*Pinguicula ionantha*

# Godfrey's butterwort

## 5-Year Review:
## Summary and Evaluation


*Photos by Vivian Negrón-Ortiz*

**U.S. Fish and Wildlife Service**
**Southeast Region**
**Panama City Field Office**
**Panama City, Florida**

# 5-YEAR REVIEW

## *Pinguicula ionantha* (Godfrey's butterwort)

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# 5-YEAR REVIEW
# *Pinguicula ionantha* (Godfrey's butterwort)

## I. GENERAL INFORMATION

### A. Methodology used to complete the review

This review was accomplished using information obtained from the Recovery Plan of June 1994, unpublished field survey results, reports of current research projects, peer reviewed scientific publications, unpublished field observations by Service, State and other experienced biologists, and personal communications. These documents are on file at the Panama City Field Office. A *Federal Register* notice announcing the review and requesting information was published on April 16, 2008 (73 FR 20702). No part of this review was contracted to an outside party. Comments and suggestions from peer reviewers were incorporated as appropriate (see Appendix A). This review was completed by the Service's lead recovery botanist for this plant in the Panama City Field Office, Florida. See Appendix A for a summary of the peer review.

### B. Reviewers

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## C. Background

**1. FR Notice citation announcing initiation of this review:**
73 FR 20702 (April 16, 2008): Endangered and threatened wildlife and plants: 5-Year Status Review of 18 Southeastern Species.

**2. Species status:** Unknown (Recovery Data Call 2008); the species status is unknown until all the Element Occurrences[1] (EOs or occurrences) are revisited. See section II.C.1.a for current information.

**3. Recovery achieved**: 1 (0-25% recovery objectives completed); see section II.B.3 for details on recovery criterion and actions, and how each action has or has not been met.

**4. Listing history**
Original Listing

FR notice: 58 FR 37432-37443: Endangered and threatened wildlife and plants: Status for five Florida plants.
Date listed: July 12, 1993
Entity listed: species
Classification: Threatened

**5. Associated rulemakings**
Not applicable

**6. Review History**
Status Review: No formal 5-year reviews have been conducted on *P. ionantha* since the Recovery Plan was written and approved.

Recovery Data Call: 2003; 2004; 2005; 2006; 2007; 2008 (unknown)

**7. Species' Recovery Priority Number at start of review (48 FR 43104):**
The Godfrey's butterwort is assigned a recovery priority of 14 because the degree of threat is low, it is a species, and has a high recovery potential.

**8. Recovery Plan or Outline**
Name of plan: Recovery Plan for four plants of the lower Apalachicola Region, Florida: *Euphorbia telephioides* (telephus spurge), *Macbridea alba* (white birds-in-a-nest), *Pinguicula ionantha* (Godfrey's butterwort), and *Scutellaria floridana* (Florida skullcap).

**Date issued**: June 22, 1994

[1] Element Occurrence (EO): an area of land and/or water in which a species or natural community is, or was, present. For species, it corresponds with the local population (portion of a population or a group of nearby populations). It is also referred to as occurrence, location, or site.

**Dates of previous plans**: N/A

## II. REVIEW ANALYSIS

### A. Application of the 1996 Distinct Population Segment (DPS) policy

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because *P. ionantha* is a plant, the DPS policy is not applicable and not addressed further in this review.

### B. Recovery Criteria

#### 1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

The recovery plan includes a recovery objective for delisting the species as well as the criterion. The objectives are to guarantee that the populations in Apalachicola National Forest (ANF) are secure, and to conserve the species outside the ANF by protecting habitat through land acquisition, and changes in management practices on government land, rights-of way (ROW), and private land. For delisting the species the goal is to adequately protect and manage 15 populations distributed throughout the species' historical range for 10 years. The plan states that these goals are by necessity only preliminary, and they will be refined.

#### 2. Adequacy of recovery criteria.

**a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?**

***No***. The recovery criterion was based on available data at the time the plan was published 15 years ago.

**b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

***No***. The recovery plan only addressed factors A – habitat destruction and modification, which is still a threat, and B – overutilization for commercial, recreational, scientific, or educational purposes. See sections II.B.3 and II.C.2 for description of current information and threats.

**3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

The recovery plan lists a delisting criterion to adequately protect and manage 15 populations distributed throughout the species' historical range for 10 years. This recovery criterion addresses factors A and B. Factor C is not relevant to *P. ionantha*. Factors D and E, although relevant to this species, were not addressed by the Recovery Plan.

We summarize our progress below under existing recovery actions. Recovery actions 1-5 address factor A. Recovery action 6 addresses factor B.

***Recovery Action 1:*** Protect population in ANF and on other public lands

This action has been partially met.

***1.1.*** Management/general monitoring in ANF

Management is an ongoing action conducted by the U.S. Forest Service (USFS). The ANF has a yearly 120,000+ acre prescribed burning program (L. Kirn, Apalachicola National Forest, 2009, pers. comm.). According to L. Kirn (2009, pers. comm.), two to three compartments are burned every year during the growing and dormant seasons, or both.

Monitoring. Three permanent marked plots were established in 1997 to monitor the numbers of plants annually (L. Kirn, 2009, pers. comm.).

***1.2.*** Conduct population biology studies

This action has been partially met.

***Demographic responses to prescribed fire*** -- Kesler et al. (2008) studied the effects of prescribed fire on demography of 12 populations of *P. ionantha* over a period of two years in ANF and Tate's Hell State Forest (THSF), and used these data to project the effect of fire frequency and season on population growth. The study showed that *P. ionantha* responds strongly and positively to prescribed fire. The results indicated that 57% of the yearly variation in population growth was related to time since last burn; shortening the 4-yr fire return interval currently used at the study sites will have a positive impact on

*A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

population growth due to increases in fecundity and individual plant growth. According to their model, population growth is expected to be maximized by annual growing season (June-July) or bi-annual dormant season (Dec-Feb; delay response of 430 days) fires. According to Kesler (2006), this delayed response could be explained by the lack of a seed bank. The growth response to days since last fire was nearly equal for individuals in the small and medium size classes. However, post-fire growth of the medium size class made a larger contribution to increased population growth following a fire event. This was because the small and medium plants are the only size classes that can grow. The large size class could either stay in the large size class (stasis), shrink (regression), or die. Burning during the flowering period (mid-Feb to April) was not part of their study but is likely to negatively affect population growth rates (seed production and seedling establishment are precluded).

Their model indicates that the timing of the fire event had an influence on fecundity contributions of *P. ionantha*. The authors found that the post-fire increase in fecundity was almost three times more important to population growth than individual plant growth. Increased fecundity is associated with increased seedling establishment, which last up to 430 days following a fire event; shading and plant competition by surrounding vegetation appear to reduce this positive effect.

Based on this study, the fire return interval could be reduced to about 2 years. The authors' observations in the field led them to conclude that the rarity of this species is a result of the rarity of its herb bog habitat, i.e. an estimated 85 to 98% of this habitat has been lost (Folkerts 1982).

Other population biology studies such as genetic and pollination, have not been carried out (see section IV, actions 3 and 8).

***1.3***. Conduct botanical inventories on public land, possible purchase areas, and selected private land.

***1.31.*** *Pinguicula* survey in Apalachicola National Forest

This recovery action is ongoing and conducted primarily by the USFS, FWS botanist, Florida Natural Areas Inventory (FNAI), and H. Kesler (Folius Consulting, AL).

***Recovery action 2:*** Manage rights-of-way

This is an ongoing action. *P. ionantha* is found scattered along the ANF right-of-way (ROW) on State Route (SR) 65. Protective measures have been established with Talquin Electric during annual maintenance and the upcoming pole replacement.

Management for other *P. ionantha* elements of occurrences found in ROW outside SR 65 has not been initiated.

***Recovery action* 3*:*** Protect and manage these plants outside ANF

***3.1.*** Secure protection

This is an ongoing action. To date, about nine protected populations have been secured: one population on the St. Joseph Buffer Preserve (SJBP), Gulf County; one population at Lathrop Bayou, Bay County; one population (but potentially extirpated) at Box-R Wildlife Management Area (Box-R WMA), Franklin County; and seven populations at Tate's Hell State Forest, Franklin County.

No land acquisition has been accomplished for specific protection of *P. ionantha*.

***3.2.*** Develop and implement management and monitoring plans for protected sites

This recovery action has been partially met. Management plans have been developed and implemented by the: Florida Fish and Wildlife Conservation Commission (FWCC) for the Box-R WMA(FWCC 2006); Bureau of Land Management (BLM) and the St. Joe Timberland Company (Timberland Company) for the Lathrop Bayou (BLM 2008).

Box-R WMA consists of 8,397 acres in Franklin County and is managed by the FWCC. Management for this species includes application of prescribed fire every 2-3 years during the growing season, and avoidance of: 1) rutting and soil compactation in wetlands; 2) placing of firebreaks in wetlands ecotones; and 3) using herbicides on roadsides (FWCC 2006). FNAI has recorded one element of occurrence of *P. ionantha* within Box-R WMA, but monitoring has not been initiated.

The management plan for 539 acres of Lathrop Bayou, located at the eastern end of East Bay (Bay County) and owned by the BLM (189 acres), Timberland Company (206 acres), and the Genecov Group (144 acres; BLM 2008), focuses on habitat improvements to benefit endemic plants and animals (e.g., prescribed burns, management of red-cockaded woodpecker, and monitoring of several plants and animals). About 25 flowering plants and more than 100 seedlings were found in 2008 in a 1/2 acre on BLM property (L. Keppner, Keppner Biological Services, 2008, pers. comm.).

***Recovery action 4:*** Conduct systematic and other studies

This recovery action has been partially addressed.

Chromosome studies among species of *Pinguicula* including the six species in the southeastern United States indicated that *P. ionantha* has the same ploidy level,

i.e., 2n = 22, as *P. pumila* and *P. primuliflora*; the number for the other three species (*P. caerulea, P. lutea, and P. planifolia*) is 2n=32 (Casper and Stimper 2009, Godfrey and Stripling 1961).

Chloroplast DNA sequences studies strongly support a sister group relationship between *P. ionantha* and *P. primuliflora* (Casper and Stimper 2009, Cieslak et al. 2005). Although Godfrey and Stripling (1961) separated *P. ionantha* from *P. primuliflora* based on chromosome number, this was based on an incorrect count (2n=32) for *P. primuliflora*, according to Casper and Stimper (2009). Because these two species have the same chromosome number and are morphologically similar, Casper and Stimper (2009) suggested further studies are necessary to address the taxonomic status of these two species. For specific recommendations, see section IV, action 7.

***Recovery action 5:*** Garden propagation and reintroduction

This recovery action is ongoing and has not been completed.

Seed germination and plant transplantation experiments were conducted at Historic Bok Sanctuary (Bok Sanctuary), Lake Wales, Florida during 2006 and 2007. Twenty-three plants including soil and nine leaf-cuttings were collected from St. Joseph Bay State Buffer Preserve (SJBSBP), Gulf County and THSF, Franklin County (Peterson and Campbell 2007). Although some plants flowered eight to ten months after the 2006 collecting trip, all individuals have subsequently died. According to Peterson and Campbell (2007), mortality was likely due to the type of containers (i.e., plastic non-draining pots with terra-cotta clay) used in the experiments. Leaf-cuttings, a successful technique for a few species in the genus, were not an optimal propagation method for *P. ionantha* because all the collected leaves died after two weeks. However, J. Clemens (2009, pers. comm.) of CarnivorousPlant.com has observed plantlets forming on the proximal end of severed leaves. Therefore, leaf-cuttings could be a good propagation technique.

The Bok Sanctuary collected 26 capsules containing a total of 2,024 seeds from SJBSBP: 465 were kept at ambient storage; 1,103 seeds were refrigerated; and 200 were sent to Peter D'Amato (California carnivores) for propagation work (Peterson and Campbell 2007). Six months after the collecting was done, 456 seeds were used in the seed experiments, but germination was unsuccessful as of December 2007. No additional work was pursued in 2008 (Campbell, Bok Sanctuary, 2009, pers. comm.). D'Amato, however, successfully germinated about half a dozen plants, and expects that more will germinate during late winter or spring; seeds tend to take a long time to germinate and winter stratification helps with this process (Campbell, 2009, pers. comm.). Kesler (2009, pers. comm.) successfully germinated *P. ionantha* seeds in vitro using a media with vitamins after seeds were sterilized.

***Recovery action 6:*** Protect *P. ionantha* from depredations due to collecting.

This recovery action has been partially addressed. See section C.2.b.

## C. Updated Information and Current Species Status

### 1. Biology and Habitat

#### a. Abundance, population trends, demographic features, or demographic trends:

*P. ionantha* Godfrey (Godfrey's butterwort) is a carnivorous plant located in Bay, Calhoun, Franklin, Gulf, Liberty, and Wakulla counties (Fig. 1). Several locations appear to be extirpated due to loss of habitat and/or habitat modification. We have poor information regarding trends because surveys were conducted irregularly and based on either presence/absence and/or qualitative visual estimates of the density of Godfrey's butterwort (Jenkins et al. 2007, Kirn, 2009, pers. comm.); most sites were visited only once; and actual counts of plants were rarely provided. The information below is organized by county.

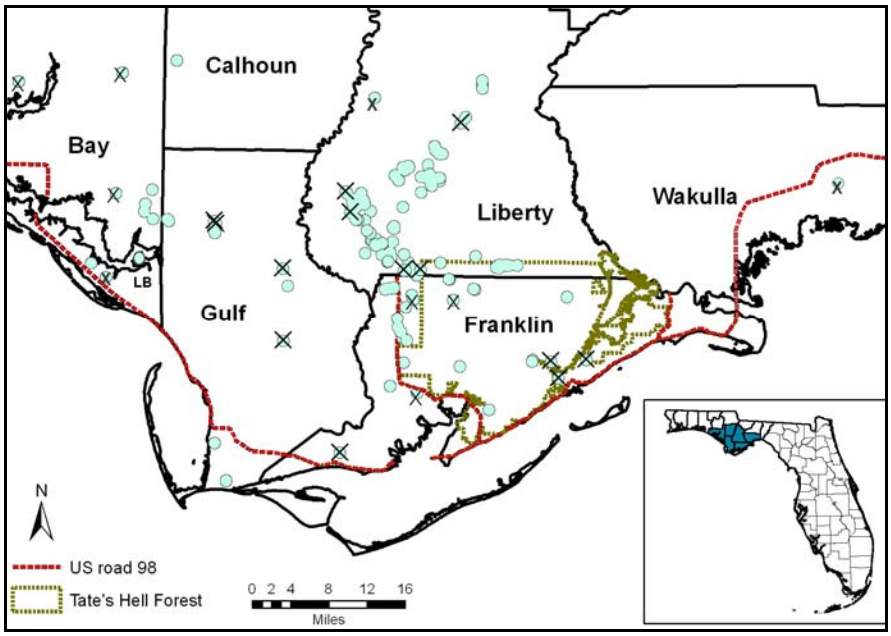


**Fig. 1. Map of Florida (inset) showing the counties and locations of *P. ionantha*. LB= Lathrop Bayou; X = EOs with populations or plants not found during recent surveys.**

**<u>Bay County</u>**

Eleven surveys conducted in Bay County between 1960 and 2009 indicated the presence of nine occurrences (FNAI 2008, L. Keppner, 2008, pers. comm.). One EO (see section I.C.2. for definition) was documented in 1960; two EOs were

documented in 1970; five EOs were documented by the FNAI in early 1990s, and two EOs were documented in 2001 (FNAI 2008) and 2008 (Keppner, 2008, pers. comm.), respectively. The actual counts of plants were provided for only three occurrences (total of 53 plants); therefore we don't have accurate numbers for this county. Five of these occurrences were re-surveyed in 2008 and 2009, but plants were not found by the FWS botanist for four of these sites. The occurrences were found disturbed, near railroads, in ditches, or destroyed (V. Negrón-Ortiz, 2008 and 2009 surveys).

The BLM property at the Lathrop Bayou has about 25 flowering plants and more than 100 seedlings (L. Keppner, 2008, pers. comm.). This small population was first reported in 1997 by a Service biologist (BLM 2008), but had not been seen since that time. With the inception of management and surveys in 2002, the population was located again in 2008.

**Calhoun County**

One population in a disturbed bog containing 20 plants was documented in 2004 by FNAI. This small population has not been re-surveyed.

**Gulf County**

Ten surveys conducted in Gulf County between 1960 and 2008 indicated the presence of 11 occurrences (FNAI 2008). Plants were counted in six of these locations with counts ranging from 108 to 150 plants. Most sites without counts were referred to as 'plants flowering' or 'present'. Three occurrences were surveyed in 2006 and 2008, but plants were not found. The sites were found drastically altered (e.g., clearcut, residential development).

**Franklin County**

Twenty-two surveys conducted in Franklin County between 1960 and 2009 indicated the presence of 22 occurrences (FNAI 2008); a new population was found during the 2009 survey (FDS 2009). Eleven populations are protected at the Tate's Hell State Forest (Fig. 1); however, only four populations were found with plants in the 2009 survey (FDS 2009). Estimated counts were only stated for 15 of the occurrences, ranging from 1,126 to $3,045^{+}$ plants. Plants for seven occurrences documented between 1961 and the 1980s were not found during 2006 and 2008 surveys (Kesler and Trusty 2008; Negrón-Ortiz, 2008 surveys): four sites were found in fire suppressed areas; one in a dense lightly bedded pine plantation; and two were clearcut.

**Liberty County**

Approximately 21 surveys conducted in Liberty County between 1956 and 2001 indicated the presence of about 39 FNAI locations or occurrences, some with multiple subpopulations (FNAI 2008). Many data points could be counted in more than one EO. Points within 1 km should all be associated with one EO (A.

Jenkins, 2008, pers. comm.; Fig. 1); therefore, this would technically consider 17 EOs to be present. These populations are protected at the ANF. The total estimated number of plants reported for 35 (90 %) of the occurrences ranged from $6{,}618^{+}$ to $22{,}314^{+}$. However, recent surveys indicated a decline of about 39% in the maximum number of estimated plants (8,718 plants are currently present or reported; FNAI 2008, Kesler and Trusty 2008). Six populations were not found during 2006, 2008, and 2009 surveys (Kesler and Trusty 2008; Negrón-Ortiz, 2008 and 2009 surveys).

**Wakulla County**

Herbarium collections of *P. ionantha* in this County were made from a ditch, a disturbed site containing very few plants north of the town of St. Marks (L.C. Anderson, Florida State University, 2008, pers. comm.). The site was visited by L.C. Anderson a few years later but plants were not found. The number of plants in the collecting location was not counted or estimated.

**b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**
Genetic studies have not been conducted in this genus.

**c. Taxonomic classification or changes in nomenclature:**

| | |
|---|---|
| Kingdom: | Plantae |
| Division: | Magnoliophyta |
| Class: | Magnoliopsida |
| Order: | Scrophulariales |
| Family: | Lentibulariaceae |
| Genus: | *Pinguicula* L. |
| Species: | *ionantha* Godfrey |
| Common name: | Godfrey's butterwort, violet butterwort |

*Pinguicula* L., the second most diverse genus of the carnivorous Lentibulariaceae, is monophyletic and composed of about 85 to 100 species native to Europe, North America, Asia, South and Central America, and southern Mexico (Cieslax et al. 2005, Degtjareva et al. 2006). Members of this genus use sticky, glandular leaves to trap and digest insects. Six species can be found in Florida, of which *P. ionantha* Godfrey is endemic (Gluch 2005). All Florida species belong to the section or subgenus *Isoloba* (Cieslax et al. 2005, Gluch 2005), characterized by uniform corolla lobes, a cylindrical tube with a palate and a short spur.

*Pinguicula ionantha* has a rosette of fleshy, bright green-yellow leaves of up to 15 cm across that can be characterized by upward rolled leaf edges. The plants stay in rosette form all year. The flowers rise from late February to April according to temperatures. The flowers, borne on stalks of about 10 to15 cm in height, are about two centimeters across and possess five pale violet to white petals all of the same shape corolla. The throat of the corolla and the corolla tube are deeper violet with dark violet veins. A yellow to olive spur 4 to 5 mm long is present on

the corolla and the palate is yellow with a purple base and covered with yellow hairs (Godfrey and Stripling 1961, Godfrey and Wooten 1981).

**d. Spatial distribution, trends in spatial distribution, or historic range:**

*Pinguicula ionantha* grows in the Florida panhandle between Tallahassee and Panama City (Godfrey and Wooten 1981, FNAI 2008). Originally, the Recovery Plan (1994) only reported the species in Bay, Franklin, Gulf, and Liberty counties, however, herbarium specimens no. 70198 and 9117 collected in 1971 and 1986, respectively, and located at Robert K. Godfrey Herbarium (Florida State Univ.) confirmed the species is also found in Wakulla County. In addition, the geographical distribution has been extended to Calhoun County based on an observation by A. Johnson (FNAI) in 2004 of 20 plants.

Based on information provided by FNAI (2008) and recent surveys, there were 83 historically documented occurrences. A total of 62 populations were revisited in 2006, 2008, and 2009 surveys: 33 populations were revisited by Kesler and Trusty (2008) during April 2006, and 19 populations were visited by Negrón-Ortiz during 2008 and 2009 surveys. Plants were present at 24 (47%) of these populations. Searches did not locate plants at 22 (43%) of the previously-recorded sites (Fig. 1). Additionally, high water or a dense woody midstory prevented access to six previously recorded populations in Gulf and Franklin counties (Kesler and Trusty 2008, Negrón-Ortiz, 2008 surveys).

This species appears to be declining in population and plant number. It is worth noting that the area has been under severe drought for that last four years, which could have contributed to this decline (T. Miller, Florida State University, 2009, pers. comm.).

**e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**

*Pinguicula ionantha* occurs in herb bog habitats embedded in longleaf pine savannas. Specifically, it is found between a lower elevation habitat dominated by pond cypress (*Taxodium ascendens*) overstory and a slightly higher elevation pine flatwoods dominated by an overstory of longleaf pine (*Pinus palustris*). This species inhabits seepage bogs, deep swampy bogs, ditches, and depressions in grassy pine flatwoods and savannas. It survives in open peat or sandy peat in very wet areas, in shallow standing water or sometimes even submerged for several days after a heavy rain (Godfrey and Stripling 1961, Negrón-Ortiz, 2008, pers. observ.).

The longleaf pine savanna habitat where this species occurs is defined as a fire-dependent community and is dominated by wiregrass (*Aristida stricta*), spurned panic grass (*Panicum spretum*), flattened pipewort (*Eriocaulon compressum*) and Chapman's beakrush (*Rhynchospora chapmanii*) (Kindell 1997). In Franklin and

Liberty counties, it co-occurs with other imperiled plants, including *Macbridea alba* (white birds-in-a-nest) and *Scutellaria floridana* (Florida skullcap), both Federally listed as threatened species. It is locally abundant in ANF, where fire management is maintained.

## 2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

### a. Present or threatened destruction, modification or curtailment of its habitat or range:

Habitat modification is the primary threat identified in the Recovery Plan for *P. ionantha* and remains the primary threat to this plant. Timbering, urban development, and fire management and suppression in this region have changed the ecosystems. The threats are discussed in more detail below:

1. Pulpwood production in the outer Coastal Plain in the Apalachicola Basin

The timber industry in North Florida became well established in the 1850s (FNAI 2005). It started in Franklin County in the 1870s and continued to be a prominent industry until the mid-1990s (Howell and Hartsell 1995). The Timberland Company had close to a million acres in timber in the eastern region of the panhandle, and they plan to continue to harvest and replant indefinitely. The Company also owned a paper mill in Port St. Joe until it was sold and shut down in 1999. According to J. Huffman (2009, pers. comm.) tree farming, i.e., privately owned forest managed for timber production (clearcutting, mechanical site preparation, and pine plantations), is a primary threat since there still is a mill in Panama City (Bay County) and there are many thousands of acres of tree farms. Therefore, tree farming is a threat to this species.

2. Coastal real estate and road development

Urban development continues to threaten Godfrey's butterwort. The Timberland Company is one of the largest private landowners in Florida, and one of the largest operating real estate companies in the Southeast. The Company develops both residential and commercial properties along roadways and near or within business districts in the region. Urbanized land in Florida, statewide, is projected to double by 2060 along with doubling of the population to 36 million (http://www.1000friendsofflorida.org/PUBS/2060/01-Northwest-Florida).

Many *P. ionantha* locations are found along U.S. and state roads. Construction activity may directly kill individual plants or convert habitat to unsuitable habitat; widening may convert native habitat to managed road side; and culvert modification may change drainage patterns, which may change seasonal hydrology. Evidence suggests past road improvements have resulted in localized extirpation of Godfrey's butterwort in ANF (Kesler and Trusty 2008). Therefore, because they contribute to habitat loss, road widening and new roads continue to pose a threat to the species.

3. Fire suppression

Suppression of fire during the growing season continues to threaten the pineland and savanna's flora as fire is an important factor in the maintenance of flatwoods (Abrahamson and Hartnett 1990). Fire influences community structure and composition (Abrahamson and Hartnett 1990), and with insufficient frequency in longleaf pine communities, a woody midstory quickly develops (Glitzenstein et al. 1995), negatively affecting the understory diversity.

Thus, fire suppression continues to be a threat to *P. ionantha*. Lack of fire, and subsequent growth of shrubs (particularly encroachment of *Cyrilla racemiflora* L., commonly known as swamp titi) and saplings in the understory, in addition to shading by planted pines, inhibits this species emergence (Negrón-Ortiz, 2008, pers. observ.; FNAI 2008, Kesler et al. 2008). Declining fire frequency reduces *P. ionantha* abundance in areas where it was previously observed in great quantities (FNAI 2008). In recently burned areas, however, plant emergence is prolific within one year of the fire event (Kesler and Trusty 2008).

Several studies have shown that frequent prescribed fire regimes are important for maintenance of flatwoods diversity (Hiers et al. 2007). Therefore, frequent prescribed burnings, i.e., < 3 yr interval, are needed to maintain optimal *P. ionantha* populations (Kesler et al. 2008). At present, the ANF utilizes a 3- to 5-yr interval burn rotation; Box-R WMA utilizes 2-3 yr; and Lathrop Bayou uses 2- to 7-yr interval.

**b. Overutilization for commercial, recreational, scientific, or educational purposes:**

This factor is a threat, but the magnitude has been reduced. Butterworts are widely cultivated, grown and sold by plant enthusiasts and nurseries. *Pinguicula ionantha* was overcollected in the 1970s (58 FR 37440). Many thousands of plants propagated by tissue culture were sold without permits, but the plant is no longer commercially available in large quantities (D'Amato, 2009, pers. comm.).

In order to implement conservation measures and regulations, the Service granted a permit (TE061005-1) to the International Carnivorous Plant Society (ICPS) in 2003, which allows the society to sell seeds of endangered and threatened carnivorous plants only within the USA. Some restrictions apply to this permit (see http://www.carnivorousplants.org/statements/seedcollect.html); in addition, an annual report is required stipulating their selling activities. Collecting guidelines for live plants are being developed by the ICPS: they do not recommend collecting live plants unless it is for scientific purposes such as herbaria, the species has never been introduced to cultivation, or because a variant (a taxon exhibiting slight differences in form). The Nurseries Stock Restrictions manual summarizes the entry status of regulated plant material capable of or intended for propagation (USDA 2008).

**c. Disease or predation:**

There is no evidence to suggest that this factor is a threat.

**d. Inadequacy of existing regulatory mechanisms:**

Section 7(b)(4) and 7(b)(2) of the Endangered Species Act (Act) generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed threatened and endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulations or in the course of any violation of a State criminal trespass law. Seeds of both threatened and endangered species found on Federal land are regulated under the Act. However, the seeds of threatened species are not regulated if they come from cultivated plants (7 CFR 319.37.2, USDA 2008). Since *P. ionantha* is a threatened species, growers can obtain and sell seeds from other growers.

Several populations of *P. ionantha* occur on private timberland and ROWs. While the Act requires Federal agencies to carry out programs for the conservation of endangered and threatened species, no such programs are stipulated for private landowners. The Act does not provide for protection of plants on private lands as long as the activity is permissible under state/local laws. The State requires permission of private landowners for collecting of State-listed plants from their property.

*Pinguicula ionantha* is protected under Florida State Law, chapter 85-426, which includes preventions of take, transport, and the sale of the plants listed under the State Law. The rule Chap. 5B-40, Florida Administrative Code, contains the "Regulated Plant Index" (5B-40.0055) and lists endangered, threatened, and commercially exploited plant species for Florida; defines the categories; lists instances where permits may be issued; and describes penalties for violations (http://www.virtualherbarium.org/EPAC).

Bay County code of ordinance (chapter 19- Environmental Standards), under sections 1907 and 1909, provides restrictions, constraints and requirements to protect and preserve designated habitat conservation areas for rare, threatened, or endangered species, and wetlands (http://www.municode.com/Resources/gateway.asp?pid=14281&sid=9). Calhoun, Gulf, Franklin, and Liberty Counties do not have such regulations.

Highway ROW maintenance activities are not always reviewed for threatened and endangered species impact. However, if there is a Federally-funded activity (e.g., construction, mowing, or maintenance projects) affecting protected species, the Service can recommend consultation to the Florida Department of Transportation (FDOT) under section 7 of the Act (M. Mittiga, USFWS, 2009, pers. comm.). The FDOT routinely consults with the Service on all major road construction activities.

### e. Other natural or manmade factors affecting its continued existence:

**Herbicide**. While the Recovery Plan mentioned that the use of herbicide or the wrong type of herbicide is a threat when it is used to control vegetation on power line ROWs, we no longer consider this a threat because mowing is now the common practice to maintain ROWs in Florida. Franklin and Liberty counties allow only "selective application or spot treatment" due to impacts concerning the ANF and waters within Apalachicola Bay and River basin.

**Saltwater inundation caused by hurricanes**. Saltwater inundation from storm surges caused by hurricanes represents a new threat. Kesler and collaborators (*in* Kesler and Trusty 2008) monitored one population in Franklin County, which was flooded during Hurricane Francis in 2004. In 2005, they observed that the plant number declined from about 100 to two individuals.

## D. Synthesis

Godfrey's butterwort is a carnivorous plant presently located in six Florida panhandle counties (Fig. 1). It is extremely vulnerable because of its limited range, its specific habitat preference, and rarity of habitat. The main threat to this species is habitat loss. Conversion of much of the forest land to pulpwood plantations (clearcutting, mechanical site preparation, and pine plantations) have possibly extirpated some populations. Development pressures in the Florida panhandle are extreme; urbanized land is projected to increase two-fold in the near future. Informal consultation has resulted in minimizing impacts from road projects, specifically for SR 65 in the ANF. Overcollection was a threat of high importance in the past, but the present magnitude has been reduced. No problems have been detected with disease and predation.

Land conversion coupled with disruption of fire regimes of the longleaf pine-wiregrass ecosystem is responsible for the rapid decline of the ecosystem where *P. ionantha* is found. Demographic studies indicated that *P. ionantha* is a fire-dependent species (Kesler et al. 2008). Lack of fire, or reduced fire frequency, and subsequent growth of shrubs and saplings in the understory, reduces *P. ionantha* abundance. Where fire management is implemented, it stimulates the emergence of individuals and maintains healthy, stable populations (e.g., populations at ANF).

Current survey information indicates a decline in the number of populations. Eighty-three EOs distributed throughout this species' range were documented between 1956 and 2009 with an estimated 7,920 to 25,577 plants for 49 of those EOs. Based on current survey information, 22 (26%) of these 83 EOs appear to be extirpated due to development and/or habitat modification. The estimated maximum counts of plants were also affected, with a 46% decrease in numbers; only 11,671 plants are now reported for the remaining 61 EOs. However, since surveys were conducted irregularly and based on either presence/absence and/or qualitative visual estimate of the density of Godfrey's butterwort (Jenkins et al. 2007, Kirn, 2009, pers. comm.); with most sites visited only once; and the actual counts of plants rarely provided, a comprehensive population survey is needed in order to better assess the current status of this species.

*Pinguicula ionantha* continues to meet the definition of a threatened species as a result of the habitat destruction or modification due to development and fire suppression and its effect on the plant's present narrow distribution and low population numbers. Studies have demonstrated variation among the number of plants necessary for a population to survive risks of extinction (Given 1994, Matthies et al. 2004, Menges 1990). However, Matthies et al. (2004) study of 379 populations of eight threatened species in northern Germany demonstrated that very small populations face a considerable risk of extinction, while the risk for populations with more than 1000 individuals was very small. Consequently, since most of the *P. ionantha* populations have less than 1000 individuals, any impact to existing populations could cause loss of these populations. In addition, the criterion for delisting the species, i.e., protect and manage 15 populations distributed throughout the species' historical range for 10 years, has not been met.

## III. RESULTS

### A. Recommended Classification

**__x__ No change is needed**

### B. New Recovery Priority Number: 8C

The change from a Recovery Priority Number (RPN) of 14 to 8C is recommended because the degree of threat to the habitat of *P. ionantha* has increased from being low to moderate. As the species is in conflict with development and growth, the conflict category 'C' has been added to the RPN.

## IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Manage ROW

   Continue fostering conservation practices for utility and highway ROWs with the Forest Service, Talquin Electric, FDOT, and USFWS; a ROW Best Management Practices plan should be developed and implemented.

2. Since habitat loss and degradation are leading causes of endangerment for *P. ionantha*, designating habitat that is critical for survival and recovery is recommended.

3. Evaluate the current species' status

   - Complete a comprehensive census (e.g., the total number of individuals, number of flowering vs. non-flowering plants, and whether seedling recruitment is occurring) throughout the present distribution including all the historical locations to determine the species' status.
   - Determine the levels and distribution of genetic diversity. Knowledge of the levels and distribution of genetic variation in species of conservation concern can be important for the development of efficient and effective conservation practices. For example, the identification of populations with rare alleles or with elevated levels of genetic

diversity may lead to greater efforts for their preservation relative to less genetically unique populations.

4. Conduct surveys/inventories on potentially new sites. This action can include the use of species distribution modeling methods to initially determine potential sites, with subsequent validation or inspection of the sites for plants.

5. Establish frequent growing-season fire regimes (i.e., 2-3 yr interval) on selected areas such as Tate's Hell State Forest, St. Joseph State Buffer Preserve, and ANF to maintain optimal conditions of *P. ionantha* populations. Re-visit sites shortly after a burn event and mark individual plants. Populations tend to be more evident after a fire event (H. Kesler, 2008, pers. communication).

6. Garden propagation and reintroduction. An *ex-situ* plant collection should be actively pursued and implemented with a botanical garden. Studies on the viability of dry-stored seeds, the timing of germination, and whether a persistent seed bank is present should be addressed.

7. Conduct population biology studies at ANF

   a. Compare the demographic performance of *P. ionantha* in pinelands and road habitats. Survey for seedling recruitment and survival of tagged individuals (plant height and reproduction) for a period of 3-5 years in or near roadside populations of SR 65 and pinelands.

   b. Conduct long-term studies to determine whether the observed declines in abundance reflect acceptable stochasticity or if they are indicative of dangerously declining populations. This study could be continued using the Kesler sites.

8. Conduct systematic studies to examine the current taxonomic classification. A systematic study of taxonomic section Isoloba, to which *P. ionantha* belongs, with emphasis on southeastern United States species involving morphological (e.g., use of multivariate analyses) and molecular data is recommended. This will help test the monophyly (i.e., developed from a single ancestor) of *P. ionantha*.

9. Conduct pollination studies. Pollinators are critical to the long-term persistence of many flowering plant species because they provide a mechanism for ensuring seed set and often facilitate gene flow between plants and plant populations.

10. The recovery plan should be updated to define objective measurable criteria and better address the five listing factors.

## V. REFERENCES

Abrahamson, W.G., and D.C. Hartnett. 1990. Pine flatwoods and dry prairies. *In*, R. Myers & J.J. Ewel [editors]. Ecosystems of Florida, Univ. Press of Florida, FL.

Bureau of Land Management (BLM). 2008. Lathrop Bayou. Final habitat management plan environmental assessment. Jackson, MS.

Casper, S.J., and R. Stimper. 2009. Chromosome numbers in *Pinguicula* (Lentibulariaceae): survey, atlas, and taxonomic conclusions. Plant Syst. Evol . 277:21–60.

Cieslax, J.S. Polepalli, A. White, K. Müller, T. Borsch, W. Barthlott, J. Steiger, A. Marchant, and L. Legendre. 2005. Phylogenetic analysis of *Pinguicula* (Lentibulariaceae): Chloroplast DNA sequences and morphology support several geographically distinct radiations. American J. Bot. 92: 1723–1736.

Degtjareva, G.V, S.J. Casper, F.H. Hellwig, A.R. Schmidt, J. Steiger, and D.D. Sokoloff. 2006. Morphology and nrITS Phylogeny of the genus *Pinguicula* L. (Lentibulariaceae), with special attention to embryo evolution. Plant Biol. 8: 778–790.

Florida Division of Forestry (FDF). 2009. 2009 survey report. Florida Division of Forestry, Tallahassee.

Florida Natural Areas Inventory (FNAI). 2005. History: Timbering in North Florida. Apalachicola region resources on the web. FNAI.org/ARROW.

Florida Natural Areas Inventory (FNAI). 2008. *Pinguicola ionantha* element occurrence record.

Folkerts, G. 1982. The Gulf Coast pitcher plant bogs. Am. Sci. 70: 260–267.

Given, D. 1994. Principles and practices of plant conservation. Timber Press, Inc. Portland, Oregon.

Glitzenstein, J.S., W.J. Platt, and D.R. Streng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. Ecological Monographs. 65: 441–476.

Gluch, O. 2005. *Pinguicula* species (Lentibulariaceae) from the southeastern United States: observations of different habitats in Florida. Acta Bot. Gallica. 152: 197-204.

Godfrey, R.H., and H.L. Stripling. 1961. A synopsis of *Pinguicula* (Lentibulariaceae) in the southeastern United States. American Midland Naturalist. 66: 395–409.

Godfrey, R.K., and J.W. Wooten. 1981. Aquatic and wetland plants of southeastern United States: Dicotyledons. Univ. Georgia Press, Athens. 933 pp.

Hiers, J.K., J. J. O'Brien, R.E. Will, and R.J. Mitchell. 2007. Forest floor depth mediates understory vigor in xeric *Pinus palustris* ecosystems. Ecological Applications. 17: 806–814.

Howell, M., and A. Hartsell. 1995. Southern Pulpwood Production, 1993. Resource Bulletin SE-152. 32pp.

http://www.municode.com/Resources/gateway.asp?pid=14281&sid=9. Minicode.com. Information accessed in 2009.

http://www.1000friendsofflorida.org/PUBS/2060/01-Northwest-Florida.pdf. 2006. Florida 2060: A Population Distribution Scenario. A Research Project Prepared for 1000 Friends of Florida by the GeoPlan Center at the University of Florida. Information accessed in 2009.

http://www.virtualherbarium.org/EPAC. Notes on Florida's endangered and threatened plants. Information accessed in 2009.

Jenkins, A., P.K. Diamond, and G.E. Schultz. 2007. United States Forest Service: Rare plant monitoring Apalachicola National Forest and Ocala National Forest. Florida Natural Areas Inventory (FNAI): 41 pp.

Kesler, H.C. 2006. Conservation of a Florida endemic carnivorous plant: Godfrey's butterwort, *Pinguicula ionantha*. 85 pp. Thesis, Auburn Univ., Auburn AL.

Kesler, H.C. and J.L. Trusty. 2008. Godfrey's butterwort (*Pinguicula ionantha*) conservation action plan. Folius Consulting. Camp Hill, AL.

Kesler, H.C., J.L. Trusty, S.M. Hermann, and C. Guyer. 2008. Demographic responses of *Pinguicula ionantha* to prescribed fire: a regression-design LTRE approach. Oecologia. 156: 545-557.

Matthies, D., I. Bräuer, W. Maibom, and T. Tscharntke. 2004. Population size and the risk of local extinction: empirical evidence from rare plants. Oikos. 105: 481-488.

Menges, E. 1990. Population viability analysis for an endangered plant. Conservation Biology. 4: 52-62.

Peterson, C.L., and C.C. Campbell. 2007. Seed collection and research on eight rare plants species of the Florida Panhandle region. USFWS grant agreement 401815G173.

Schulze, D.M., J.L Walker, T.P. Spira. 2002. Germination and seed bank studies of *Macbridea alba* (Lamiaceae), a federally threatened plant**.** Castanea. 67: 280-289.

U.S. Department of Agriculture (USDA). 2008. Nursery stock restrictions manual. p. 289.

U.S. Fish and Wildlife Service. 1994. Recovery Plan - Recovery Plan for four plants of the lower Apalachicola Region, Florida: *Euphorbia telephioides* (telephus spurge), *Macbridea alba* (white birds-in-a-nest), *Pinguicula ionantha* (Godfrey's butterwort), and *Scutellaria floridana* (Florida skullcap).

U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants: 5-Year Status Review of 18 Southeastern Species. Federal Register. 73: 20702.

**U.S. FISH AND WILDLIFE SERVICE 5-YEAR REVIEW**
***Pinguicula ionantha* (Godfrey's butterwort)**

**Current Classification**: Threatened

**Recommendation resulting from the 5-Year Review**

__x__ No change is needed

**Reclassification Priority Number**: 8C

**The review was completed by botanist Dr. Vivian Negrón-Ortiz, Panama City Field Office.**

**FIELD OFFICE APPROVAL**:

**Lead Field Supervisor, Fish and Wildlife Service**

Approve _____ Date 5-21-09

**REGIONAL OFFICE APPROVAL:**

Acting
**Lead Regional Director, Fish and Wildlife Service**

Approve _____ Date 7-8-09

**APPENDIX A**
**Summary of peer review for the 5-year review of**
***Pinguicula ionantha* (Goffrey's butterwort)**

## A. Peer Review Method

The document was peer-reviewed internally by Lorna Patrick, Mary Mittiga, and Janet Mizzi of the Panama City Field Office. Once the comments were added to the document, it was sent to three outside reviewers (see below). The outside peer reviewers were chosen based on their qualifications and knowledge of the species.

**B. Peer Review Charge:** The below guidance was provided to the reviewers.

1. Review all materials provided by the Service.
2. Identify, review, and provide other relevant data that appears not to have been used by the Service.
3. Do not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.
4. Provide written comments on:
   - Validity of any models, data, or analyses used or relied on in the review.
   - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
   - Oversights, omissions, and inconsistencies.
   - Reasonableness of judgments made from the scientific evidence.
   - Scientific uncertainties by ensuring that they are clearly identified and characterized, and those potential implications of uncertainties for the technical conclusions drawn are clear.
   - Strengths and limitation of the overall product.
5. All peer reviews and comments will be public documents, and portions may be incorporated verbatim into our final document with appropriate credit given to the author of the review.

## C. Summary of Peer Review Comments/Report

**Mr. Kesler** provided a few editorial comments related to his study on effects of prescribed fire on demography of *P. ionantha*. He also mentioned his successful in vitro seed germination protocol for *P. ionantha* using a media with vitamins.

**Ms. Kirn** provided a few editorial comments and the information related to the three permanent plots established in 1997 at ANF.

**Dr. Miller** provided a careful review using the peer review guidance and a few editorial comments. In summary, he concluded that the strength of this report was its completeness and clarity, the data were honestly presented, the scientific evidence and its evaluation seemed sound, and the materials appeared complete and well written. He indicated that at least two types of data are needed. First, long-term studies should be initiated to follow temporal patterns. All

populations fluctuate-do the recently observed declines in abundance reflect acceptable stochasticity or are they indicative of dangerously declining populations? Only long-term studies can provide an answer, and such studies could be continued using the Kesler sites. Second, surveys for previously unidentified sites should be conducted. Perhaps a niche or habitat model could be constructed to identify potential sites for this species.

**D. Response to Peer Review**

All peer reviewer comments were evaluated and incorporated where appropriate.