



David Moynahan | St. Marks NWR

# At-Risk Species Assessment on Southern National Forests, Refuges, and Other Protected Areas



National  
Wildlife Refuge  
Association

[refugeassociation.org](http://refugeassociation.org)

National Wildlife Refuge Association

Mark Sowers, Editor

October 2017

1001 Connecticut Avenue NW, Suite 905, Washington, DC 20036 • 202-417-3803 • [www.refugeassociation.org](http://www.refugeassociation.org)



## Table of Contents

<b>Introduction and Methods.....</b>	<b>3</b>
<b>Results and Discussion .....</b>	<b>9</b>
<b>Suites of Species: Occurrences and Habitat Management.....</b>	<b>12</b>
<b>Progress and Next Steps .....</b>	<b>13</b>
<b>Appendix I: Suites of Species.....</b>	<b>17</b>
Florida Panhandle .....	18
Peninsular Florida.....	28
Southern Blue Ridge and Southern Ridge and Valley .....	39
Interior Low Plateau and Cumberland Plateau, Central Ridge and Valley .....	46
Piedmont and South Atlantic Coastal Plain.....	53
Mississippi and North-Central Alabama .....	60
Lower Mississippi Valley-Interior Highlands (Ozarks, Ouachitas) .....	66
Caribbean—Puerto Rico and U.S. Virgin Islands .....	71
<b>Appendix II: Species not reported on protected areas .....</b>	<b>74</b>
<b>Appendix III: Species that have been withdrawn from petitions .....</b>	<b>79</b>
<b>Addendix IV: Species that may be eligible for withdrawal from petitions .....</b>	<b>81</b>
<b>Appendix V: Southeastern Partners in Plant Conservation, SePPCon 2016.....</b>	<b>82</b>

Photo by Alan Cressler | *Lindera subcoriacea* B.E. Wofford (Bog Spicebush).





## Introduction and Methods

### Background and Objectives

In 2011, the Southeast Region of the U.S. Fish and Wildlife Service (Service) began working with states, federal agencies, and other partners on an At-Risk Species Conservation Initiative to address nearly 500 animal and plant species that were petitioned for listing under the federal Endangered Species Act (ESA). In 2011, a legal settlement was reached under which the Service agreed to make listing determinations for the candidate species on the 2010 Candidate Notice of Review and to make 90-day findings for petitioned species by the end of fiscal year 2016. On September 1, 2016, the Service released a National Seven Year Work Plan that provided a schedule for making listing determinations on 363 species by the end of fiscal year 2023 (another 235 species remain to be scheduled). Approximately half of the remaining listing determinations concern species that occur in the Southeast Region. Many of the petitioned species are locally occurring aquatic species for which there was limited information available on range and population status. In 2013 and 2014, the National Wildlife Refuge Association (NWRA) worked in cooperation with the Service's Southeast Region on a project that convened biologists and subject matter experts to assess the role that the 129 national wildlife refuges in the Southeast might play in the conservation of at-risk species, including identifying data gaps and inventory or survey needs, examining threats, and identifying management actions that could enhance habitat on and around refuges to benefit the petitioned species.

The At-Risk Species Project Phase I consisted of a series of six workshops facilitated by NWRA that focused on national wildlife refuges, and brought together refuge and ecological services biologists from the Service, state agency biologists, academic experts, and non-governmental conservation organization (NGO) representatives. Phase I workshops were determined to be a success in both the level of engagement and the results. Workshop participants recommended developing a second phase that would engage other public land agencies in a broader cooperative effort to evaluate species status, design coordinated action steps to address habitat needs, and identify opportunities for joint agency and landowner efforts.

National forests cover large expanses of land in the Southeast and were assumed to pro-



Photo by Alan Cressler | *Macbridea caroliniana* (Walter) Blake (Carolina Birds-in-a-nest).

vide habitat for large numbers of petitioned species, making them an obvious focus of the effort to evaluate petitioned species. Recognizing their important role in at-risk species conservation, the U.S. Forest Service (USFS) joined the existing partnership between NWRA and the Service through a cooperative agreement and became an additional funding partner for Phase II of the project.

Phase II built on the methods established in Phase I, but looked beyond refuges to assess at-risk species occurrences on the land holdings of all federal and state agencies as well as other public and private conservation lands, with a particular focus on national forests. The objectives of this phase were:

1. to quantify the role that protected areas are already playing in supporting at-risk species populations



Photo by Jonathan Mays | *Aramus guarauna* (Limpkin) — adult feeding on apple snail.

2. to highlight knowledge gaps regarding at-risk species status and habitat needs and identify opportunities for beneficial management practices and monitoring efforts
3. to foster cooperation among public agencies, as well as non-government organizations (NGOs) and private landowners on management and monitoring actions to benefit at-risk species.

## Definitions

In establishing the list of southeastern **at-risk species** to be evaluated in this project, partners agreed to include species at any stage of the ESA petition process (petitioned, candidate for listing, or proposed for listing) in the Southeast Region at the time the project began. All species on the original list have been retained throughout Phase II, including those species for which listing determinations were made during the course of the project as well as those that were withdrawn from the petition.

**Locally occurring** is the term we employ for species whose ranges are restricted to a limited geographic area. An emphasis was placed on locally occurring species because the occurrence of significant populations of these species on protected areas would offer an important conservation opportunity. Also, their restricted ranges make these species especially susceptible to habitat loss and degradation. Each of the at-risk species identified as locally occurring was associated with one (or, in a few cases two or three) focal areas identified within the Southeast. Identifying locations with multiple locally occurring species allows conservation attention to more efficiently focus on species status and guide local conservation measures. These **focal areas** were defined by partners and Service staff at the outset of the project by identifying clusters of locally occurring species whose known ranges were overlapping or contiguous (Figure 1). Focal areas were named according to their geographic area (e.g. West Florida Panhandle); a recognized ecoregion or dominant geographic feature (e.g. Southern Blue Ridge, Cumberland Plateau); or, particularly when dealing with primarily aquatic species, a river drainage basin. A full list of locally occurring species by focal area is available at <https://www.fws.gov/southeast/reading-room/?q=At-risk+species>.

**Species of concern** are species not currently petitioned for listing, but whose current population status and trends suggest they may be at risk in the near future. These species have been recommended by experts as needing surveys and assessment to identify preemptive actions that could prevent these species from being petitioned at a later date. A list of species of concern reported at workshops is available at <https://www.fws.gov/southeast/reading-room/?q=At-risk+species>.

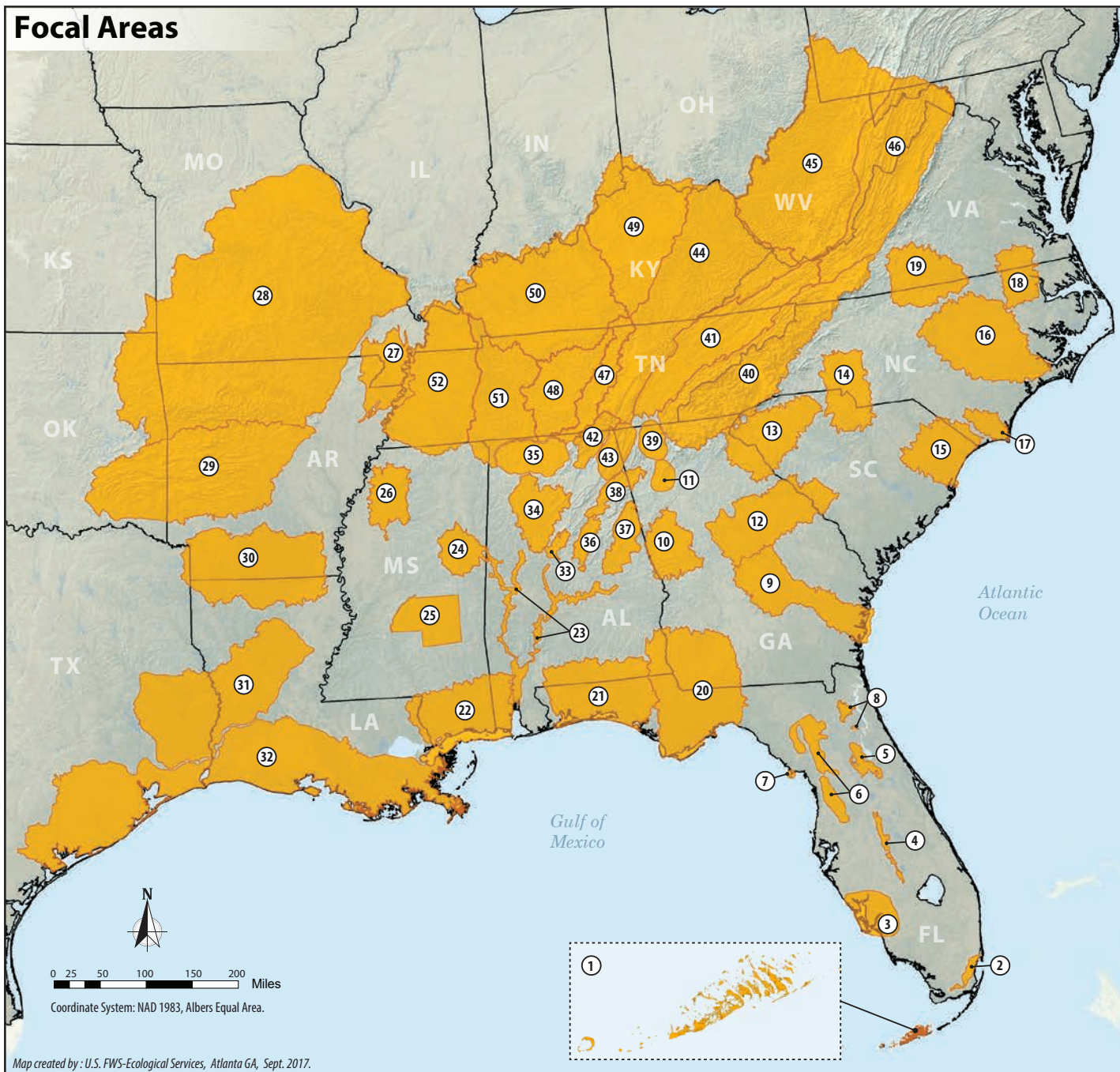
Though the primary focus of this project was the occurrence of at-risk species on public lands administered by federal or state agencies, occurrences on several NGO- or privately-owned sites were also reported by SMEs and included in the dataset. For this reason, we generally use the term **protected areas** for the various land units discussed in this document. This aligns with terminology used by the U.S. Geological Survey in its Protected Area Database of the United States, which we used to verify the names and locations of reported land units.





Figure 1

## Focal Areas



### Focal Areas

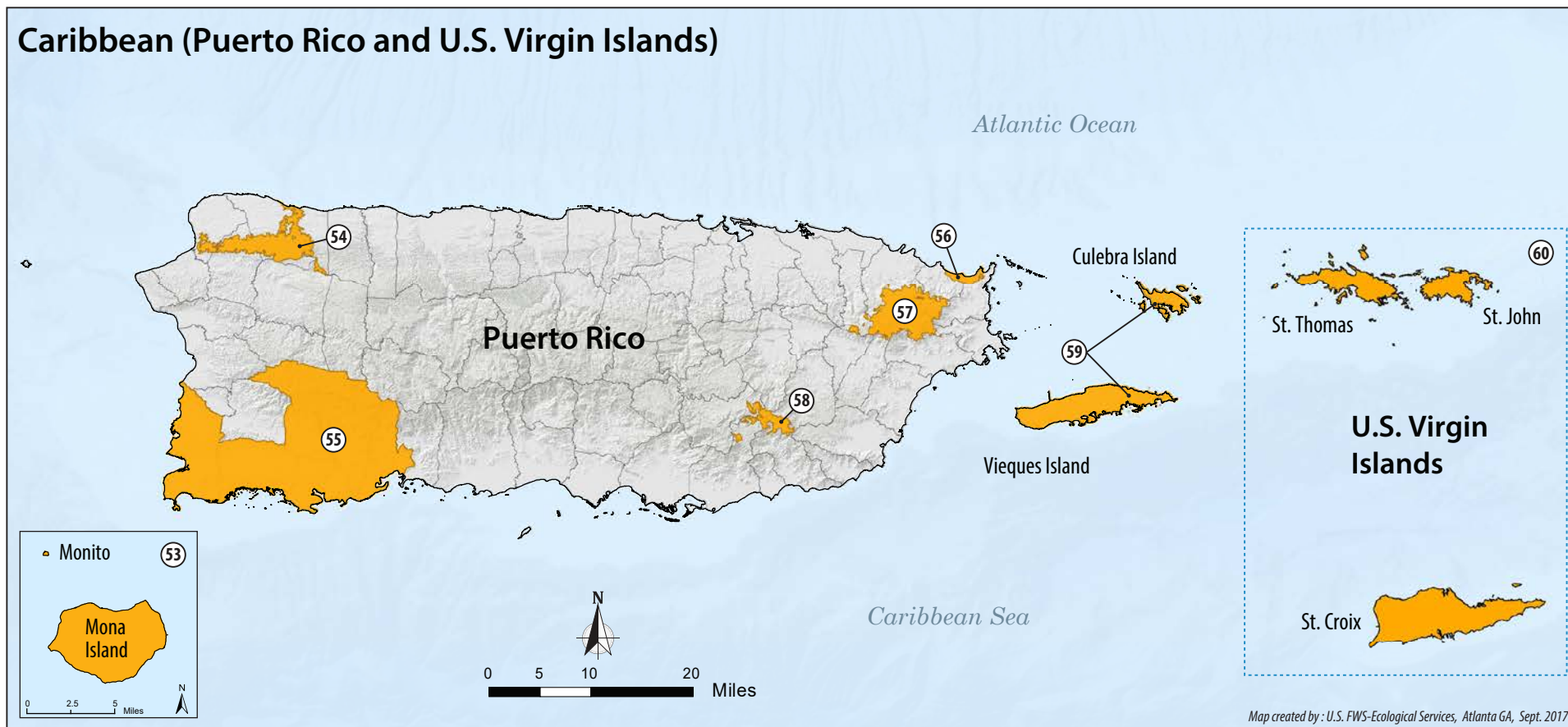
1. Lower Florida Keys
2. Miami Ridge
3. Charlotte Harbor
4. Lake Wales Ridge
5. Ocala Hills and Ridges
6. Brooksville Ridge
7. Cedar Keys-Gulf Hammock
8. Lower St. Johns River
9. Altamaha-Lower Ocmulgee & Oconee
10. Middle Chattahoochee-Upper Flint
11. Etowah
12. Upper Ocmulgee & Oconee
13. Upper Savannah & Santee
14. Yadkin-Upper Pee Dee
15. Waccamaw-Lower Pee Dee
16. Tar-Neuse
17. Cape Fear
18. Chowan-Lower Roanoke
19. Upper Roanoke
20. Apalachicola-East Florida Panhandle
21. West Florida Panhandle
22. Southern Pine Hills-Southern Lowlands
23. Tombigbee-Alabama Alluvial Plain
24. Noxubee
25. Jackson Prairie
26. North Mississippi Delta
27. Missouri Bootheel
28. Ozark Highlands
29. Ouachita Highlands
30. West Gulf Coastal Plain-Southern AR / Northern LA
31. West Gulf Coastal Plain-Central LA / East Texas
32. Coastal Prairies and Marshes
33. Upper Cahaba
34. Black Warrior
35. Southern Highland Rim / Middle TN Valley
36. Lower Coosa
37. Tallapoosa River
38. Upper Coosa
39. Conasauga
40. Southern Blue Ridge
41. Central Ridge and Valley
42. Paint Rock Valley
43. Lookout Plateau
44. Northern Cumberland Plateau
45. Western Allegheny Plateau & Central Appalachians
46. Northern Ridge & Valley
47. Eastern Highland Rim
48. Central Basin
49. Bluegrass and Kentucky Knobs
50. Pennyroyal Plateau and Shawnee Hills
51. Western Highland Rim
52. Upper East Gulf Coastal Plain / MS Valley Loess Plain

Map created by : U.S. FWS-Ecological Services, Atlanta GA, Sept. 2017.



Figure 1 continued

## Caribbean (Puerto Rico and U.S. Virgin Islands)



### Focal Areas

- 53. Mona and Monito Islands (PR)
- 54. Northwestern Karst
- 55. Southwest Puerto Rico
- 56. Northeast Ecological Corridor Nature Reserve
- 57. El Yunque
- 58. Carite
- 59. Culebra and Vieques Islands (PR)
- 60. U.S. Virgin Islands





## Workshops

From late 2015 to early 2017, NWRA staff worked with a core team of Service and USFS partners to conduct eight workshops across the Southeast, with each workshop footprint loosely tied to a broad physiographic region (Figure 2). A ninth meeting, the Southeastern Partners in Plant Conservation, described in a following section, was held in Atlanta and gathered data specific to plant species. Following the successful model used in Phase I of this project, planning teams were assembled for each workshop area to assist in identifying subject matter experts (SMEs) and representatives from federal and state agencies, NGOs, and academic institutions to invite as participants. All invitees were encouraged to attend in person, but teleconference capabilities were arranged for each workshop for any participants unable to travel to the workshop location.

A list of at-risk species was prepared for assessment within each region based on the species' known ranges. Workshop proceedings were divided into sessions focused on taxonomic groups with each species discussed in turn. Participants were asked to provide input on general population status, threats to the species and its habitat, occurrences on public lands and other protected areas, current monitoring, and recommended management actions.

Occurrences on protected areas were classified in one of four categories:

**O+** = a significant population that could play an important role in conserving the species;

**O** = confirmed occurrence on the land unit in question;

**P** = a potential occurrence- appropriate habitat is thought to be present and the location is within the species' range, but no recent records of the species;

**U** = the location is within the species' reported range but it is unknown if the species or its habitat occurs there.

Additional species of concern were suggested by partners or SMEs before and during workshops. These additions were assessed in detail as time permitted during workshops, but official at-risk species were given priority.

This method of collecting data has both benefits and drawbacks. Participants were able



Photo by Jonathan Mays | *Hyla andersonii* (Pine Barrens Treefrog) — adult male on Eglin Air Force Base.

to provide unpublished knowledge of species occurrences, and having multiple experts in a room together facilitated dialogue that we believe increased the overall quality of data. Additionally, we hope that bringing these individuals together with specific discussions on at-risk species cultivated and supported valuable working relationships and highlighted opportunities for collaboration across agencies. On the other hand, contributed information was limited to the personal knowledge of those who were able to attend, and the sheer volume of reported occurrences did not allow us to confirm each individual report. With this in mind, we present the data in this document as reported by workshop participants, and cannot claim to have exhaustive information of every occurrence of the included species.

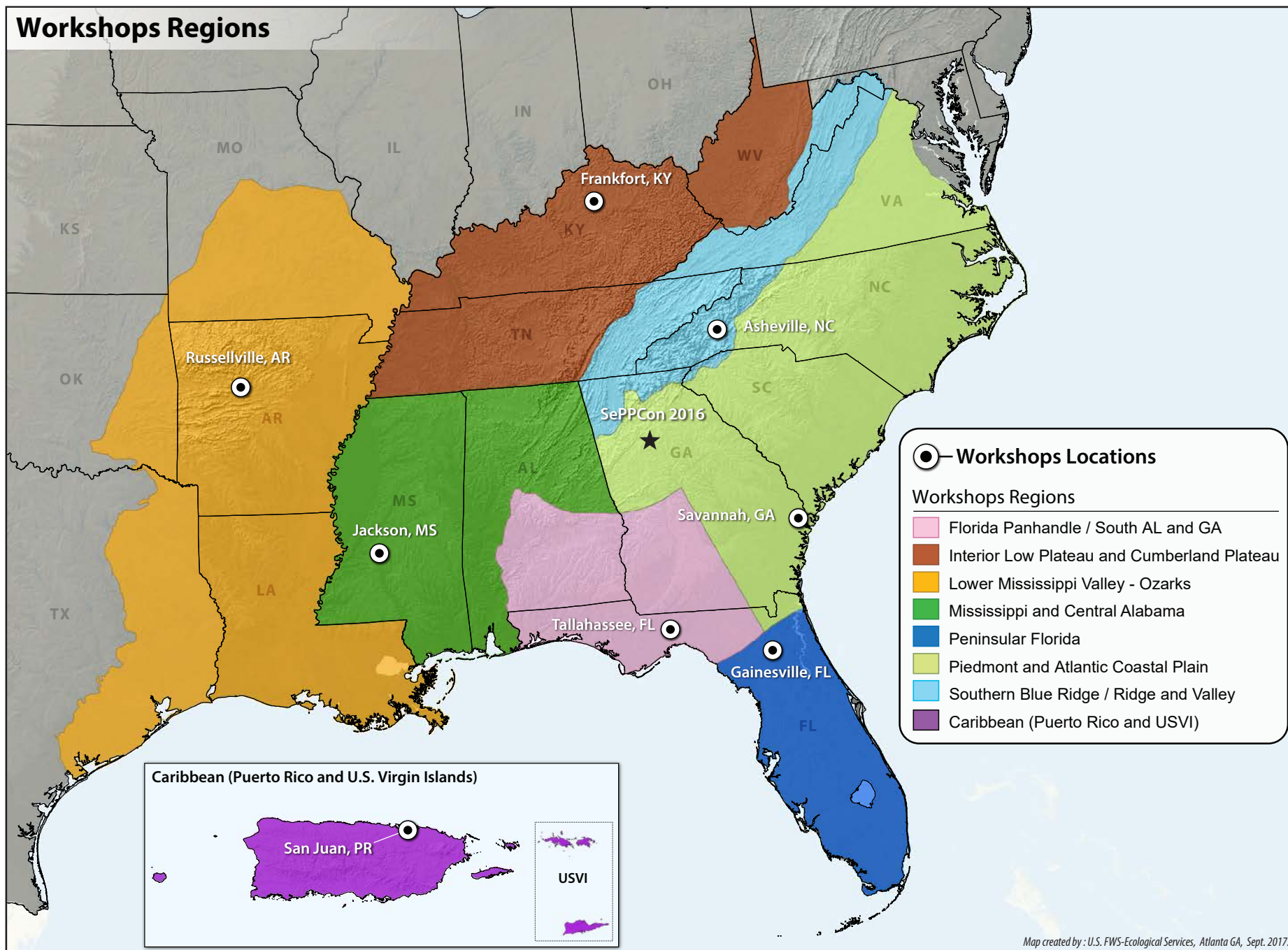
The broader scope of Phase II of the project prevents us from effectively presenting the full occurrence dataset within this report, but partial findings are presented in Appendix I. Occurrences for at-risk species will be available in the online At-Risk Species Finder maintained by the Service at <https://www.fws.gov/southeast/finder/#/>.

More information and resources related to Phase II are also available online at <https://www.fws.gov/southeast/reading-room/?q=At-risk+species>.

The data stored there includes the data collection spreadsheet and participant contact information for each workshop, the full dataset of at-risk species occurrences, and lists of locally occurring species and species of concern.



Figure 2







## Results and Discussion

The eight workshops held from late 2015 to early 2017 included nearly 400 participants, with each workshop having representatives from the USFS and Service, as well as other federal agencies, multiple state agencies, academic institutions, and NGOs (Table 1). In addition to the regular workshops, the Atlanta Botanical Garden, with participation from the Georgia Plant Conservation Alliance (GPCA), hosted the Southeastern Partners in Plant Conservation (SePPCon) workshop in November 2016. SePPCon brought together some 160 participants from 22 states, Puerto Rico, and the US Virgin Islands.

**Table 1** Phase II workshops and summary information.

Region	Location	Participants	Agencies
Florida Panhandle	Tallahassee, FL	43	16
Piedmont and Coastal Plain	Savannah, GA	71	21
Caribbean (Puerto Rico and USVI)	San Juan, PR	39	15
Mississippi and North-Central Alabama	Jackson, MS	50	22
Southern Blue Ridge, Ridge and Valley	Asheville, NC	48	11
Interior Low Plateau, Cumberland Plateau	Frankfort, KY	48	17
Lower Mississippi Valley-Ozarks	Russellville, AR	51	11
Peninsular FL	Gainesville, FL	38	10

During the course of the workshops, participants evaluated a total of 490 at-risk species in 8 broad taxonomic groups (Table 2). Of these, 368 species had at least one potential occurrence reported on protected areas (O+, O, or P). Unless otherwise noted, the following summary data are based on this subset. This left 122 species with no locations reported on protected areas or only reports of unknown habitat status (U). Summary data suggested that the U classification was applied inconsistently among workshops (reported frequently in some cases and very rarely in others), and the decision was made not to include them in the analysis. A large number of species of concern were reported as occurring on protected areas, but were likewise not included in the results summary. (see <https://www.fws.gov/southeast/reading-room/?q=At-risk+species>)

**Table 2** The 490 at-risk species evaluated during workshops broken down by taxonomic group.

Taxon	Number
Birds	8
Crustaceans (crayfish, amphipods, isopods)	91
Fish	54
Herpetofauna (amphibians, reptiles)	70
Insects	73
Mammals	7
Mussels, snails, molluscs	84
Plants	103



Photo by Jonathan Mays | *Perimyotis subflavus* (Tricolored Bat) — roosting during winter in a Florida panhandle cave.

Of the 368 at-risk species with occurrences reported on protected areas, 328 (>89%) had at least one potential occurrence on federal land. Of these 328 species, 140 occur only on federal lands and 188 occur on federal land and other types of protected areas. This leaves 40 species with no reported occurrences on federal lands which were reported on state, local or NGO conservation lands.

National forests (NFs) and national wildlife refuges (NWRs) were home to 292 at-risk species, including 87% of those species that occur only on federal land. A breakdown of at-risk species occurrences by land managing agency/organization (Table 3) shows a strong concentration of these populations on federal lands, with 64% of total occurrences and 60% of O+ populations. USFS and Service properties, in particular, have higher numbers of at-risk species and O+ populations than any other single agency.

**Table 3** At-risk species occurrences by agency.

Agency	O+	O	P	Total
U.S. Forest Service	129	144	93	366
U.S. Fish and Wildlife Service	57	266	189	512
Dept. of Defense	30	69	19	118
National Park Service	37	38	15	90
Tennessee Valley Authority	9	14	11	34
Army Corps of Engineers	11	8	5	24
Other Federal	5	8	0	13
State	142	348	43	533
Local	10	49	2	61
NGO/The Nature Conservancy/Private	30	27	7	64
Total	460	971	384	1815

## Identifying key protected areas

Just over 600 protected areas were reported to host populations of at-risk species. To investigate which specific land units may contribute most to at-risk species conservation, we ranked them on three criteria: (1) number of at-risk species, (2) number of locally occurring species associated with a focal area, and (3) number of O+ populations. For each criteria, the protected areas in the top 20 positions (including ties) were selected. These land units could be considered prime opportunities for at-risk species conservation, where targeted management actions could have broad impacts on a substantial number of at-risk species. Combining these lists and accounting for duplicates gave us 40 key protected areas that provide opportunities for conservation of multiple at-risk species (Table 4). Thirty-four of these fall under one of five federal agencies: Department of Defense (DOD) (2 units), Department of Energy (DOE) (1 unit), National Park Service (NPS) (4 units), USFS (16 units), and the Service (11 units). Five are state properties, including state forests, water management areas, and one game land, and one is an NGO-owned property.

Together, these 40 key protected areas are home to 246 at-risk species, representing approximately 75% of all at-risk species associated with protected areas. The selected

protected areas support 211 O+ populations for 139 species (about 47% of all reported O+ populations). O+ populations are present on 38 of the 40 key protected areas (range 1-14, average 5.8). There are confirmed O+ and O populations on the 40 key protected areas for 216 species, leaving 30 species with only potential populations. About 51% of the populations on these 40 lands occur on USFS land units.

**Table 4** Key protected areas selected by rank on three criteria- number of at-risk species, number of locally occurring species, and number of O+ populations deemed important for conservation.

Unit Name	Manager/ Owner	Acres	Number of At-Risk Species	Local Species	O+
Eglin AFB	DOD	463,128	22	11	11
Fort Stewart	DOD	279,270	11	1	6
Savannah River Site	DOE	198,344	12	0	4
Jones Ecological Research Center	NGO	29,000	9	0	4
Big South Fork Nat. River and Rec. Area	NPS	125,310	11	2	6
Everglades NP	NPS	1,505,976	7	3	4
Great Smoky Mountains NP	NPS	522,419	13	7	2
Mammoth Cave NP	NPS	52,830	9	2	8
Apalachicola River Water Mgmt. Area	State	35,506	7	6	4
Blackwater River SF	State	189,848	13	7	6
Econfina Creek Water Mgmt. Area	State	41,000	7	7	4
Sandhills Game Land	State	61,236	6	1	4
Tate's Hell SF	State	202,000	8	7	1
Apalachicola NF	USFS	562,660	29	20	7
Bankhead NF	USFS	181,230	10	5	6
Chattahoochee-Oconee NF	USFS	866,468	29	16	14





Table 4 continued

Unit Name	Manager/ Owner	Acres	Number of At-Risk Species	Local Species	O+
Cherokee NF	USFS	655,598	24	9	8
Conecuh NF	USFS	83,852	30	15	1
Daniel Boone NF	USFS	560,841	17	2	9
DeSoto NF	USFS	518,587	17	7	2
George Washington and Jefferson NF	USFS	1,788,900	29	11	9
Mark Twain NF	USFS	1,491,840	12	10	7
Nantahala NF	USFS	531,270	22	13	11
Ocala NF	USFS	383,697	19	7	9
Ouachita NF	USFS	1,788,429	14	14	10
Ozark-St. Francis NF	USFS	1,160,266	8	8	3
Pisgah NF	USFS	512,758	20	12	10
Sumter NF	USFS	370,901	15	5	8
Talladega NF	USFS	394,537	15	5	4
Cahaba River NWR	USFWS	3,689	14	3	3
Conasauga River NWR (proposed)	USFWS	18,750	15	7	8
Grand Bay NWR	USFWS	10,263	12	8	1
National Key Deer Refuge	USFWS	8,542	12	12	10
Lower Suwannee NWR	USFWS	52,472	19	5	2
Mississippi Sandhill Crane NWR	USFWS	19,836	13	7	3
Mountain Bogs NWR	USFWS	23,478	23	8	3
Paint Rock River NWR (proposed)	USFWS	25,120	14	2	0
St. Marks NWR	USFWS	72,089	18	6	3
Tennessee NWR	USFWS	51,359	14	1	0
Wheeler NWR	USFWS	34,430	9	6	4

## Locally Occurring Species

Of the 490 at-risk species discussed during the workshops, 305 were considered locally occurring to a particular focal area. Occurrences on protected areas were identified for 232 of these species, leaving 73 with either no reported protected area occurrences or only U reports. The 40 key land units discussed above had potential or confirmed occurrences for 148 locally occurring at-risk species (approximately 65% of those with occurrence data), as well as 126 O+ populations for 87 species. Continuing the trend noted above, over half the reported populations of locally occurring species on key land units are on USFS land units.

## Discussion

Our results show that 75% of the populations of the at-risk species classified as O+, O, or P occur on just a few land units (40 of more than 600), and that the majority of top-ranked land units are federal lands. This is evidence that a few agencies, notably the USFS and Service, have a leading role to play in the conservation of at-risk species in the Southeast. Coordinated, comprehensive at-risk management efforts within and between these agencies could have a considerable impact on the status of large numbers of at-risk species. The large expanses of national forest land are the most notable for the number of at-risk species present, and some of the largest and most diverse assemblages of locally occurring species present in the Southeast (namely, the Apalachicola-East Florida Panhandle, the Southern Blue Ridge, and the Ozarks-Ouachita Mountains) are found in landscapes centered on national forests.

Land units identified in this process could be pilot sites for management actions for at-risk species habitat, with USFS and Service land managers taking the lead. Lessons learned and successful strategies could then be shared through interagency partnerships and cooperation with managers of surrounding protected areas, particularly those that harbor important at-risk species habitat. About 80% of the protected areas in our dataset, including an estimated 368 non-federal land units, had three or fewer at-risk species occurrences, but these include 154 O+ populations and 308 occurrences of locally occurring species, with several of these species having only a single occurrence reported on other protected areas.



## Suites of Species: Occurrences and Habitat Management

In Appendix I, we present the reported occurrences of at-risk species by the physiographic areas covered in Phase II workshops. Seeking to make this information as useful as possible for land managers, we have separated these lists into tables of ‘suites’ of species that occur in the same broadly defined habitat types. Each habitat type is accompanied by a brief discussion of management recommendations for desired habitat conditions. The recommendations are presented in general terms, as a more detailed prescriptive approach is beyond the scope of this project. Where appropriate, species are identified with particular ecological systems within a habitat type and/or with a focal area for locally occurring species. Within suites, the species are grouped by focal area first (if available), and then by taxonomic groups. In these tables, taxa are identified as follows: birds (B), crustaceans-crayfish, amphipods, isopods (C), fish (F), herpetofauna (H), insects (I), mammals (M), mussels and snails (MS), and plants (P).

The 40 key protected areas discussed previously were assigned to physiographic regions, and we report specific occurrences of at-risk species on these units in Appendix I. Due to the large number of protected areas in the dataset, additional occurrences on other lands are reported at an agency/organization level, listing the highest reported population classification (O+, O, P) among occurrences on lands managed by that agency. The specific data for these occurrences will be available online at <https://www.fws.gov/southeast/reading-room/?q=At-risk+species>, and within the At-Risk Species Finder maintained by the Service. Users can find a particular at-risk species within the database, click the more information (“eye”) icon and find a list of associated protected areas with occurrences. In the near future, users will also be able to query the database for a specific protected area and view a list of associated species.

The threats posed by fire suppression and the subsequent successional and habitat changes, as well as the need for well planned fire management, were reported for all terrestrial and wetland habitat types in many physiographic regions. Ideal fire regimes vary significantly among ecological systems and habitat types with regards to seasonality, return interval, and severity, and any or all of these variables may change based on whether a system is being managed for restoration or maintenance. The widespread necessity of fire management in the Southeast and the need for methodical application to achieve desired conditions led project partners to identify fire as a primary focus for a proposed third phase of this project to be devoted to habitat management.



Photo by Jonathan Mays | *Pithophis melanoleucus mugitus* (Florida Pine Snake) — adult male; Ocala National Forest.

A large number of at-risk species occur in freshwater aquatic habitats, making management of rivers and streams an essential component of at-risk species conservation. However, many of the threats impacting these habitats and their species occur upstream and downstream of protected areas, limiting the ability of land managers to take direct action to address them. Such threats reported by SMEs include agricultural runoff and other non-point source pollution, impoundments, water withdrawal, sedimentation, siltation, and general habitat destruction related to development.

Workshop participants reported several other management issues and threats that are relevant for multiple habitat types on land units across the Southeast. Some of the most commonly reported issues are habitat degradation associated with invasive species (e.g. non-native competitors, emergent diseases, and loss of ecosystem functions such as pollination), localized human activity (erosion, disturbance from recreation, changes in hydrology), and the need to evaluate the impacts of non-fire silvicultural treatments, including herbicides.





## Progress and Next Steps

### Phase III At-Risk Species Project

Information collected during this project demonstrates the key role national forests play in conserving at-risk species. As discussed above, national forests were found to hold far more populations of conservation significance (O+) than any other single land type within the study area, well above figures for other federal agencies in the region and only marginally lower than the total for all state agencies in the 14 states for which data were gathered. This places the USFS in a natural leadership role to address the needs of at-risk species and potentially preclude the need for listing in many cases. Synthesis of these occurrence data with reported habitat types, threats, and management recommendations



Photo by Alan Cressler | *Forestiera godfreyi* L.C. Anderson (Godfrey's Forestiera).

will aid in targeting key habitat types and developing management priorities to benefit both specific local needs and region-wide coordination. We have now reached the crucial point of this project: delivering our findings to the land managers, fire practitioners, and decision makers working on the ground in a way that builds on existing land management practices in order to create positive conservation outcomes for at-risk species.

To this end, we recommend continuing the successful partnership between the USFS and the Service, with continued facilitation by NWRA and the GPCA, to plan and implement six Phase III workshops on national forest sites to develop management recommendations and guidelines for at-risk and federally listed species on national forests, refuges, and other protected areas. While the first two phases of workshops focused on collecting data on distribution, population status, and habitat information for at-risk species throughout the Southeast, Phase III will convert this information into prescriptions for real management actions designed to improve habitat for at-risk species. NWRA staff are prepared to continue their role in overseeing workshop preparation and logistics, communication with invited participants, and in-person facilitation at workshops under a cooperative agreement with the USFS and the Service. Working within the same geographic regions delineated in Phases I and II, Phase III will build upon the success of previous workshops to formulate practical at-risk species management guidelines and actions that can be implemented on a cooperative basis across the landscape. We intend to fully engage potential partners in these efforts to create practical management recommendations that can be easily incorporated into existing management programs. We will also begin developing sub-regional strategies that will address Service goals for the recovery of at-risk and listed species. The expected outcome of the Phase III workshops is the development of effective management practices for landscape and community restoration, especially the restoration for fire-dependent ecosystems such as transitional wetlands, scrub habitats, and longleaf pine forests. We also expect to develop quantitative guidelines for restoration needs, including population targets for at-risk and listed species associated with fire-dependent ecosystems. For longleaf pine landscapes, Phase III workshops will directly support USFS objectives for longleaf pine restoration, in cooperation with multiple partners, including the Longleaf Alliance.



## Species that may be eligible for petition withdrawal

To date, 45 at-risk species have been withdrawn from listing consideration by the petitioners in light of new information on their current population status. Ten of these species are plants which were withdrawn based on the recommendations of SePPCon participants. Discussions with SMEs during the series of at-risk species workshops led to suggestions that nearly 20 additional species may be secure enough to not warrant federal listing. (see Appendix II for both lists). We believe it is crucial to work with SMEs to investigate all species that may have potential for withdrawal to reduce the backlog of petitioned species and avoid expending agency resources on relatively secure species whose petitions are unlikely to result in federal listing. In many cases, particularly for locally occurring species, attempting to implement protections at the state level before pursuing federal listing may be the preferred course of action.

## Species not reported on protected areas

For 122 species, there are no reported occurrences on protected areas. These species included 22 crayfish, 21 beetles, 21 snails, 11 fishes, 11 vascular plants, 9 mussels, 6 reptiles, 6 amphibians, 4 caddisflies, 2 birds, 2 amphipods, 2 isopods, 2 snowflies, 1 non-vascular plant, 1 mollusc, and 1 butterfly (see Appendix III). There is limited information on the life history, threats, or conservation needs of many of these species. This lack of information makes it difficult to distinguish those species that are not under threat from those that are in serious need of conservation action. As more information becomes available for these species, and conservation needs are identified, the species should be brought to the attention of Partners of Fish and Wildlife (PFW), Coastal Program (CP) biologists, and state biologists working in private lands assistance programs. Private lands assistance programs, such as these may be able to deliver conservation actions for these species on private lands. Service biologists in the PFW and CP are familiar with Farm Bill programs and can likewise identify species that are appropriate for consideration.

## SePPCon 2016

The inaugural Southeastern Partners in Plant Conservation (SePPCon) meeting was held November 1-3, 2016, at the Atlanta Botanical Garden. This event was coordinated by the Atlanta Botanical Garden's Center for Southeastern Conservation and cospon-

sored by the Service, USFS, NWRA, Georgia Department of Natural Resources, and the Georgia Plant Conservation Alliance. The goal of this regional gathering was to bring together government agencies, land managers, botanical gardens, university programs, and botanical experts to inform each other on best practices and topics relevant to rare plant conservation and to form a cohesive network of resources to support regional efforts for at-risk and listed plant species in the southeastern U.S.

The meeting was attended by about 160 people from 22 states, the U.S. Virgin Islands, and Puerto Rico. Additional organizations represented at the conference included the American Public Gardens Association, Center for Biological Diversity, Smithsonian Environmental Research Center, Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative (LCC), South Atlantic LCC, The Nature Conservancy, state Natural Heritage Programs, universities, botanical gardens, utility companies, and other agencies



Photo by Alan Cressler | *Scutellaria ocmulgee* Small (Ocmulgee Skullcap).



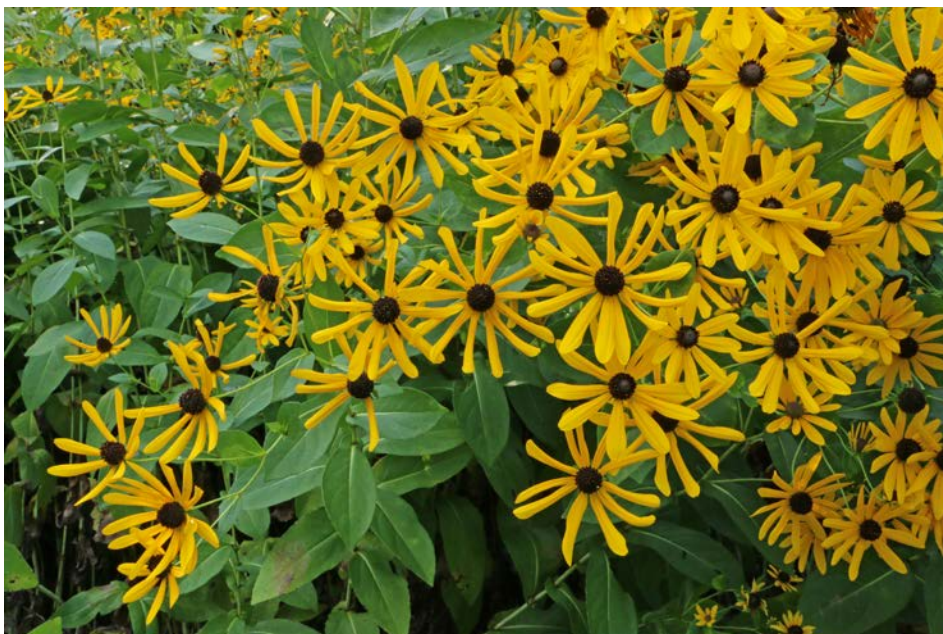


Photo by Alan Cressler | *Rudbeckia auriculata* (Perdue) Kral (Swamp Black-eyed Susan).

and organizations. The official footprint of this conference included these states and territories: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri (Southern), North Carolina, Oklahoma (Eastern), South Carolina, Tennessee, Texas (Eastern), Virginia, West Virginia (Southern), and Puerto Rico & the Virgin Islands.

The SePPCon conference featured three days of plenary symposia and concurrent workshop sessions. Sessions were tailored to multiple interests, provided training and skill development, and served to fill in information gaps for 82 at-risk plant species that have been petitioned for federal protection by the Center for Biological Diversity. Additionally, 191 federally listed species were also included in the planning list in order to capture information and needs from the experts attending. The Service's National Listing Work Plan for addressing listing and critical habitat decisions was released in 2016. The new work plan will allow the Service to meet its current and future ESA obligations while creating new opportunities for conservation partnerships. Southeastern Partners in Plant Conservation is part of a regional effort to enhance cooperative conservation efforts for plants.

Geographic Technical Planning sessions at SePPCon included moderators from the Service, USFS, and Natural Heritage Program botanists from several states. These sessions helped to validate and supplement critical information on the status and needs for at-risk federally listed plant species. Participants shared information about at-risk and federally listed plants on protected areas, matched species with needed conservation actions, and prioritized them for additional planning efforts. Subsequent planning sessions included land managers, botanists, and subject-matter experts who delved into topics based on categories of need to identify information gaps and actions that should be or are already being applied to conserve these species.

Capacity building sessions provided training opportunities for current, new, and potential partners from horticultural institutions. Representatives from the sponsoring organizations, as well as other groups, presented best practices and guidelines for conducting ex situ and in situ conservation work. These groups included NatureServe, the Center for Plant Conservation, North Carolina Botanical Garden, Missouri Botanical Garden, the State Botanical Garden of Georgia, and the New England Wildflower Society. Partners from 24 botanical gardens, arboreta, nature centers, and zoos or aquariums were



Photo by Jonathan Mays | *Cordulegaster sayi* (Say's Spiketail) — adult female.



in attendance, representing new collaborators and successful examples for conservation. Other sessions, including a panel presentation on Funding, Tools & Resources, a Partner Poster Expo, and a Listening Session provided interactive opportunities for learning and networking.

Southeastern Partners in Plant Conservation was a pivotal event that has facilitated increased coordination, efficiency, and support for existing state-based plant conservation alliances in Alabama, North Carolina, and Texas. Since the SePPCon gathering, Florida, Tennessee, and South Carolina have held inaugural Plant Conservation Alliance (PCA) meetings for their own states. Georgia, Alabama, and Tennessee PCAs met in Chattanooga for a tri-state meeting in May 2017. The network created by SePPCon efforts has also provided communication where PCAs do not formally exist, including the following states and sub-regions: Caribbean sub-region, Lower Mississippi Valley & Ouachita/Ozark sub-region, Kentucky, North Carolina, West Virginia & Virginia.

A workshop on state-level alliances was offered by the Georgia Plant Conservation Alliance to provide networking expertise, skills, and models to be used within and among other states to promote cooperative conservation. Breakout groups for the following states and areas were mentored by GPCA members: Alabama, Florida, Kentucky, North Carolina, South Carolina, Tennessee, U.S. Virgin Islands & Puerto Rico, and the Lower Mississippi Valley (including parts of Arkansas, Mississippi, Oklahoma, and Texas). By creating and enhancing proactive conservation opportunities, such as candidate conservation agreements and conservation alliances, SePPCon facilitated networking, built capacity, and identified actionable items for conserving imperiled plants throughout the Southeast.

In light of the updated information shared by scientists and other knowledgeable partners at the SePPCon meeting, ten plant species were withdrawn from the Center for Biological Diversity petition for listing. The Service was acknowledged for its partnerships and its efforts to gather updated information on vulnerable species and to identify species that do not need focused conservation action. New data on species status and threats have provided states and agencies with information they need to take steps to conserve and safeguard imperiled plant species.

For additional SePPCon results and participant information, see Appendix IV.



Photo by John Jensen | *Clemmys guttata* (Spotted turtle)





## Appendix I: Suites of Species and Habitat Management

**Taxa groups:** birds (B), crustaceans-crayfish, amphipods, isopods (C), fish (F), herpetofauna (H), insects (I), mammals (M), mussels and snails/molluscs (MS), and plants (P).

**Population status codes:** O+ = a significant population that could play an important role in conserving the species, O = confirmed occurrence on the land unit in question, P = a potential occurrence-appropriate habitat is thought to be present and the location is within the species' range, but no recent records of the species



Photo by Jonathan Mays | *Sciurus niger shermani* (Sherman's Fox Squirrel).



## Florida Panhandle (including adjacent areas of southern Georgia and Alabama)

Key protected areas: Apalachicola National Forest (ANF), Apalachicola River Water Management Area (ARWMA), Blackwater River State Forest (BRSF), Conecuh National Forest (CNF), Eglin Air Force Base (EAFB), Lower Suwannee Nation Wildlife Refuge (LSNWR), St. Marks National Wildlife Refuge (SMNWR), Tate's Hell State Forest (THSF)

**Beaches and dunes:** Disturbance, particularly by public use or mammalian predators, should be reduced to protect beach nesting and roosting shorebirds and waders. Additionally, ensure that open sandy areas and wet depressions are not overtaken by vegetation.

BEACHES AND DUNES															
	Scientific Name	Common Name	Focal Area	ANF	CNF	ECWMA	EAFB	LSNWR	SMNWR	USFS	USFWS	Other Fed.	State	Local	NGO
P	<i>Rhexia salicifolia</i>	Panhandle Meadow beauty	West FL Panhandle	O	P	O+							O		
H	<i>Crotalus adamanteus</i>	Eastern Diamondback rattlesnake	Widespread												
B	<i>Calidris canutus rufa</i>	Red knot	Widespread				P	O	O+		O+	O	O+		O+
H	<i>Gopherus polyphemus</i>	Gopher tortoise	Widespread					O		O	O	O	O	O	





**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Fire is a key management action to maintain these desired conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. Beyond fire, another important consideration is the maintenance, and possibly recreation, of appropriate hydrology.

BOGS, FENS, SEEPS													
	Scientific Name	Common Name	Focal Area	ANF	BRSF	CNF	ECWMA	EAFF	JERC	USFS	Other Fed.	State	NGO
P	<i>Sarracenia rubra ssp. wherryi</i>	Wherry's sweet pitcherplant	Southern Pine Hills			O						O	O
I	<i>Somatochlora calverti</i>	Calvert's Emerald	West FL Panhandle	O		P						P	
I	<i>Gomphus westfalli</i>	Westfall's Clubtail	West FL Panhandle		O+			O+					
P	<i>Eriocaulon nigrobracteatum</i>	Blackbract pipewort	West FL Panhandle				O			O			
P	<i>Sarracenia rubra ssp. gulfensis</i>	Gulf Sweet Pitcherplant	West FL Panhandle		O+			O+			O	O	
P	<i>Lilium iridollae</i>	Panhandle lily	West FL Panhandle		O+	O		O+			O	O	
H	<i>Rana okaloosae</i>	Florida bog frog			O+			O+					
P	<i>Lindera subcoriacea</i>	Bog spicebush				O					P		
P	<i>Ludwigia spathulata</i>	Spathulate seedbox				P			P				



**Caves-karst, springs:** Protection against direct disturbance at spring sites, including through inappropriate public use (erosion), trash, and pollution, is key. Maintaining the quality of the aquifer is crucial, requiring the management of non-point source pollution (including agricultural runoff) and water withdrawals within the system. Good management of the surrounding terrestrial habitats and maintaining the natural vegetative cover is also an important consideration.

CAVES-KARST, SPRINGS							
	Scientific Name	Common Name	Focal Area	ANF	SMNWR	State	Local
C	<i>Crangonyx grandimanus</i>	Florida Cave Amphipod	Apalachicola-Eastern Panhandle	O+	O		
C	<i>Crangonyx hobbsi</i>	Hobb's Cave Amphipod	Apalachicola-Eastern Panhandle	O+	O	O+	
C	<i>Procambarus horsti</i>	Big Blue Springs Cave Crayfish	Apalachicola-Eastern Panhandle		O	O	
C	<i>Cambarus cryptodytes</i>	Dougherty Plain Cave Crayfish	Apalachicola-Eastern Panhandle			O	P
C	<i>Procambarus orcinus</i>	Woodville Karst Cave Crayfish	Apalachicola-Eastern Panhandle	O+		O+	
H	<i>Eurycea wallacei</i>	Georgia Blind Salamander	Apalachicola-Eastern Panhandle			O	P

**Estuarine systems:** This habitat is threatened by sea level rise and shoreline armoring, as well as pollution and trash from the shoreline as well as from tidal inputs. The potential use of prescribed fire should be researched, as there is some evidence that it slows down subsidence and likely results in increased diversity of vegetation.

ESTUARINE SYSTEMS											
	Scientific Name	Common Name	Ecological systems	CNF	EAFB	LSNWR	SMNWR	USFWS	Other Fed.	State	NGO
F	<i>Alosa alabamae</i>	Alabama shad	Brackish and saltwater marshes	O		O	O	O			
B	<i>Laterallus jamaicensis</i>	Black Rail				O	O	O		O	
B	<i>Calidris canutus rufa</i>	Red knot			P	O	O+	O+	O	O+	O+
F	<i>Fundulus jenkinsi</i>	Saltmarsh topminnow								P	





**Forested wetlands:** On mineral soils, mid successional conditions are desired, and thinnings are needed to open the canopy and increase vertical and horizontal structure. The at-risk plants occurring on forested wetlands vary as to whether they require canopy openings or do well in shade, and this is a key consideration in the application of management actions, including minimizing disturbance. Habitats on organic soils, including baygalls and Atlantic white cedar, are considered to have more of a fire regime with a longer return time for disturbance.

## FORESTED WETLANDS

	Scientific Name	Common Name	Ecological systems	Focal Area	ANF	ARWMA	BRSF	CNF	ECWMA	EAFB	JERC	LSNWR	SMNWR	THSF	USFS	USEWS	Other Fed.	State	NGO
H	<i>Lampropeltis getula meansi</i>	Apalachicola Common Kingsnake	Mineral soils	Apalachicola-Eastern Panhandle	O									O					
P	<i>Lythrum curtissii</i>	Curtis's Loosestrife		Apalachicola-Eastern Panhandle														O	
P	<i>Sideroxylon thornei</i>	Swamp Buckhorn or GA Bully	Mineral soils	Apalachicola-Eastern Panhandle	P	O+				O								O+	
H	<i>Amphiuma pholeter</i>	One-Toed Amphiuma	Mineral soils	West FL Panhandle	O			O		O		O	O			O		O	O
P	<i>Arnoglossum diversifolium</i>	Variableleaf Indian plantain	Mineral soils-riparian	West FL Panhandle	O								P					O	
H	<i>Desmognathus auriculatus</i>	Southern Dusky Salamander	Mineral soils		P			P		O		O	O	O	O	O			
H	<i>Clemmys guttata</i>	Spotted Turtle	Mineral/organic soils		O								P			O		O	
P	<i>Lindera subcoriacea</i>	Bog spicebush	Mineral/organic soils					O									P		
P	<i>Lobelia boykinii</i>	Boykin's lobelia	Mineral soils								O+								P
P	<i>Coreopsis integrifolia</i>	Ciliate leaf tickseed	Mineral soils													P		O	
P	<i>Croton elliotii</i>	Elliott's croton	Mineral soils					P			O+					P		P	
P	<i>Salix floridana</i>	Florida Willow	Mineral soils		O							P	O					O	
P	<i>Rhynchospora crinipes</i>	Hairy peduncled beakrush	Mineral soils		O		O+	P		O+			O						
P	<i>Fimbristylis perpusilla</i>	Harper's fimbristylis	Mineral soils								O+								



**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.

## FRESHWATER AQUATIC-RIVERS AND STREAMS

	Scientific Name	Common Name	Focal Area	ANF	ARWMA	BRSF	CNF	EAFB	LSNWR	SMNWR	THSF	USFWS	Other Fed.	State
F	<i>Cyprinella callitaenia</i>	Bluestripe shiner	Apalachicola-Eastern Panhandle	O	O+							O	O	
H	<i>Graptemys barbouri</i>	Barbour's Map Turtle	Apalachicola-Eastern Panhandle	P								O		O
H	<i>Pseudemys nelsoni</i>	Florida Red-bellied Turtle	Apalachicola-Eastern Panhandle	O	O							O		O
MS	<i>Anodonta heardi</i>	Apalachicola floater	Apalachicola-Eastern Panhandle	O+	O+						P	O		
MS	<i>Alasmodonta triangulata</i>	Southern Elktoe	Apalachicola-Eastern Panhandle	P	O+									
F	<i>Percina aurora</i>	Pearl darter	Southern Pine Hills											O+
MS	<i>Medionidus walkeri</i>	Suwannee Moccasinshell	Suwannee River Basin						P				P	O+
H	<i>Graptemys ernsti</i>	Escambia Map Turtle	West FL Panhandle			O+	O	O+						O
I	<i>Stylurus potulentus</i>	Yellow-sided Clubtail	West FL Panhandle			O	P	P						
MS	<i>Margaritifera marrianae</i>	Alabama pearlshell	West FL Panhandle				O							
MS	<i>Pleurobema strodeanum</i>	Fuzzy pigtoe	West FL Panhandle				O							
MS	<i>Fusconaia rotulata</i>	Round ebonyshell	West FL Panhandle				P							
MS	<i>Hamiota australis</i>	Southern sandshell	West FL Panhandle				O							O
MS	<i>Fusconaia burkei</i>	Tapered pigtoe	West FL Panhandle											O
P	<i>Nuphar lutea ssp. ulvacea</i>	West Florida Cow Lily	West FL Panhandle			O	P	O+					O	O+
F	<i>Anguilla rostrata</i>	American eel	Widespread				O		O	O			O	
F	<i>Alosa alabamae</i>	Alabama shad					O		O	O		O		
F	<i>Pteronotropis euryzonus</i>	Broadstripe Shiner										O	O	
F	<i>Crytallaria asprella</i>	Crystal Darter												
F	<i>Acipenser oxyrinchus desotoi</i>	Gulf sturgeon					O							
F	<i>Percina crypta</i>	Halloween darter											P	
H	<i>Macrochelys temminickii</i>	Alligator Snapping Turtle				O	O	O				P		
H	<i>Clemmys guttata</i>	Spotted Turtle		O						P		O		O





## FRESHWATER AQUATIC-RIVERS AND STREAMS

	Scientific Name	Common Name	Focal Area	ANF	ARWMA	BRSF	CNF	EAFB	LSNWR	SMNWR	THSF	USFWS	Other Fed.	State
I	<i>Oxyethira setosa</i>	Setose cream and brown mottle microcaddisfly						O						
MS	<i>Elliptio arcata</i>	Delicate spike					O+							
MS	<i>Anodontoides radiatus</i>	Rayed creekshell					P						P	O+
P	<i>Potamogeton floridanus</i>	Florida Pondweed											P	O+

**Freshwater transitional:** This broad habitat type includes freshwater marshes, lake and pond shore habitats, and transitions between pine and wetlands (cypress dome and bogs). Woody encroachment, invasive species (including fire ants, hogs, and plant species), and a disrupted water table are key threats in these habitats. For lake and pond shores or transitional habitats, the desired conditions call for maintaining the continuity of open herbaceous-dominated conditions within the matrix of habitat types, as well as minimizing breaks that would disrupt hydrology or the effects of fire. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. For freshwater marshes, mechanical removal should be used to restore desired conditions, followed by prescribed fire to maintain those conditions.

## FRESHWATER TRANSITIONAL

	Scientific Name	Common Name	Ecological systems	Focal Area	ANF	ARWMA	BRSF	CNF	ECWMA	EAFB	JERC	LSNWR	SMNWR	THSF	USFS	USFWS	Other Fed.	State
P	<i>Lythrum curtissii</i>	Curtis's Loosestrife	Pond and lake shore	Apalachicola-Eastern Panhandle														O
P	<i>Hymenocallis henryae</i>	Henry's Spider lily	Pond and lake shore, pine associated	Apalachicola-Eastern Panhandle	O									O			O	O
P	<i>Linum westii</i>	West's Flax	Pond and lake shore, pine associated	Apalachicola-Eastern Panhandle	O			O						O				O
C	<i>Procambarus apalachicola</i>	Coastal Flatwoods Crayfish	Pond and lake shore, pine associated	West FL Panhandle						O							O	O
C	<i>Cambarellus blacki</i>	Cypress Crayfish	Pond and lake shore	West FL Panhandle				P										O



## FRESHWATER TRANSITIONAL

	Scientific Name	Common Name	Ecological systems	Focal Area	ANF	ARWMA	BRSF	CNF	ECWMA	EAEB	JERC	LSNWR	SMNWR	THSF	USFS	USFWS	Other Fed.	State
P	<i>Xyris longisepala</i>	Karst Pond xyris	Pond and lake shore	West FL Panhandle	O			P	O+	O+			O					
P	<i>Rhexia salicifolia</i>	Panhandle Meadow-beauty	Pond and lake shore, pine associated	West FL Panhandle	O			P	O+									O
P	<i>Rhexia parviflora</i>	Small-flower Meadow-beauty	Pond and lake shore, pine associated	West FL Panhandle	O+		O		O+	O+				O				O
P	<i>Hypericum lissophloeus</i>	Smooth-barked St. John's-wort	Pond and lake shore	West FL Panhandle					O+									
B	<i>Laterallus jamaicensis</i>	Black Rail	Freshwater marshes									O	O			O		O
H	<i>Clemmys guttata</i>	Spotted Turtle	Marshes and pond shores		O								P			O		O
P	<i>Croton elliotii</i>	Elliott's croton	Pond and lake shore					P			O+					P		P
P	<i>Fimbristylis perpusilla</i>	Harper's fimbristylis									O+							
P	<i>Hartwrightia floridana</i>	Hartwrightia	Pond and lake shore, pine associated													O		
P	<i>Najas filifolia</i>	Narrowleaf Naiad	Pond and lake shore		P										P			O
P	<i>Ludwigia spathulata</i>	Spathulate seedbox	Pond and lake shore, pine associated					P			P							
P	<i>Rhynchospora thornei</i>	Thorne's beaked-rush	Pond and lake shore			O				O+	O		O+					



**Open pine woodlands:** These habitats include subgroups of flatwoods/savannas and sandhills/woodlands. Both of these groups require the maintenance of an open canopy with an herbaceous-dominated groundcover and minimal shrub and mid-story cover. Management through fire and forestry are important for restoring or preserving these conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. A range of forestry techniques are available to convert dense stands to a more open canopy where needed. Flatwoods and savannas have more of a hydrologic component to management, where it is important to maintain continuity and minimize obstructions.

OPEN PINE WOODLANDS AND SAVANNAS																				
	Scientific Name	Common Name	Ecological systems	Focal Area	ANF	ARWMA	BRSF	CNF	ECWMA	EAFB	JERC	LSNWR	SMNWR	THSF	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Lampropeltis getula meansi</i>	Apalachicola Common Kingsnake	Flatwoods and savannas	Apalachicola-Eastern Panhandle	O									O						
P	<i>Nyssa ursina</i>	Bear gum	Flatwoods and savannas	Apalachicola-Eastern Panhandle					O											
P	<i>Hymenocallis henryae</i>	Henry's Spider-lily	Flatwoods and savannas	Apalachicola-Eastern Panhandle	O									O			O	O		
P	<i>Linum westii</i>	West's Flax	Flatwoods and savannas	Apalachicola-Eastern Panhandle	O			O						O				O		
C	<i>Procambarus apalachicola</i>	Coastal Flatwoods Crayfish	Flatwoods and savannas	West FL Panhandle						O							O	O		
P	<i>Lilium iridollae</i>	Panhandle Lily	Flatwoods and savannas	West FL Panhandle			O+	O		O+							O	O		
P	<i>Rhexia salicifolia</i>	Panhandle Meadow-beauty	Flatwoods and savannas	West FL Panhandle	O			P	O+									O		
P	<i>Rhexia parviflora</i>	Small-flower Meadow-beauty	Flatwoods and savannas	West FL Panhandle	O+		O		O+	O+				O				O		
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake	Woodlands and sandhills	Widespread																





## OPEN PINE WOODLANDS AND SAVANNAS

	Scientific Name	Common Name	Ecological systems	Focal Area	ANF	ARWMA	BRSF	CNF	ECWMA	EAFB	JERC	LSNWR	SMNWR	THSF	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake	Woodlands and sandhills							O+	O	O	O+			O	O	O		O
H	<i>Lithobates capito</i>	Gopher Frog	Woodlands and sandhills		O+		P			O	O+							O		O
H	<i>Gopherus polyphemus</i>	Gopher tortoise	Woodlands and sandhills									O			O	O	O	O	O	
H	<i>Ophisaurus mimicus</i>	Mimic Glass Lizard	Flatwoods and savannas					O												
H	<i>Heterodon simus</i>	Southern Hognose Snake	Woodlands and sandhills		O		O	O		O	O					P	O	O		O
H	<i>Clemmys guttata</i>	Spotted Turtle			O								P			O		O		
H	<i>Notophthalmus perstriatus</i>	Striped Newt	Woodlands and sandhills		O						P	P				P		O+		
I	<i>Cordulegaster sayi</i>	Say's spiketail	Woodlands and sandhills		O		O	P		O								O		
P	<i>Lobelia boykinii</i>	Boykin's lobelia									O+									P
P	<i>Croton elliotii</i>	Elliott's croton						P			O+					P		P		
P	<i>Hartwrightia floridana</i>	Hartwrightia	Flatwoods and savannas													O				
P	<i>Balduina atropurpurea</i>	Purple balduina	Flatwoods and savannas													P				
P	<i>Rhynchospora thornei</i>	Thorne's beaked-rush	Flatwoods and savannas			O				O+	O		O+							



**Shrub-scrub:** Substantial patches of open sand with connectivity between beaches and uplands are crucial. In locations with few open patches, prescribed fire and/or mechanical thinning may be necessary. Sandhills scrub is likely to require more aggressive fire or mechanical management than coastal scrub.

## SHRUB-SCRUB

	Scientific Name	Common Name	Ecological systems	ANF	BRSF	CNF	EAFB	JERC	LSNWR	SMNWR	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake					O+	O	O	O+		O	O	O		O
H	<i>Lithobates capito</i>	Gopher Frog	Sandhills scrub, coastal scrub	O+	P		O	O+						O		O
H	<i>Gopherus polyphemus</i>	Gopher tortoise	Sandhills scrub, coastal scrub						O		O	O	O	O	O	
H	<i>Heterdon simus</i>	Southern Hognose Snake		O	O	O	O	O				P	O	O		O
P	<i>Lindera subcoriacea</i>	Bog spicebush	Shrub-scrub wetland			O							P			

**Upland hardwoods and conifers:** In this region, this habitat grouping is primarily composed of southern mixed mesic hardwoods, with desired conditions of a patchwork of closed and open canopy. Where canopy opening is needed, managers should be cautious of effects on shade-dependent species. Invasive species control is another important component.

## UPLAND HARDWOODS—SOUTHERN MIXED MESIC HARDWOOD

	Scientific Name	Common Name	Focal Area	ANF	ARWMA	BRSF	CNF	EAFB	JERC	LSNWR	SMNWR	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake						O+	O	O	O+		O	O	O		O
H	<i>Gopherus polyphemus</i>	Gopher tortoise								O		O	O	O	O	O	
H	<i>Heterdon simus</i>	Southern Hognose Snake		O		O	O	O	O				P	O	O		O
I	<i>Cordulegaster sayi</i>	Say's spiketail		O		O	P	O							O		
P	<i>Baptisia megacarpa</i>	Apalachicola Wild Indigo	Apalachicola-Eastern Panhandle												O		
P	<i>Salix floridana</i>	Florida Willow		O						P	O				O		
P	<i>Forestiera godfreyi</i>	Godfrey's privet									P				O		



## Peninsular Florida: Everglades National Park (ENP), Lower Suwannee National Wildlife Refuge (LSNWR), National Key Deer Refuge (NKDR), Ocala National Forest (ONF)

**Beaches and dunes:** Disturbance, particularly by public use or mammalian predators, should be reduced to protect beach nesting and roosting shorebirds and waders. Additionally, ensure that open sandy areas and wet depressions are not overtaken by vegetation.

BEACHES AND DUNES														
	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	NKDR	ENP	LSNWR	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Plestiodon (Eumeces) insularis</i>	Cedar Key Mole Skink	Dunes	Cedar Keys				O+		O+				
H	<i>Plestiodon (Eumeces) egregius egregius</i>	Florida Keys Mole Skink	Dunes	Lower FL Keys		O+						O	O	
H	<i>Sceloporus woodi</i>	Florida Scrub Lizard		Numerous public lands	O					O	O			
H	<i>Gopherus polyphemus</i>	Gopher tortoise		Widespread	O		O	O		O+	O	O	O	
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake					O			O	O	O	O	
B	<i>Calidris canutus rufa</i>	Red knot						O		O				





**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Fire is a key management action to maintain these desired conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. Beyond fire, another important consideration is the maintenance, and possibly recreation, of appropriate hydrology.

### COASTAL PLAIN BOG

	Scientific Name	Common Name	Focal Area	ONF	NKDR	ENP	LSNWR	USFS	USFWS	Other Fed.	State	Local	NGO
MS	<i>Floridobia monroensis</i>	Enterprise Siltsnail	Ocala Ridges and Hills									O	

**Caves-karst, springs:** Protection against direct disturbance at spring sites, including through inappropriate public use (erosion), trash, and pollution, is key. Maintaining the quality of the aquifer is crucial, requiring the management of non-point source pollution (including agricultural runoff) and water withdrawals within the system. Good management of the surrounding terrestrial habitats and maintaining the natural vegetative cover is also an important consideration.

### CAVES-KARST, SPRINGS

	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	LSNWR	USFWS	State	NGO
C	<i>Procambarus lucifugus alachua</i>	Alachua Light Fleeting Cave Crayfish	Caves-karst	Brooksville Ridge		P		O	
C	<i>Procambarus leitheuseri</i>	Coastal Lowland Cave Crayfish	Caves-karst	Brooksville Ridge			P	O+	
C	<i>Procambarus acherontis</i>	Orlando Cave Crayfish	Caves-karst	Brooksville Ridge				O+	
C	<i>Procambarus pallidus</i>	Pallid Cave Crayfish	Caves-karst	Brooksville Ridge				O	
C	<i>Procambarus erythrops</i>	Santa Fe Cave Crayfish	Caves-karst	Brooksville Ridge				O+	O+
C	<i>Troglocambarus maclanei</i>	Spider Cave Crayfish	Caves-karst	Brooksville Ridge			P	O	O
C	<i>Procambarus delicatus</i>	Bigcheek Cave Crayfish	Caves-karst	Ocala Ridges and Hills	O+				
C	<i>Procambarus franzi</i>	Orange Lake Cave Crayfish	Caves-karst	Ocala Ridges and Hills				O	
C	<i>Procambarus attiguus</i>	Silver Glen Springs Crayfish	Caves-karst	Ocala Ridges and Hills	O+				
C	<i>Procambarus lucifugus lucifugus</i>	Withlacoochee Light-fleeing Cave Crayfish	Caves-karst				P		



## CAVES-KARST, SPRINGS

	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	LSNWR	USFWS	State	NGO
MS	<i>Floridobia mica</i>	Icketucknee (Ichetucknee) Siltsnail	Springs	Brooksville Ridge				O+	
MS	<i>Aphaostracon asthenes</i>	Blue Spring Hydrobe Snail	Springs	Ocala Ridges and Hills				O+	
MS	<i>Aphaostracon pycnum (pycnus)</i>	Dense Hydrobe Snail	Springs	Ocala Ridges and Hills	O+				
MS	<i>Aphaostracon monas</i>	Wekiwa Hydrobe Snail	Springs	Ocala Ridges and Hills				O	
P	<i>Vicia ocalensis</i>	Ocala Vetch	Springs	Ocala Ridges and Hills	O+				

**Estuarine systems:** This habitat is threatened by sea level rise and shoreline armoring, as well as pollution and trash from the shoreline as well as from tidal inputs. The potential use of prescribed fire should be researched, as there is some evidence that it slows down subsidence and likely results in increased diversity of vegetation.

## ESTUARINE

	Scientific Name	Common Name	ONF	NKDR	ENP	LSNWR	USFS	USFWS	Other Fed.	State	Local	NGO
B	<i>Calidris canutus rufa</i>	Red knot				O		O				
F	<i>Alosa alabamae</i>	Alabama shad				O		O				



**Forested wetlands:** On mineral soils, mid-successional conditions are desired, and thinnings are needed to open the canopy and increase vertical and horizontal structure. The at-risk plants occurring on forested wetlands vary as to whether they require canopy openings or do well in shade, and this is a key consideration in the application of management actions, including minimizing disturbance. Habitats on organic soils, including baygalls and Atlantic white cedar, are considered to have more of a fire regime with a longer return time for disturbance.

## FORESTED WETLANDS

	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	ENP	LSNWR	USFS	USFWS	Other Fed.	State	Local	NGO
P	<i>Lythrum flagellare</i>	Lowland Loosestrife	Mineral soils	Charlotte Harbor					O		O	O	
P	<i>Aeschynomene pratensis</i>	Meadow Joint-vetch	Organic soils	Miami Ridge		O+			P		O+		
P	<i>Salix floridana</i>	Florida Willow	Mineral soils-riparian	Ocala Ridges and Hills	O+								
I	<i>Euphyes dukesi calhouni</i>	Duke's Skipper	Mineral/organic soils	Ocala Ridges and Hills			O+		O		O+	O+	
H	<i>Amphiuma pholeter</i>	One-Toed Amphiuma	Mineral soils	West FL Panhandle			O		O+		O		
H	<i>Desmognathus auriculatus</i>	Southern Dusky Salamander	Mineral soils				O						
P	<i>Encyclia cochleata var. triandra</i>	Clamshell Orchid	Mineral soils			O+			O+	O+	O+		
P	<i>Hartwrightia floridana</i>	Hartwrightia	Mineral/organic soils		O				P	O+	O		O
H	<i>Clemmys guttata</i>	Spotted Turtle	Mineral/organic soils		O			O+	O+		O	O	
P	<i>Illicium parviflorum</i>	Yellow Anisetree	Organic soils		O+						O+		





**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.

FRESHWATER AQUATIC—RIVERS AND STREAMS/LAKES AND PONDS								
	Scientific Name	Common Name	Focal Area	ONF	LSNWR	USFWS	State	Local
I	<i>Oecetis parva</i>	Little Oecetis Longhorn Caddisfly	Brooksville Ridge (numerous public lands)					
C	<i>Procambarus pictus</i>	Black Creek Crayfish	Lower St. Johns				O	
P	<i>Elliptio monroensis</i>	St. John's Elephantear	Ocala Ridges and Hills	O		O	O	O
F	<i>Anguilla rostrata</i>	American eel	Widespread		O			
F	<i>Alosa alabamae</i>	Alabama shad			O	O		
MS	<i>Elliptio ahenea</i>	Southern Lance		O		O	O	
MS	<i>Medionidus walkeri</i>	Suwannee Moccasinshell			P		O+	



## Freshwater transitional habitat includes freshwater marshes, lake and pond shore habitats, and transitions between pine and wetlands (cypress dome and bogs).

Woody encroachment, invasive species (including fire ants, hogs, and plant species), and a disrupted water table are key threats in these habitats. For lake and pond shores or transitional habitats, the desired conditions call for maintaining the continuity of open herbaceous-dominated conditions within the matrix of habitat types, as well as minimizing breaks that would disrupt hydrology or the effects of fire. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. For freshwater marshes, mechanical removal should be used to restore desired conditions, followed by prescribed fire to maintain those conditions. Lake shore habitat in this region is threatened by eutrophication resulting from nearby development. Freshwater marshes in this region, specifically at St. Johns NWR, harbor the most reliable population of the black rail.

FRESHWATER TRANSITIONAL														
	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	NKDR	ENP	LSNWR	USFS	USFWS	Other Fed.	State	Local	NGO
M	<i>Sigmodon hispidus insulicola</i>	Insular Cotton Rat	Freshwater marsh	Charlotte Harbor						O+		O	O	O+
M	<i>Oryzomys palustris pop.2</i>	Sanibel Island Rice Rat	Freshwater marsh	Charlotte Harbor						O+				O+
P	<i>Lythrum flagellare</i>	Lowland Loosestrife	Pond and lake shores	Charlotte Harbor						O		O	O	
P	<i>Hypericum edisonianum</i>	Edison's Ascyrum	Pond and lake shores	Lake Wales Ridge						O	O	O		O
B	<i>Laterallus jamaicensis</i>	Black Rail						O		O+		O		
H	<i>Clemmys guttata</i>	Spotted Turtle			O				O+	O+		O	O	
I	<i>Libellula jesseana</i>	Purple Skimmer			O					P		O+		



## Grasslands:

**Dry prairie** has a predominance of grassy/herbaceous species with very few trees and scattered palmetto patches. Very little dry prairie is remaining in desired conditions due to a combination of a preponderance of dormant season fire, cattle grazing, and conversion to cool season pastures. Additionally, a tendency for a higher incidence of flooding is impacting some species. Management needs include removing dense patches of palmetto and working toward a prescribed fire regime that is appropriate for this system.

The desired conditions for **wet prairies** are a dominant grassy/herbaceous plant community on consistently wet, but not inundated, soils. Natural fires have historically sustained these habitats by preventing the encroachment of shrubs and trees. Wet prairies are also sensitive to physical disturbances or alterations (human activity or development) to the soil surface that alter hydrology and majorly impact species composition.

GRASSLANDS												
	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	ENP	LSNWR	USEWS	Other Fed.	State	Local	NGO
B	<i>Grus canadensis pratensis</i>	Florida Sandhill Crane		Kissimmee Valley	O					O	O	
P	<i>Hypericum edisonianum</i>	Edison's Ascyrum	Wet prairies	Lake Wales Ridge				O	O	O		O
P	<i>Digitaria pauciflora</i>	Florida pineland crabgrass	Wet prairies	Miami Ridge					O			
P	<i>Elytraria caroliniensis var. angustifolia</i>	Narrowleaf Carolina Scalystem	Wet prairies	Miami Ridge		O		O	O	O	O	
P	<i>Aeschynomene pratensis</i>	Meadow Joint-vetch		Miami Ridge		O+		P		O+		
H	<i>Lithobates capito</i>	Gopher Frog		Widespread	O		O	O+	O	O	O	
H	<i>Gopherus polyphemus</i>	Gopher tortoise		Widespread	O	O	O	O+	O	O	O	
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake				O		O	O	O	O	
P	<i>Hartwrightia floridana</i>	Hartwrightia			O			P	O+	O		O





**Open pine woodlands:** These habitats include subgroups of flatwoods/savannas and sandhills/woodlands. Both of these groups require the maintenance of an open canopy with an herbaceous-dominated groundcover and minimal shrub and mid-story cover. Management through fire and forestry are important for restoring or preserving these conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. A range of forestry techniques are available to convert dense stands to a more open canopy where needed. Flatwoods and savannas have more of a hydrologic component to management, where it is important to maintain continuity and minimize obstructions.

## OPEN PINE WOODLANDS AND SAVANNAS

	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	ENP	LSNWR	USFWS	Other Fed.	State	Local	NGO
M	<i>Eumops floridanus</i>	Florida bonneted bat		Charlotte Harbor				O		O	O	
P	<i>Hypericum edisonianum</i>	Edison's Ascyrum	Flatwoods and savannas	Lake Wales Ridge				O	O	O		O
H	<i>Sceloporus woodi</i>	Florida Scrub Lizard	Woodlands and sandhills	Numerous public lands	O			O	O			
H	<i>Lithobates capito</i>	Gopher Frog	Woodlands and sandhills	Numerous public lands	O		O	O+	O	O	O	
H	<i>Lampropeltis extenuata</i>	Short Tailed King Snake	Woodlands and sandhills	Numerous public lands	O		P	O		O	O	
H	<i>Gopherus polyphemus</i>	Gopher tortoise	Woodlands and sandhills	Widespread	O	O	O	O+	O	O	O	
P	<i>Hartwrightia floridana</i>	Hartwrightia	Flatwoods and savannas		O			P	O+	O		O
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake	Woodlands and sandhills			O		O	O	O	O	
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake	Woodlands and sandhills		O+			O+	O+			
H	<i>Heterodon simus</i>	Southern Hognose Snake	Woodlands and sandhills				O	O		O	O	
H	<i>Notophthalmus perstriatus</i>	Striped Newt	Woodlands and sandhills		O+		P		O	O+	O	
H	<i>Clemmys guttata</i>	Spotted Turtle			O			O+		O	O	



## Tropical woodlands:

**Pine rocklands** have as desired conditions open pine (mainly South Florida slash pine) with herbaceous groundcover. This habitat is very fragmented, with less than 1% of historical pine rocklands remaining. Most of these fragments are out of condition due to invasion of woody species and palmetto, which will require removal by mechanical means or herbicide and prescribed fire where conditions are appropriate. Many small fragments are surrounded by development, making it difficult to implement fire treatments.

**Tropical hardwoods** are similar to pine rocklands, but more passively managed without the use of fire. There are specific microhabitats within these systems that require opening (cactus barrens, coastal berms). Canopy opening should be considered for purposes of structural diversity, but attempts at opening should be balanced against the need to control for invasive species. The invasion of animal predators (pythons, cats) is also an issue for species within this habitat.

**Mangroves** are expanding due to warmer winters in recent years, but at the same time mature mangroves are being cleared for development. Protection is key for mangroves, but there are no recommendations for active management.

TROPICAL WOODLANDS													
	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	NKDR	ENP	LSNWR	USFWS	Other Fed.	State	Local	NGO
M	<i>Eumops floridanus</i>	Florida bonneted bat		Charlotte Harbor					O		O	O	
M	<i>Sigmodon hispidus insulicola</i>	Insular Cotton Rat	Mangroves	Charlotte Harbor					O+		O	O	O+
M	<i>Oryzomys palustris pop. 1</i>	Pine Island Rice Rat	Mangroves	Charlotte Harbor					P		O	O	
H	<i>Thamnophis sauritus pop. 1</i>	Eastern Ribbonsnake	Mangroves	Lower FL Keys		O+							
H	<i>Diadophis punctatus acricus</i>	Key Ringneck Snake	Pine Rocklands, hardwoods	Lower FL Keys		O+							
H	<i>Kinosternon baurii pop. 1</i>	Striped Mud Turtle	Mangroves, hardwoods	Lower FL Keys		O+							
I	<i>Strymon acis bartrami</i>	Bartram's hairstreak butterfly	Pine Rocklands	Lower FL Keys		O+				O			
I	<i>Cyclargus thomasi bethunebakeri</i>	Miami blue butterfly	Hardwoods	Lower FL Keys					O+				
I	<i>Euphyes pilatka klotsi</i>	Palatka Skipper	Pine Rocklands, mangroves	Lower FL Keys		O+				O			
P	<i>Chamaecrista lieata var. keyensis</i>	Big Pine partridge pea	Pine Rocklands	Lower FL Keys		O+							
P	<i>Consolea corallicola</i>	Florida Semiphore cactus	Hardwoods	Lower FL Keys		O+							
H	<i>Tantilla oolitica</i>	Rim Rock Crowned Snake	Pine Rocklands, hardwoods	Miami Ridge		O			O	O	O	O	O



## TROPICAL WOODLANDS

	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	NKDR	ENP	LSNWR	USFWS	Other Fed.	State	Local	NGO
I	<i>Anaea troglodyta floridalis</i>	Florida leafwing butterfly	Pine Rocklands	Miami Ridge			O+						
P	<i>Argythamnia blodgettii</i>	Blodgett's silverbush	Pine Rocklands/ Coastal berm	Miami Ridge		O							
P	<i>Digitaria pauciflora</i>	Florida pineland crabgrass	Pine Rocklands, hardwoods	Miami Ridge						O			
P	<i>Aeschynomene pratensis</i>	Meadow Joint-vetch	Pine Rocklands	Miami Ridge			O+		P		O+		
P	<i>Elytraria caroliniensis</i> var. <i>angustifolia</i>	Narrowleaf Carolina Scalystem	Pine Rocklands	Miami Ridge			O		O	O	O	O	
P	<i>Chamaesyce deltoidea pinetorum</i>	Pineland sandmat	Pine Rocklands	Miami Ridge								O	
P	<i>Linum arenicola</i>	Sand flax	Pine Rocklands	Miami Ridge		O+							
P	<i>Chamaesyce deltoidea serpyllum</i>	Wedge spurge	Pine Rocklands	Miami Ridge		O+							
H	<i>Gopherus polyphemus</i>	Gopher tortoise		Widespread	O		O	O	O+	O	O	O	
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake					O		O	O	O	O	
I	<i>Cicindelidia floridana</i>	Miami tiger beetle		Miami Ridge						O+		O+	
P	<i>Epidendrum strobiliferum</i>	Big Cypress Epidendrum							P		O+		
P	<i>Oncidium (Trichocentrum) undulatum</i>	Cape Sable Orchid	Mangroves				O+		P		O		
P	<i>Encyclia cochleata</i> var. <i>triandra</i>	Clamshell Orchid					O+		O+	O+	O+		



**Upland hardwoods and conifers:** In this region, this habitat grouping is primarily composed of southern mixed mesic hardwoods, with desired conditions of a patchwork of closed and open canopy. Where canopy opening is needed, managers should be cautious of effects on shade-dependent species. Invasive species control is another important component.

UPLAND HARDWOODS AND CONIFERS												
	Scientific Name	Common Name	Ecological Systems	Focal Area	ONF	ENP	LSNWR	USFWS	Other Fed.	State	Local	NGO
M	<i>Sigmodon hispidus insulicola</i>	Insular Cotton Rat	Maritime forest	Charlotte Harbor				O+		O	O	O+
M	<i>Blarina carolinensis shermani</i>	Sherman's Short tail Shrew	Maritime forest	Charlotte Harbor				O		O	O	
H	<i>Sceloporus woodi</i>	Florida Scrub Lizard	Maritime forest	Numerous public lands	O			O	O			
H	<i>Gopherus polyphemus</i>	Gopher tortoise		Widespread	O	O	O	O+	O	O	O	
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake				O		O	O	O	O	
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake			O+			O+	O+			
H	<i>Heterodon simus</i>	Southern Hognose Snake					O	O		O	O	
P	<i>Forestiera godfreyi</i>	Godfrey's privet	Mixed Mesic Hardwood		O+		P	P		O+		
P	<i>Illicium parviflorum</i>	Yellow Anisetree			O+					O+		





## Southern Blue Ridge and Southern Ridge and Valley

Key protected areas: Chattahoochee-Oconee National Forest-Blue Ridge, Conasauga, and Chattooga Ranger Districts (CONF), Cherokee National Forest (CNF), Proposed Conasauga River National Wildlife Refuge (CRNWR), George Washington-Jefferson National Forests (GWJNF), Great Smoky Mountains National Park (GSMNP), Mountain Bogs National Wildlife Refuge (MBNWR), Nantahala National Forest (NNF), Pisgah National Forest (PNF), Sumter National Forest-Andrew Pickens Ranger District (SNF), Talladega National Forest-Shoal Creek and Talladega Ranger Districts (TNF)

**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Most sites require an early emphasis on manual/mechanical thinning and selective herbicide use, with the eventual goal of restoring the system to a maintenance level where fire and/or grazing could be used to maintain desired conditions. Prescribed fire should be considered, especially in surrounding upland areas and transitional zones, so long as decisions surrounding fire timing and interval are based on the initial state of the site and regular condition assessments. Fire breaks should be minimized. Livestock can be used judiciously to provide grazing disturbance (goats are appropriate to manage invasive species, while cattle help maintain open conditions on the site), but this should be carried out under a specific grazing plan. Many mountain bogs are remnants surrounded by development, and would require heavy equipment to restore or create appropriate hydrological conditions. Augmentation or reintroduction of key species into suitable habitat on protected lands could be considered where appropriate following appropriate guidelines from the Center for Plant Conservation. Feral hogs are a specific threat to this system and a major issue in the region, and corral trapping has been found to be the most effective means for removal.

BOGS, FENS, SEEPS																	
	Scientific Name	Common Name	Ecological Systems	Focal Area	CONF	CNF	MBNWR	NNF	PNF	SNF	TNF	USFS	USFWS	Other Fed.	State	NGO	
P	<i>Sarracenia purpurea var. montana</i>	Mountain purple pitcherplant	Mountain bogs and fens	Southern Blue Ridge	O		O+	O+	O+						O+		
P	<i>Platanthera integrilabia</i>	White fringeless orchid	Mountain bogs, seepage wetland		O	O+	P				O		O	O	O		
P	<i>Rudbeckia heliopsidis</i>	Sunfacing coneflower	Seepage wetland							O+		O		O			
B	<i>Vermivora chrysoptera</i>	Golden Winged Warbler					O	O	O						O		



**Caves-karst, springs:** Protection against direct disturbance at spring sites, including through inappropriate public use (erosion), trash, and pollution, is key. Maintaining the quality of the aquifer is crucial, requiring the management of non-point source pollution (including agricultural runoff) and water withdrawals within the system. Good management of the surrounding terrestrial habitats and maintaining the natural vegetative cover is also an important consideration.

CAVES-KARST, SPRINGS																
	Scientific Name	Common Name	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	Other Fed.	State		
H	<i>Gyrinophilus gulolineatus</i>	Berry Cave Salamander	Central Ridge and Valley										P			
I	<i>Pseudanophthalmus praetermissus</i>	Overlooked Cave Beetle	Central Ridge and Valley				O									
I	<i>Pseudanophthalmus hirsutus</i>	Cudjo's cave beetle	North Cumberland Plateau				P						O+			
C	<i>Stygobromus morrisoni</i>	Morrison's Cave Amphipod					O									
H	<i>Aneides aeneus</i>	Green Salamander		O+			O+		O	O+		O+	O	O+		
I	<i>Pseudanophthalmus cordicollis</i>	Little Kennedy Cave Beetle					O									
M	<i>Myotis leibii</i>	Eastern Small Footed Myotis		O	O+		P	O	O	O+	O+	O	O	O		
M	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis				P			O						O	

**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.

FRESHWATER AQUATIC—RIVERS AND STREAMS																	
	Scientific Name	Common Name	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	TNF	USFWS	Other Fed.	State	NGO
F	<i>Percina williamsi</i>	Sickle Darter	Central Ridge and Valley		P		P	P		P	P				P		
I	<i>Tallaperla lobata</i>	Lobed Roachfly	Central Ridge and Valley				O									O+	
F	<i>Percina kusha</i>	Bridled Darter	Conasauga		O+	O+											
F	<i>Etheostoma brevirostrum</i>	Holiday Darter	Conasauga	O+	O+	O+							O+		O+	O+	



## FRESHWATER AQUATIC—RIVERS AND STREAMS

	Scientific Name	Common Name	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	TNF	USFWS	Other Fed.	State	NGO
F	<i>Noturus munitus</i>	Frecklebelly madtom				O											
C	<i>Cambarus fasciatus</i>	Etowah crayfish	Etowah	O+											O+	O+	
C	<i>Cambarus callainus</i>	Big Sandy Crayfish	North Cumberland Plateau				O+										
I	<i>Acroneuria kosztarabi</i>	Virginia stone	North Cumberland Plateau				O+										
F	<i>Notropis ariommus</i>	Popeye Shiner	Ridge and Valley				P										
C	<i>Cambarus speciosus</i>	Beautiful Crayfish	Southern Blue Ridge	P												O	
C	<i>Cambarus chaugaensis</i>	Chauga Crayfish	Southern Blue Ridge	O+					O	O+	O+	O+				O+	
C	<i>Cambarus coosawattae</i>	Coosawattae Crayfish	Southern Blue Ridge												O+		
C	<i>Cambarus eeseehensis</i>	Grandfather Mountain Crayfish	Southern Blue Ridge								O+						
C	<i>Cambarus parrishi</i>	Hiwassee Headwater Crayfish	Southern Blue Ridge	O+						O+							
C	<i>Cambarus georgiae</i>	Little Tennessee Crayfish	Southern Blue Ridge	O+						O+	O+						
F	<i>Moxostoma sp.</i>	Sicklefin redhorse	Southern Blue Ridge	P						P					O+	O+	
C	<i>Cambarus scotti</i>	Chattooga River Crayfish	Upper Coosa Ridge and Valley										P				
MS	<i>Villosa umbrans</i>	Coosa Creekshell	Upper Coosa Ridge and Valley	O+	O+	O+											
F	<i>Etheostoma trisella</i>	Trispot Darter		P		O+									P		
H	<i>Cryptobranchus alleganiensis alleganiensis</i>	Eastern hellbender			O		O		P	O	O						
MS	<i>Villosa nebulosa</i>	Alabama Rainbow		O+	O+								O+				
MS	<i>Alasmidonta varicose</i>	Brook floater		O+							O	O+					
MS	<i>Medionidus conradicus</i>	Cumberland Moccasinshell			P	O	O+		O							O+	O+
MS	<i>Elliptio arcata</i>	Delicate spike		O	O	P											



## FRESHWATER AQUATIC—RIVERS AND STREAMS

	Scientific Name	Common Name	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	TNF	USFWS	Other Fed.	State	NGO
MS	<i>Fusconaia subrotunda</i>	Longsolid					P			P					O+	O+	O+
MS	<i>Pleurobema rubrum</i>	Pink pigtoe					P		O								
MS	<i>Toxolasma lividum</i>	Purple lilliput							O								
MS	<i>Pleurobema dolabelloides</i>	Slabside pearlymussel							O								
MS	<i>Leptoxis virgate</i>	Smooth Rocksnail (Mudalia)			O+											O	
MS	<i>Pleurobema oviforme</i>	Tennessee Clubshell			O		P	O	O	O					O+	O	
MS	<i>Lasmigona holstonia</i>	Tennessee Heelsplitter			O		O+		O							O+	O+
MS	<i>Pleurobema barnesiana</i>	Tennessee pigtoe			O				O					O	O		

**Forested wetlands** are represented in the Appalachians by low elevation **riparian woodlands**—structurally and compositionally diverse forests along riversides that are subject to regular disturbance from flooding.

## FORESTED WETLANDS (RIPARIAN)

	Scientific Name	Common Name	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	TNF	USFS	USFWS	Other Fed.	State
C	<i>Cambarus cymatilis</i>	Conasauga Blue Burrower	Conasauga	O		O+											
I	<i>Ophiogomphus edmundi</i>	Edmund's Snaketail	Southern Blue Ridge	O	O	O				O	O						
I	<i>Macromia margarita</i>	Margarita River Skimmer	Southern Blue Ridge	P						P	P						
P	<i>Megaceros aenigmaticus</i>	Hornwort	Southern Blue Ridge	O+				O	P	O+				O+			
H	<i>Urspeleperpes brucei</i>	Patch-nosed Salamander		O+								O+					O
H	<i>Desmognathus aeneus</i>	Seepage salamander							O				P			P	
H	<i>Clemmys insculpta</i>	Wood Turtle					O										
I	<i>Ophiogomphus incurvatus</i>	Appalachian snaketail		P	O		O	P			O		O+		O	P	O





## FORESTED WETLANDS (RIPARIAN)

	Scientific Name	Common Name	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	TNF	USFS	USFWS	Other Fed.	State
I	<i>Gomphus consanguis</i>	Cherokee clubtail		O	O	O	O									O	
P	<i>Minuartia godfreyi</i>	Godfrey's Stitchwort			P									P			
P	<i>Marshallia grandiflora</i>	Large-flowered Barbara's buttons						P		P	P						
P	<i>Waldsteinia (Geum) lobata</i>	Piedmont barren strawberry		O+						P	P	O+				O+	O+
P	<i>Solidago arenicola</i>	Southern racemose goldenrod														O+	
P	<i>Potamogeton tennesseensis</i>	Tennessee Pondweed			O		O	O									

## Shrub-scrub, grasslands

**Prairie** restoration can begin by reintroducing dormant season fire. If this is not possible, another form of disturbance such as mowing during the winter-spring transition can be used. Any fire or mowing should be done in a variable and patchy distribution. Annual fire is appropriate during an initial restoration phase, but in intact habitat the return interval should be based on observations of a suite of native and non-native woody plants that require management. There should be an emphasis on growing season fire where appropriate, and prescribed fire may be supplemented with mechanical thinning and selective herbicide use.

**Grassy mountain balds** often have their open grassy conditions maintained by grazing. Restoration may require mechanical thinning treatments to manage woody encroachment, as fire is reportedly difficult to employ on these sites.

**Shrub-scrub, glades and barrens:** Maintain low shrub and patchy herbaceous/grassy conditions, while avoiding mature cedar dominance. Mechanical treatments can be applied to remove the mature trees, and fire applied to maintain patches of herbaceous groundcover. Augmentation or reintroduction of key species into suitable habitat on protected lands could be considered where appropriate following appropriate guidelines from the Center for Plant Conservation. These systems are also subject to impacts from recreation.

**Rock outcrops:** Maintain rock faces and pay particular attention to isolated patches of plant species. Succession/woody encroachment and invasive species are important to manage for, as are potential impacts from recreation such as trash dumping and damage caused by off-road vehicles. It is crucial to preserve variety for the specific needs of the various species present. For example, green salamander require shady areas and small crevices, preferably on side slopes under full canopy, while in more open conditions crevices are employed for roosting by small-footed bats. For plants, Augmentation or reintroduction of key species into suitable habitat on protected lands could be considered where appropriate following appropriate guidelines from the Center for Plant Conservation.



## SHRUB-SCRUB, GLADES AND BARRENS, ROCK OUTCROPS

	Scientific Name	Common Name	Ecological Systems	Focal Area	CONF	CNF	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	TNF	USFS	Other Fed.	State
H	<i>Plethodon petraeus</i>	Pigeon Mountain Salamander		Lookout Plateau												O+
P	<i>Fissidens appalachensis</i>	Appalachian Fissidens Moss	Cliffs, domes, rock outcrops	Southern Blue Ridge		O		P		O+	O+	P				
P	<i>Plagiochila caduciloba</i>	Gorge Leafy Liverwort	Cliffs, domes, rock outcrops	Southern Blue Ridge	O+	O		O+	P	O+	O+	O+				
P	<i>Plagiochila sharpii</i> ssp. <i>sharpii</i>	Sharp's Leafy Liverwort	Cliffs, domes, rock outcrops	Southern Blue Ridge		P		O+		O+	O+				O+	
B	<i>Vermivora chrysoptera</i>	Golden winged Warbler							O	O	O					O
H	<i>Aneides aeneus</i>	Green Salamander	Rock outcrops		O+		O+		O	O+		O+			O	O+
P	<i>Symphyotrichum geogianum</i>	Georgia Aster											O+			
P	<i>Minuartia godfreyi</i>	Godfrey's Stitchwort				P								P		O

## Upland hardwoods and montane conifers:

**Spruce-fir/northern hardwoods:** Threatened by climate change and acid rain, with the balsam woolly adelgid a specific threat to the fir component. The spruce component should, at minimum, be restored to create more of a spruce-hardwood mix at higher elevations (>3500ft). This can be achieved by punching gaps in the canopy among hardwoods and planting spruce.

**High elevation red oak/Table Mountain-pitch pine:** Maintain open oak or pine condition, while emphasizing the maintenance of herbaceous groundcover and patches of moderate shrub density. These systems are adapted to frequent fires of variable intensity, but intense fires are required to open cones.

**Eastern hemlock-white oak:** This is an upper slope riparian system whose desired condition may never be achievable due to the hemlock decline caused by the hemlock woolly adelgid. The desired condition is mature forest with a closed canopy, providing thermal cover along streams. It is currently unclear which species will replace the hemlock in its role.

**Mixed mesophytic:** Occurs in basic and acidic coves, with a diverse assemblage of tree species. The desired condition consists of large older trees mixed with gaps for variable horizontal and vertical diversity and higher herbaceous diversity. The herbaceous layer is the most vulnerable element, threatened by soil compaction, dramatic changes in canopy cover, feral hogs, and other disturbance. The system continues to be impacted by the legacy of historical clear cutting. Various forestry techniques could be applied to this system to maximize structural and compositional diversity, retention of the largest trees and snags, and leaving coarse woody debris on the ground.



**Mesic oak hickory** is similar to mixed mesophytic with different species and is more subject to natural disturbances, including wind and extreme fire events.

**Xeric oak hickory** has a desired condition with a more open woodland/savanna aspect with emphasis on herbaceous cover and scattered patches of shrubs. This system is more susceptible to regular fire. The present condition for many stands is characterized by too dense of stocking, white pine invasion, and in some cases rhododendron invasion, with hogs playing an additional disturbance role. Discovering the mix of silviculture and burning that is most appropriate for this system will require additional study.

## UPLAND HARDWOODS AND MONTANE CONIFERS

	Scientific Name	Common Name	Ecological Systems	Focal Area	CONF	CNF	CRNWR	GWJNF	GSMNP	MBNWR	NNF	PNF	SNF	Other Fed.	State	NGO
H	<i>Plethodon amplus</i>	Blue Ridge Gray-cheeked Salamander		Southern Blue Ridge						P					O+	O+
H	<i>Plethodon cheoah</i>	Cheoah Bald Salamander		Southern Blue Ridge							O+					
H	<i>Plethodon meridianus</i>	South Mountain Gray-cheeked Salamander		Southern Blue Ridge						O+					O+	
H	<i>Plethodon welleri</i>	Weller's Salamander	Spruce-fir/Northern Hardwoods	Southern Blue Ridge				O+		P		O+			O+	O+
I	<i>Megaleuctra williamsae</i>	Smokies Needlefly	Spruce-fir/Northern Hardwoods	Southern Blue Ridge				P						O+		
I	<i>Allocapnia fumosa</i>	Smokies snowfly	Spruce-fir/Northern Hardwoods	Southern Blue Ridge				O						O		
P	<i>Tsuga caroliniana</i>	Carolina Hemlock		Southern Blue Ridge		O+		O+		O		O+		O+		O+
B	<i>Vermivora chrysoptera</i>	Golden winged Warbler								O	O	O			O	
H	<i>Plethodon punctatus</i>	Cow Knobs or White-spotted Salamander						O+								
H	<i>Aneides aeneus</i>	Green Salamander			O+			O+		O	O+		O+	O	O+	
M	<i>Myotis leibii</i>	Eastern Small-footed Myotis			O	O+		P	O	O	O+	O+	O	O	O	
M	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis					P			O					O	
P	<i>Waldsteinia (Geum) lobata</i>	Piedmont barren strawberry			O+						P	P	O+	O+	O+	



## Interior Low Plateau and Cumberland Plateau, Central Ridge and Valley

Key protected areas: Daniel Boone National Forest (DBNF), Big South Fork National River and Recreation Area (BSF), Mammoth Cave National Park (MCNP), Tennessee National Wildlife Refuge (TNWR), Proposed Paint Rock River National Wildlife Refuge (PRRNWR), Wheeler National Wildlife Refuge (WNWR)

**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Fire is a key management action to maintain these desired conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. Beyond fire, another important consideration is the maintenance, and possibly recreation, of appropriate hydrology.

### BOGS, FENS, SEEPS

	Scientific Name	Common Name	Ecological Systems	Focal Area	DBNF	BSF	USFS	Other Fed.	State	NGO
P	<i>Eurybia saxicastellii</i>	Rockcastle Wood-Aster		North Cumberland Plateau	O+	O+				
P	<i>Arenaria (Stellaria) fontinalis</i>	Water Stitchwort	Seepage fen	Pennyroyal Plateau and Shawnee Hills				O+	O+	O+
P	<i>Platanthera integrilabia</i>	White fringeless orchid	Appalachian bog and fen, seepage wetland		O+	O+	O+	O	O+	
B	<i>Vermivora chrysoptera</i>	Golden winged Warbler			O		O+		O	





**Caves-karst, springs:** Protection against direct disturbance at spring sites, including through inappropriate public use (erosion), trash, and pollution, is key. Maintaining the quality of the aquifer is crucial, requiring the management of non-point source pollution (including agricultural runoff) and water withdrawals within the system. Good management of the surrounding terrestrial habitats and maintaining the natural vegetative cover is also an important consideration.

CAVES-KARST, SPRINGS														
	Scientific Name	Common Name	Ecological Systems	Focal Area	DBNF	MCNP	TNWR	PRRNR	WNWR	USFS	USFWS	Other Fed.	State	
C	<i>Orconectes packardi</i>	Appalachian Cave Crayfish	Caves-karst	North Cumberland Plateau	P									
I	<i>Pseudanophthalmus hirsutus</i>	Cudjo's cave beetle	Caves-karst	North Cumberland Plateau						P		O+		
I	<i>Pseudanophthalmus virginicus</i>	Maiden Spring Cave Beetle	Caves-karst	North Cumberland Plateau									O	
F	<i>Amblyopsis spelaea</i>	Northern cavefish	Caves-karst	Pennyroyal Plateau and Shawnee Hills		O+								
I	<i>Psuedanophthalmus colemanensis</i>	Coleman cave beetle	Caves-karst	Pennyroyal Plateau and Shawnee Hills									O	
C	<i>Cambarus jonesi</i>	Alabama cave crayfish	Caves-karst	Southern Highland Rim					O			P		
H	<i>Gyrinophilus palleucus</i>	Tennessee Cave Salamander	Caves-karst	Southern Highland Rim				P	O+			O	O	
F	<i>Elassoma alabamae</i>	Spring pygmy sunfish	Springs	Southern Highland Rim					O+			O		
M	<i>Myotis leibii</i>	Eastern Small-footed Myotis	Caves-karst				O			O+	O	O		
M	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis	Caves-karst				P				O	O	O	



**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.

## FRESHWATER AQUATIC-RIVERS AND STREAMS

	Scientific Name	Common Name	Focal Area	DBNF	BSF	MCNP	TNWR	PRRNR	WNWR	USFS	USFWS	Other Fed.	State	Local	NGO
F	<i>Etheostoma striatulum</i>	Striated Darter	Central Basin (Upper Duck)										O		
C	<i>Cambarus williami</i>	Brawleys Fork Crayfish	Eastern Highland Rim										O+		
F	<i>Fundulus julisia</i>	Barren's Topminnow	Eastern Highland Rim				P								
MS	<i>Pleurocera pyrenella</i>	Skirted Hornsnail	Lookout Plateau						P						
C	<i>Cambarus pristinus</i>	Pristine Crayfish	North Cumberland Plateau										O+		
C	<i>Cambarus jezerinaci</i>	Spiny Scale Crayfish	North Cumberland Plateau									O+	O+		
F	<i>Notropis ariommus</i>	Popeye Shiner	North Cumberland Plateau		O+					P					
F	<i>Etheostoma microlepidum</i>	Smallscale Darter	Pennyroyal Plateau and Shawnee Hills										O+		
MS	<i>Villosa ortmanni</i>	FRKY (Kentucky) Creekshell	Pennyroyal Plateau and Shawnee Hills			O									
F	<i>Etheostoma tuscumbia</i>	Tuscumbia Darter	Southern Highland Rim						O+			O+		O+	
I	<i>Amphinemura mockfordi</i>	Tennessee Forestfly	Southern Highland Rim					P							
C	<i>Oronectes burri</i>	Blood River Crayfish	Upper East Gulf Coastal Plain									O+	O+		
C	<i>Orconectes wrighti</i>	Hardin Crayfish	Upper East Gulf Coastal Plain									O	O		
F	<i>Noturus gladiator</i>	Piebald Madtom	Upper East Gulf Coastal Plain								P		P		
C	<i>Cambarus bouchardi</i>	Big South Fork Crayfish		P	P										
F	<i>Etheostoma sagitta spilotum</i>	Kentucky arrow darter		O+											
F	<i>Etheostoma maculatum</i>	Spotted Darter				O+							O+		
F	<i>Etheostoma tippecanoe</i>	Tippecanoe Darter		O	O+	O+									
H	<i>Macrochelys temminckii</i>	Alligator Snapping Turtle									O	O+			
H	<i>Cryptobranchus alleganiensis alleganiensis</i>	Eastern hellbender		O+			P			O	P	O+	O		



## FRESHWATER AQUATIC-RIVERS AND STREAMS

	Scientific Name	Common Name	Focal Area	DBNF	BSF	MCNP	TNWR	PRRNR	WNWR	USFS	USFWS	Other Fed.	State	Local	NGO
I	<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle			P										O+
MS	<i>Medionidus conradicus</i>	Cumberland Moccasinshell		O	O+			O		O+	O		O+		O+
MS	<i>Ptychobranhus subtentum</i>	Fluted kidneyshell		O+	O		O						O+		
MS	<i>Lithasia duttoniana</i>	Helmet Rocksnail					P								
MS	<i>Fusconaia subrotunda</i>	Longsolid		O+		O+	O	O		P	O	O+	O+		O+
MS	<i>Pleurobema rubrum</i>	Pink pigtoe				O+	P	O	O	O	O	O			
MS	<i>Toxolasma lividum</i>	Purple lilliput						O	O		O				
MS	<i>Quadrula cylindrica cylindrica</i>	Rabbitsfoot mussel		O		O+	P	O					P		O+
MS	<i>Obovaria subrotunda</i>	Round Hickorynut		O+		O+	P	O			O		O+		
MS	<i>Simpsonaias ambigua</i>	Salamander Mussel		O+			P						O		
MS	<i>Pleurocera curta</i>	Shortspire Hornsnail					P				P				
MS	<i>Pleuroaia dolabelloides</i>	Slabside pearlymussel					P	O			O		P		
MS	<i>Cumberlandia monodonta</i>	Spectaclecase				O+							O+		
MS	<i>Pleurobema oviforme</i>	Tennessee Clubshell		O+				O		O	O	O+	O+		
MS	<i>Lasmigona holstonia</i>	Tennessee Heelsplitter						O		O+	O		O+		O+
MS	<i>Pleuroaia barnesiana</i>	Tennessee pigtoe						O		O	O	O			
P	<i>Fimbristylis perpusilla</i>	Harper's fimbristylis						P		O+					



**Forested wetlands** are represented by **low-elevation riparian woodlands**—structurally and compositionally diverse forests along riversides that are subject to regular disturbance from flooding.

FORESTED WETLANDS (MINERAL SOILS)													
	Scientific Name	Common Name	Ecological Systems	Focal Area	DBNF	BSF	PRRNR	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Desmognathus abditus</i>	Cumberland Dusky Salamander	Riparian	North Cumberland Plateau						O			
P	<i>Eurybia saxicastellii</i>	Rockcastle Wood-Aster	Riverscour	North Cumberland Plateau	O+	O+							
P	<i>Arenaria (Stellaria) fontinalis</i>	Water Stitchwort	Riparian	Pennyroyal Plateau and Shawnee Hills						O+	O+		O+
I	<i>Amphinemura mockfordi</i>	Tennessee Forestfly	Stream and riparian	Southern Highland Rim			P						
C	<i>Fallicambarus hortonii</i>	Hatchie Burrowing Crayfish	Riparian	Upper East Gulf Coastal Plain					P	P	O+	O+	
I	<i>Speyeria idalia</i>	Regal Fritillary	Stream and riparian					P		O			
P	<i>Marshallia grandiflora</i>	Large-flowered Barbara's-buttons	Stream and riparian			O+		P		O+	O+		
P	<i>Potamogeton tennesseensis</i>	Tennessee Pondweed	Floodplain		P	O		O		O			





## Shrub-scrub, grasslands

**Shrub-scrub, glades and barrens:** Maintain low shrub and patchy herbaceous/grassy conditions, while avoiding mature cedar dominance. Mechanical treatments can be applied to remove the mature trees, and fire applied to maintain patches of herbaceous groundcover. Augmentation or reintroduction of key species into suitable habitat on protected lands could be considered where appropriate following appropriate guidelines from the Center for Plant Conservation. These systems are also subject to impacts from recreation.

**Rock outcrops:** Maintain rock faces and pay particular attention to isolated patches of plant species. Succession/woody encroachment and invasive species are important to manage for, as are potential impacts from recreation such as trash dumping and damage caused by off-road vehicles. It is crucial to preserve variety for the specific needs of the various species present. For example, green salamander require shady areas and small crevices, preferably on side slopes under full canopy, while in more open conditions crevices are employed for roosting by small-footed bats. For plants, Augmentation or reintroduction of key species into suitable habitat on protected lands could be considered where appropriate following appropriate guidelines from the Center for Plant Conservation.

**Prairie** restoration can begin by reintroducing dormant season fire. If this is not possible, another form of disturbance such as mowing during the winter-spring transition can be used. Any fire or mowing should be done in a variable and patchy distribution. Annual fire is appropriate during an initial restoration phase, but in intact habitat the return interval should be based on observations of a suite of native and non-native woody plants that require management. There should be an emphasis on growing season fire where appropriate, and prescribed fire may be supplemented with mechanical thinning and selective herbicide use.

### SHRUB-SCRUB, BARRENS AND GLADES, ROCK OUTCROPS, PATCH PRAIRIES

	Scientific Name	Common Name	Ecological Systems	Focal Area	DBNF	BSF	PRRNR	Other Fed.	State	Local	NGO
P	<i>Physaria globosa</i>	Shorts bladderpod		Pennyroyal Plateau and Shawnee Hills				O+	O	O+	
P	<i>Leavenworthia exigua</i> var. <i>laciniata</i>	Kentucky gladeceess		Pennyroyal Plateau and Shawnee Hills					O+	O+	O+
H	<i>Aneides aeneus</i>	Green Salamander	Rock outcrops		O	O	P	O	O+		



## Upland hardwoods and montane conifers:

**Mixed mesophytic:** Occurs in basic and acidic coves, with a diverse assemblage of tree species. The desired condition consists of large older trees mixed with gaps for variable horizontal and vertical diversity and higher herbaceous diversity. The herbaceous layer is the most vulnerable element, threatened by soil compaction, dramatic changes in canopy cover, feral hogs, and other disturbance. The system continues to be impacted by the legacy of historical clear cutting. Various forestry techniques could be applied to this system to maximize structural and compositional diversity, retention of the largest trees and snags, and leaving coarse woody debris on the ground.

**Mesic oak hickory** is similar to mixed mesophytic with different species and is more subject to natural disturbances, including wind and extreme fire events.

**Xeric oak hickory** has a desired condition with a more open woodland/savanna aspect with emphasis on herbaceous cover and scattered patches of shrubs. This system is more susceptible to regular fire. The present condition for many stands is characterized by too dense of stocking, white pine invasion, and in some cases rhododendron invasion, with hogs playing an additional disturbance role. Discovering the mix of silviculture and burning that is most appropriate for this system will require additional study.

### UPLAND HARDWOODS AND MONTANE CONIFERS

	Scientific Name	Common Name	Ecological Systems	DBNF	BSF	TNWR	PRRNR	USFS	USFWS	Other Fed.	State
B	<i>Vermivora chrysoptera</i>	Golden winged Warbler		O				O+			O
H	<i>Aneides aeneus</i>	Green Salamander		O	O		P			O	O+
H	<i>Ambystoma barbouri</i>	Streamside Salamander	Dry-mesic oak forest								O+
M	<i>Myotis leibii</i>	Eastern Small-footed Myotis				O		O+	O	O	
M	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis				P			O	O	O



## Piedmont and South Atlantic Coastal Plain

**Key protected areas:** Chattahoochee-Oconee National Forest-Oconee Section (CONF), Fort Stewart, Sandhills Game Land (SGL), Savannah River Site (SRS), Sumter National Forest-Enoree and Long Cane Ranger Districts (SNF)

**Beaches and dunes:** Disturbance, particularly by public use or mammalian predators, should be reduced to protect beach nesting and roosting shorebirds and waders. Additionally, ensure that open sandy areas and wet depressions are not overtaken by vegetation.

**Estuarine systems:** This habitat is threatened by sea level rise and shoreline armoring, as well as pollution and trash from the shoreline as well as from tidal inputs. The potential use of prescribed fire should be researched, as there is some evidence that it slows down subsidence and likely results in increased diversity of vegetation.

BEACHES AND DUNES						
	Scientific Name	Common Name	Focal Area	USFWS	State	NGO
B	<i>Calidris canutus rufa</i>	Red knot		O+		
ESTUARINE						
F	<i>Alosa aestivalis</i>	Blueback herring	Widespread			
B	<i>Laterallus jamaicensis</i>	Black Rail		O+	O+	O+
B	<i>Ammodramus maritimus macgillivraii</i>	MacGillivray's Seaside Sparrow		O	O+	O+
F	<i>Alosa pseudoharengus</i>	Alewife		O		
I	<i>Problema bulenta</i>	Rare Skipper		O+	O+	

**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Fire is a key management action to maintain these desired conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. Beyond fire, another important consideration is the maintenance, and possibly recreation, of appropriate hydrology.



## BOGS, FENS, SEEPS

	Scientific Name	Common Name	Ecological Systems	SRS	Ft. Stewart	USFS	USFWS	Other Fed.	State	NGO
I	<i>Somatochlora calverti</i>	Calvert's Emerald							P	
P	<i>Rudbeckia auriculata</i>	Eared coneflower						P		
P	<i>Balduina atropurpurea</i>	Purple balduina (Purple disk honeycombhead)	Coastal Plain Bogs		O+		P	O	O	O+
P	<i>Ludwigia ravenii</i>	Raven's seedbox				P		O		
P	<i>Eriocaulon koernickianum</i>	Small-headed pipewort							O	
P	<i>Ludwigia spathulata</i>	Spathulate seedbox		O					O	
P	<i>Sporobolus teretifolius</i>	Wireleaf dropseed	Coastal Plain Bogs		O+				O	O+

**Forested wetlands:** On mineral soils, mid-successional conditions are desired, and thinnings are needed to open the canopy and increase vertical and horizontal structure. The at-risk plants occurring on forested wetlands vary as to whether they require canopy openings or do well in shade, and this is a key consideration in the application of management actions, including minimizing disturbance. Habitats on organic soils, including baygalls and Atlantic white cedar, are considered to have more of a fire regime with a longer return time for disturbance

## FORESTED WETLANDS:

	Scientific Name	Common Name	Ecological Systems	SNF	SRS	Ft. Stewart	SGL	USFS	USFWS	Other Fed.	State	NGO
H	<i>Clemmys guttata</i>	Spotted Turtle	Mineral soils						O			
C	<i>Cambarus harti</i>	Piedmont blue burrower (local to Chattahoochee-Flint)	Mineral soils								P	
C	<i>Distocambarus youngineri</i>	Saluda crayfish (Newberry burrowing crayfish)	Mineral soils	P								
H	<i>Desmognathus auriculatus</i>	Southern Dusky Salamander	Mineral soils			O+						
I	<i>Ophiogomphus incurvatus</i>	Appalachian snaketail	Mineral soils		O							
I	<i>Gomphus septima</i>	Septima's clubtail	Mineral soils	P				O	P	P	O	
P	<i>Lindera subcoriacea</i>	Bog spicebush	Organic soils		O+		O+	O	O	O+	O+	O



## FORESTED WETLANDS:

	Scientific Name	Common Name	Ecological Systems	SNF	SRS	Ft. Stewart	SGL	USFS	USFWS	Other Fed.	State	NGO
P	<i>Lobelia boykinii</i>	Boykin's lobelia	Organic soils		O	O		O		O	O+	O
P	<i>Nuphar sagittifolia</i>	Cape Fear spatterdock or Yellow Pond lily	Mineral soils				O		O+	O	O	O
P	<i>Macbridea caroliniana</i>	Carolina birds-in-a-nest	Mineral soils		O+	O		O+		O+	O	
P	<i>Coreopsis integrifolia</i>	Ciliate-leaf tickseed	Mineral soils					P			O+	
P	<i>Rhynchospora crinipes</i>	Hairy-peduncled beaked-rush	Mineral soils							O+		
P	<i>Scutellaria ocmulgee</i>	Ocmulgee skullcap	Mineral soils						O	O+	O+	
P	<i>Ludwigia spathulata</i>	Spathulate seedbox	Mineral soils		O						O	
P	<i>Eupatorium paludicola</i>	Swamp justiceweed (Bay boneset)	Mineral soils						P	O		

**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.

## FRESHWATER AQUATIC

	Scientific Name	Common Name	Focal Area	SNF	CONF	SRS	SGL	USFS	USFWS	Other Fed.	State	NGO
MS	<i>Alasmodonta arcuata</i>	Altamaha arc-mussel	Altamaha-Ocumulgee						P			
P	<i>Isoetes microvela</i>	Thin-wall quillwort	Cape Fear								O	
C	<i>Orconectes virginianensis</i>	Chowanoke Crayfish	Chowan-Lower Roanoke						O+			
C	<i>Cambarus spicatus</i>	Broad River spiney crayfish (Little River Crayfish)	Piedmont	P							O+	
H	<i>Necturus lewisi</i>	Neuse River waterdog	Tar-Neuse					P		O	O	
F	<i>Elassoma boehlkei</i>	Carolina pygmy sunfish	Waccamaw						O+		O	
MS	<i>Lampsilis fullerkati</i>	Waccamaw fatmucket	Waccamaw								O+	





## FRESHWATER AQUATIC

	Scientific Name	Common Name	Focal Area	SNF	CONF	SRS	SGL	USFS	USFWS	Other Fed.	State	NGO
F	<i>Cyprinella xaenura</i>	Altamaha Shiner			O				O			
F	<i>Percina crypta</i>	Halloween darter	Chattahoochee-Flint							P		
F	<i>Pseudemys rubriventris</i>	Northern Red-bellied Cooter							O			
F	<i>Moxostoma robustum</i>	Robust Redhorse							O			
I	<i>Gomphus septima</i>	Septima's clubtail		P				O	P	P	O	
MS	<i>Fusconaia masoni</i>	Atlantic pigtoe						P	P		O	
MS	<i>Alasmidonta varicosa</i>	Brook floater		O+		O		O			O	
MS	<i>Elliptio fraterna</i>	Brother spike		P								
MS	<i>Lasmigona subviridis</i>	Green floater						P			O	
MS	<i>Toxolasma pullus</i>	Savannah lilliput				O		P	O		O	
MS	<i>Elliptio lanceolata</i>	Yellow lance									O	
P	<i>Nuphar sagittifolia</i>	Cape Fear spatterdock or Yellow Pond lily					O		O+	O	O	O
P	<i>Isoetes hyemalis</i>	Winter or Evergreen quillwort							P	O		



**Freshwater transitional:** This broad habitat type includes freshwater marshes, lake and pond shore habitats, and transitions between pine and wetlands (cypress dome and bogs). Woody encroachment, invasive species (including fire ants, hogs, and plant species), and a disrupted water table are key threats in these habitats. For lake and pond shores or transitional habitats, the desired conditions call for maintaining the continuity of open herbaceous-dominated conditions within the matrix of habitat types, as well as minimizing breaks that would disrupt hydrology or the effects of fire. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. For freshwater marshes, mechanical removal should be used to restore desired conditions, followed by prescribed fire to maintain those conditions.

FRESHWATER TRANSITIONAL										
	Scientific Name	Common Name	Ecological Systems	SRS	Ft. Stewart	USFS	USFWS	Other Fed.	State	NGO
B	<i>Laterallus jamaicensis</i>	Black Rail	Freshwater marshes				O+		O+	O+
P	<i>Lobelia boykinii</i>	Boykin's lobelia		O	O	O		O	O+	O
P	<i>Ptilimnium ahlesii</i>	Carolina bishopweed (Bishopweed)					O+			
P	<i>Croton elliotii</i>	Elliott's croton		O+						
P	<i>Minuartia godfreyi</i>	Godfrey's Stitchwort	Freshwater marshes			P				
P	<i>Ludwigia brevipes</i>	Long Beach seedbox					O		O	
P	<i>Ludwigia spathulata</i>	Spathulate seedbox		O					O	
P	<i>Eupatorium paludicola</i>	Swamp justiceweed (Bay boneset)					P	O		
P	<i>Rhynchospora thornei</i>	Thorne's beaked-rush						O	O	O



**Open pine woodlands:** These habitats include subgroups of flatwoods/savannas and sandhills/woodlands. Both of these groups require the maintenance of an open canopy with an herbaceous-dominated groundcover and minimal shrub and mid-story cover. Management through fire and forestry are important for restoring or preserving these conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. A range of forestry techniques are available to convert dense stands to a more open canopy where needed. Flatwoods and savannas have more of a hydrologic component to management, where it is important to maintain continuity and minimize obstructions.

## OPEN PINE WOODLANDS AND SAVANNAS

	Scientific Name	Common Name	Ecological Systems	Focal Area	SRS	Ft. Stewart	SGL	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Eurycea chamberlaini</i>	Chamberlain's dwarf salamander	Flatwoods and savannas	Widespread (NC,SC)									
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake	Woodlands and sandhills	Widespread					O+	O	O+		O+
H	<i>Gopherus polyphemus</i>	Gopher tortoise	Woodlands and sandhills	Widespread					O				
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake	Woodlands and sandhills		O	O+	O+	O	O	O	O		
H	<i>Lithobates capito</i>	Gopher Frog	Woodlands and sandhills		O+	O+	O	O+	O	O+	O		
H	<i>Ophisaurus mimicus</i>	Mimic Glass Lizard				P		O			P		
H	<i>Heterodon simus</i>	Southern Hognose Snake	Woodlands and sandhills		O	O	O+	O	O	O	O		
H	<i>Notophthalmus perstriatus</i>	Striped Newt	Woodlands and sandhills			O+					O+		
I	<i>Cordulegaster sayi</i>	Say's spiketail	Woodlands and sandhills			O+			P				
P	<i>Macbridea caroliniana</i>	Carolina birds-in-a-nest	Flatwoods and savannas		O+	O		O+		O+	O		
P	<i>Amorpha georgiana</i>	Georgia leadplant	Flatwoods and savannas				O+		O	O+	O+	O	
P	<i>Balduina atropurpurea</i>	Purple balduina (Purpledisk honeycombhead)	Flatwoods and savannas			O+			P	O	O		O+
P	<i>Sporobolus teretifolius</i>	Wireleaf dropseed	Flatwoods and savannas			O+					O		O+



**Shrub-scrub:** Substantial patches of open sand with connectivity between beaches and uplands are crucial. In locations with few open patches, prescribed fire and/or mechanical thinning may be necessary. Sandhills scrub is likely to require more aggressive fire or mechanical management than coastal scrub

## SHRUB-SCRUB

	Scientific Name	Common Name	SNF	SRS	Ft. Stewart	SGL	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake		O	O+	O+	O	O	O	O		
H	<i>Lithobates capito</i>	Gopher Frog		O+	O+	O	O+	O	O+	O		
H	<i>Heterodon simus</i>	Southern Hognose Snake		O	O	O+	O	O	O	O		
P	<i>Symphiotrichum georgianum</i>	Georgia Aster	O+				O		O+	O+	O	O
P	<i>Rudbeckia heliopsidis</i>	Sunfacing coneflower								O		

**Upland hardwoods and conifers:** In this region, this habitat grouping is primarily composed of southern mixed mesic hardwoods, with desired conditions of a patchwork of closed and open canopy. Where canopy opening is needed, managers should be cautious of effects on shade-dependent species. Invasive species control is another important component.

## UPLAND HARDWOODS AND CONIFERS

	Scientific Name	Common Name	Focal Area	SNF	SRS	Ft. Stewart	SGL	USFS	USFWS	Other Fed.	State
H	<i>Eurycea chamberlaini</i>	Chamberlain's dwarf salamander	Widespread (NC, SC)								
H	<i>Pituophis melanoleucus mugitus</i>	Florida Pine Snake			O	O+	O+	O	O	O	O
H	<i>Urselaperpes brucei</i>	Patch-nosed Salamander									O
M	<i>Myotis leibii</i>	Eastern Small-footed Myotis		O							
P	<i>Forestiera godfreyi</i>	Godfrey's privet							O		O+
P	<i>Carex impressinervia</i>	Impressed-nerved Sedge		P				O			O
P	<i>Scutellaria ocmulgee</i>	Ocmulgee skullcap							O	O+	O+
P	<i>Waldsteinia (Geum) lobata</i>	Piedmont barren strawberry								O+	O+



## Mississippi and North-Central Alabama

**Key protected areas:** Bankhead National Forest (BNF), Cahaba River National Wildlife Refuge (CRNWR), DeSoto National Forest (DNF), Grand Bay National Wildlife Refuge (GBNWR), Mississippi Sandhill Crane National Wildlife Refuge (MSCNWR), Talladega National Forest-Oakmulgee Ranger District (TNF)

**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Fire is a key management action to maintain these desired conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. Beyond fire, another important consideration is the maintenance, and possibly recreation, of appropriate hydrology.

BOGS, FENS, SEEPS														
	Scientific Name	Common Name	Ecological systems	Focal Area	DNF	GBNWR	MSCNWR	TNF	USFS	USFWS	Other Fed.	State	NGO	
P	<i>Hexastylis speciosa</i>	Harper's Heartleaf	Seeps	Tombigbee-Alabama Alluvial Plain				O						
C	<i>Fallicambarus burrisi</i>	Burrowing Bog Crayfish	Coastal plain bog	Southern Pine Hills		P						O		
C	<i>Fallicambarus danielae</i>	Speckled Burrowing Crayfish	Coastal plain bog	Southern Pine Hills	O	P	O					O		
P	<i>Sarracenia rubra ssp. wherryi</i>	Wherry's sweet pitcherplant	Coastal plain bog	Southern Pine Hills					O			O	O	
P	<i>Lindera subcoriacea</i>	Bog spicebush			O	P	P		O		O			
P	<i>Symphyotrichum puniceum var. scabriceale</i>	Rough-stemmed Aster							O	P	O	P		
P	<i>Rudbeckia heliopsisidis</i>	Sunfacing coneflower	Seepage wetland						O			O		
P	<i>Platanthera integrilabia</i>	White fringeless orchid	Mountain bogs, seepage wetland					O		O	O	O		





**Estuarine systems:** This habitat is threatened by sea level rise and shoreline armoring, as well as pollution and trash from the shoreline as well as from tidal inputs. The potential use of prescribed fire should be researched, as there is some evidence that it slows down subsidence and likely results in increased diversity of vegetation.

## ESTUARINE SYSTEMS

	Scientific Name	Common Name	Focal Area	GBNWR	MSCNWR	USFS	USFWS	Other Fed.	State
F	<i>Fundulus jenkinsi</i>	Saltmarsh topminnow	Southern Pine Hills	O	O		P	O	O
B	<i>Laterallus jamaicensis</i>	Black Rail		O	O				P
F	<i>Anguilla rostrata</i>	American eel				O	O	O+	

**Forested wetlands:** On mineral soils, mid-successional conditions are desired, and thinnings are needed to open the canopy and increase vertical and horizontal structure. The at-risk plants occurring on forested wetlands vary as to whether they require canopy openings or do well in shade, and this is a key consideration in the application of management actions, including minimizing disturbance. Habitats on organic soils, including baygalls and Atlantic white cedar, are considered to have more of a fire regime with a longer return time for disturbance.

## FORESTED WETLANDS (MINERAL SOILS)

	Scientific Name	Common Name	Focal Area	BNF	CRNWR	DNF	GBNWR	MSCNWR	TNF	USFS	USFWS	Other Fed.	State	Local	NGO
H	<i>Amphiuma pholeter</i>	One-Toed Amphiuma	West FL Panhandle			O	P	O		O					
H	<i>Desmognathus auriculatus</i>	Southern Dusky Salamander				O				P			P		
I	<i>Ophiogomphus incurvatus</i>	Appalachian snaketail			P				O+		P		O+	O+	
I	<i>Gomphus consanguis</i>	Cherokee clubtail									P			O+	
I	<i>Gomphus septima</i>	Septima's clubtail			O+										O+
P	<i>Lindera subcoriacea</i>	Bog spicebush				O	P	P		O		O			
P	<i>Lobelia boykinii</i>	Boykin's lobelia					O	P							
P	<i>Rhynchospora crinipes</i>	Hairy-peduncled beakrush				P		P		P		O			
P	<i>Thalictrum debile</i>	Southern meadowrue		O		P				O+	P	O+	P		



**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.

## FRESHWATER AQUATIC-RIVERS AND STREAMS, LAKES AND PONDS

	Scientific Name	Common Name	Focal Area	BNF	CRNWR	DNF	GBNWR	MSCNWR	TNF	USFS	USFWS	Other Fed.	State	Local	NGO
C	<i>Procambarus lagniappe</i>	Lagniappe Crayfish	Tombigbee-Alabama Alluvial Plain									P			
C	<i>Orconectes jonesi</i>	Sucarnoochee River Crayfish	Tombigbee-Alabama Alluvial Plain								P	P			
H	<i>Graptemys pulchra</i>	Alabama Map Turtle	Tombigbee-Alabama Alluvial Plain		O						O	P			
H	<i>Graptemys nigrinoda</i>	Black-knobbed Map Turtle	Tombigbee-Alabama Alluvial Plain		O						O	P			
F	<i>Percina sipsi</i>	Bankhead darter	Black Warrior Basin	O+											
F	<i>Etheostoma bellator</i>	Warrior darter	Black Warrior Basin	O+											
H	<i>Necturus alabamensis</i>	Black warrior waterdog	Black Warrior Basin	O											
F	<i>Noturus munitus</i>	Frecklebelly madtom			P				O		O	O+	O+		
C	<i>Cambarus unestami</i>	Blackbarred Crayfish	Lookout Plateau									O+	O+		
MS	<i>Pleurocera pyrenella</i>	Skirted Hornsnail	Lookout Plateau								P				
C	<i>Procambarus lylei</i>	Shutispear crayfish	N MS Delta							P		P			
C	<i>Hobbseus yalobushensis</i>	Yalobusha Riverlet Crayfish	N MS Delta									O			
C	<i>Orconectes hartfieldi</i>	Yazoo Crayfish	N MS Delta							P	P				
C	<i>Hobbseus cristatus</i>	Crested Riverlet Crayfish	Noxubee							P	O				
C	<i>Hobbseus petilus</i>	Tombigbee Rivulet Crayfish	Noxubee							P					
C	<i>Cambarus cracens</i>	Slenderclaw crayfish	Sand Mountain									P			
F	<i>Etheostoma tuscumbia</i>	Tuscumbia Darter	Southern Highland Rim								O+	O+		O+	



## FRESHWATER AQUATIC-RIVERS AND STREAMS, LAKES AND PONDS

	Scientific Name	Common Name	Focal Area	BNF	CRNWR	DNF	GBNWR	MSCNWR	TNF	USFS	USFWS	Other Fed.	State	Local	NGO
C	<i>Cambarellus lesliei</i>	Angular Dwarf Crayfish	Southern Pine Hills			P	O+	O+			P		O+		
H	<i>Graptemys gibbonsi</i>	Pascagoula Map Turtle	Southern Pine Hills			O+							O		
I	<i>Stylurus potulentus</i>	Yellow-sided Clubtail	West FL Panhandle			O	O	O		P					
P	<i>Nuphar lutea ssp. ulvacea</i>	West Florida Cow-lily	West FL Panhandle				P			P			O		
F	<i>Villosa nebulosa</i>	Alabama Rainbow		O+					O+						
F	<i>Anguilla rostrata</i>	American eel								O	O	O+			
F	<i>Percina brevicauda</i>	Coal darter			O+										
H	<i>Macrochelys temminickii</i>	Alligator Snapping Turtle			P	O	O	O		O	O	P	P		
H	<i>Cryptobranchus alleganiensis alleganiensis</i>	Eastern hellbender										O	O		
I	<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle													O+
I	<i>Lepidostoma morsei</i>	Morse's Little Plain Brown Sedge				P							P		
MS	<i>Elliptio arca</i>	Alabama Spike		O+	O								O+		
MS	<i>Elliptio arcata</i>	Delicate spike		O+	O+					O+			O+		
MS	<i>Pleurobema rubrum</i>	Pink pigtoe								O	O				
MS	<i>Toxolasma lividum</i>	Purple lilliput									O				
MS	<i>Quadrula cylindrica cylindrica</i>	Rabbitsfoot mussel											P		
MS	<i>Obovaria subrotunda</i>	Round Hickorynut								O					
MS	<i>Pleuronaia dolabelloides</i>	Slabside pearlymussel									O		P		
P	<i>Rhynchospora thornei</i>	Thorne's beaked-rush			P								P		P



**Open pine woodlands and savannas:** These habitats include subgroups of flatwoods/savannas and sandhills/woodlands. Both of these groups require the maintenance of an open canopy with an herbaceous-dominated groundcover and minimal shrub and mid-story cover. Management through fire and forestry are important for restoring or preserving these conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. A range of forestry techniques are available to convert dense stands to a more open canopy where needed. Flatwoods and savannas have more of a hydrologic component to management, where it is important to maintain continuity and minimize obstructions.

A unique habitat in this region is the Mississippi sandhill crane savanna, which formerly stretched from eastern Louisiana to the Apalachicola. Today it remains in patches mostly restricted to the area from southeast Louisiana to southwest Alabama. Characterized as nearly treeless savanna with occurrence of native trees, particularly longleaf pine, with a transition to little bluestem at its western extent. This habitat historically had a short fire return interval and is easily invaded by woody plants if a fire interval is missed. Therefore a combination of regular fire and invasive control is key to maintain desired conditions, as well as efforts to plug ditches and remove slash pine.

Shrub-scrub: Substantial patches of open sand with connectivity between beaches and uplands are crucial. In locations with few open patches, prescribed fire and/or mechanical thinning may be necessary. Sandhills scrub is likely to require more aggressive fire or mechanical management than coastal scrub.

OPEN PINE WOODLANDS AND SAVANNAS, GRASSLANDS, SCRUB-SHRUB															
	Scientific Name	Common Name	Ecological systems	Focal Area	BNF	CRNWR	DNF	GBNWR	MSCNWR	TNF	USFS	USFWS	Other Fed.	State	Local
C	<i>Procambarus barbiger</i>	Jackson Prairie crayfish	Tallgrass prairie	Jackson prairie							O+				
P	<i>Leavenworthia crassa</i>	Fleshy-fruit glade	Shrub-scrub	Southern Highland Rim	O+										
C	<i>Cambarellus diminutus</i>	Least Crayfish	Flatwoods and savannas, coastal savanna and wet prairie	Southern Pine Hills				O	O+					O+	
C	<i>Procambarus fitzpatricki</i>	Spinytail Crayfish	Flatwoods and savannas, coastal savanna and wet prairie	Southern Pine Hills			O+		O+						
H	<i>Pituophis melanoleucus lodingi</i>	Black pine snake	Woodlands and sandhills, maritime scrub	Southern Pine Hills			O						O	O	
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake					O							O	
H	<i>Lithobates capito</i>	Gopher Frog									O				
H	<i>Gopherus polyphemus</i>	Gopher tortoise					O							O	O
H	<i>Heterodon simus</i>	Southern Hognose Snake								P	O	P			
P	<i>Arabis georgiana</i>	Georgia rockcress	Shrub-scrub			O				P					



**Upland hardwoods and conifers:** In this region, this habitat grouping is primarily composed of southern mixed mesic hardwoods, with desired conditions of a patchwork of closed and open canopy. Where canopy opening is needed, managers should be cautious of effects on shade-dependent species. Invasive species control is another important component.

UPLAND HARDWOODS AND CONIFERS													
	Scientific Name	Common Name	Focal Area	BNF	CRNWR	DNF	TNF	USFS	USFWS	Other Fed.	State	Local	NGO
P	<i>Carex brysonii</i>	Bryson's sedge	Black Warrior Basin	O						O			
H	<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake				O					O		
H	<i>Gopherus polyphemus</i>	Gopher tortoise				O					O	O	
H	<i>Aneides aeneus</i>	Green Salamander		O					P	O	O		
P	<i>Carex impressinervia</i>	Impressed-nerved Sedge			P	O	P	O	P	O	O		P
P	<i>Thalictrum debile</i>	Southern meadowrue		O		P		O+	P	O+	P		





## Lower Mississippi Valley (Mississippi Alluvial Plain, West Gulf Coastal Plain)-Interior Highlands (Ozarks, Ouachitas)

Key protected areas: Mark Twain National Forest (MTNF), Ouachita National Forest (OuNF), Ozark-St. Francis National Forest (OzNF), (Though not identified during analysis of Key protected areas, the Kisatchie National Forest, and the National Forests in Texas are important locations for locally occurring species of the West Gulf Coastal Plain)

**Bogs, fens, seeps:** Woody encroachment and invasive species are the biggest threats to this habitat type, and therefore efforts should be directed to maintain open herbaceous, grass-dominated conditions surrounding bogs. Fire is a key management action to maintain these desired conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. Beyond fire, another important consideration is the maintenance, and possibly recreation, of appropriate hydrology.

BOGS, FENS, SEEPS										
	Scientific Name	Common Name	Ecological Systems	Focal Area	OuNF	USFS	USFWS	Other Fed.	State	NGO
C	<i>Fallicambarus strawni</i>	Saline Burrowing Crayfish	Coastal plain bog	West Gulf Coastal Plain s AR/n LA	P		P		O	
I	<i>Somatochlora margarita</i>	Texas Emerald	Coastal plain bog	West Gulf Coastal Plain c LA/e TX		O+	P	P	O	
P	<i>Symphyotrichum puniceum</i> var. <i>scabricaule</i>	Rough-stemmed Aster				P		P		
P	<i>Trillium texanum</i>	Texas Trillium	Bog and fen			O+		P		O

**Estuarine systems:** This habitat is threatened by sea level rise and shoreline armoring, as well as pollution and trash from the shoreline as well as from tidal inputs. The potential use of prescribed fire should be researched, as there is some evidence that it slows down subsidence and likely results in increased diversity of vegetation.

**Freshwater aquatic:** Maintaining the riparian buffer in streamside management zones is key for managing runoff and reducing the associated nutrients and sediments from upslope activities that reach surface waters. The riparian zone also regulates water temperature and is a source of woody debris, a factor in maintaining stream morphology and the desired sediment substrate. Any potential barriers, including culverts and road crossings should adhere to existing best management practices, and fish passage should remain unimpaired. Invasive species management is also an important consideration.



**Springs:** Protection against direct disturbance at spring sites, including through inappropriate public use (erosion), trash, and pollution, is key. Maintaining the quality of the aquifer is crucial, requiring the management of non-point source pollution (including agricultural runoff) and water withdrawals within the system. Good management of the surrounding terrestrial habitats and maintaining the natural vegetative cover is also an important consideration.

## ESTUARINE-BRACKISH AND SALT MARSHES

	Scientific Name	Common Name	Focal Area	MTNF	OuNF	OzNF	USFS	USFWS	Other Fed.	State	NGO
I	<i>Automeris louisiana</i>	Louisiana Eyed Silkmoth	Coastal prairies and marshes					O		O	

## FRESHWATER AQUATIC-RIVERS AND STREAMS

F	<i>Noturus taylori</i>	Caddo Madtom	Ouachita Mountains		O+				O		
F	<i>Noturus lachneri</i>	Ouachita Madtom	Ouachita Mountains		O+				O		
F	<i>Etheostoma pallidorsum</i>	Paleback Darter	Ouachita Mountains		O+						
F	<i>Notropis perpallidus</i>	Peppered Shiner	West Gulf Coastal Plain s AR/n LA		O+			O	O+		
F	<i>Notropis suttkusi</i>	Rocky Shiner	West Gulf Coastal Plain s AR/n LA		O+			O+			
C	<i>Orconectes eupunctus</i>	Coldwater Crayfish	Ozark Highlands	O+						P	
C	<i>Orconectes marchandi</i>	Mammoth Spring Crayfish	Ozark Highlands							O	
F	<i>Percina cymatotaenia</i>	Bluestripe Darter	Ozark Highlands	O+					O+		
F	<i>Erimystax harrisi</i>	Ozark chub	Ozark Highlands	O+		O+			O+		
F	<i>Notropis ozarcanus</i>	Ozark Shiner	Ozark Highlands	O+		O			O+		O+
MS	<i>Leptoxis arkansensis</i>	Arkansas Mudalia	Ozark Highlands	P		O			O+		
MS	<i>Marstonia ozarkensis</i>	Ozark Pyrg	Ozark Highlands							O+	
F	<i>Percina nasuta</i>	Longnose Darter	Ozarks-Ouachitas Highlands	O+	O+	O+		P	O+		
MS	<i>Cyprogenia aberti</i>	Western Fanshell	Ozarks-Ouachitas Highlands	O	O	P			O	O+	
C	<i>Orconectes maletae</i>	Kisatchie Painted Crayfish	West Gulf Coastal Plain c LA/e TX				O+		O+		
F	<i>Pteronotropis hubbsi</i>	Bluehead Shiner	West Gulf Coastal Plain s AR/n LA					O			
I	<i>Leuctra szczytkoi</i>	Louisiana Needlefly	West Gulf Coastal Plain c LA/e TX				O				
MS	<i>Pleurobema riddellii</i>	Louisiana Pigtoe					O+	O	O	O	
MS	<i>Potamilus amphichaenus</i>	Texas Heelsplitter					O	P			
MS	<i>Fusconaia askewi</i>	Texas Pigtoe					O+	P	P		



## ESTUARINE-BRACKISH AND SALT MARSHES

	Scientific Name	Common Name	Focal Area	MTNF	OuNF	OzNF	USFS	USFWS	Other Fed.	State	NGO
MS	<i>Fusconaia lananensis</i>	Triangle Pigtoe					O+	P			
H	<i>Macrochelys temminickii</i>	Alligator Snapping Turtle						O+			
H	<i>Cryptobranchus alleganiensis alleganiensis</i>	Eastern hellbender		O+							
MS	<i>Pleurobema rubrum</i>	Pink pigtoe						O		O+	
MS	<i>Toxolasma lividum</i>	Purple lilliput		O+				O	O		
H	<i>Eurycea tynerensis</i>	Oklahoma Salamander	Ozark Highlands	O+		O+		O+	O+		

**Forested wetlands:** On mineral soils, mid-successional conditions are desired, and thinings are needed to open the canopy and increase vertical and horizontal structure. The at-risk plants occurring on forested wetlands vary as to whether they require canopy openings or do well in shade, and this is a key consideration in the application of management actions, including minimizing disturbance. Low-elevation riparian woodlands—structurally and compositionally diverse forests along riversides that are subject to regular disturbance from flooding.

## FORESTED WETLANDS AND RIPARIAN

	Scientific Name	Common Name	Ecological systems	Focal Area	MTNF	OuNF	OzNF	USFWS	Other Fed.	State	NGO
P	<i>Physostegia correllii</i>	Correll's False Dragon-head	Riparian	Coastal prairies and marshes					O	O	
C	<i>Fallicambarus harpi</i>	Ouachita Burrowing Crayfish	Riparian	Ouachita Mountains		O					
C	<i>Procambarus reimeri</i>	Irons Fork Burrowing Crayfish	Riparian	Ouachita Mountains		O+				O	
I	<i>Amblyscirtes linda</i>	Linda's roadside-skipper	Riparian	Ozark Highlands	O				O	O	
I	<i>Somatochlora ozarkensis</i>	Ozark Emerald	Riparian	Ozarks-Ouachitas Highlands	P	O+	O	O+		O+	
P	<i>Helianthus occidentalis ssp. plantagineus</i>	Shinner's Sunflower	Riverscours/ riparian	West Gulf Coastal Plain c LA/e TX		O	P				
H	<i>Desmognathus auriculatus</i>	Southern Dusky Salamander	Mineral soils					P		O	O+
P	<i>Bartonia texana</i>	Texas Screwstem							P	P	P



## Grasslands:

**Prairie** restoration can begin by reintroducing dormant season fire. If this is not possible, another form of disturbance such as mowing during the winter-spring transition can be used. Any fire or mowing should be done in a variable and patchy distribution. Annual fire is appropriate during an initial restoration phase, but in intact habitat the return interval should be based on observations of a suite of native and non-native woody plants that require management. There should be an emphasis on growing season fire where appropriate, and prescribed fire may be supplemented with mechanical thinning and selective herbicide use.

GRASSLANDS								
	Scientific Name	Common Name	Ecological Systems	Focal Area	OuNF	OzNF	USFWS	State
C	<i>Procambarus regalis</i>	Regal Burrowing Crayfish	Tallgrass prairie	West Gulf Coastal Plain s AR/n LA			P	P
P	<i>Helianthus occidentalis ssp. plantagineus</i>	Shinner's Sunflower	Tallgrass prairie	West Gulf Coastal Plain c LA/e TX	O	P		
I	<i>Papaipema eryngii</i>	Rattlesnake Master Borer	Native prairie					O

**Open pine woodlands** require the maintenance of an open canopy with an herbaceous-dominated groundcover and minimal shrub and mid-story cover. Management through fire and forestry are important for restoring or preserving these conditions. Frequency and seasonality are important factors to consider when applying fire, and general recommendations are to emphasize growing season burning, maintain variability, and minimize fire breaks. While in the process of restoring a fire regime, surrogate treatments, including mechanical thinning and selective herbicide use, should be considered for use alongside fire. The restoration period may also require dormant season burning. A range of forestry techniques are available to convert dense stands to a more open canopy where needed.

PINE WOODLANDS								
	Scientific Name	Common Name	Ecological Systems	Focal Area	USFS	USFWS	Other Fed.	State
I	<i>Somatochlora margarita</i>	Texas Emerald	Longleaf pine woodland	West Gulf Coastal Plain c LA/e TX	O+	P	P	O
H	<i>Pituophis ruthveni</i>	Louisiana Pine snake	Longleaf pine woodland	West Gulf Coastal Plain c LA/e TX	O+		O	



## Upland hardwoods and montane conifers:

**Oak-hickory forest:** mix of various oak and hickory species, with soil types, moisture and elevation affecting composition. Subject to natural disturbances, including wind and fire events to open up the canopy and reduce the understory to allow for oak-hickory dominance. Lack of fire has allowed maples and other competing trees to prevent oak regeneration and resulted in denser forest than was historically present.

### UPLAND HARDWOODS AND MONTANE CONIFERS

	Scientific Name	Common Name	Ecological Systems	Focal Area	OuNF	OzNF	USFS	USFWS
H	<i>Plethodon caddoensis</i>	Caddo Mountain Salamander		Ouachita Mountains	O+			
H	<i>Plethodon fourchensis</i>	Fourche Mountain Salamander		Ouachita Mountains	O+			
P	<i>Helianthus occidentalis ssp. plantagineus</i>	Shinner's Sunflower	Oak savannas	West Gulf Coastal Plain c LA/e TX	O	P		
M	<i>Myotis leibii</i>	Eastern Small-footed Myotis						O
M	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis					O	





## Caribbean—Puerto Rico and U.S. Virgin Islands

**Freshwater:** In-stream modifications including barriers (e.g. dams and culverts), channelization, and modified shorelines, as well as pollution, siltation, water withdraws and unauthorized filling of wetlands are the dominant threats and stressors facing freshwater systems in Puerto Rico. All of Puerto Rico's native freshwater fish and shrimp are diadromous and require migrations to and from the sea; thus the collection of in-stream modifications are especially problematic by greatly limiting habitat. Management actions include barrier removals, addition of fish ladders/passages on barriers that cannot be removed, implementation of erosion control best practices and improved enforcement of water pollution regulations. Limit harvest of shrimps and gobies and create inland protected areas for migration and spawning.

### FRESHWATER

	Scientific Name	Common Name	Occurrences
F	<i>Anguilla rostrata</i>	American eel	None Reported
F	<i>Sicydium spp.</i>	Sirajo goby	None Reported

**Marine:** For the Caribbean marine species identified (Goliath Grouper and Queen Conch), sea grass beds, coral reefs (especially deep corals), and sand flats are the critical habitats. Importantly is connectivity among the various habitat types. Some of the biggest threats to all of the habitats include land-based sources of pollution including sedimentation and nutrients associated with deforestation, development, and agricultural. Over-fishing in general, as well as over-fishing of particular functional groups, for example predators and herbivores, resulting in trophic imbalances are leading stressors and threats. Suggested management activities include best practices that reduce land-based sources of pollution, especially sediments and nutrients (but also plastics and chemicals), as well as revised and enforced fishery regulations.

### MARINE

	Scientific Name	Common Name	Occurrences
F	<i>Epinephelus itajara</i>	Goliath grouper	None Reported
MS	<i>Lobatus gigas</i>	Queen conch	None Reported



**Estuaries:** This habitat is threatened by sea level rise and shoreline armoring, as well as pollution and trash from the shoreline as well as from tidal inputs. Protection and restoration of existing coastal wetlands is critical, as is implementation of best practices to reduce sediment, nutrient, plastic, and chemical pollution. Fishery harvest needs to be monitored and regulated in conjunction with users at the local estuary level.

ESTUARIES			
	Scientific Name	Common Name	Public Lands
B	<i>Laterallus jamaicensis jamaicensis</i>	Black Rail	Laguna Cartgena NWR (P), Vieques NWR (P)
F	<i>Epinephelus itajara</i>	Goliath grouper	None Reported

**Terrestrial Forests:** Puerto Rico is in the subtropical life zone and supports six different forest types (in order of abundance): subtropical moist (59%), subtropical wet (23.5%), subtropical dry (15.5%), lower montane wet (1.21%), subtropical rain (0.15%), and lower montane rain (0.13%). Forest composition and structure across these life zones are largely derived by their temperature and rainfall patterns. Extensive descriptions of each life can be found in Miller and Lugo (2009) and Ewel and Whitmore (1973) (among other sources). Development, including urbanization, industrial, and agricultural, which results in direct habitat loss as well as habitat fragmentation is the largest threat and stressor across most of the island and across the three dominant life zones (moist, wet, and dry forests). In contrast, climate change, including both temperature increases and changes in rainfall patterns is the greatest threat to the higher altitude (and rarest) life zones (lower wet montane, rain, and lower montane forests). Much of the karst region is forested and presently under protection, however, this does not include the coastal cliff areas of this region where the Harlequin Butterfly is found. Risk to its habitat include tropical storms and hurricanes that could alter habitat conditions (although storms might also create more favorable habitat, we require a better understanding of the butterflies habitat requirements). Non-natural threats to habitat may include coastal development and tourism. Major management actions include development and protection of corridors between and among protected areas, expansion of protected areas, and prevention and control of invasive species. Promoting sustainable development around protected areas and corridors is also sound policy.

TERRESTRIAL FORESTS				
	Scientific Name	Common Name	Ecological System	Occurrences
H	<i>Gonocalyx concolor</i>	No common name	Montane forest	Carite Commonwealth Forest (O+)
H	<i>Eleutherodactylus juanriveroi</i>	Plain Coqui/Llanero Coqui	FW wetlands	None Reported
P	<i>Varronia rupicola (Cordia rupicola)</i>	No common name	Dry Forest	None Reported
P	<i>Solanum conocarpum</i>	Marron bacora/Marron bacoba	Dry Forest	Virgin Islands NP (O+)
H	<i>Eleutherodactylus schwartzi</i>	Virgin Islands Coqui	Dry Forest	None Reported
I	<i>Atlantea tulita</i>	Puerto Rican Harlequin Butterfly	Coastal Forests	None Reported
B	<i>Catharus bicknelli</i>	Bicknell's Thrush	Wet forest	None Reported
B	<i>Pterodroma hasitata</i>	Black-capped Petrel		None Reported



## TERRESTRIAL FORESTS

	Scientific Name	Common Name	Ecological System	Occurrences
C	<i>Gecarcinus ruricola</i>	Purple Land Crab	Coastal Forests	
H	<i>Spondylurus magnacruzae</i>	Greater Saint Croix Skink	Coastal Forests	Green Cay NWR (O)
H	<i>Spondylurus nitidus</i>	Puerto Rican skink	Coastal Forests	Guajataca SF (O), Guanica SF (P)
H	<i>Spondylurus sloanii</i>	Virgin Islands bronze skink	Coastal Forests	Buck Island NWR (O+)
H	<i>Capitellum parvicruzae</i>	Lesser Saint Croix skink	Coastal Forests	None Reported
H	<i>Spondylurus semitaeniatus</i>	Lesser Virgin Islands skink	Coastal Forests	None Reported
H	<i>Spondylurus spilonotus</i>	Greater Virgin Islands skink	Coastal Forests	None Reported
B	<i>Dendroica angelae</i>	Elfin Woods Warbler	Montane forest	El Yunque NF (O+), Maricao SF (O+)

**Offshore Islands:** The smaller, largely uninhabited islands around Puerto Rico (and the US Virgin Islands) are home and critical habitat to several threatened, endangered, and at-risk species populations. The cays themselves are under threat of development and exploitation (largely focused on tourism), invasive species (especially rats, goats, mice, mongoose, cats, and dogs), sea level rise, and changing temperature and precipitation patterns. While a few individual cays, or isolated archipelagos have management plans, across the region there is a lack of coordinated management, especially in reference to invasive species and climate change. Development of a cross-agency management guidance plan would be the most effective means of assuring resource conservation across the network of cays, while at the site level eradication of plant and vertebrate invasive species is critical.

## OFFSHORE ISLANDS

	Scientific Name	Common Name	Ecological System	Public Lands
H	<i>Spondylurus monae</i>	Mona skink	Mona Island	None Reported
H	<i>Spondylurus monitae</i>	Monito skink	Monito Island	None Reported
H	<i>Spondylurus culebrae</i>	Culebra skink	Culebra and surrounding islands	Culebra NWR (O+)

**Caves:** there are over 2,000 caves throughout Puerto Rico that support several rare, endemic, and at-risk species. Caves are threatened by exploitation, e.g. tourism, and land use / hydrologic changes in adjacent lands. Limiting access and protection of terrestrial and riparian areas surrounding the caves are the recommended management practices.

## CAVES

	Scientific Name	Common Name	Public Lands
H	<i>Eleutherodactylus cooki</i>	Cave Coqui/Rock Frog/Demon of Puerto Rico/Guajon	None Reported



## Appendix II: Species not reported on protected areas

Sci. Name	Common Name	Taxon	Locally Occurring
<i>Eleutherodactylus cooki</i>	Cave Coqui/Rock Frog/Demon of Puerto Rico/ Guajon	Amphibian	Caribbean
<i>Eleutherodactylus jasperii</i>	Golden Coqui	Amphibian	Caribbean
<i>Eleutherodactylus juanriveroi</i>	Plain Coqui/Llanero Coqui	Amphibian	Caribbean
<i>Eleutherodactylus schwartzi</i>	Virgin Islands Coqui	Amphibian	Caribbean
<i>Pseudobranchius striatus lustricolus</i>	Gulf Hammock Dwarf Siren	Amphibian	Florida Gulf Hammock
<i>Gyrinophilus subterraneus</i>	West Virginia Spring Salamander	Amphibian	
<i>Catharus bicknelli</i>	Bicknell's Thrush	Bird	
<i>Pterodroma hasitata</i>	Black-capped Petrel	Bird	
<i>Procambarus latipleurum</i>	Wingtail crayfish	Crustacean	Apalachicola-eastern Florida Panhandle
<i>Procambarus lucifugus</i>	Florida Cave Crayfish	Crustacean	Brooksville Ridge caves and springs
<i>Cambarus chasmodactylus</i>	New River Crayfish	Crustacean	Central Ridge and Valley
<i>Lirceus culveri</i>	Rye Cove Isopod	Crustacean	Central Ridge and Valley
<i>Orconectes blacki</i>	Calcasieu Crayfish	Crustacean	Coastal Prairies and Marshes
<i>Orconectes incomptus</i>	Tennessee Cave Crayfish	Crustacean	Eastern Highland Rim
<i>Procambarus milleri</i>	Miami Cave Crayfish	Crustacean	Miami Ridge Rocklands
<i>Cambarus veteranus</i>	Guyandotte Crayfish	Crustacean	Northern Cumberland Plateau
<i>Procambarus pogum</i>	Bearded red crayfish	Crustacean	Noxubee
<i>Procambarus cometes</i>	Mississippi Flatwoods crayfish	Crustacean	Noxubee
<i>Hobbseus orconectoides</i>	Oktibbeha Riverlet Crayfish	Crustacean	Noxubee
<i>Orconectes sheltae</i>	Shelta Cave crayfish	Crustacean	Southern Highland Rim/ Middle Tennessee Valley
<i>Cambarus obeyensis</i>	Obey Crayfish	Crustacean	Upper East Gulf Coastal Plain
<i>Procambarus econfinae</i>	Panama City Florida crayfish	Crustacean	West Florida Panhandle and adjacent SE AL
<i>Bouchardina robisoni</i>	Bayou Bodcau Crayfish	Crustacean	West Gulf Coastal Plain
<i>Fallicambarus gilpini</i>	Jefferson County Crayfish	Crustacean	West Gulf Coastal Plain



Sci. Name	Common Name	Taxon	Locally Occurring
<i>Fallicambarus petilicarpus</i>	Slenderwrist Burrowing Crayfish	Crustacean	West Gulf Coastal Plain
<i>Caecidotea cannula</i>	A Cave Obligate (Cannulate) Isopod	Crustacean	
<i>Distocambarus devexus</i>	Broad River burrowing crayfish	Crustacean	
<i>Stygobromus cooperi</i>	Cooper's Cave Amphipod	Crustacean	
<i>Cambarus elkensis</i>	Elk River Crayfish	Crustacean	
<i>Cambarus nerterius</i>	Greenbrier Cave Crayfish	Crustacean	
<i>Cambarus strigosus</i>	Lean crayfish	Crustacean	
<i>Distocambarus carlsoni</i>	Mimic crayfish	Crustacean	
<i>Stygobromus parvus</i>	Minute Cave Amphipod	Crustacean	
<i>Procambarus morrissi</i>	Putnam County Cave Crayfish	Crustacean	
<i>Etheostoma forbesi</i>	Barrens Darter	Fish	Eastern Highland Rim
<i>Thoburnia atripinnis</i>	Blackfin Sucker	Fish	Pennyroyal Plateau and Shawnee Hills
<i>Etheostoma tecumsehi</i>	Shawnee Darter	Fish	Pennyroyal Plateau and Shawnee Hills
<i>Noturus furiosus</i>	Carolina madtom	Fish	Tar-Neuse
<i>Etheostoma pseudovulatum</i>	Egg-mimic Darter	Fish	Western Highland Rim (Lower Duck)
<i>Noturus fasciatus</i>	Saddled Madtom	Fish	Western Highland Rim (Lower Duck)
<i>Etheostoma osburni</i>	Candy Darter	Fish	
<i>Crytallaria asprella</i>	Crystal Darter	Fish	
<i>Epinephelus itajara</i>	Goliath grouper	Fish	
<i>Percina macrocephala</i>	Longhead Darter	Fish	
<i>Noturus gilberti</i>	Orange-fin madtom	Fish	
<i>Agarodes logani</i>	Logan's agarodes caddisfly	Insect	Apalachicola-eastern Florida Panhandle
<i>Hydroptila sykorae</i>	Sykora's hydroptila caddisfly	Insect	Apalachicola-eastern Florida Panhandle
<i>Psuedanophthalmus caecus</i>	Clifton cave beetle	Insect	Bluegrass-Kentucky Knobs
<i>Psuedanophthalmus troglodytes</i>	Louisville cave beetle	Insect	Bluegrass-Kentucky Knobs
<i>Psuedanophthalmus parvus</i>	Tatum cave beetle	Insect	Bluegrass-Kentucky Knobs
<i>Atlantea tulita</i>	Puerto Rican Harlequin Butterfly	Insect	Caribbean
<i>Psuedanophthalmus insularis</i>	Baker Station cave beetle	Insect	Central Basin
<i>Psuedanophthalmus tirsias</i>	Indian Grave Point cave beetle	Insect	Central Basin
<i>Psuedanophthalmus paulus</i>	Nobletts cave beetle	Insect	Central Ridge and Valley



Sci. Name	Common Name	Taxon	Locally Occurring
<i>Pseudanophthalmus sanctipauli</i>	Saint Paul Cave Beetle	Insect	Central Ridge and Valley
<i>Allocaenia brooksii</i>	Sevier snowfly	Insect	Central Ridge and Valley
<i>Pseudanophthalmus sericus</i>	Silken Cave Beetle	Insect	Central Ridge and Valley
<i>Pseudanophthalmus thomasi</i>	Thomas's Cave Beetle	Insect	Central Ridge and Valley
<i>Pseudanophthalmus fowlerae</i>	Fowler's cave beetle	Insect	Eastern Highland Rim
<i>Pseudanophthalmus inquisitor</i>	Inquirer cave beetle	Insect	Eastern Highland Rim
<i>Pseudanophthalmus frigidus</i>	Icebox cave beetle	Insect	Northern Cumberland Plateau
<i>Glyphopsyche sequatchie</i>	Sequatchie caddisfly	Insect	Northern Cumberland Plateau
<i>Pseudanophthalmus avernus</i>	Avernus Cave Beetle	Insect	
<i>Pseudanophthalmus intersectus</i>	Crossroad's Cave Beetle	Insect	
<i>Pseudanophthalmus montanus</i>	Dry Fork Valley Cave Beetle	Insect	
<i>Pseudanophthalmus hubbardi</i>	Hubbard's Cave Beetle	Insect	
<i>Pseudanophthalmus hubrichti</i>	Hubricht's Cave Beetle	Insect	
<i>Allocaenia cunninghami</i>	Karst snowfly	Insect	
<i>Pseudanophthalmus limicola</i>	Madden's Cave Beetle	Insect	
<i>Pseudanophthalmus pontis</i>	Natural Bridge Cave Beetle	Insect	
<i>Pseudanophthalmus egberti</i>	New River Valley Cave Beetle	Insect	
<i>Pseudanophthalmus potomacus (potomaca)</i>	South Branch Valley Cave Beetle	Insect	
<i>Triaenodes tridontus</i>	Three-toothed Triaenodes Caddisfly	Insect	
<i>Pyganodon gibbosa</i>	Inflated floater	Mussel	Altamaha-Ocumulgee
<i>Elliptio purpurella</i>	Inflated Spike	Mussel	Apalachicola-eastern Florida Panhandle
<i>Pleurobema athearni</i>	Canoe Creek pigtoe	Mussel	Lower Coosa
<i>Quadrula asperata archeri</i>	Tallapoosa orb	Mussel	Tallapoosa
<i>Villosa choctawensis</i>	Choctaw bean	Mussel	West Florida Panhandle and adjacent SE AL
<i>Fusconaia escambia</i>	Narrow pigtoe	Mussel	West Florida Panhandle and adjacent SE AL
<i>Ptychobranhus jonesi</i>	Southern kidneyshell	Mussel	West Florida Panhandle and adjacent SE AL
<i>Obovaria unicolor</i>	Alabama hickorynut	Mussel	
<i>Lampsilis raphinesqueana</i>	Neosho mucket	Mussel	Ozark Highlands
<i>Harrisia aboriginum</i>	Aboriginal prickly-apple	Plant	Charlotte Harbor
<i>Linum carteri var. carteri</i>	Carters small-flowered flax	Plant	Miami Ridge Rocklands





Sci. Name	Common Name	Taxon	Locally Occurring
<i>Sideroxylon reclinatum</i> ssp. <i>Austrofloridens</i>	Everglades bully	Plant	Miami Ridge Rocklands
<i>Brickellia mosieri</i>	Florida brickell-bush	Plant	Miami Ridge Rocklands
<i>Trichomanes punctatum</i> ssp. <i>floridanum</i>	Florida bristle fern	Plant	Miami Ridge Rocklands
<i>Dalea carthagenensis</i> var. <i>floridana</i>	Florida prairie clover	Plant	Miami Ridge Rocklands
<i>Helianthus verticillatus</i>	Whorled sunflower	Plant	Upper Coosa Ridge and Valley
<i>Fissidens hallii</i>	Hall's pocket moss	Plant	
<i>Dichanthelium hirstii</i>	Hirst Brothers' Panic Grass	Plant	
<i>Calamovilfa arcuata</i>	Rivergrass	Plant	
<i>Alnus maritima</i> ( <i>Alnus maritima</i> ssp. <i>georgiensis</i> )	Seaside alder (Georgia Alder subspecies)	Plant	
<i>Varronia rupicola</i> ( <i>Cordia rupicola</i> )	Varronia rupicola ( <i>Cordia rupicola</i> )	Plant	
<i>Spondylurus spilonotus</i>	Greater Virgin Islands skink	Reptile	Caribbean
<i>Capitellum parvicruzae</i>	Lesser Saint Croix skink	Reptile	Caribbean
<i>Spondylurus semitaeniatus</i>	Lesser Virgin Islands skink	Reptile	Caribbean
<i>Spondylurus monae</i>	Mona skink	Reptile	Caribbean
<i>Spondylurus monitae</i>	Monito skink	Reptile	Caribbean
<i>Clonophis kirtlandii</i>	Kirtland's Snake	Reptile	
<i>Marstonia agarhecta</i>	Ocmulgee marstonia	Snail	Altamaha-Ocumulgee
<i>Marstonia castor</i>	Beaverspond (Beaverpond) marstonia	Snail	Apalachicola-eastern Florida Panhandle
<i>Elimia melanoides</i>	Black mudalia	Snail	Black Warrior Basin
<i>Elimia showalteri</i>	Compact elimia	Snail	Cahaba
<i>Strombus gigas</i>	Queen conch	Snail	Caribbean
<i>Elimia arachnoidea</i>	Spider Elimia	Snail	Central Ridge and Valley
<i>Io fluvialis</i>	Spiny Riversnail	Snail	Central Ridge and Valley
<i>Elimia vanuxemiana</i>	Cobble elimia	Snail	Lower Coosa
<i>Elimia alabamensis</i>	Mud Elimia	Snail	Lower Coosa
<i>Elimia lachryma</i>	Nodulose Coosa River snail	Snail	Lower Coosa
<i>Elimia chiltonensis</i>	Prune elimia	Snail	Lower Coosa
<i>Elimia bellula</i>	Walnut elimia	Snail	Lower Coosa
<i>Aphaostracon theiocrenetum</i>	Clifton Spring Hydrobe Snail	Snail	Ocala Ridges and Hills
<i>Aphaostracon chalarogyrus</i>	Freemouth Hydrobe Snail	Snail	Ocala Ridges and Hills



Sci. Name	Common Name	Taxon	Locally Occurring
<i>Floridobia ponderosa</i>	Ponderosa (Ponderous) Siltsnail	Snail	Ocala Ridges and Hills
<i>Floridobia parva</i>	Pygmy Siltsnail	Snail	Ocala Ridges and Hills
<i>Floridobia wekiwae</i>	Wekiwa Siltsnail	Snail	Ocala Ridges and Hills
<i>Elimia acuta</i>	Acute Elimia	Snail	Southern Highland Rim/ Middle Tennessee Valley
<i>Leptoxis picta</i>	Spotted Rocksnail	Snail	Tombigbee/Alabama Alluvial Plain
<i>Lithasia curta</i>	Knobby Rocksnail	Snail	Western Highland Rim
<i>Rhodacmea elatior</i>	Domed Ancyloid	Snail	
<i>Somatogyrus alcoviensis</i>	Reverse pebblesnail	Snail	



## Appendix III: Species that have been withdrawn from petitions

Species that have had petitions withdrawn due to updated information on population status and occurrences.

Scientific Name	Common Name	Taxon
<i>Amphiuma pholeter</i>	One-Toed Amphiuma	Amphibian
<i>Desmognathus aeneus</i>	Seepage salamander	Amphibian
<i>Problema bulenta</i>	Rare Skipper	Butterfly
<i>Cambarus unestami</i>	Blackbarred Crayfish	Crayfish
<i>Fallicambarus burrisi</i>	Burrowing Bog Crayfish	Crayfish
<i>Cambarus scotti</i>	Chattooga River Crayfish	Crayfish
<i>Fallicambarus hortonii</i>	Hatchie Burrowing Crayfish	Crayfish
<i>Procambarus lagniappe</i>	Lagniappe Crayfish	Crayfish
<i>Cambarellus diminutus</i>	Least Crayfish	Crayfish
<i>Cambarus chasmodactylus</i>	New River Crayfish	Crayfish
<i>Fallicambarus strawni</i>	Saline Burrowing Crayfish	Crayfish
<i>Orconectes jonesi</i>	Sucarnoochee River Crayfish	Crayfish
<i>Cordulegaster sayi</i>	Say's spiketail	Dragonfly
<i>Cyprinella xaenura</i>	Altamaha Shiner	Fish
<i>Pteronotropis hubbsi</i>	Bluehead Shiner	Fish
<i>Cyprinella callitaenia</i>	Bluestripe shiner	Fish
<i>Pteronotropis euryzonus</i>	Broadstripe Shiner	Fish
<i>Etheostoma pseudovulatum</i>	Egg-mimic Darter	Fish
<i>Noturus lachneri</i>	Ouachita Madtom	Fish
<i>Noturus fasciatus</i>	Saddled Madtom	Fish
<i>Etheostoma bellator</i>	Warrior darter	Fish
<i>Alasmodonta arcuata</i>	Altamaha arc-mussel	Mussel
<i>Anodonta heardi</i>	Apalachicola floater	Mussel
<i>Pyganodon gibbosa</i>	Inflated floater	Mussel



Scientific Name	Common Name	Taxon
<i>Toxolasma pullus</i>	Savannah lilliput	Mussel
<i>Pleurobema rubellum</i>	Warrior pigtoe	Mussel
<i>Megaceros aenigmaticus</i>	Hornwort	Non-Vascular Plant
<i>Plagiochila caduciloba</i>	Gorge leafy liverwort	Non-Vascular Plant
<i>Plagiochila sharpii</i> ssp. <i>sharpii</i>	Sharp's Leafy Liverwort	Non-Vascular Plant
<i>Kinosternon baurii</i> pop. 1	Striped Mud Turtle - Lower FL Keys	Reptile
<i>Elimia vanuxemiana</i>	Cobble Elimia	Snail
<i>Elimia showalteri</i>	Compact Elimia	Snail
<i>Lithasia duttoniana</i>	Helmet Rocksnail	Snail
<i>Elimia alabamensis</i>	Mud Elimia	Snail
<i>Pleurocera curta</i>	Shortspire Hornsnail	Snail
<i>Leptoxis virgata</i>	Smooth Rocksnail (aka Mudalia)	Snail
<i>Elimia olivula</i>	Caper Elimia	Snail
<i>Elimia ampla</i>	Ample Elimia	Snail
<i>Nyssa ursina</i>	Bear Tupelo or Dwarf Blackgum	Vascular Plant
<i>Elytraria caroliniensis</i> var. <i>angustifolia</i>	Narrowleaf Carolina Scalystem	Vascular Plant
<i>Waldsteinia (Geum) lobata</i>	Piedmont barren strawberry	Vascular Plant
<i>Calamovilfa arcuata</i>	Rivergrass	Vascular Plant
<i>Solidago arenicola</i>	Southern Racemose Goldenrod	Vascular Plant
<i>Arnoglossum diversifolium</i>	Variable-leaved (Variableleaf) Indian-Plantain	Vascular Plant
<i>Nuphar lutea</i> ssp. <i>ulvacea</i>	West Florida Cow-lily	Vascular Plant



## Appendix IV: Species that may be eligible for withdrawal from petitions

Species suggested by experts during workshops as likely being secure and could be considered for petition withdrawal.

Scientific Name	Common Name	Taxon
<i>Eurycea tynerensis</i>	Oklahoma Salamander	Amphibian
<i>Oecetis parva</i>	Little Oecetis Longhorn Caddisfly	Caddisfly
<i>Orconectes virginienis</i>	Chowanoke Crayfish	Crayfish
<i>Ophiogomphus australis</i>	Southern Snaketail	Dragonfly
<i>Gomphus westfalli</i>	Westfall's Clubtail	Dragonfly
<i>Erimystax harrisi</i>	Ozark chub	Fish
<i>Notropis ozarcanus</i>	Ozark Shiner	Fish
<i>Fundulus jenkinsi</i>	Saltmarsh topminnow	Fish
<i>Toxolasma lividum</i>	Purple lilliput	Mussel
<i>Anodontoidea radiatus</i>	Rayed creekshell	Mussel
<i>Elliptio ahenea</i>	Southern Lance	Mussel
<i>Pseudemys rubriventris</i>	Northern Red-bellied Cooter	Reptile
<i>Lobelia boykinii</i>	Boykin's lobelia	Vascular Plant
<i>Croton elliotii</i>	Elliott's croton	Vascular Plant
<i>Amorpha georgiana</i>	Georgia leadplant	Vascular Plant
<i>Thalictrum debile</i>	Southern meadowrue	Vascular Plant
<i>Ludwigia spathulata</i>	Spathulate seedbox	Vascular Plant
<i>Sporobolus teretifolius</i>	Wireleaf dropseed	Vascular Plant



## Appendix V: Southeastern Partners in Plant Conservation 2016

### Prioritization of Taxa from designated Geographic Areas by Assigned Category of Need

PRIORITIZATION OF TAXA FROM DESIGNATED GEOGRAPHIC AREAS BY ASSIGNED CATEGORY OF NEED									
Geographic Area	Category of Need								
	Land Acquisition	Fire or Land Management	Water or Hydrology	Seed Banking or Horticulture	Augmentation or Reintroduction	Cooperative Planning and Networking	Reproductive Biology	Surveys Needed	Genetics or Taxonomy
Florida Panhandle, Southeast Alabama, and Southwest Georgia	<i>Dichanthelium hirstii</i>	<i>Lindera subcoriacea</i>	<i>Croton elliotii</i>	<i>Arnoglossum diversifolium</i>	<i>Balduinia atropurpurea</i>	<i>Dichanthelium hirstii</i>	<i>Hartwrightia floridana</i>	<i>Baptisiamegacarpa</i>	<i>Dichanthelium hirstii</i>
	<i>Hartwrightia floridana</i>	<i>Lobelia boykinii</i>	<i>Dichanthelium hirstii</i>	<i>Dichanthium hirstii</i>	<i>Hartwrightia floridana</i>	<i>Eriocaulon nigrobacteatum</i>	<i>Lindera subcoriacea</i>	<i>Dichanthelium hirstii</i>	<i>Hymenocallis henryae</i>
	<i>Macbridea carolinina</i>	<i>Rhexia parviflora</i>	<i>Lindera subcoriacea</i>	<i>Hartwrightia floridana</i>	<i>Macbridea caroliniana</i>	<i>Lilium iridollae</i>	<i>Lobelia boykinii</i>	<i>Hartwrightia floridana</i>	<i>Lilium iridollae</i>
	<i>Sarracenia alabamensis</i> var. <i>wherryi</i>	<i>Salix floridana</i>	<i>Lobelia boykinii</i>	<i>Lindera subcoriacea</i>	<i>Sarracenia alabamensis</i> var. <i>wherryi</i>	<i>Najas filifolia</i>	<i>Potamogeton floridanus</i>	<i>Lindera subcoriacea</i>	<i>Nyssa ursina</i>
	<i>Sarracenia rubra</i> ssp. <i>gulfensis</i>	<i>Sarracenia alabamensis</i> var. <i>wherryi</i>	<i>Rudbeckia auriculata</i>	<i>Sarracenia alabamensis</i> var. <i>wherryi</i>	<i>Sarracenia rubra</i> ssp. <i>gulfensis</i>	<i>Sarracenia rubra</i> ssp. <i>gulfensis</i>		<i>Lobelia boykinii</i>	<i>Sarracenia rubra</i> ssp. <i>gulfensis</i>
			<i>Salix floridana</i>	<i>Sarracenia rubra</i> ssp. <i>gulfensis</i>					
			<i>Sarracenia alabamensis</i> var. <i>wherryi</i>						
			<i>Sarracenia rubra</i> ssp. <i>gulfensis</i>						





## PRIORITIZATION OF TAXA FROM DESIGNATED GEOGRAPHIC AREAS BY ASSIGNED CATEGORY OF NEED

Geographic Area	Category of Need								
	Land Acquisition	Fire or Land Management	Water or Hydrology	Seed Banking or Horticulture	Augmentation or Reintroduction	Cooperative Planning and Networking	Reproductive Biology	Surveys Needed	Genetics or Taxonomy
Peninsular Florida and Caribbean	<i>Hartwrightia floridana</i>	<i>Aeschynomene pratensis</i>	<i>Aeschynomene pratensis</i>	<i>Aeschynomene pratensis</i>	<i>Encyclia cochleata</i> var. <i>triandra</i>	<i>Elytraria caroliniensis</i> var. <i>angustifolia</i>	<i>Epidendrum strobiliferum</i>	<i>Aeschynomene pratensis</i>	<i>Encyclia cochleata</i> var. <i>triandra</i>
	<i>Hypericum edisonianum</i>	<i>Elytraria caroliniensis</i> var. <i>angustifolia</i>	<i>Hypericum edisonianum</i>	<i>Epidendrum strobiliferum</i>	<i>Najas filifolia</i>	<i>Hartwrightia floridana</i>	<i>Lythrum flagellare</i>	<i>Encyclia cochleata</i> var. <i>triandra</i>	<i>Epidendrum strobiliferum</i>
	<i>Illicium parviflorum</i>	<i>Hartwrightia floridana</i>	<i>Illicium parviflorum</i>	<i>Hartwrightia floridana</i>	<i>Oncidium undulatum</i>	<i>Hypericum edisonianum</i>	<i>Najas filifolia</i>	<i>Hartwrightia floridana</i>	<i>Hypericum edisonianum</i>
	<i>Najas filifolia</i>	<i>Hypericum edisonianum</i>	<i>Najas filifolia</i>	<i>Hypericum edisonianum</i>	<i>Salix floridana</i>	<i>Illicium parviflorum</i>	<i>Oncidium undulatum</i>	<i>Hypericum edisonianum</i>	<i>Najas filifolia</i>
	<i>Salix floridana</i>	<i>Lythrum flagellare</i>	<i>Vicia ocalensis</i>	<i>Najas filifolia</i>	<i>Vicia ocalensis</i>	<i>Vicia ocalensis</i>	<i>Vicia ocalensis</i>	<i>Illicium parviflorum</i>	<i>Oncidium undulatum</i>
	<i>Vicia ocalensis</i>			<i>Oncidium undulatum</i>				<i>Najas filifolia</i>	
				<i>Vicia ocalensis</i>				<i>Vicia ocalensis</i>	



## PRIORITIZATION OF TAXA FROM DESIGNATED GEOGRAPHIC AREAS BY ASSIGNED CATEGORY OF NEED

Geographic Area	Category of Need								
	Land Acquisition	Fire or Land Management	Water or Hydrology	Seed Banking or Horticulture	Augmentation or Reintroduction	Cooperative Planning and Networking	Reproductive Biology	Surveys Needed	Genetics or Taxonomy
Southern Blue Ridge, Ridge and Valley, Interior Low and Cumberland Plateaus	<i>Arenaria fontinalis</i>	<i>Arenaria fontinalis</i>	<i>Fimbristylis perpusilla</i>	<i>Arenaria fontinalis</i>	<i>Arenaria fontinalis</i>	<i>Minuartia godfreyi</i>	<i>Arenaria fontinalis</i>	<i>Arenaria fontinalis</i>	<i>Fimbristylis perpusilla</i>
	<i>Fimbristylis perpusilla</i>	<i>Minuartia godfreyi</i>	<i>Fissidens appalachensis</i>	<i>Minuartia godfreyi</i>	<i>Fimbristylis perpusilla</i>	<i>Potamogeton tennesseensis</i>	<i>Marshallia grandiflora</i>	<i>Calamovilfa arcuata</i>	<i>Fissidens appalachensis</i>
	<i>Minuartia godfreyi</i>	<i>Rudbeckia heliopsisidis</i>	<i>Minuartia godfreyi</i>	<i>Potamogeton tennesseensis</i>	<i>Minuartia godfreyi</i>	<i>Rudbeckia heliopsisidis</i>	<i>Minuartia godfreyi</i>	<i>Marshallia grandiflora</i>	<i>Minuartia godfreyi</i>
	<i>Rudbeckia heliopsisidis</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Potamogeton tennesseensis</i>	<i>Rudbeckia heliopsisidis</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Potamogeton tennesseensis</i>	<i>Minuartia godfreyi</i>	<i>Potamogeton tennesseensis</i>
	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Tsuga caoliniana</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Schenoplectis hallii</i>	<i>Tsuga carolina</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>	<i>Solidago arenicola</i>	<i>Sarracenia purpurea</i> var. <i>montana</i>
	<i>Schenoplectus hallii</i>		<i>Schenoplectus hallii</i>						
Mississippi and North-Central Alabama	<i>Calamovilfa arcuata</i>	<i>Lindera subcoriacea</i>	<i>Calamovilfa arcuata</i>	<i>Lindera coriacea</i>	<i>Lobelia boykinii</i>	<i>Lindera coriacea</i>	<i>Carex brysonii</i>	<i>Carex brysonii</i>	<i>Nuphar lutea</i> ssp. <i>ulvacea</i>
	<i>Lindera subcoriacea</i>	<i>Rhynchospora thornei</i>	<i>Lobelia boykinii</i>	<i>Sarracenia rubra</i> var. <i>wherryi</i>		<i>Rhynchospora crinipes</i>	<i>Carex impressinerva</i>	<i>Carex impressinerva</i>	<i>Sarracenia rubra</i> var. <i>wherryi</i>
	<i>Lobelia boykinii</i>	<i>Rudbeckia auriculata</i>	<i>Nuphar lutea</i> ssp. <i>ulvacea</i>	<i>Waldsteinia lobata</i>		<i>Rudbeckia auriculata</i>		<i>Lindera subcoriacea</i>	<i>Symphyotrichum puniceum</i> var. <i>scabricaula</i>
	<i>Sarracenia rubra</i> var. <i>wherryi</i>	<i>Rudbeckia heliopsisidis</i>	<i>Rhynchospora crinipes</i>			<i>Rudbeckia heliopsisidis</i>		<i>Rhynchospora crinipes</i>	
	<i>Waldsteinia lobata</i>	<i>Sarracenia rubra</i> var. <i>wherryi</i>	<i>Solidago arenicola</i>			<i>Sarracenia rubra</i> var. <i>wherryi</i>		<i>Rhynchospora thornei</i>	



## PRIORITIZATION OF TAXA FROM DESIGNATED GEOGRAPHIC AREAS BY ASSIGNED CATEGORY OF NEED

Geographic Area	Category of Need								
	Land Acquisition	Fire or Land Management	Water or Hydrology	Seed Banking or Horticulture	Augmentation or Reintroduction	Cooperative Planning and Networking	Reproductive Biology	Surveys Needed	Genetics or Taxonomy
Piedmont and Coastal Plain of Georgia, North and South Carolina	<i>Amorpha georgiana</i>	<i>Balduina atropurpurea</i>	<i>Lindera subcoriacea</i>	<i>Amorpha georgiana</i>	<i>Amorpha georgiana</i>	<i>Amorpha georgiana</i>	<i>Fimbristylis perpusilla</i>	<i>Aeschynomene virginica</i>	<i>Alnum maritima ssp. georgiensis</i>
	<i>Balduina atropurpurea</i>	<i>Dichanthelium hirstii</i>	<i>Lobelia boykinii</i>	<i>Balduina atripurpurea</i>	<i>Lindera subcoriacea</i>	<i>Dichanthelium hirstii</i>	<i>Lobelia boykinii</i>	<i>Amorpha georgiana</i>	<i>Dichanthelium hirstii</i>
	<i>Dichanthelium hirstii</i>	<i>Lobelia boykinii</i>		<i>Coreopsis integrifolia</i>	<i>Ptilimnium ahlesii</i>	<i>Scutellaria ocmulgee</i>	<i>Macbridea caroliniana</i>	<i>Arnoglossum diversifolium</i>	<i>Eriocaulon koernickanum</i>
	<i>Lindera subcoriacea</i>	<i>Rudbeckia auriculata</i>		<i>Dichanthelium hirstii</i>	<i>Rudbeckia auriculata</i>	<i>Symphyotrichum georgianum</i>		<i>Lindera subcoriacea</i>	<i>Ptilimnium ahlesii</i>
	<i>Lobelia boykinii</i>	<i>Symphyotrichum georgianum</i>		<i>Lindera subcoriacea</i>	<i>Rudbeckia heliopsisidis</i>			<i>Lobelia boykinii</i>	
				<i>Rudbeckia auriculata</i>				<i>Sporobolus teretifolius</i>	
Lower Mississippi Valley-Ozarks	<i>Bartonia texana</i>	<i>Helianthus occidentalis</i>	<i>Bartonia texana</i>	<i>Physostegia correllii</i>	<i>Physostegia correllii</i>	<i>Bartonia texana</i>	<i>Bartonia texana</i>	<i>Bartonia texana</i>	<i>Bartonia texana</i>
	<i>Helianthus occidentalis</i>	<i>Physostegia correllii</i>	<i>Symphyotrichum puniceum</i> var. <i>scabricaule</i>			<i>Physostegia correllii</i>	<i>Physostegia correllii</i>	<i>Physostegia correllii</i>	<i>Helianthus occidentalis</i>
	<i>Trillium texanum</i>	<i>Symphyotrichum puniceum</i> var. <i>scabricaule</i>	<i>Trillium texanum</i>			<i>Symphyotrichum puniceum</i> var. <i>scabricaule</i>	<i>Trillium texana</i>	<i>Trillium texana</i>	<i>Symphyotrichum puniceum</i> var. <i>scabricaule</i>



### SePPCon attendee affiliations

Organization Type	Count
Arboretum	2
Botanical Garden	28
County government	2
Independent	10
Landscape Conservation Cooperative	2
Museum	2
National Park	2
National Wildlife Refuge	4
Nature Center	3
NatureServe	3
Non-profit	7
Private company	5
School	3
State Heritage	16
The Nature Conservancy	3
Tennessee Valley Authority	1
University	22
U.S. Army Corps of Engineers	1
U.S. Forest Service	19
U.S. Fish & Wildlife Service	13
Local Utility Company	9
Zoo	3
<b>Total</b>	<b>160</b>



Photo by Alan Cressler | *Baptisia megacarpa* Chapman ex Torrey & A. Gray (Apalachicola Wild Indigo).

**Our deepest thanks to the hundreds of workshop participants who contributed to this project**

**CORE PROJECT TEAM:**

**Duke Rankin**, T&E Species Program Manager, U.S. Forest Service

**Chuck Hunter**, Chief, Division of Strategic Resource Management and Southeast Regional Refuge Biologist, National Wildlife Refuge System, USFWS

**Mike Chouinard**, Senior Ecologist, Inventory & Monitoring Program, USFWS

**Mike Harris**, At-Risk Species Coordinator, USFWS Southeast Region

**Dennis David**, Project Manager/FL ECO Consulting, National Wildlife Refuge Association

**Carrie Radcliffe**, Atlanta Botanical Garden

**Jennifer Cruse-Sanders**, Director, State Botanical Garden of Georgia, University of Georgia

**Mark Sowers**, Conservation Fellow-Data Manager and Editor, National Wildlife Refuge Association

**Mark Musaus**, Southeast Regional Representative, National Wildlife Refuge Association

For more information, please contact the National Wildlife Refuge Association



1001 Connecticut Avenue NW, Suite 905, Washington, DC 20036 • 202-417-3803 • [www.refugeassociation.org](http://www.refugeassociation.org)