institution within the GPCA. The policy/protocols document is informally known as the “GPCA Safeguarding Agreement” and is the de facto membership document for institutional participation in the GPCA. The document served to expand the scope and accelerate the process for determining and approving *ex situ* plant conservation projects in Georgia. There are currently 36 signatories to the Safeguarding Agreement.

Safeguarding, as it applies to plants, refers to all types of propagation and/or outplanting activities that constitute a conservation strategy of last resort. Specifically, safeguarding refers to various propagation and outplanting activities as they relate to *ex situ* or *in situ* efforts, including re-introductions, augmentations/enhancements, and introductions.

In Georgia, the primary vehicle for rare plant safeguarding, as well as rare plant conservation in general, is the Georgia Plant Conservation Alliance (GPCA). The GPCA, is an innovative network of public gardens, government agencies, academic institutions, utility companies and environmental organizations committed to preserving Georgia’s endangered flora. Formed in 1995 its mission is to study and preserve Georgia’s flora through multi-disciplinary research, education, and advocacy; facilitate the recovery of rare, threatened, and endangered plants of Georgia and the southeastern US through collaborative efforts within our state; and communicate the importance of preserving biodiversity worldwide.

Old Priority 4. Conduct surveys for nonvascular species.

One of the groups of plants least understood are the nonvascular bryophytes (mosses, liverworts, hornworts). Little is known about bryophytes in the state including distribution, habitat requirements, and abundance data. It would be important to survey for their diversity, habitat specifics, for rare, threatened, special concern mosses and liverworts.

Since 2005, a few bryological surveys have been conducted primarily by Paul Davison, University of North Alabama, Florence and Ken McFarland, University of Tennessee, Knoxville. These surveys included searches for new populations of the headwaters hornwort (*Megaceros aenigmaticus*), and general moss collections from diverse habitats. During general collecting trips in Blue Ridge and Cumberland Plateau sites of North Georgia, significant mosses and

liverworts were documented. A checklist of Georgia liverworts was completed and a few rarities were added to the database. Other bryologists have recently reported their collections from specialized habitats, especially areas of the Altamaha Grit Formation in Coffee and Jeff Davis Cos. This geologic feature within the Southeastern Plains ecoregion resembles outcrops of sandstone often with deep crevices and cliffs and was found to harbor the rare moss *Eccremidium floridanum* in seepy depressions on the exposed bedrock.

Lichenologists are conducting final fieldwork surveying most of Georgia's 159 counties to create an atlas of the lichens of Georgia. Very few lichens have yet been added to the conservation database as special concern plants. Only one Georgia lichen is federally listed, the rock gnome lichen (*Gymnoderma lineare*), found only in the Blue Ridge. Rarity ranks need to be assigned to a preliminary list of rare Georgia lichens that has been generated from atlas data, and support given for the upkeep of a county distribution atlas.

Old Priority 5. Assess conservation status of selected wetlands of Northwest Georgia.

In 2008 and 2009, the Atlanta Botanical Garden was contracted to survey likely habitats in northwestern GA for new occurrences of Tennessee yellow-eyed grass (*Xyris tennesseensis*) and monkey-face orchid (*Platanthera integrilabia*). The botanical survey employed topographic maps, soil surveys, and known locations of *X. tennesseensis* and *P. integrilabia* to help identify areas of suitable habitat for both target species. The counties of focus for *X. tennesseensis* included Bartow, Carroll, Cherokee, Chattooga, Floyd, and Gordon Counties. Stephens County in northeastern Georgia was included in the survey as well, specifically for the monkey-face orchid. The surveys focused on spring heads, spring runs, and their nearby creek channels. Several sites with impoundments were also surveyed that might have historically been springs. In total, nearly 50 sites were surveyed. Surveys were conducted during August through October to coincide with flowering and fruiting.

As a result of the surveys, three new Tennessee yellow-eyed grass populations were discovered (two in Bartow Co. and one in Floyd Co.), including the Clear Creek Lake Springs site which contained over 20,000 flowering stems making it Georgia's largest known population of this species. Much additional suitable habitat was identified for the yellow-eyed grass. While this survey did not locate any new populations of *P. integrilabia*, areas with suitable habitat were identified, most of which were located on protected public property. These sites represent good potential for the establishment of safeguarding populations *in situ*. There is also substantial property left to survey with the hopes of finding new populations.

Some progress has also been made on sag ponds in Northwest Georgia in the Ridge and Valley ecoregion. Two recent exploratory visits revealed several coastal plain disjuncts and rediscovery of one of Georgia's Lost Plants, pale mannagrass (*Glyceria pallida*, now known as *Torreyochloa pallida*). Additional surveys and inventories of the dozen or so remaining, intact sag ponds of Bartow Co. are needed. Atop the Cumberland Plateau additional floristic work is needed on sag ponds, especially those shown to support one of our rare sedges, tussock sedge (*Carex stricta*).

Old Priority 6. Assess conservation status of graminoids.

Very little is understood for this complex group of plants that makes up a large component of our state's diversity (focus on *Rhynchospora* and *Dichantheium*). Based on the SWAP (2005) evaluation, it is clear that there are numerous globally rare (G1, G2) species in need of current status surveys.

Limited work has been accomplished with graminoids, although numerous collections and observations were made. Some examples of rare graminoids are at least safeguarded in propagation and initial steps taken to safeguard *in situ*. Tawny cottongrass (*Eriophorum virginicum*) has successfully been propagated from seed collected from Georgia's single extant site. Autumn Beakrush or Solitary Beakrush (*Rhynchospora solitaria*), known from 3 extant sites, none protected, may be the rarest beaksedge known. It is a Georgia endemic described by Roland Harper in 1901. His type locality is destroyed, all but one remaining site is inaccessible due to uncooperative landowners. The accessible site is an unmanaged, frequently disturbed, roadside seepage bog with a few scattered plants, one of which was salvaged and remains in cultivation. Hirst Brother's panic grass (*Dichantheium hirstii*) was finally relocated in 2014 after not being found since 1947 – a nearly 67-year absence. The limesink depression pond/wet savanna in which it was found harbors other rarities, including Harper's beaksedge (*Rhynchospora harperi*). Meager sedge (*Carex exilis*), a state record, was discovered since the last SWAP in an Atlantic whitecedar bog on the Fall Line Sandhills. Attention has been given to a few more graminoids of conservation concern that appear to be habitat indicators, such as northern long sedge (*Carex folliculata*) in mountain bogs, and Wolf's Spikerush (*Eleocharis wolfii*) and bog oat-grass (*Danthonia epilis*) of Lithonia gneiss granitic outcrops. At least 6 new species of *Carex* found in Georgia have been described since SWAP (2005), and keys to *Dichantheium* and *Rhynchospora* much improved by Richard LeBlond in Weakley's revision of his on-line flora ([Flora of the Southern and Mid-Atlantic States](#)).

Old Priority 7. Promote markets for the use of native species.

Wildlife Division Biologists have gained valuable insight and developed protocols for the use of native plant species, through the Private Lands Program (PLP), habitat restoration and management of public lands by WRD biologists, and through collaborations and partnerships with other organizations, such as the NRCS, Georgia Exotic Pest Plant Council (GAEPPC), Georgia Plant Conservation Alliance (GPCA), and the Georgia Native Plant Society (GNPS). The use of native plants is inextricably linked to the eradication/control of invasive plant species, and the identification of suitable alternatives for agriculture, horticulture, and erosion control. The GAEPPC has worked to develop a list of alternatives, as has the GNPS. The NRCS and the GPCA actively restore habitats (both large, general-vegetation acreage and small rare plant communities) using native species. These activities are, in turn, helping to increase the markets, both demand for and supply of native species.

The Protected Plants of Georgia can be propagated and sold with proper documentation and permitting. The Plants Technical Team has many horticultural and nursery representatives who promote the use of native plants. Several gardens now feature native plants, especially butterfly gardens and GADNR botanists are involved with recommending native host plants and nectar

sources. Recently many of our native plants, including some rarer ones that propagate well and exhibit favorable garden qualities, are being grown at a new facility at the State Botanical Garden in Athens called the Mimsie Lanier Center for Native Plant Studies is a research, education and plant production center that propagates native Georgia plants for habitat restoration, endangered species recovery and introduction to the gardening community. There is also the Georgia Native Plant Initiative, formed in 2010 that the State Botanical Garden coordinates to bring together commercial growers, horticultural scientists, land managers, landscape architects and restoration ecologists. By working together Georgia's plant conservationist are helping to make some of Georgia's attractive native plants available in the trade. The GADNR botanists rely on botanical gardens and native plant nurseries to propagate high priority plants for habitat restoration and other safeguarding activities.

Old Priority 8. Restore mountain bog habitats.

Mountain bogs are one of the most critically endangered habitats of the Southern Appalachians. The bogs are typically small – from a half-acre to 5 acres – and usually associated with seeps, springs and small creeks. These are early successional habitats that support a variety of unique and imperiled flora and fauna, including the federally threatened bog turtle (*Glyptemys muhlenbergii*) and swamp pink (*Helonias bullata*), possibly the state's rarest reptile and plant species, respectively. Other exceptionally rare and state-protected mountain bog plants include the montane purple pitcher plant (*Sarracenia purpurea* var. *montana*), which has been petitioned for federal listing, Carolina bog laurel (*Kalmia carolina*), Canada burnet (*Sanguisorba canadensis*) and Cuthbert's turtlehead (*Chelone cuthbertii*).

For 22 years, the Nongame Conservation Section (NCS), working independently and as a member of the Georgia Plant Conservation Alliance (GPCA), has engaged in mountain bog restoration. Restoration is on-going at 8 bogs in Rabun and Union counties. The restoration focus is on manual woody competition removal, small scale "hydro-engineering", invasive species removal, introduction of prescribed fire at both landscape and bog-proper levels, and reintroductions of rare flora. Mountain Bog restoration within NCS is largely a collaboration between botanists and herpetologists. For additional SWAP accomplishments and issues, see priority actions related to bog turtles and mountain bog restoration in the Reptile and Amphibians Technical Team Report.

A cornerstone of the mountain bog restoration program is the propagation and outplanting of rare mountain bog plants. More than 5,000 individuals of five rare-plant species have been propagated during the last 20 years. During the last 10 years over 1,000 individual plants have been outplanted (*in situ*) into appropriate habitats. The remaining plants are in conservation holdings (*ex situ*) at GPCA gardens. Seedling recruitment has been documented for swamp pink and purple mountain pitcherplant at three restored bogs – this includes an F2 generation (*i.e.*, grandchildren) in, at least, one bog.

In 2007, the GPCA obtained a Wildlife Action Opportunities Fund (WAOF) Grant from the Wildlife Conservation Society and Doris Duke Foundation. DNR biologists were instrumental in securing this grant. Funds were used, in part, to: a) hire a GPCA Mountain Bog Program Coordinator; b) expand the pace of mountain bog active management/restoration; c) assist in the ground-truthing of 330 potential montane wetland sites identified from a GIS survey prepared by

the Natural Resources Spatial Analysis Laboratory (NARSAL) of UGA; and d) contract a detailed (6-inch contour interval) topographic site survey of a portion of Hale Ridge Bog, a necessary first step in the restoration of this bog, which is in need of substantial hydrologic repair.

In 2013, Georgia acquired a new partner in mountain bog restoration, the Bog Learning Network (BLN). The BLN, modeled after the highly successful Fire Learning Network (FLN), is an association of state and federal agencies, NGOs, academicians, and private consultants and land managers who have some responsibility for or interest in mountain bogs. Their mission is to help advance the stewardship and management of Southern Appalachian bogs (GA, NC, SC, TN, VA) by providing a forum for sharing information and resources. Its creation reflects a heightened regional interest in mountain bog conservation and restoration, which includes the recent proposal to create a Mountain Bogs National Wildlife Refuge. Nongame Conservation Section staff was invited to serve on the steering committee of the BLN.

Old Priority 9. Conduct surveys for species historically recorded in the state.

Many globally rare species have only historically been recorded in the state; they have not been seen since prior to the mid-1990s. The standard time since the last observation is 20 years (20-25 years is also practical) for a plant to be assigned a rarity rank of “SH” (State Historic). Consequently, it is imperative that surveys and herbarium work be conducted to assist in locating populations, documenting their abundance and condition, and begin collecting landowner information to initiate conservation measures. Some progress has been made in relocating Georgia’s “Lost Plants.”

Table 1 was prepared to include plants with the state rarity rank of SH. This is a list of plants not seen within the recent past – usually within the last 20 years, or since about the mid-1990s. No conservation action can be taken on the SH plants until they have been relocated. At that time they will be considered high priority species.

Since SWAP (2005) important rediscoveries have been made. Some representative rediscoveries of SH plants made since SWAP (2005) are listed below with notes on ecoregion of occurrence and habitat.

- *Agalinis decemloba*, Ten-lobed purple foxglove – Southwestern Appalachians; grassy openings in Virginia pine/scarlet oak forest over sandstone
- *Agalinis georgiana*, Georgia purple foxglove – Southeastern Plains; well-managed, longleaf pine/wiregrass woodland
- *Carya laciniosa*, shellbark hickory – Ridge and Valley; bottomland hardwoods
- *Clintonia borealis*, bluebead lily – Blue Ridge; northern hardwood forest bordering a boulderfield
- *Crataegus aemula*, Rome Hawthorn – Ridge and Valley; opening in calcareous flatwoods
- *Crataegus dispar*, Aiken Hawthorn – Piedmont; xeric, mixed oak-hickory-shortleaf pine forest edge

- *Delphinium alabamicum*, Alabama larkspur – Ridge and Valley; shale barrens with sparse redcedar and dense *Cheilanthes lanosa*, hairy lipfern. Note: Habitat newly classified as a G1
- *Dichanthelium hirstii*, Hirst Brothers' Panic Grass – Southeastern Plains; wet savanna in seasonal depression pond
- *Lonicera canadensis* – Blue Ridge; rocky, forested, north-facing slope at head of cove hardwood forest
- *Parnassia grandifolia* – Blue Ridge; open seep over serpentine.
- *Ruellia noctiflora*, Night-Blooming Wild Petunia - Southern Coastal Plain; mowed roadside and powerline rights-of-way surrounded by remnant slash pine flatwoods.

Old Priority 10. Provide incentives to conserve imperiled plants and habitats.

This priority action item was recognized as a genuine need in the mid-1990s. In 1999, WRD created the Private Lands Program (PLP) through new initiatives and consolidating existing forestry and wildlife stewardship incentive programs. The numerous programs under the PLP “umbrella” (e.g., Bobwhite Quail Initiative, Forestry Stewardship Program, and Forestry for Wildlife Stewardship Program) also provided funding to support wildlife biologists to administer these programs. A useful public document, entitled “A Landowners Guide to Conservation Incentives” was produced (currently in its 4th Edition [2010]). A central feature of the PLP was, and is, the plethora of Farm Bill programs promoting land protection, management, restoration, and stewardship. Another significant development was the passage of the Georgia Land Conservation Act (2005) establishing the Georgia Land Conservation Program (GLCP). The GLCP works to preserve a statewide network of land and water resources by promoting partnerships between cities and counties in Georgia, state and federal agencies, landowners, and other private sector partners.

The NCS biologists supported this effort by conducting plant and vegetation surveys, providing technical support to PLP biologists, and promoting the program during the performance of their duties throughout the state, especially when interacting with private landowners.

Part 2

Updated and New SWAP (2015) Plants Technical Team Priorities

Priority 1. Continue to build the Georgia Plant Conservation Alliance; expand and enhance the rare plant safeguarding program.

The Georgia Plant Conservation Alliance (GPCA) is an innovative network of 36 public gardens, government agencies, academic institutions, utility companies and environmental organizations committed to preserving Georgia’s endangered flora. Formed in 1995, with DNR as a charter member, GPCA initiates and coordinates efforts to protect natural habitats and endangered species through biodiversity management, public education, and rare plant safeguarding.

The GPCA has experienced tremendous growth during the last decade. Growth can be seen in the areas of institutional membership, programmatic scope, volunteer network, and resources contributed by member institutions. Institutional membership has doubled, and member

institutions are engaged in recovery projects for nearly 80 imperiled plant species. Over 60 of these are in safeguarding programs at botanical gardens, arboreta and seed banks, with close to 50 species being successfully introduced back into the wild. Monetary and in-kind contributions by GPCA member institutions have amounted to an estimated \$1.5 million in direct and indirect support for plant conservation since its inception. More than \$1.1 million of this was supplied by non-DNR members supporting high-priority species and habitats identified in the SWAP (2005). A significant portion of the contributions have come from the trained GPCA volunteer force known as Botanical Guardians, now numbering in excess of 140, and contributing more than 2,000 hours of conservation work during the last calendar year. The NCS staff has been instrumental in building both the GPCA as an organization, and in building the safeguarding program as a conservation strategy/approach. The NCS resources provided in support of the GPCA and plant conservation were leveraged substantially by GPCA partners (about 5:1).

The growth of the GPCA should continue to be supported robustly with staff resources. Additionally, the continuing development of the GPCA Safeguarding Database (maintained by the Atlanta Botanical Garden) should be supported. The database is designed to keep track of the *ex situ* collections of all GPCA propagation partners, and the *in situ* outplantings across the state. It contains inventory, location, monitoring and survivorship data, and is linked to an ArcGIS geospatial database complementing the Biotics and NatureServe databases. Lastly, some degree of funding support should be provided periodically for GPCA member institutions involved in rare plant propagation, especially for NCS-initiated plant conservation projects.

Priority 2. Conduct statewide assessment of significantly rare natural communities; provide staff to adequately populate the conservation database with natural community data.

The conservation database used by GADNR, Nongame Conservation Section staff contains nearly 6,400 site records for rare plants, but is lacking in detailed data for natural communities. Lacking a full-time vegetation ecologist, the GADNR is handicapped and a serious effort should be made in hiring a full-time vegetation ecologist. Since SWAP (2005), a significant step forward in describing natural communities accessible to the public was taken. The 675-page book entitled *The Natural Communities of Georgia* was published in 2013. Botanists continue to discover unique natural communities, inventory known ones, and rely on outside. Some of these have been recently described using the ecological framework developed by NatureServe. Although there are coarse land cover analyses for Georgia, none have thoroughly assessed many of the rarer (fine-scale) natural community types.

Priority 3. Develop Element Occurrence Rank specifications and use the Conservation Rank Calculator for revamping state rarity ranks.

The specifications used to determine the overall quality of a rare plant occurrence can be detailed using methodology developed by NatureServe. In this way, states consistently rank occurrences and the better ones can be prioritized for further conservation action. Some of Georgia's special plants need to have specifications developed. This is particularly important for species that are either endemic to, or primarily within Georgia. Element Occurrence Ranks are much needed by the conservation community in order to prioritize conservation efforts. Numerous metrics (*e.g.*,

population size, viability, habitat protectability and condition, etc.) would have to be field-assessed.

The Conservation Rank Calculator is a tool that automates the process of assigning a conservation status rank – an evaluation of the level of risk of extinction of a species, in other words, the use of state rarity ranks. Rarity ranks are used to establish priorities with the rarest species assigned a conservation status or rarity rank of S1 (at the state level) or G1 (at the global level). The most common species are ranked S5 (at the state level) or G1 (at the global level). The Conservation Rank Calculator is used extensively by NatureServe and its member programs and collaborators that collect and evaluate data for species and ecosystems of concern using a common methodology. The Rank Calculator tool facilitates the accurate application of this methodology and promotes greater accuracy and consistency of the assessments. The Rank Calculator tool has not yet been applied to Georgia's plants.

Priority 4. Continue to conduct surveys for nonvascular species.

One of the groups of plants least understood are the nonvascular plants, including bryophytes (mosses, liverworts, hornworts) and lichens. Little is known about Georgia bryophytes, especially concerning distribution, habitat requirements, and abundance. Some recent surveys were for rare liverworts and hornworts, such as headwaters hornwort, *Megaceras aenigmaticus* (*Nothoceras aenigmaticus*) and a suite of gorge liverworts. Special habitats, such as Altamaha Grit outcrops have had preliminary bryophyte and lichen surveys. All of these surveys generally result in state records and occurrences for regionally important nonvascular plants. One example is the state record Florida pygmy moss, *Eccremidium floridanum*, found on exposed, seepy, sandstone-like outcrops of Altamaha Grit. Florida pygmy moss is ephemeral and diminutive, but seems to be a quality habitat indicator of seepy outcrops in the vicinity of other plants of conservation concern. The Altamaha Grit outcrops are nearly unique to Georgia, with perhaps one outlier known from panhandle Florida. Such distinctive habitats and the diverse physiography of Georgia, strongly indicate that Georgia has important nonvascular plant diversity that needs to be documented. Rarity ranks and element occurrence data are needed for nonvascular plants of significance.

Lichens may be better known in Georgia due to volunteer efforts and county record distribution efforts of Malcolm Hodges, Sean Beaching, and Bill Buck. There needs to be an attempt to assign rarity ranks to significant lichens. Also, website resources need to be supported to promote knowledge of county distributions. The federally listed rock gnome lichen, *Gymnoderma lineare*, known from one high quality rock cliff in the Blue Ridge, is in need of further protection efforts. The face of the rock cliff supports numerous vascular plants of significance, but additional nonvascular plant inventory is justified.

Second, is the state record Florida pygmy moss, *Eccremidium floridanum*. Florida pygmy moss is ephemeral and diminutive, but seems to be an good indicator of seepy outcrops in the vicinity of other plants of conservation concern. The Altamaha Grit outcrops are mostly in Georgia, with perhaps one outlier known from panhandle Florida. Conservation actions are being put into place on newly acquired state lands and exemplified already at the Broxton Rocks Preserve, Coffee Co.

Priority 5. Assess the conservation status of selected wetlands, especially the isolated wetlands, including the sag ponds of Northwest Georgia, and, the limesink depression ponds of Southwest Georgia.

There are a variety of wetlands in Northwest Georgia (e.g., sag ponds, fens, seeps, spring runs, calcareous flatwoods) that support several rare plant species and communities. These wetland habitats need adequate surveys and appropriate conservation attention. An even less explored area is on the Dougherty Plain, part of the Southeastern Plains ecoregion of Southwest Georgia. Literally 100s of isolated limesink depression ponds exist in this region and dozens need to be thoroughly explored during the entire growing season. Over 25 rare vascular plants are known to inhabit seasonal ponds on the Dougherty Plain. Most lack recent information and it is likely that a few state records and range extensions will be encountered.

Extensive pre-planning using the latest aerial photography and soils data will help select suitable ponds for exploration. Preliminary field surveys confirm that appropriate surveys needs to be conducted throughout the growing season and that each pond has its own seasonal variation in water depth, may or may not have adequate drawdown zones, and variable light conditions due to fire suppression, lowering of the water table, or other disturbances. In the case of Hirst Brothers' panic grass (*Dichanthelium hirstii*), a federal Candidate recently relocated in a pond habitat in Sumter Co., the common maidencane (*Panicum hemitomon*) can overcome the rare grass, shading it out of existence. Furthermore, it appears that fire, often recommended as a management tool for curtailing woody plant invasions in ponds (e.g., establishment of pondcypress thickets in seasonal pond/wet savanna habitats), may increase maidencane to the point of seriously impacting some of the pond rarities. If significant pond vegetation is discovered, management needs will have to be addressed.

These wetland communities are currently under increased threat due to residential and commercial development, pond construction, intensive agricultural demands for water, conversion of hardwoods to planted pine plantations and anything disrupting hydrology. It is important to generate fine-scale GIS coverages (maps) and natural community and rare plant records for the conservation database (Biotics). Also, the number, size and condition of target habitats including an assessment of hydrology, plant communities, threats, conservation opportunities, and ownership are needed.

Priority 6. Continue restoration of mountain bog habitats.

A major accomplishment since SWAP (2005) has been the restoration of selected mountain bog communities. Efforts to reintroduce, augment, or establish rare plant populations must continue. These efforts should work in conjunction with restoration efforts for the bog turtle. Mountain bogs have been historically neglected from a stewardship perspective resulting in the decline or disappearance of many signature species. Restoration of bog habitats would include reduction of woody cover, expansion of *Sphagnum* mats, establishment and augmentation of rare species populations, and restoration of natural hydrology.

Priority 7. Conduct surveys for species historically recorded for Georgia.

Many globally rare species were historically recorded in the state, but have not been observed for 20 or more years and are in need of current status surveys. Consequently, it is imperative that surveys and herbarium work be conducted to assist in locating populations, documenting their abundance and condition, and begin collecting landowner information to initiate conservation measures. Eventually, those found can be evaluated further and may become high priority plants for research and additional conservation actions. Examples of State Historic (SH) plants are given in Table 1. These plants can be popularly termed Georgia's Lost Plants and information distributed to the public.

Priority 8. Identify rare plant populations seriously threatened by invasive exotic species, develop prompt and effective responses; act to eliminate or moderate threats.

Most of the concern, discussion, and focus regarding invasive species usually involve broad-based, landscape-level planning, research, and management schemes. While this macro-approach is appropriate for addressing the larger problem, and building coalitions, enacting legislation, changing public policy, and driving market-based solutions, it tends to ignore problems associated with small sites and/or those in need of an urgent response. In those instances where the focus is on a small sites requiring an urgent response, it is because the invader is one for which there is zero tolerance, such as cogongrass (*Imperata cylindrica*). In this situation, the Georgia Forestry Commission (GFC) will attack any size infestation within 72 hours of discovery and repeat-treat until the infestation is ruled to be eliminated. An aquatic example would be the Asian northern snakehead fish (*Channa argus*), where zero-tolerance is based on the nature of the perpetrator rather than on the imminent threat to potential victims.

Rare plant populations are particularly at risk due to the sessile nature of plants, as well as the low number of individuals and other conditions (genetics, physiology, life history, ecological niche) associated with their rarity. A rare plant population, or an entire rare plant site containing numerous rare plant species, could potentially be destroyed within a few years when under assault by a suite of invasive species. They could certainly be extirpated in less than a decade (before the next SWAP revision in 2025). One example would be the beech-magnolia hardwood forests and ravines along the Flint River at Montezuma Bluffs WMA, where some portions of lush understory that includes relict trillium (*Trillium reliquum*) and ovate catchfly (*Silene ovata*) near an abandoned trailer park are rapidly succumbing to competition and shading from English ivy (*Hedera helix*), Japanese honeysuckle (*Lonicera japonica*), Chinese privet (*Ligustrum sinense*), and Kudzu (*Pueraria montana*).

In a situation involving marauding feral pigs, extirpation could potentially happen in the time span of a few days, depending on the circumstances. The range of feral pigs in Georgia has increased by nearly 5-fold in the last 30 years. A conservative estimate of the feral hog population in the U.S. is between 5-10 million animals. Annually, these swine account for environmental and agricultural losses of \$1.5 billion across the country. In sites along Big Grocery Creek in the Oaky Woods WMA, hogs are vigorously rooting and causing great damage to the rich assemblage of spring ephemerals associated with the limestone bluffs and floodplain.

Within the last two years, more and more invasions of the unique blackland prairies of Oaky Woods have been observed and wild pig encounters are increasing.

Certain populations and sites are so special and contain such rarities as to require immediate corrective action. Sites known to be under imminent threat should be quickly evaluated and a management approach decided upon. Management action should proceed quickly. Rare plant sites impacted by invasive animal species may require the assistance of other sections within the GADNR Wildlife Resources Division (e.g., Game Management and Fisheries). Additionally, the Nongame Conservation Section will survey other special rare plant populations suspected of being at risk from invasive species. If found to be under imminent threat, they will receive the same expeditious evaluation and treatment mentioned above.

Priority 9. Assist the U. S. Fish and Wildlife Service with data collection and implementation of the Conserving At-Risk Species Program.

In the next 10 years the USFWS (SE Region) will evaluate a record number of species for possible listing under the Endangered Species Act (ESA). This is partially a result of successful petitioning for these evaluations by outside public interest groups (Center for Biological Diversity and Wild Earth Guardians). It is the desire of the USFWS not to list these species, but rather to engage in proactive conservation, with public and private partners, that is both voluntary and innovative, thereby precluding the need to list them under the ESA. The five action areas of the Conserving At-Risk Species Program include: (1) prioritizing “at-risk” species for pro-active conservation needs; (2) developing voluntary conservation actions that can be taken; (3) building partnerships with state and other federal agencies; (4) collecting data for listing decisions; and, (5) engaging in outreach to individuals, NGOs, and Congressional staffers.

The Nongame Conservation Section staff will help prioritize at risk species by identifying data gaps and unknowns involving species distribution, population, conservation status, and threats. They will also help determine those species that are “decision-ready” and which are appropriate for pro-active conservation. In the case of data gaps and unknowns, they will conduct status surveys of populations and update the Biotics database accordingly. They may also be asked to provide expert opinion regarding proposed USFWS actions/decisions. They will also assist with the development of practical and biologically appropriate pro-active conservation actions. One of these actions may be the development of a Candidate Conservation Agreement (CCA). See next priority action item.

Priority 10. Assist the U. S. Fish and Wildlife Service with the development of Candidate Conservation Agreements (CCAs) for selected plants of conservation concern; maintain active monitoring and management of plants already covered by established CCAs.

Candidate Conservation Agreements (CCAs) and Candidate Conservation Agreements with Assurance (CCAAs) are two specific instruments for pro-active conservation. CCAs are voluntary conservation agreements between the USFWS and one or more public or private parties. The Service works with its partners to identify threats to Candidate species, plan the measures needed to address the threats and conserve these species, identify willing landowners, develop agreements, and design and implement conservation measures and monitor their

effectiveness. CCAAs expand on the concept of traditional CCAs by providing non-federal landowners with additional incentives for engaging in voluntary proactive conservation through assurances that limit future conservation obligations.

A recent example of a CCA with significant involvement from GADNR staff involved the Georgia aster (*Symphyotrichum georgianum*). In 1999, the USFWS made the Georgia aster a Candidate for listing under the Endangered Species Act. The Georgia aster remained on the list for 15 years as the USFWS applied its resources to higher priority species. During this interim, state agencies and conservation organizations continued to survey for new populations and to work on the conservation of the species. In 2014, the USFWS determined listing was not necessary if precluded by a broad-based, range-wide, pro-active conservation plan (i.e., CCA). Georgia DNR was a major contributor to the development of the agreement and to consensus building among the disparate partners across four states (AL, GA, NC, and SC). In particular, Nongame Conservation Section (NCS) staff developed the management approaches and monitoring protocols.

NCS will continue to assist the USFWS with development of CCAs (and CCAAs) for species whose range includes Georgia, and for which these conservation instruments are biologically and ecologically appropriate.

Priority 11. Continue to expand the knowledge base and use of native plants.

Wildlife Resources Division biologists will continue to improve the state of restoration science using native plants through DNR's many restoration and management initiatives/activities. WRD will continue to work with important partners and collaborators, such as the Natural Resources Conservation Service (NRCS), Georgia Exotic Pest Plant Council (GAEPPC), Georgia Plant Conservation Alliance (GPCA), and the Georgia Native Plant Society (GNPS) to identify native species that could be used in lieu of invasive species for purposes of controlling erosion, landscaping, gardening, etc. There are several native plant nurseries and gardens in Georgia where collaboration is encouraged. GADNR staff presents educational programs, provides permits to sell propagated rare plants and rescued plants, collects seed, and otherwise suggests appropriate native plants for cultivation. Noteworthy efforts are undertaken by several GPCA members, including commercial nurseries, experimental gardens (e.g., Georgia Perimeter College, Decatur; Chattahoochee Nature Center, Roswell; Atlanta Botanical Garden) and the new research propagation facilities at the Mimsie Lanier Center for Native Plant Studies, State Botanical Garden, Athens.

Priority 12. Assist the Private Lands Program biologists with technical support and outreach to private landowners owning significant botanical sites.

The Nongame Conservation Section (NCS) botanists will continue to support the Private Lands Program (PLP) and PLP biologists with technical botanical assistance focusing on general vegetation and rare plant communities, as well as rare plant species information. NCS botanists will continue to promote the various aspects of the PLP, numerous Farm Bill programs (e.g., EQUIP, WHIP, CRP, and PFW), and other options (e.g., conservation easements, GA Conservation Tax Credit Program, and CUVA) to private landowners throughout the state. They

will work with the WRD/NRCS Contribution Agreement biologists located in USDA offices to provide outreach regarding the need and potential cost share for conserving rare and declining habitats and plant species. The NCS botanists will assist with botanical training for PLP biologists, NRCS biologists, and landowners, as needed. The NCS botanists will actively promote important sites that deserve permanent protection from development.

Collaboration with land trust organizations and other GADNR staff involved with real estate issues is becoming more and more essential if rare plant habitats are to be conserved. GADNR should consider full support of a biologist whose primary purpose is to work with private landowners to find conservation incentives and protection alternatives for isolated populations of high priority plants for which acquisition is not likely. Small sites, often the last stand for rare plants, need attention as well as large hunting areas and parks. The role of organizations such as The Nature Conservancy in acquisition of small sites (areas under 500 acres down to 10 acres or less) has dramatically decreased over the last decade. The need for land trusts and other holders of conservation easements for botanical sites must be promoted.

In general, imperiled plants require specific habitat management and, as a consequence, their enhancement and protection should become a part of most programs that fund habitat improvement. Habitat management incentives should at least indirectly serve to conserve known sites of botanical significance. Landowners have responded resoundingly to the availability of incentives for conservation practices. There are incentives to help conserve imperiled habitats and species, but more attention must be placed on protection alternatives for isolated populations of high priority plant species for which acquisition may be the only option for permanent protection.