

RECOVERY PLAN

FOUR PLANTS OF THE LOWER APALACHICOLA REGION, FLORIDA

<i>Euphorbia telephioides</i>	(Telephus spurge)
<i>Macbridea alba</i>	(White birds-in-a-nest)
<i>Pinguicula ionantha</i>	(Godfrey's butterwort)
<i>Scutellaria floridana</i>	(Florida skullcap)



U.S. Fish and Wildlife Service
Southeast Region

Recovery Plan
for
Four Plants of the Lower Apalachicola Region,
Florida

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Macbridea alba (white birds-in-a-nest)
Pinguicula ionantha (Godfrey's butterwort)
Scutellaria floridana (Florida skullcap)

Prepared by

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June 22, 1994

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ACKNOWLEDGEMENTS

This recovery plan attempts to correctly represent the views of the numerous persons cited in its text; without them, the plan could not have been prepared, nor would have revisions to the draft recovery plan been so extensive. The participants in a 1993 field session on road maintenance in sensitive Apalachicola habitats provided a number of ideas and perspectives that are reflected here. Any inaccuracies or other difficulties with this plan remain the responsibility of the Fish and Wildlife Service.

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EXECUTIVE SUMMARY

Current Species Status: *Euphorbia telephioides* (Telephus spurge), *Macbridea alba* (white birds-in-a-nest), *Scutellaria floridana* (Florida skullcap), and *Pinguicula ionantha* (Godfrey's butterwort) are all listed as threatened species, primarily due to habitat modification for forestry purposes. A number of candidates for listing occur in the same area, including *Hymenocallis henryae* (Panhandle spider lily), and the endangered *Spigelia gentianoides* (gentian pinkroot) is nearby.

Habitat requirements and Limiting Factors: All inhabit poorly-drained coastal pinelands, with frequent fires. Their exact habitat preferences vary from low ridges (Telephus spurge) to understories of pinelands (*Macbridea*) to seepage bogs too wet for pines (*Scutellaria*) to seasonally-flooded cypress ponds (*Pinguicula*). These plants respond poorly to lack of fire, excessive shade, excessive ground disturbance, and improved drainage—all features of present-day forest management on private land.

Recovery Objective: To ensure that the three species that occur in Apalachicola National Forest are secure there, and to attempt to conserve all four species outside the National Forest by protecting habitat through acquisition, changes in management practices on government-owned or managed land (such as road rights-of-way), and, if private landowners should be interested, through changes in management of private land.

Recovery Criteria: Each of the four species will be considered for delisting when 15 populations are adequately protected and managed throughout its historic range. Existing public land (mainly the Apalachicola National Forest) does not suffice for recovery.

Major Actions Needed:

- (1) Protect populations in Apalachicola National Forest (and other public lands) by:
 - providing prescribed fire
 - taking care not to allow ground disturbance from logging, fire management, or other sources to adversely affect these threatened plants
 - conducting surveys and population biology studies to ensure that populations are at least stable and that genetic diversity is safeguarded.
- (2) Manage rights-of-way inhabited by these plants to enhance their survival.
- (3) Protect and manage populations outside Apalachicola National Forest through purchase, conservation easements, or other means; develop conservation plans for these sites.
- (4) Conduct systematic and other studies; arrange reintroduction where appropriate and feasible; monitor collecting of Godfrey's butterwort.

Estimated cost of recovery, apportioned among the major actions, in thousands of dollars:

Year	Action 1	Action 2	Action 3	Action 4	Total
1995	37	2	6	0	45
1996	11	2	12	4	29
1997	11	6	15	11	43
1998	11	6	19	11	47
1999	5	6	20	0	31
Total	75	22	72	26	195

Date of Recovery: Possibility of recovery depends on voluntary cooperation of landowners and/or successfully protecting sites through purchase or easements.

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PART I. INTRODUCTION

A. BACKGROUND

Listing and Ecosystem Background

This recovery plan covers four herbaceous plants from the lower Apalachicola region of the Florida panhandle (see Table 2, p.4). Three of them were added to the List of Endangered and Threatened Plants together: *Euphorbia telephioides* (Telephus spurge), *Macbridea alba* (white birds-in-a-nest), and *Scutellaria floridana* (Florida skullcap)(U.S. Fish and Wildlife Service 1992). The fourth species is *Pinguicula ionantha* (Godfrey's butterwort), which was proposed for listing separately because it is a carnivorous plant, and would be of special interest to carnivorous plant gardeners, other horticultural hobbyists, the horticultural trade, and scientists who specialize in these plants. The final rule listing *Pinguicula ionantha* was subsequently consolidated with other species (U.S. Fish and Wildlife Service 1993a). The four species are included in a single recovery plan because they occupy more or less the same habitats, and all four (along with numerous other narrowly endemic plants in the same area) require conservation of their entire savannah and bog ecosystems, rather than narrowly-focussed species-by-species measures. These four herbs were listed based on conservative assessments of threats to the Apalachicola area ecosystems, so unless conservation measures for the four herbs are successful, further listing proposals will be necessary.

The four threatened herbs are part of an exceptionally rich flora of herbs and sedges—with numerous locally-distributed (endemic) species—found in the lowlands along the Gulf coast on both sides of the lower Apalachicola River, from the vicinity of Panama City east to the Ochlockonee River. The lower Apalachicola region has little topographical relief, extensive wetlands, and pinelands. In this flat landscape, the pinelands and associated savannahs have the water table at or near the surface for part of the year. Table 1, adapted from Clewell (1986), explains the pineland and savannah vegetation, using Clewell's term of *fireland* to distinguish these areas with frequent understory fires from the evergreen shrub bogs, swamps, and hardwood forests where fires are infrequent. Clewell (1985) has a valuable introduction to physiography and habitats of the Panhandle, and Wolfe et al. (1988) are also useful.

In the Atlantic and Gulf coastal plains of the southeastern United States, endemic plant species are concentrated in relatively small areas. The lower Apalachicola region (including the southern Apalachicola National Forest) is a prime example of such an area, as is the new Jennings State Forest near Jacksonville, whereas the Osceola National Forest in northeast Florida has no endemic plants. Andre Clewell attempted to explain the pattern as the result of history: opportunities for native species to expand their ranges depend largely on the availability of unoccupied space that can be colonized, and historically, most of the region has been fully occupied by plants, effectively blocking plant migrations except during times of rapid climate change. He suggested that climate may have changed rapidly enough 5,000 years ago to allow substantial migrations (Clewell 1986). Alan Weakley (North Carolina Natural Heritage Program, pers. comm. 1987) has made similar observations. It is possible that paleoecological research

will yield clues to present-day plant distributions. Although the vegetation and flora of the Coastal Plain has remained relatively stable over the past 20,000 years (Delcourt and Delcourt 1993), the present-day Coastal Plain is much narrower than its full-glacial counterpart. The present-day climate is also different from its glacial counterpart, and the Pleistocene megafauna are gone.

The Apalachicola region's grassy pine flatwoods, seepage slopes, cypress ponds, and bogs have been studied by botanists since the 1830's, when physician Alvan¹ Wentworth Chapman of Apalachicola began sending plant specimens to Harvard's Asa Gray. In the twentieth century, botanists from the Tallahassee area (Florida State University, U.S. Forest Service, Tall Timbers Research Station, Florida Natural Areas Inventory [FNAI]) have studied the area. However, savannahs have attracted rather little, and rather late attention for conservation (Frost et al. 1986). Many have been destroyed or degraded. The Forest Service's interest in protecting and managing exemplary savannahs in the Apalachicola National Forest, which goes back at least 20 years (Clewell 1971) has made it possible to understand how savannah landscapes may have appeared, and may have functioned, before present-day industrial land management.

Many savannahs of 50 or more years ago were probably the results of logging followed by frequent fire, with little regeneration of longleaf pine. The Apalachicola National Forest was established in part to restore timber production to exploited lands; the present-day wet savannahs of the National Forest appear to be on sites where inundations prevented longleaf pine from becoming established by drowning it while in the grass stage (Guy Anglin, Forest Service, pers. comm. 1993). The wet savannahs evidently also have too great a fire frequency for young (and very fire-vulnerable) slash pines to survive. The private forest products industry has very successfully developed the outer Coastal Plain in the Apalachicola area for pulpwood production. Unfortunately, pulpwood management and its side effects (decreased fire frequency, fire management practices, ground disturbance, increased shade) have adversely affected the savannah flora to the extent that some plant species require protection under the Endangered Species Act. To be successful, conservation efforts aimed at the listed Apalachicola plants must conserve many more plant species in their fire-maintained habitats. Conservation efforts can be considered at least partially successful if the Fish and Wildlife Service can avert having to list more species, and if the Service can avoid changing the listed species from threatened to endangered status.

¹most references spell the first name this way. "Alvin" appears to be an error.

Table 1. Firelands vegetation communities, adapted from Clewell 1986, pp. 367-368.

Plant communities	Soil moisture in summer wet season	Usual soil texture	Vegetation
PINELANDS (pine barrens)	Dry to moist, not remaining saturated long after rains		Open, pine-dominated overstory
<u>High Pinelands</u>			Ground cover herbaceous/grassy, not shrubby
1. Longleaf pine-xeric oak woods (sandhills vegetation)	Rapid percolation of rainwater	Sandy	Understory of scrub oaks with turkey oak or sometimes bluejack oak dominant.
1a. Longleaf pine-coastal scrub oak woods	"	"	Understory with sand live oak common.
1b. Xeric oak woods	"	"	Lacking pine overstory due to failure of natural pine regeneration following logging.
2. Longleaf pine savannahs	Moderate percolation of rainwater	Loamy	No understory; grass-herb ground cover
<u>Flatwoods</u>			Ground cover shrubby; saw palmetto common
3. Pine Flatwoods (pine-palmetto flatwoods)	Moderate or slow percolation of rainwater	Sandy	Pine overstory
3a. Longleaf pine flatwoods	"	"	Longleaf pine overstory
3b. Slash pine flatwoods	"	"	Slash pine overstory; occurred originally along the Gulf coast and later inland as slash pine invaded logged longleaf pine flatwoods
3c. Longleaf pine-slash pine flatwoods	"	"	Longleaf and slash pines in overstory, the result of partial invasion of slash pines into former longleaf pine flatwoods after clear cutting.
3d. Palmetto prairies	"	"	No pine overstory, due to failure of natural pine regeneration after logging.
4. Boggy flatwoods (moist pine barren)	Soil surface saturated for days at a time after rains	Sandy-peaty	Longleaf and/or slash pine overstory (less commonly pond pine) and sometimes pond-cypress, blackgum, sweetbay, white cedar, etc.
4a. Pond pine flats	"	"	Pond pine overstory.
BOGS	Soil surface remains saturated for weeks at a time		No overstory: trees absent or nearly so.
<u>Grass-sedge seepage bogs</u> (marginal bogs, strands)	Water table seeping from soil surface	Sandy-peaty	Scattered shrubs or small trees often present; natural or sometimes the result of clear cutting of boggy flatwoods, which reduces transpiration, causing a prolongation of the hydroperiod.
<u>Grass-sedge savannahs</u>	Water table perched due to soil's impermeable clay layer	Clayey	Shrubs and trees essentially absent except St. Johns-wort (<i>Hypericum</i>).

Table 2. Summary of the four species

species	<i>Euphorbia telephioides</i>	<i>Macbridea alba</i>	<i>Pinguicula ionantha</i>	<i>Scutellaria floridana</i>
geographic distribution	Bay, Gulf, and Franklin Counties from Panama City Beach to east of Apalachicola.	Bay, Gulf, Franklin, and Liberty Counties, Florida.	Bay, Franklin, Gulf, and Liberty counties.	Gulf, Franklin, and Liberty Counties
habitat	Among scrubby oaks on low sand ridges near coast	savannahs, road edges	seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and grassy savannahs. Often occurs in shallow standing water.	savannahs, road edges
plant family	Spurge family	Mint family	Bladderwort family	Mint family
appearance	Smooth leaves, milky sap. Several related species.	Opposite leaves, brilliant white flowers clustered at top of plant	Rosette of yellow, sticky leaves with a single flower stalk	Opposite leaves, lavender flowers 1" long
flowering season	From April through July (Kral 1983)	From May into July (Kral 1983, Godfrey and Wooten 1981)	March and April (Kral 1983)	May and June (Kral 1983)
In Apalachicola National Forest?	no	yes, including the healthiest populations.	yes	yes
In other public lands?	not known, although selected areas, especially in Gulf County, should be searched.	no	no	no

Taxonomy, Description, and Distribution:

Euphorbia telephioides (Telephus spurge)

Euphorbia telephioides is a member of the spurge family (Euphorbiaceae). It was named by Alvin Wentworth Chapman (1860), who provided no explanation for his choice of name, but rather clearly intended to indicate a resemblance to another plant, most likely the garden plant *Sedum telephium* (orpine, live-forever, or stonecrop) or the similar North American *Sedum telephioides*. Both have short stems and smooth, fleshy leaves, much like the spurge as Chapman described it. Someone coined "common" name of "Telephus spurge" for *Euphorbia telephioides* because the stonecrops are named for Telephus (mythical son of Hercules)(Fernald 1950), perhaps by way of the Mediterranean plant genus *Telephium*. A more appropriate common name for our spurge might have been "stonecrop spurge".

Small (1933) preferred to split the huge genus *Euphorbia* into smaller genera, renaming this species *Galarhoeus telephioides*. Taxonomists since then have left the genus *Euphorbia* intact. Webster (1967) established a new subsection of the genus *Euphorbia*, *Inundatae*, that includes *Euphorbia telephioides* and two other species native to the Florida panhandle: *Euphorbia floridana* and *E. inundata*.

Euphorbia telephioides is a perennial herb with a stout storage root. Stems are numerous, giving the plant a bushy appearance, and are up to 30 cm (1 ft)² tall. Stems and leaves are smooth and have latex (milky sap). The largest leaves are 3-6 cm (1-2 in) long, elliptic or oblanceolate, with the midrib and margins usually maroon. The inflorescence is a cyathium (a structure resembling a flower, containing a single stalked female flower and several male flowers, each reduced to a single stamen). Flowering is from April through July (Kral 1983). Clewell (1985) and Kral (1983) provide guidance for distinguishing this species from the most similar species, *Euphorbia inundata*, a taller plant of moister habitats.

Euphorbia telephioides is known from sites within 4 miles of the Gulf of Mexico (FNAI 1989; D. White, then of FNAI, *in litt.* 1990). The plant occurs in Bay, Gulf, and Franklin Counties from Panama City Beach to east of Apalachicola (Map 1, page 7).

Macbridea alba (White birds-in-a-nest)

The genus *Macbridea*, which belongs to the mint family (Lamiaceae or Labiatae), consists of only two species (Kral 1983, Godfrey and Wooten 1981). *Macbridea alba* Chapman was first collected about 1860 by A. W. Chapman and a friend named Gausman (Roger Sanders, then a graduate student at University of Texas, currently at Bot. Res. Inst. of Texas, *in litt.* 1977), and it was named by Chapman (1860). *Macbridea alba* is an upright, usually single-stemmed, odorless perennial herb with fleshy rhizomes. It is about 30-40 cm (1 ft) tall with opposite leaves

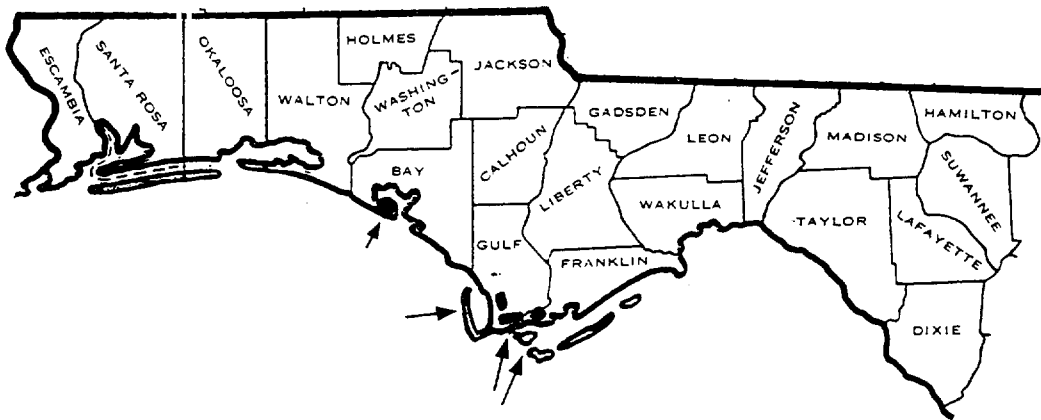
²Measurements: centimeter=cm, millimeter=mm, foot=ft, inch=in

up to 10 cm (4 in) long, 1-2 cm (0.5-1 in) broad, with winged petioles. Except for one site, all the plants at a site are either smooth or hairy (L. Anderson, Florida State University, pers. comm. 1990; Anderson *in* FNAI 1989). The flowers are clustered at the top of the plant in a short spike with bracts. Each flower has a green calyx about 1 cm (0.5 in) long and a brilliant white corolla 3 cm (1 in) long. The corolla is two-lipped, the upper lip hoodlike. Flowering is from May into July (Kral 1983, Godfrey and Wooten 1981). In flower, *Macbridea alba* is conspicuous and unmistakable. The other species in the genus, *Macbridea caroliniana*, has pink to lavender flowers, inhabits "marshes, bogs, bottomland woodlands" from southeast North Carolina to north Florida and southern Alabama (Godfrey and Wooten 1981, p. 611). It is a candidate for Federal listing (U.S. Fish and Wildlife Service 1993b).

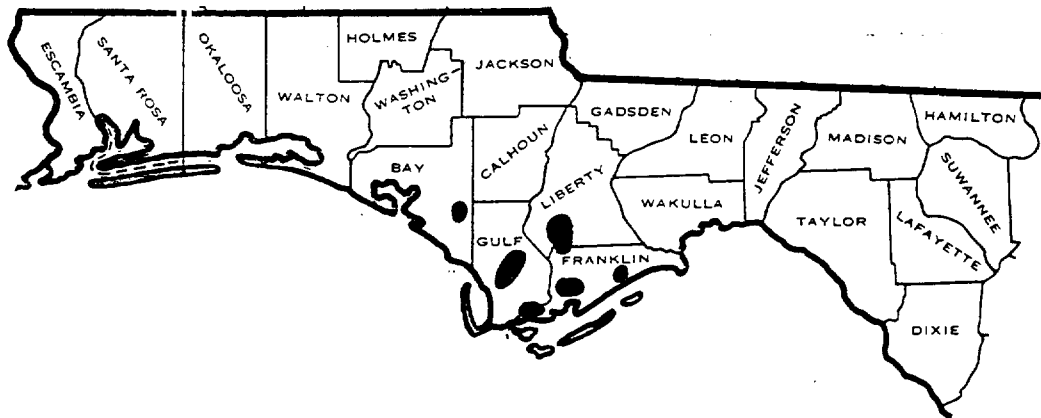
The range of *Macbridea alba* is in Bay, Gulf, Franklin, and Liberty Counties, Florida (Map 2, page 7). The largest, most vigorous populations are in Apalachicola National Forest. Surveys by the FNAI show the Forest as having 41 of the 63 known occurrences for the plant, a number that is misleading because the FNAI divided patches of *Macbridea alba* into occurrences recognizing the Forest Service's compartment/stand system of small management units (D. Hardin, Florida Division of Forestry [previously with FNAI] *in litt.* 1991). This resulted in a higher count of occurrences (sites) in the National Forest than would have been the case on private land. Revisits to *Macbridea* sites in the National Forest in 1990 yielded different stem counts than in 1987, much lower at some sites, higher at others (Dr. Joan Walker, U.S. Forest Service, *in litt.* 1991).

Macbridea alba inhabits grassy pine flatwoods that (at least seasonally) are usually drier than the seepage bogs inhabited by *Scutellaria floridana* (Florida skullcap). Dr. Joan Walker commented in 1990 (pers. comm.) that *Macbridea alba* occurs in a wider range of sites than had been appreciated. Originally, it seemed confined to a narrow range of hydrologic conditions, just uphill from *Verbesina chapmanii* (Chapman crownbeard, a member of the aster family). However, *Macbridea* has been seen in sites dry enough to support running oak (*Quercus pumila*) and *Baptisia* (wild indigo). A *Macbridea* population, found by Wilson Baker (The Nature Conservancy), that had appeared to be ring-shaped, encircling a low hill, now turns out to cover the hill, too. In a longleaf pine mesic flatwoods, there is evidence of disturbance from old stump removal or other disturbances, including what appears to have been a road. *Macbridea* seems to grow only on sites where there had been some disturbance. Dr. Walker surmised that *Macbridea* may require regular recruitment from seed and is a poor competitor with other plants, requiring bare ground to germinate and grow. *Macbridea alba* appears to persist through pulpwood harvest, site preparation (other than bedding, which may be more damaging than other site preparation methods), and planting. It does not survive the shaded, fire-free conditions of young slash pine plantations, although it may persist on the edges of pine plantations.

Map 1: Distribution of *Euphorbia telephioides*.



Map 2: Distribution of *Macbridea alba*.



Pinguicula ionantha (Godfrey's butterwort)

Pinguicula ionantha Godfrey (Godfrey's butterwort or violet-flowered butterwort) is a member of the bladderwort family (Lentibulariaceae), a small family of carnivorous plants closely related to the snapdragon family (Scrophulariaceae). *Pinguicula ionantha* has a rosette of fleshy, oblong, bright green leaves that are rounded at their tips, with only the edges rolled upward. The rosette is about 15 cm (6 in) across. The upper surfaces of the leaves are covered with short glandular hairs that capture insects. The flowers are on leafless stalks (scapes) about 10-15 cm (4-6 in) tall. When a flower is fully open, its corolla is about 2 cm (almost 1 in) across. The five corolla lobes are pale violet to white. The throat of the corolla and the corolla tube are deeper violet with dark violet veins. The corolla has a spur 4-5 mm (0.2 in) long that is yellow to olive (Godfrey and Stripling 1961, Godfrey and Wooten 1981).

Pinguicula ionantha is one of three *Pinguicula* species in the southeastern United States whose leaves are usually submerged and are relatively flat, rather than rolled up around the edges. The other two species are *Pinguicula primuliflora* (a butterwort), whose flowers have a differently shaped and colored corolla, and *Pinguicula planifolia* (Chapman's butterwort), which has red to reddish leaves and much narrower corolla lobes. All three species are endemic to northwestern Florida (Kral 1983), with *Pinguicula ionantha* the most narrowly distributed, and apparently the least abundant, of the three. The other two species, in addition to *P. ionantha*, may merit conservation concern.

The geographic range of *Pinguicula ionantha* is near the Gulf coast between Tallahassee and Panama City, in Bay, Franklin, Gulf, and Liberty counties (Godfrey and Wooten 1981, FNAI 1989) (Map 3, page 10). An extensive field survey for potentially threatened and endangered plants in the range of *Pinguicula ionantha* (FNAI 1989) located only one new site for this plant. Reports by Donald Schnell (International Carnivorous Plant Society, *in litt.* 1990) and comments in Kral (1983), Thomas Gibson (currently at University of Wisconsin, Madison, *in litt.*, ca. 1978), and Loran Anderson (*in* FNAI 1989), show that *Pinguicula ionantha* is locally abundant in Apalachicola National Forest and is (or was until recently) locally abundant in Franklin County. A survey for this butterwort during its flowering season could provide more detailed information on its status. In particular, existing surveys appear to be biased toward sightings of the plant in roadside ditches. It should be present in many cypress ponds and other seasonal wetlands.

Pinguicula ionantha inhabits seepage bogs on gentle slopes, deep quagmire bogs, ditches, and depressions in grassy pine flatwoods and grassy savannahs. Its leaves are typically covered by standing water during the winter and early spring, when it flowers. The most similar species, *Pinguicula primulifolia*, occurs in the same geographic area, but it often occupies a somewhat different habitat, occurring in flowing water and shaded areas. The habitat difference provided a clue to Godfrey and Stripling (1961) that the two species were distinct. Another endemic butterwort species, *Pinguicula planifolia* (Chapman's butterwort), occurs with *Pinguicula*

ionantha at one site. In Franklin County, *Pinguicula ionantha* occurs at a savannah with a particularly rich flora, including *Macbridea alba* (white birds-in-a-nest) and *Scutellaria floridana* (Florida skullcap), both federally listed as threatened species.

***Scutellaria floridana* (Florida skullcap)**

Scutellaria floridana Chapman is a member of the mint family, described by A.W. Chapman (1860) and upheld by Epling (1942). It is a perennial herb with swollen storage roots. Its stems are quadrangular and sparingly branched, solitary or in small groups. The leaves are opposite, 2-4 cm (1-1.5 in) long, linear, with strongly inrolled margins and a blunt, purplish tip. The flowers are solitary in the axils of short leafy bracts. Flower stalks are 5 mm (0.2 in) or less long. The flower has a bell shaped calyx with a cap or "scutellum" on its upper side. The corolla is bright lavender-blue, at least 2.5 cm (1 in) long, with a throat and an upper and lower lip. The lower lip is white in the middle. Flowering is in May and June (Kral 1983). The Florida panhandle has eight other species of *Scutellaria* (skullcaps) that occupy a variety of habitats; *Scutellaria floridana* and *Scutellaria integrifolia* appear to be the only species in flatwoods and savannahs. The latter species has broader leaves than those of *Scutellaria floridana* (Clewell 1985).

Scutellaria floridana was reported from 11 sites in Gulf, Franklin, and Liberty Counties, Florida, including 5 sites in Apalachicola National Forest (FNAI 1989; D. White, *in litt.* 1990)(Map 4). The Apalachicola National Forest has no large populations of this species, which is restricted to a narrow hydroperiod zone at the edges of wetlands (J. Walker, pers. comm. 1990).

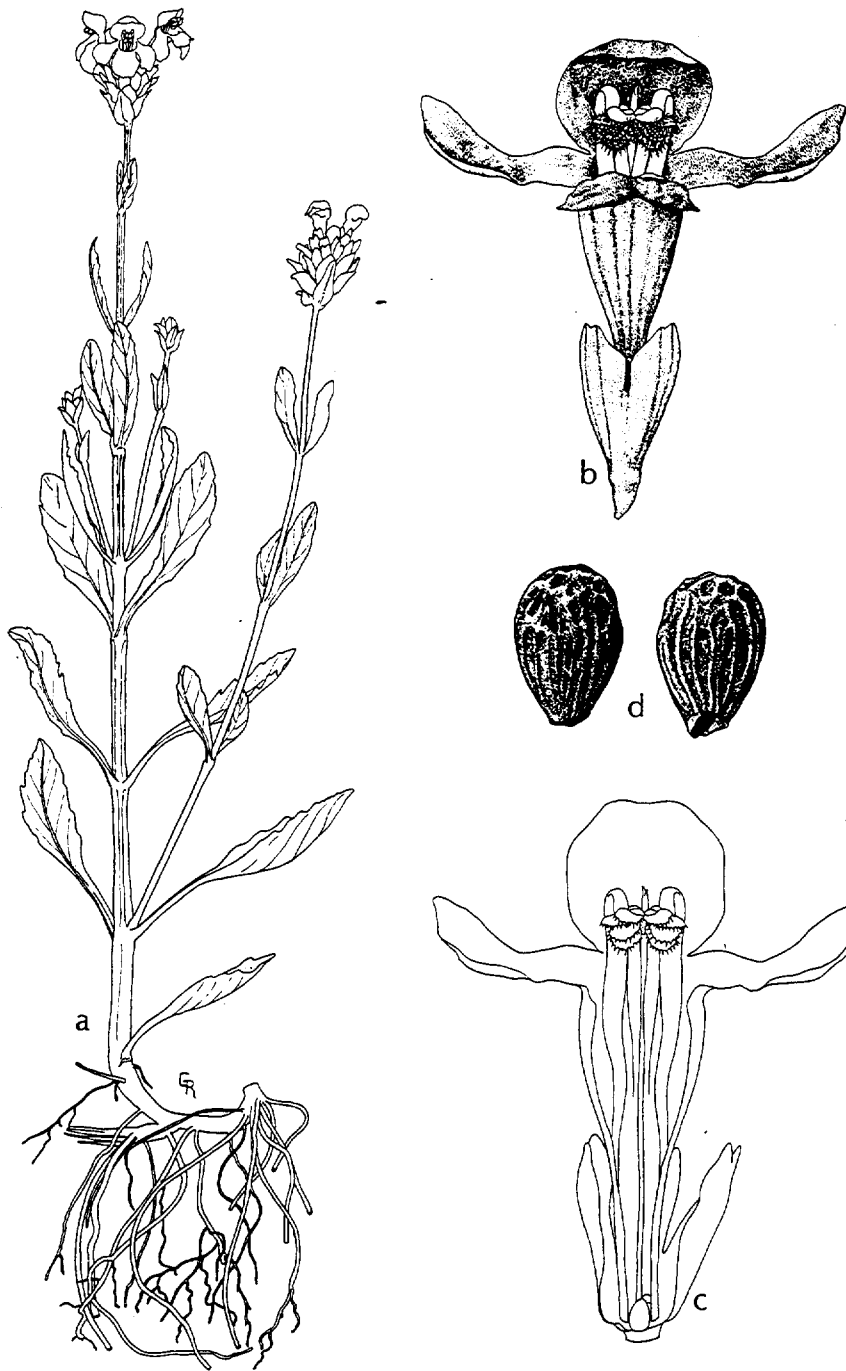
Map 3: Distribution of *Pinguicula ionantha*



Map 4: Distribution of *Scutellaria floridana*.



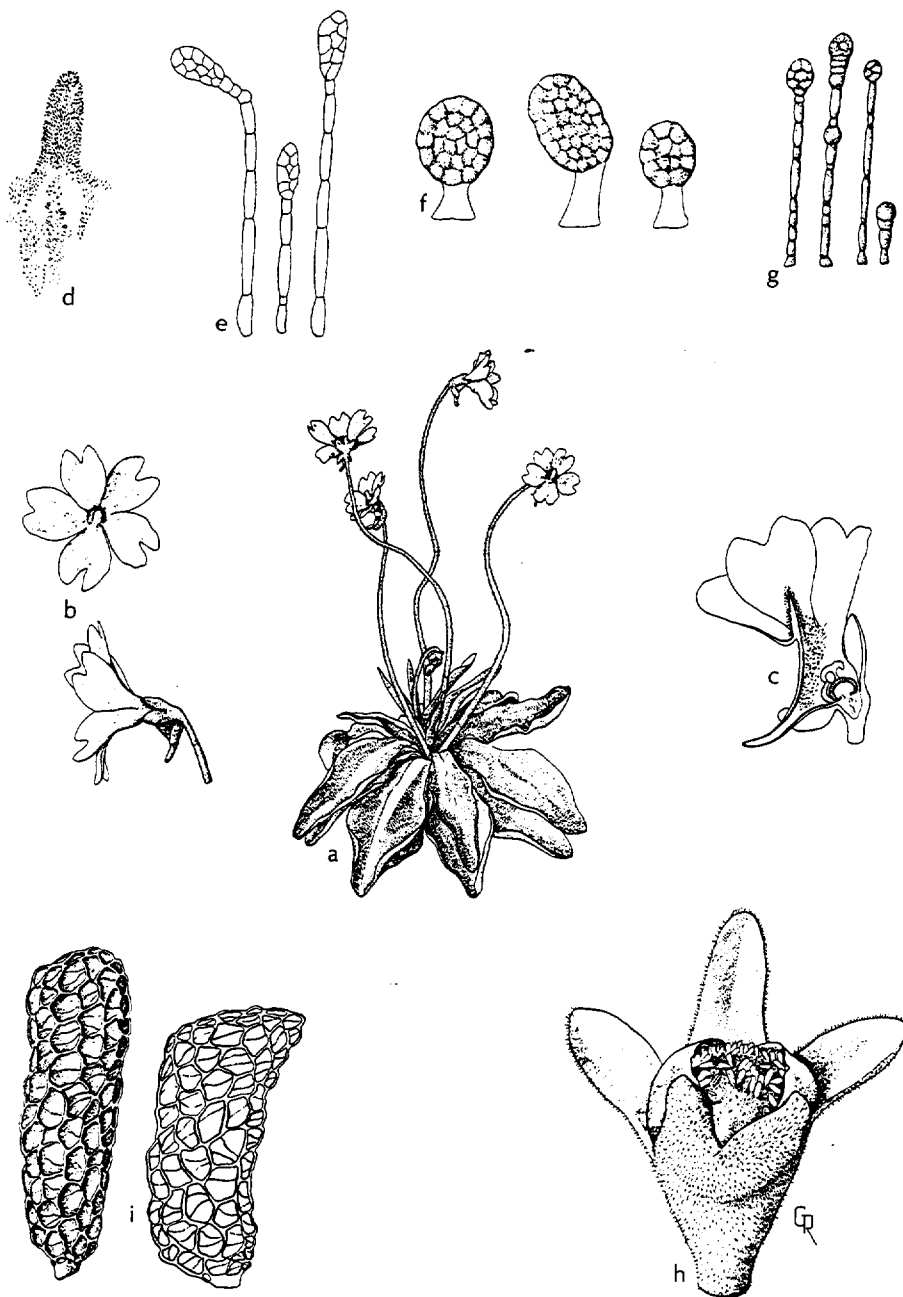
Fig. 1. Line drawing of *Macbridea alba*



a, habit; b, flower; c, longitudinal section of flower, semi-diagrammatic; d, seed, two views

Drawing by Grady W. Reinert, reproduced from Robert K. Godfrey and Jean W. Wooten, *Aquatic and Wetland Plants of Southeastern United States: Dicotyledons*. Athens: University of Georgia Press (1981), page 610. © 1981 by The University of Georgia Press, Athens, Georgia.

Fig. 2. Line drawing of *Pinguicula ionantha*



a, habit; b, flower, face view and lateral view; c, flower, longitudinal section; d, trichomes on palate, ridge of corolla tube behind palate, and on inner walls of corolla tube; e, trichomes, much enlarged, from palate; f, from ridge of tube behind palate, g, from inner wall of tube; h, capsule; i, seed.

Drawing by Grady W. Reinert, reproduced from Robert K. Godfrey and Jean W. Wooten, *Aquatic and Wetland Plants of Southeastern United States: Dicotyledons*. Athens: University of Georgia Press (1981), page 680. © 1981 by The University of Georgia Press, Athens, Georgia.

B. THREATS

Habitat destruction and modification.

The primary threat to these plants is adverse modification of habitats rather than their outright destruction. The successful development of the outer Coastal Plain in the Apalachicola area for pulpwood production has been at the expense of fire-adapted, shade-intolerant grasses, sedges, and forbs. These plants carpeted the ground in pinelands or, in savannahs and seepage bogs, were the entire vegetation. The four plant species in this recovery plan do not appear to have been entirely extirpated from substantial areas of their geographic ranges, but field surveys strongly support the inference that they have become much less abundant and have perhaps disappeared from the interiors of planted pine stands.

Lack of prescribed fire or prescribed fire during the dormant season is detrimental to much of the pineland and savannah flora (Robbins and Myers in prep.; Platt et al. 1988). Legal liability strongly discouraged private landowners in Florida from applying prescribed fire until the 1990 Florida legislature passed a prescribed burning bill to encourage the responsible use of fire. Increasing interest in growing season burning by researchers and public land managers may influence some private landowners. In the Apalachicola National Forest, the Forest Service has applied prescribed fire for many years, for changing reasons, and with changing procedures and timing. The National Forest also continues to have significant numbers of wildfires.

The rules to list *Euphorbia telephioides* (Telephus spurge), *Macbridea alba* (white birds-in-a-nest), *Pinguicula ionantha* (Godfrey's butterwort), and *Scutellaria floridana* (Florida skullcap) as threatened species were based on information contained in a status survey by the FNAI (1989) which supported Kral's (1983, p. 983) assessment that "none of these species persist where drainage is perfected and fire is kept out, though they may be increased by clearcutting. Mechanical site preparation reduces or eliminates them, and even bedding presents but a temporary solution in that the plants persisting in the pine rows are shaded out when crowns of plantation pines close."

The status survey also expressed concern over encroachment by titi (*Cyrilla racemiflora*) and other evergreen shrubs into herbaceous vegetation, which is known to have occurred on a large scale in Apalachicola National Forest, where foresters are planning to reclaim 35,000 acres of titi for pine timber production (National Forests in Florida 1985). Because grass-herb seepage bogs with rich floras tend to occur just outside titi thickets, the seepage bogs have been seriously affected by titi encroachment, which has been promoted by forest managers' habit of cutting fire lines just outside the titi, sheltering titi from prescribed fires and allowing it to spread between fires—producing a ratchet effect of titi encroachment. Titi encroachment certainly occurs on private lands, too.

The entire range of *Euphorbia telephioides* (Telephus spurge) is within 4 miles of the Gulf coast. This means that coastal real estate and road development destroys this species' habitat.

Road widening near Panama City Beach is known to have affected this species. It is not clear to what extent this species is fire-dependent, nor is anything known about the effects of site preparation for planting pines.

Pinguicula ionantha (Godfrey's butterwort) inhabits some of the same sites as *Macbridea alba* (white birds-in-a-nest) and *Scutellaria floridana* (Florida skullcap), so it is subject to the same problems as them. *Pinguicula* inhabits isolated wetlands including cypress ponds, which are often greatly altered by efforts to improve drainage for silviculture. Even so, there may be enough remaining suitable wetlands on private land to allow this species to persist; further fieldwork could determine the severity of threat. Although reports cited in the listing package indicate that *Pinguicula* disappeared from some roadsides, it is necessary to bear in mind that the roadsides may not represent a very significant portion of the plant's habitat. Although this plant occurs in savannah habitats with frequent fires, it is not known whether it occurs exclusively in fire-maintained habitats.

Power line rights-of-way provide habitat for these three species, especially *Euphorbia telephioides* in Franklin County (FNAI 1989). On such rights-of-way, use of herbicides (or at least the wrong herbicides) to control vegetation, rather than bush-hogging or mowing, could adversely affect *Euphorbia telephioides* and the other species. Conversely, if the utilities are interested, their rights-of-way offer opportunities to conserve these plants.

At the time of writing of this recovery plan, Forest Service staff were drafting plant habitat management guide for *Macbridea alba*, *Scutellaria floridana*, and *Pinguicula ionantha*. The draft guide notes these additional threats:

- (1) Fertilization of pine plantations, especially with phosphorus fertilizers, encourages growth of woody plants at the expense of native herbs, which are presumably highly adapted to low-nutrient conditions.
- (2) Harvest of trees results in damage to herbs from dragging of logs with wheeled and tracked equipment and habitat damage due to soils rutting, mixing, and compaction caused by equipment operation in soft wet soils.
- (3) Fire suppression coupled with a greater density of pine trees and shrubs results in greater evapotranspiration than from a thin pine canopy with grassy understory.
- (4) Firelines tend to be placed in transitions between flatwoods and wetlands, degrading the transitional habitat and, more important, preventing the spread of fire into wetlands.
- (5) Driving vehicles across savannahs and wetlands may kill individual plants and will degrade the habitat by rutting.

Commercial and Recreational Harvest

The use of the savannahs in Apalachicola National Forest for educational purposes and tourism creates a risk of *Macbridea alba* collecting: when in flower, it's conspicuous and likely to be casually picked.

Many carnivorous plants are taken commercially or by hobbyists, especially pitcher plants (*Sarracenia* spp.) and Venus' fly-trap (*Dionaea muscipula*). There is a possibility that take may eventually become a threat to *Pinguicula ionantha* (Godfrey's butterwort), but conversations with knowledgeable botanists and nursery operators at an October, 1993 meeting on pitcher plant conservation at the Atlanta Botanical Garden did not turn up any such threat at the present time. The commercial market for *Pinguicula*, especially in Europe, has been taken up by commercially propagated Mexican species (D. Schnell [International Carnivorous Plant Society], R. Hanrahan [nurseryman, Powder Springs, Georgia], T.L. Mellichamp [Univ. of N.C. at Charlotte], *in litt.*, 1990).

C. EXISTING CONSERVATION MEASURES

The U.S. Forest Service conserves endangered and threatened plants, and plants proposed for listing as endangered and threatened, as required of all Federal agencies under the Endangered Species Act of 1973, as amended. It also protects "sensitive" plants, including candidates for future Federal listing. In the Apalachicola National Forest, removal of pine stumps (for naval stores) has been at least temporarily discontinued, and most of the National Forest lands are being burned, often during the April-September growing season. Efforts are being made to keep plowed fire lines out of ecotones, and in some cases, to rehabilitate fire lines. The Forest Service only issues collecting permits for listed species to holders of permits issued by the Fish and Wildlife Service. Development proposals in the Apalachicola National Forest have not been numerous, although proposals to upgrade highways can be expected.

The St. Joseph Bay Buffer CARL (Conservation and Recreation Lands) project is known to have *Euphorbia telephioides* and *Scutellaria floridana*. For 1994, this project is ranked 18. Purchase of this area would be especially important for conserving *Euphorbia*. The Tates Hell Carrabelle Tract CARL project in Franklin and Liberty Counties (ranked 17 for 1994) has *Macbridea alba*. Some land acquisition in Tates Hell is being conducted by the U.S. Forest Service; Congress appropriated \$1 million for this purpose in fiscal 1993 (Division of State Lands 1994).

D. STRATEGY FOR RECOVERY

The first step toward conserving the three plant species that occur in Apalachicola National Forest is to assure that their habitats in the Forest are secure. The U.S. Forest Service is committed by law and policy to conserving these species, so site and time-specific activities in Apalachicola National Forest are best handled by the Forest Service itself. In Apalachicola

National Forest, there is a need to coordinate plant conservation with the conservation of red-cockaded woodpeckers (*Picoides borealis*), black bears (*Ursus americanus floridanus*), flatwoods salamanders (*Ambystoma cingulatum*), and the plant *Harperocallis flava* (Harper's beauty). There may be conflict between plant and bear conservation with respect to management of titi encroachment.

The second, and potentially much more difficult, step toward conserving all four species is to make their delisting possible by arranging for habitat protection outside Apalachicola National Forest in Gulf, Bay, Franklin, or other counties. Existing land acquisition proposals under consideration by the State of Florida may protect these plants. Conservation measures on road and utility rights-of-way may also offer opportunities for conserving these plants.

Even if delisting these species does not become possible, recovery efforts will be partially successful if they (1) prevent the need to reclassify any of the plants as endangered species and if they (2) prevent or limit the need for more listings of plants in the lower Apalachicola area, which has a rich savannah flora with many endemic species, including *Cuphea aspera* (a waxweed), *Lythrum curtissii* (Curtiss' loosestrife), *Asclepias viridula* (Apalachicola milkweed), *Verbesina chapmanii* and *Hymenocallis henryae* (green pine lily or panhandle spider lily). It must be emphasized that if the three plants in Apalachicola National Forest are conserved in the Forest but decline outside the Forest, their listing status will at best stay unchanged and they might have to be relisted as endangered.

Conserving these plants on highway and utility rights-of-way is a secondary priority compared to State land acquisition or conservation agreements with private landowners. But if simple measures can be found to maintain native savannah plants on rights-of-way, they are worth pursuing. It is worth noting that the endangered plant *Harperocallis flava* is extremely dependent on one road right-of-way, and its conservation in this habitat is a much higher priority than similar work on other species. *Harperocallis* conservation on the roadside is also a Federal concern because the road in question passes through Apalachicola National Forest on Federal land. Any right-of-way program for non-Federal land will be entirely voluntary on the part of the right-of-way managers. The Florida Department of Transportation (FDOT) has changed its right-of-way "wildflower program" away from planting semidomesticated species (typically not native to Florida) toward encouraging native species (while eliminating noxious pests such as cogon grass). For any right-of-way project, input and review by right-of-way maintenance personnel is essential, and it is probably much more productive to make such contacts in person rather than attempting to obtain written review. Most "roadside" *Macbridea* and *Scutellaria* are probably under roadside powerlines, so utilities have to be involved as well as FDOT or county road departments.

Although *Pinguicula ionantha* has suffered habitat loss and modification, it may be able to persist indefinitely in wetlands on private forest land. If this is shown to be the case, and if

Pinguicula is found to be reasonably widespread on land being purchased for Apalachicola National Forest in Franklin County, its delisting might be possible.

For privately owned sites, there is no reason to expect measures short of acquisition to be effective. There is little incentive for landowners to set up conservation programs for savannah plants on their own land, especially since prescribed fire programs entail cost, inconvenience, and perhaps a risk of liability. Nor would management for savannah plants be likely to produce significant collateral benefits (in terms of game management) by increasing the value of hunting leases. There are few opportunities for government agencies to integrate endangered plant protection with wetlands protection, since ongoing silvicultural practices are exempt from Federal regulation under section 404f of the Clean Water Act (which is administered by the Environmental Protection Agency). Regulation of herbicides to protect endangered plants may affect private landowners, but herbicide regulation is aimed at preventing damage to endangered and threatened species; it is not a mechanism for benefitting them. Nevertheless, the Fish and Wildlife Service and other conservation organizations should be alert for opportunities to support experimentation with management methods that might conserve these plants on private lands.

It needs to be emphasized that private landowners, with few exceptions (involving Federal permits [e.g., for herbicide use] or state or local laws and regulations) are not obligated to conserve threatened plants. For this reason, any conservation measures on private lands need to be developed specifically to meet the owners' desires. The recovery plan can only suggest general approaches.

PART II. RECOVERY

A. Recovery Objective and Criteria

The immediate goal of this recovery plan is to ensure the continued conservation of the three species that occur in the Apalachicola National Forest and to encourage conservation of habitat for *Euphorbia telephioides* or any of the other species outside the National Forest. These plants cannot be delisted if they are conserved only in the National Forest; in fact, loss of habitat outside the Forest might require changing listing status to endangered (an especially likely prospect for *Euphorbia telephioides* and *Scutellaria floridana*). The latter species is presently known from only 11 sites.

For delisting a plant species, the Fish and Wildlife Service is typically setting a goal of adequately protecting and managing 15 populations distributed throughout the species' historical range, for 10 years (e.g. Somers 1994). To apply this criterion to these species would require determining how many populations occur in Apalachicola National Forest. The number of "occurrences" listed by the Florida Natural Areas Inventory for these species in the Forest (*Macbridea alba*—41, *Pinguicula ionantha*—4, and *Scutellaria floridana*—5) is greater than the number of populations because occurrences do not cross compartment [management unit] boundaries.

These recovery goals are by necessity only preliminary, and they will be refined.

B. Outline for Recovery Actions Addressing Threats

1. Protect populations in Apalachicola National Forest and on other public lands.

1.1 **Management/general monitoring in Apalachicola National Forest.** Detailed guidance for conserving *Macbridea alba*, *Scutellaria floridana*, and *Pinguicula ionantha* in Apalachicola National Forest is best provided by the Forest Service itself, whose staff botanists are familiar with Forest Service management practices, plans for the Forest, and the need to reconcile different management objectives for different species (including red-cockaded woodpeckers, Florida black bears, and flatwoods salamanders). Management guidance must be revised as new information becomes available and experience accumulates (as has been the case with Harper's beauty, *Harperocallis flava*). An example of how management guidelines might change in the future comes from the observation that *Macbridea alba* appears to benefit from limited soil disturbance; its conservation may turn out to be compatible with mechanized activity.

The current draft of Forest Service guidance recommends: avoid soil disturbing activities; reestablish longleaf pine where possible through natural regeneration; avoid applying fertilizer in occupied or suitable habitat for these species, limit timber harvest to dry weather (to avoid rutting), avoid stumping

(removal of stumps for naval stores), apply growing season prescribed fire (while avoiding creation of firelines). Ensure that Forest Service personnel who work with the plants can identify them when in flower.

This guidance largely deals with the avoidance of certain management practices (conducting growing season fires is the main exception) need to be augmented with a monitoring program and, as better information on the plants becomes available, positive management procedures. There is also a need to identify appropriate tree densities for areas inhabited by these plants.

The Fish and Wildlife Service reviews Forest management plans under Section 7 of the Endangered Species Act.

Monitoring can be roughly divided into two parts: general stand information (dates of fires, silvicultural treatments, information on the species composition and cover of the understory), combined with low-intensity, long-term monitoring of population sizes provides a context for studies aimed at answering questions about the individual species, which are in the next part of the outline.

Because Apalachicola National Forest is the only place where the three species are assured of protection, and because there is reason to fear that *Macbridea alba* and *Scutellaria floridana* are likely to be extirpated outside the Forest, appropriate management in the National Forest is essential to assure they will not go extinct.

- 1.2 **Conduct population biology studies.** These studies will better determine the life stage at which each species is most vulnerable and what agents are responsible for mortality. They will also measure decline or growth of selected populations (K. Kirkman, Jones Center, Ichauway pers. comm. 1994). Probably the most important outside agent in the life histories of these plants (and one of the most amenable to study) is fire.

- 1.21 **Macbridea alba.** Population structure and reproductive effort in Apalachicola National Forest should be studied, continuing the study underway by Joan Walker (U.S. Forest Service) and Deborah White (then of FNAI, currently at Kentucky State Nature Preserves Commission)(Walker and White, no date). Their original plan (Walker and White 1990) was to tag and measure at intervals approximately 100 individuals, and subject half of them to fire in March. The study was intended to provide a beginning for long-term monitoring of *Macbridea alba*, and for developing fire management strategy and "to develop criteria for prescribing possible management treatment based on population size".. A similar study is underway on *Schwalbea americana*, a Coastal Plain fire-adapted species, by K. Kirkman at the Joseph W. Jones Ecological Research Center Ichauway (Newton, Georgia).

- 1.22 **Scutellaria floridana.** Similar work is needed on *Scutellaria floridana*; because *Scutellaria* is less abundant than *Macbridea*, *Scutellaria* work is a higher priority. The *Scutellaria* project should include development of methods for expanding existing populations or creating new ones in Apalachicola National Forest or elsewhere (see task 5). Because of the low number of populations and individuals of this species in the Forest, such studies appear essential to prevent its extinction.
- 1.23 **Pinguicula ionantha.** Long-term exclusion of fire from *Pinguicula* habitats may adversely affect this species by favoring the development of a shrubby mid-story, usually with *Hypericum* (G. Anglin, U.S. Forest Service, pers. comm. 1994). Fires in the National Forest may offer opportunities to observe *Pinguicula* response, or small experimental fires (or mechanical clearing) could be tried. In connection with any such study, it would be useful to know whether *Pinguicula ionantha* numbers fluctuate in response to factors other than shade or fire. A few multi-year plots in habitat that's unlikely to be disturbed might be informative as a supplement to experimental habitat manipulation plots.
- 1.3 **Conduct botanical inventories on public land, possible purchase areas, and selected private land.** The surveys that provided sufficient information to show that these plants should be listed were not intended to provide complete information for planning their conservation.
- 1.31 **Pinguicula survey in Apalachicola National Forest.** There is a good chance that a thorough *Pinguicula ionantha* survey in the spring flowering season will turn up more populations and/or give a better estimate of the number of plants than is currently available. If an initial reconnaissance of wetlands finds that a particular type of wetland (say, cypress ponds) is especially likely to have *Pinguicula*, it might then be feasible to conduct a randomized survey of appropriate wetlands, using the National Wetland Inventory maps to select target sites. Such a survey could very likely be designed to yield statistically valid population estimates at reasonable cost. *Hymenocallis henryae* (green pine lily or panhandle spider lily) may occupy much the same habitats. If distributional information could be developed on both species, it would be desirable. The *Pinguicula* survey may be especially useful in the Franklin County areas where land is being purchased for Apalachicola National Forest.

Questions about the response of this plant to shade and/or fire are dealt with in 1.23, above.

1.32 ***Pinguicula ionantha* surveys outside Apalachicola National Forest.** Major land acquisitions south of the present boundaries of the Forest are underway, including approximately 30,000 acres in Tates Hell, which may be excellent *Pinguicula* habitat. All such acquisition areas should be surveyed. Surveys should be designed to guide any possible of monitoring of these areas for *Pinguicula* as drainage and fire regimes are restored.

If private landowners are interested, surveys could be conducted to determine whether current forestry management practices leave sufficient populations and habitat for *Pinguicula* intact. If so, the species could probably be delisted.

1.33 ***Euphorbia telephioides* surveys.** The St. Joseph Peninsula has apparently not been searched for *Euphorbia telephioides*, which is present (and seems to be locally abundant) immediately to the east on similar coastal sand ridges. The Eglin Air Force Base satellite property on the peninsula should be searched (if the Air Force hasn't arranged a botanical inventory already), as well as the St. Joseph Peninsula State Park. On the mainland near the peninsula, the small mainland property of St. Vincent National Wildlife Refuge on road 30A in Franklin County needs to be examined. Dr. Loran Anderson at Florida State University, who has done field work on St. Vincent Island, can judge whether this or other species should be sought on the island, or on other barrier islands. Tyndall Air Force Base has been inventoried by FNAI. Despite its position on a what seemingly should be a floristically rich portion of the coast, the base's flora appears disappointing. These further surveys are essential to find protectable habitat for *Euphorbia telephioides*, which in turn is essential for preventing its extinction.

2. **Manage rights-of-way.** Highway and utility rights-of-way (mostly electric powerlines along highways) harbor populations of all four plant species. Experience with managing *Harperocallis flava* (Harper's beauty), an endangered plant, on a highway right-of-way in Apalachicola National Forest may suggest approaches for conserving these species.

In Apalachicola National Forest, right-of-way management concerns will probably center on conserving Harper's beauty and on minimizing damaging impacts to adjoining native vegetation (negative impacts may include the spread of bahia grass, *Paspalum notatum*, into native vegetation). For listed plants other than Harper's beauty, the Forest's native vegetation should provide more, and better habitat than roadsides.

Outside Apalachicola National Forest, rights-of-way may offer the best, or only opportunities for conservation of these species in large parts of their ranges. It may be possible to develop improved methods of maintaining roadside drainage facilities (including ditches) to conserve savannah species. The FDOT suggested that prescribed burning of roadsides could be contemplated, in place of mowing, if demonstrated to be safe. FDOT can conduct fires for endangered species conservation under Florida

Statutes 590, Forest Protection. Electric utilities are unlikely to tolerate fires beneath their power lines, because of possible damage to poles and because smoke disrupts power transmission.

So far, there seems to have been little investigation of techniques for encouraging native plant species in flatwoods/savannah rights of way, even though numerous plant species of these habitats are listed as endangered or threatened. Many native plants appear able to fend for themselves, if given even a modest opportunity. Routine ditch scraping or cleaning, for instance, does not seem to do away with the native *Juncus* or *Rhynchospora* rushes. Experience with Harper's beauty seems to show that the timing of mowing is probably critical to discouraging dewberries (*Rubus*) and encouraging herbaceous species.

The apparent lack of existing knowledge of how to manage rights-of-way for native plants means that it is difficult to provide useful advice to managers, or to prescribe management methods, except for the obvious warning that it's probably foolish to drastically change the management of road edges that have thriving native floras. The following actions appear appropriate:

- 2.1 **Develop a regional report on right-of-way management in coastal savannah regions.** Obvious geographic areas to be covered include southeastern North Carolina (*Thalictrum cooleyi* and others), adjacent South Carolina, the Apalachicola area, the Pensacola-Mobile Bay region, and coastal Mississippi. Attempt to determine whether utilities may be interested in developing management procedures for native flora/listed plants.
 - 2.2 **Experiment with right-of-way management.** Opportunities may arise to try changes in management. Whenever possible, such changes should be done on a trial basis. The Fish and Wildlife Service will endeavor to cooperate with such tests.
3. **Protect and manage these plants outside Apalachicola National Forest.**
 - 3.1 **Secure protection.** The Florida Conservation and Recreation Lands (CARL) program has identified limited areas in Gulf County for potential purchase. Previous efforts to acquire Wards Ridge south of Port St. Joe did not materialize. For conserving plant species, large tracts of land (hundreds or thousands of acres) are generally not necessary, especially if there is assurance that adjoining lands will remain semi-natural. In the Apalachicola region, it appears reasonable to assume that most commercial forest land will remain in pulpwood production rather than be developed for residential purposes, so conservation easements on small, important sites may prove feasible. Possibly, small savannah sites might be secured through conservation easements rather than by purchase. Acquisition currently underway in Franklin County to expand Apalachicola National Forest may conserve some of these plants. If *Euphorbia telephioides* occurs adjacent to the small mainland tract

of St. Vincent National Wildlife Refuge, acquisition for the Refuge could be worthwhile. This task is essential to prevent the extinction of *Euphorbia telephioides* and to recover the other species.

- 3.2 **Develop management and monitoring plans for protected sites.** When these plants occur on public land, or become protected through the purchase of public land or conservation easements, management guidelines and monitoring programs, similar to those being developed by Apalachicola National Forest, will be needed.
- 3.3 **Implement management and monitoring for protected sites.** Once developed, plans need to be implemented indefinitely.
4. **Systematic and other studies.**
 - 4.1 **Genetic structure of *Macbridea alba*.** Dr. Loran Anderson (Florida State Univ.) has observed that all populations of *Macbridea alba*, except one, are composed of glabrous or pubescent individuals. This suggests that both pubescence forms ought to be conserved. For this reason, it would be very desirable to study the genetic structure of *Macbridea* populations to ensure that the entire species is conserved.
 - 4.2 **Comparison of *Macbridea alba* and *M. caroliniana*.** There might be some opportunities to compare the narrowly-distributed *M. alba* with the more widely distributed but still rare *M. caroliniana*, a candidate for Federal listing. Comparison of narrowly-versus-widely distributed species is currently a popular research topic among conservation biologists. It is not yet clear how results from this comparison would affect the conservation of *Macbridea alba*. However, because *Macbridea alba* is becoming the better-understood of the two species, a comparative study might contribute significantly to assessing the status of *M. caroliniana*. Thus any comparison project should be designed primarily to benefit *M. caroliniana*, with possible benefits for *M. alba* as a secondary attraction.
5. **Garden propagation and reintroduction.** Because *Scutellaria floridana* (and to a lesser extent *Macbridea alba*) would be more secure in Apalachicola National Forest if there were more populations, and because both species may have been locally extirpated (by lack of fire or construction of fire lines) from suitable sites, reintroduction of *Scutellaria*, and probably also *Macbridea*, should be attempted. It is not clear whether propagation or seeding is more likely to work. Population biology studies on *Scutellaria* (task 1.22) will provide this essential knowledge. Reintroduction of *Euphorbia telephioides* or *Pinguicula ionantha* depends on suitable, protected habitat being available and methods being developed. Garden propagation of *Scutellaria* and *Macbridea* as part of reintroduction is

essential. It is not yet clear whether it would be useful to maintain garden populations of any of the four species.³

6. **Protect *Pinguicula ionantha* from depredations due to collecting.** Collecting of *Pinguicula ionantha* is no more than a minor problem, according to experts on trade (trade in other carnivorous plants, including pitcher plants, is vastly more important [Fauna and Flora Preservation Society 1994]). Existing contacts between the Fish and Wildlife Service and the carnivorous plant community should suffice to warn of serious collecting problems. If measures are needed to discourage collecting, the Service could respond with law enforcement investigations and by changing the listing status of the species to endangered, which would invoke the severe penalties of the Endangered Species Act for removing and reducing to possession, maliciously damaging or destroying endangered plants on Federal land, or removing, cutting, digging up, or damaging, or destroying any endangered plant on any other area in violation of state laws or regulations.

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³ A higher priority for propagation and reintroduction than any of the four species in this plan may be *Harperocallis flava*. This endangered plant appears to be in cultivation, judging from an application to the Fish and Wildlife Service for a permit to sell the species several years ago; however, the Plant and Services Directory of the Association of Florida Native Nurseries for 1993-94 does not list *Harperocallis* as available from their nurseries, nor are any of the other species in this recovery plan listed in the directory. *Harperocallis* might be reintroduced to bogs from which it may have been extirpated by unsuitable fire regimes.

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PART III. IMPLEMENTATION SCHEDULE

The Implementation Schedule outlines actions and estimated costs for the recovery program. It is a guide for meeting the objective discussed in Part II of this Plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of each species and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of these species.

Priorities in Column 1 of the following Implementation Schedule are assigned as follows:

- Priority 1 An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 All other actions necessary to provide for full recovery of the species.

NOTE: Each task in the Implementation Schedule is assigned a priority number. While the number reflects the importance of the activity, it does not mean that the highest-priority tasks will necessarily be accomplished first.

Abbreviations in the Implementation Schedule:

- ANF Apalachicola National Forest
- CPC Center for Plant Conservation and member botanical gardens
- FDACS Florida Department of Agriculture and Consumer Services
- FDEP Florida Department Environmental Protection, Division of Recreation and Parks?
 Division of State Lands/Land Acquisition Planning Section?
- FDOT Florida Department of Transportation
- FNAI Florida Natural Areas Inventory
- FS U.S. Forest Service, National Forests in Florida
- FWS U.S. Fish and Wildlife Service, Ecological Services, Endangered Species, Florida.
 (Note: the new National Biological Survey may eventually play a role in
 providing scientific expertise for plant recovery projects)
- TNC The Nature Conservancy

IMPLEMENTATION SCHEDULE

Priority	Task Number	Task Description	Task Duration	Responsible Agency	Cost estimates (\$000)					Comments
					FY 1	FY 2	FY 3	FY 4	FY 5	
1	1.1	Management/monitoring in Apalachicola National Forest (ANF).	ongoing	U.S. Forest Service	2	5	5	5	5	Monitoring cost, only. Management cost has not yet been estimated.
2	1.21	<i>Macbridea alba</i> population biology in ANF.	4 years	FWS, Forest Service	3	2	2	2	0	
1	1.22	<i>Scutellaria floridana</i> population biology in ANF.	4 years	FWS, Forest Service	4	2	2	2	0	
2	1.23	<i>Pinguicula ionantha</i> population biology in ANF.	4 years	FWS, Forest Service	4	2	2	2	0	
2	1.31	<i>Pinguicula</i> survey in ANF.	1 year	FWS, Forest Service	9	0	0	0	0	
3	1.32	<i>Pinguicula ionantha</i> surveys outside ANF.	1 year	FWS, FNAI	10	0	0	0	0	
1	1.33	<i>Euphorbia telephioides</i> surveys.	1 year	FWS, FNAI	5	0	0	0	0	
3	2.1	Develop a regional report on right-of-way management in coastal savannah regions.	6 months	contractor. TNC?	8			6	6	
3	2.2	Experiment with right-of-way management.	ongoing	FWS, utilities, FDOT, county road departments	2	5	5			
2	3.1	Secure protection for the 4 plants outside ANF.	5 years?	FWS, landowners/managers	2	7	8	8	10	
2	3.2	Develop management plans for protected sites outside ANF.	4 years	FWS, landowners/managers	3	3	3	3	0	

Priority	Task Number	Task Description	Task Duration	Responsible Agency	Cost estimates (\$000)					Comments
					FY 1	FY 2	FY 3	FY 4	FY 5	
2	3.3	Implement management and monitoring for protected sites outside ANF.	ongoing	FWS, private landowners, FDEP? FDACS-Div. of Forestry?	1	2	4	8	10	
1	4.1	<i>Macbridea</i> genetic study.	2 years	FWS, universities	0	0	7	7	0	To be prioritized and funded under conservation measures for the candidate species <i>Macbridea caroliniana</i>
	4.2	Comparison of 2 species of <i>Macbridea</i> .	2 years?	FWS, universities	0	0	0	0	0	
3	5	Garden propagation and reintroduction.	ongoing/ indefinite	FWS, botanical gardens, CPC, FS	0	4	4	4	0	
2	6	Protect <i>Pinguicula ionantha</i> from depredations due to collecting.	ongoing	FWS	0	0	0	0	0	

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