

Euphorbia telephioides
(Telephus spurge)

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



Breakfast Point Mitigation Bank, Bay County, FL. Photos by Vivian Negrón-Ortiz.

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



5-YEAR REVIEW
Euphorbia telephioides* / *Telephus spurge

I. GENERAL INFORMATION

A. Methodology used to complete the review

This review was accomplished using information obtained from the Recovery Plan of June 1994, biological opinions prepared by U.S. Fish and Wildlife Service (USFWS, Service), several documents prepared by Ecological Resource Consultants, Inc., unpublished field survey results, reports of current research projects, peer reviewed scientific publications, unpublished field observations by Service, State and other experienced biologists, and personal communications.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 March 25, 2014 (79 FR 16366). Comments and suggestions from peer reviewers were incorporated as appropriate (see Appendix A). No part of this review was contracted to an outside party. This review was completed by the Service's lead recovery botanist for this plant in the Panama City Field Office, Florida.

B. Reviewers

Lead Field Office -- Dr. Vivian Negrón-Ortiz, Panama City Field Office, 850-769-0552 ext. 231

Lead Region: Southeast Regional Office: Kelly Bibb, 404-679-7132

Peer Reviewers:

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C. Background

- 1. Federal Register Notice citation announcing initiation of this review:**
79 FR 16366 (March 25, 2014)
- 2. Species status:** Overall Stable; seven populations are properly protected; three new occurrences were documented; recent surveys conducted on several sites found the species in excellent condition.
- 3. Recovery achieved:** 2 (26 - 50% recovery objectives achieved); Recovery Data Call 2014; most recovery actions are ongoing or have been partially met.

4. Listing history

Original Listing

FR notice: 57 FR 19813

Date listed: June 8, 1992

Entity listed: species

Classification: Threatened

5. Associated rulemakings

Not applicable

6. Review History

Recovery Plan: June 22, 1994

Previous 5-year Review: March 6, 2008

Recovery Data Call:

2003 (uncertain); 2004 (improving); 2005 (stable); 2006 (stable); 2007 (stable); 2008-2014 (overall stable for public/protected areas; trends in populations: unknown)

7. Species' Recovery Priority Number at start of review (48 FR 43098):

The telephus spurge is assigned a recovery priority of 2c because the degree of threat to its persistence is high, it is a species, it has a high recovery potential, and is in conflict with development and growth.

8. Recovery Plan

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

Dates of previous revisions: N/A

II. REVIEW ANALYSIS

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

Telephus spurge is a plant; therefore, it is not covered by the DPS policy and it will not be discussed further in this review.

B. Recovery Criteria

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

Yes. The recovery plan includes a recovery objective for delisting the species as well as criterion. The objective is to promote conservation of habitats for *E. telephioides*. For the species to be considered for delisting, the general criteria 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 criteria were based on the available data at the time the plan was published 20 years ago. For instance, the habitat was described as 'scrubby oaks on low sand ridges near coast', a very narrow account in view of present information. The number of localities, which were not specified in the plan, was based on a Florida Natural Areas Inventory (FNAI) report dated 1989. To date, current survey work has increased the distribution of this species to other localities within the three counties; in addition it has suggested the extirpation of some sites. Furthermore, it was not known that the species is subdioecious composed of male, female and monoecious (having male and female flowers on the same plant) plants. Subdioecy has the effect of ensuring outcrossing, but it also reduces the effective population size (number of individuals in a population who contribute offspring to the next generation), as only about half of the individuals in the population are available for plant to exchange gene with; the presence of pure males and females rather than monoecious individuals promotes outcrossing and reduces effective population size. Thus, in small or fragmented populations, chance factors may result in a population comprised of a single gender; therefore, population density may be important to ensure viability.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

No. The recovery plan only addressed factor a – habitat destruction and modification, which is still a threat. See section II.C.2 for description of current information on 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 includes four plants from the lower Apalachicola region of the

Florida panhandle. The immediate goal of the 1994 recovery plan that addressed *E. telephioides* was written as ‘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.’ The general criteria listed in the plan are to adequately protect and manage 15 populations distributed throughout the species’ historical range for 10 years. In section IV, we recommend for the plan’s recovery criteria to be revised and better defined; in section II.C. 1 and 2, we present current information on status and threats to the species; and Appendix 1 shows details and progress for each recovery action.

This plant based on best available information does not occur on the Apalachicola National Forest. However, in terms of the general criteria given to consider this plant for delisting, reference in section II.C.1, Table 1, Table 2, and Table 3 for the most up-to-date survey information on the lists of locations that have this plant. Also, to date, seven protected populations have been secured (USFWS 2005): four populations on the St. Joseph Bay State Buffer Preserve (Gulf County), and the North Glades and the Breakfast Point Mitigation Bank (BPMB) populations (Bay County), and one population at the Carrabelle-Eastpoint transmission corridor (Franklin County). The recovery criteria and threats-related criteria all address factor a - present or threatened destruction, modification or curtailment of its habitat or range. Factor b (overutilization) is not relevant to *E. telephioides*. Factors c, d, and e, although relevant to this species, were not addressed by the Recovery Plan (see section II.C.2 for current information).

C. Updated Information and Current Species Status

1. Biology and Habitat.

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

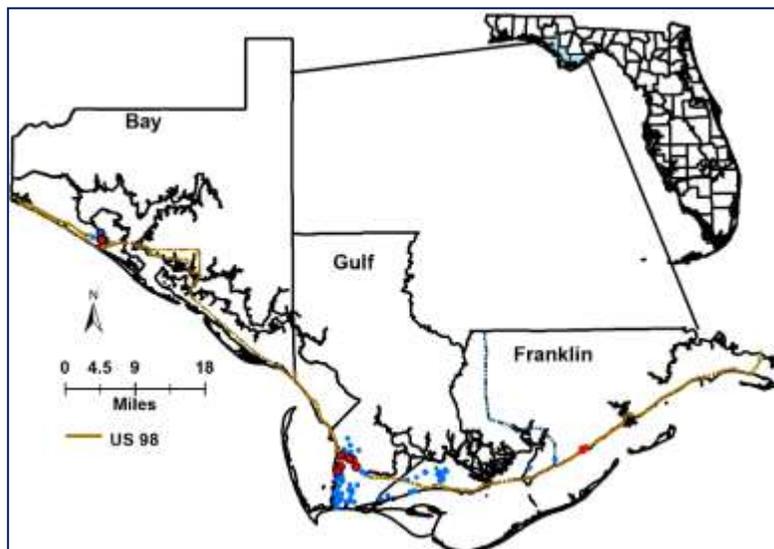


Figure 1. Map of Florida (inset) showing the counties and locations of *E. telephioides*. Populations: blue, previously reported; red: recently documented.

Euphorbia telephioides is restricted to the Florida panhandle, specifically to coastal Bay, Franklin, and Gulf counties (Fig. 1). In 1989, *E. telephioides* was known from only 22 sites (FNAI 1989). The number of populations has increased to 41 sites (Fig. 1) based on recent survey work (FNAI 2007; 2013 -2014 FWS surveys; consultation surveys).

About nine locations appear to be extirpated by development, and/or habitat modification. Because the surveys were conducted irregularly, with most sites visited only once, we have poor information regarding trends. Many locations originally described with abundant plants were found in subsequent surveys to be variably altered, thus possibly interfering with the search for *E. telephioides* (Tables 1- 3). For instance, areas with ‘very dense pine plantation with almost no herbaceous understory’ or ‘flatwoods with very dense, long unburned understory’ were described as lacking the species despite previous reports of species occurrence in the sites. This species is of ephemeral nature, that is, it can be abundant at newly disturbed sites, and then tends to disappear when the sites are revisited a few years later; therefore, while the shoot (stem and leaves) is not visible they are probably still there. The information below is organized by county, and provides a detailed account of population trends. The number of populations and plant counts are estimated given that some potential areas have not been evaluated.

Bay County



Figure 2. Locations of *E. telephioides* in Bay County. Dots = populations (blue: previously reported, red: recently documented); brown line = road US 98; white arrows: = projected development; pops. 8, 9, 43a = extirpated; NG = North Glade

Surveys conducted in Bay County between 1988 and 2014 indicated the presence of more than 19,172⁺ plants (USFWS 2007; Ecological Resource Consultants

2004; FWS 2014, unpubl. surveys). This is an estimated number given that some potential areas have not been evaluated, and others have been extirpated by development. Three locations, reported from FNAI surveys conducted in 1988, 2001, 2003 and 2004 (Table 1) occur in a partially forested area along US 98 (Fig. 2). The FNAI survey in 2001 for populations no. 8 and 43 indicated that the plants were not visible due to very dense understory or scrub layer vegetation, contrasting with the observation of the area in the 1988 survey. FNAI population no. 8 has been completely destroyed (USFWS 2008) due to development of a shopping center. FNAI population no. 43 appears to be thriving (Negrón-Ortiz, 2007-2011, pers. observ.), but 43a was not located in a 2012 survey (Negrón-Ortiz, pers. observ.).

Originally FNAI population no.7 covered an area of 8.62 acres with approximately 17,250 plants, but it was partially impacted by development in 2005 (Ecological Resource Consultants 2004; USFWS 2005) leaving 4.52 acres with about 6,831 plants. This fragmented location is known as the North Glades site (Ecological Resource Consultants 2004; USFWS 2005, 2007). The site has been maintained by mowing but may require fire to control the development of a thick understory. Recent 2012 & 2013 surveys indicated the presence of only 28 plants (Negrón-Ortiz, pers. observ.).

The 200⁺ plants located at BPMB (Table 1) are found in a pine plantation and are being managed and monitored (USFWS 2005, 2007; Ecological Resource Consultants 2004, 2007). Since the inception of management in 2005, the population has significantly increased to 1,000 plants (Tobe, 2007, pers. comm.; Negrón-Ortiz, 2010-2014, pers. observ.).

The two recently documented populations with about 290 plants (Fig. 2, white arrows) will be soon impacted by a residential development. Overall, current estimated number of plants for Bay County is about < 5,000 individuals (Table 1).

Table 1. Number of individuals per population reported from five surveys conducted on four populations of telephus spurge in Bay County. Data were taken from FNAI and the Service. The 2004 count for population 43 consists of counts of two subpopulations separated by ‘;’; * = partially destroyed; ** = completely destroyed; BPMB = Breakfast Point Mitigation Bank; --- no survey.

Population	1988	2001	2003	2004	2007	2012-2013	Managed land
7 (N. Glades)		100 ⁺	0	17,250	*6,831	28	Private
8	200	30	---	---	**	**	Private
9	200 ⁺	0				**	Private
43	200 ⁺	---	---	25 ⁺ ; 100 ⁺	200 ⁺	200 ⁺	Private
BPMB	400 ⁺			200 ⁺	1000	1000	Private
Total					8,031 ⁺	1,228	

Gulf County

Surveys conducted in Gulf County between 1988 and 2014 indicated the presence of more than 16,578 plants. These sites are found clustered in a 28 square mile area east and south of Port St. Joe, in habitats mostly dominated by longleaf or slash pine. Seven of these locations are found along US 98 (Fig. 3). Eight locations were surveyed only once (Table 2). Therefore, the current status of the plants and/or populations is unknown. Unsuccessful surveys for FNAI populations 1, 10, and 17 could be explained by habitat alteration, (i.e., cutover, rutted, ditched (FNAI 2007) and suggest extirpation (USFWS 2007); population 51 has been highly fragmented (Fig. 3; 2014 FWS pers. observ.). FNAI's survey for populations 14 and 15 showed a marked decline in numbers (Table 2). These two sites were found in moderate to dense pine plantations, thus the plant tap roots are possibly there, and the shoots could reappear after a "burn or after thinning the plantation" (FNAI 2007).



Figure 3. Locations of *E. telephioides* in Gulf County. Circles (or polys) show multiple source points for same occurrence. Dots = populations (blue: previously reported, red: recently documented). X = extirpated; X= highly fragmented; SR: Shallow Reed

Four occurrences (FNAI 3, 28, 36, and 44) are protected and managed at St. Joseph Bay State Buffer Preserve (SJBP) (USFWS 2007; Negrón-Ortiz, 2007, pers. observ.), and contain the largest number of individuals (Table 2). The Shallow Reed (SR) development site located west of SR-30 contains about 255 plants and is expected to be protected from direct impact through on-site wetland mitigation (USFWS 2007; Fig. 3), but long-term management remains uncertain. Ongoing surveys for Gulf County populations are expected to provide more current information on status.

Table 2. Number of individuals per population reported on eight surveys conducted on 23 populations of telephus spurge in Gulf County. Numbers followed by ‘ ; ’ represent subpopulations; --- no survey; SJBP = St. Joseph Bay State Buffer Preserve. Data were taken from FNAI (2007). Totals were not presented because populations are being currently surveyed.

Population	1988	1996	1999	2000	2001	2003	2004	2005/2006	Managed land
1 (1967)	---	---	---	0	---	---	---	---	Private
3 (SJBP)					30 ⁺ ;1000	25; 50; 50;100	---	---	State
4 (1988)		---	---	---	5	---	---	---	Private
6			10-20	250 ⁺	---	---	---	---	Private
10	1,500	---	---	---	0	---	---	---	Private
11	30-40			2	20	---	---	---	Private
12	200-300	---	---	---	---	---	---	---	Private
13	10-20	---	---	1	---	---	---	---	Private
14	50-100	---	---	---	2	---	---	---	Private
15	15-20	---	---	---	5	---	---	---	Private
16	50-100	---	---	---	---	---	---	---	Private
17	50	---	---	---	0	---	---	---	Private
19	3-20	25-30, 20-30 ⁺	---	---	---	150	---	---	State
27		50-100, mostly seedlings	---	---	many	---	---	---	Private
28 (SJBP)						100-500; 10; 250; 1350 ⁺ ; 575; 520; 200	---	---	State
34					1000's	---	---	---	Private
36 (SJBP)						~50; 20; 570	100 ⁺	---	State
37	5	---	---	---	---	---	---	---	Private
38				23	---	---	---	---	Private
39					1000's	---	---	---	Private
41					10-20	475; 400; 230; 1,450	---	---	Private
44 (SJBP)						50; 125; 855	---	---	State
51								3,000	Private

Franklin County



Figure 4. Locations of *E. telephioides* in Franklin County. Circles (or polys) show multiple source points for same occurrence. Dots = populations (blue: previously reported, red: recently documented); X = extirpated. Pop. 21 = Indian Pass ROW; CTC - Carrabelle transmission corridor.

Surveys conducted in Franklin County locations between 1988 and 2014 indicated the presence of about 9,723 plants. Five populations (45 - 49) were documented in 2007 (Table 3, Fig. 4). Populations 26 and 35 (Fig. 4, Table 3) were documented only from herbarium specimen information. Plants at population 26 were referred to as ‘frequent’ (without providing an actual account of plants) in 1987, but were not located in the 2005 and 2007 surveys. Habitat had been significantly altered by a residential development. Population 35 was revisited in June 2007 and 2011, but no plants were found due most likely to the density of the understory of the pine plantation. Both populations may be extirpated (USFWS 2007).

The marked difference in the number of plants reported over time for population 21 was due to habitat changes. Originally, the site was described as ‘an open savanna along roadside’. However, by the 2001 survey, the site had been modified into ‘a power line row or a dense young pine plantation.’ A 2009 consultation survey along the Florida Power Indian Pass Right-of-way yielded approximately 2,000 individuals for population 21 (D. Adkins, 2010, pers. comm., Fig. 4). Presently, the numbers of plants for population 21 are uncertain because a post-project monitoring is not available, and the effect of installing temporary matting over telephus spurge plants was not documented.

One new population of approximately 2,000 individuals was documented at the Carrabelle-Eastpoint transmission corridor (CTC; east of Franklin Co.) during a 2013 consultation survey (Flatwoods Consulting Group 2013; Fig. 4). This population is now protected and will be monitored during 2014 and 2015 by Flatwoods Consulting Group after the construction project is completed (Appendix 1, recovery action 3.2).

Table 3. Number of individuals per population reported on five surveys conducted on eleven populations of telephus spurge in Franklin County. Data were taken from FNAI and the Service. ‘;’ represent subpopulations; rd = residential development; --- no survey. Totals were not presented because populations are being currently surveyed.

Population	1988	2000	2001	2005	2007	2010-2013	Managed land
20	~50	---	30	---	---	---	Private
21	100-1000	---	15; 15	---	70; 146 ⁺	2,000 (2013: uncertain)	Private
22	50	~50	---	---	---	---	Private
26 (1987)	---	---	---	0	rd	rd	Private
35 (1990)		---	---	---	0	0	Private
40			5	---	1,400	1,400	State
45					110-160	not located	State
46					~36	---	State
47					3	---	Private
48					1	---	State
49					23	---	State
CTC						2,000	Private
Total	~200-1,000				~1,789-1,812 ⁺		

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)

Trapnell et al. (2012) studied the genetic composition of *E. telephioides*. Twenty-three allozyme loci were resolved for 17 populations. Species-wide genetic diversity was high, ranking *E. telephioides* among the highest 10% of plant species surveyed. However, genetic differentiation among populations is lower than that observed for other herbaceous outcrossing perennial plant species. The eleven populations in Gulf County are more different from one another than populations within Franklin or Bay Counties, so they may represent older, more stable populations. Data suggest that high rates of gene flow have historically occurred between populations because they were probably more continuously distributed in Bay, Gulf and Franklin counties; therefore their relative contemporary isolation is probably recent.

c. Taxonomic classification or changes in nomenclature:

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Malpighiales
Family:	Euphorbiaceae
Genus:	<i>Euphorbia</i> L.
Species:	<i>telephioides</i> Chapman
Common name:	telephus spurge

There have been no changes in taxonomic classification since 2008.

d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range:

Euphorbia telephioides is endemic to the Florida panhandle and restricted to Bay, Gulf, and Franklin counties. It is unknown whether *E. telephioides* was once continuously distributed throughout the three counties or populations were restricted to local habitat patches. The present remaining patches are separated by clear cuts, pine plantations or residential/commercial development.

In 1992, when the species was listed, it was known from 22 localities in the three counties, all within 4 miles of the Gulf coast (57 FR 19813). To date, the species is still constrained to the same three counties, but the number of occurrences within the counties has increased to 41. Development has resulted in (or potentially resulted in) extirpation of several populations (Figs. 2-4), and has left other sites highly fragmented (Figs. 2 and 3). Three new populations have been found: a future development site (Breakfast Point, Bay County), a subdivision (Shallow Reeds development site, Gulf County), and a powerline (Carrabelle-transmission corridor, Franklin County). Only the Carrabelle transmission

corridor population will be protected. The habitat preference originally described for the species has been expanded (see section II.C.1.e below).

e. Habitat or ecosystem conditions:

At the time the recovery plan was written, the habitat was described as ‘scrubby oaks on low sand ridges near coast’. To date, *E. telephioides* is known to occur in a wider range of habitats. No new changes in habitat have been documented since the 2008 5-year review. It continues to be reported from xeric¹ to mesic pine flatwoods and in scrubby pinelands dominated by wiregrass and/or *Pinus palustris* or *P. elliotii*. Although uncommon, telephus spurge was observed growing in wetlands with seepage slope species and in small thick clumps of wire grass surrounded by pine or cypress (Rountree et al. 2005).

Telephus spurge can be locally abundant along disturbed sandy, sunny roads, and in sites with bedding. It can be found sporadically abundant in dense grass of unburned scrubby flatwoods (Negrón-Ortiz, 2007-2014, pers. observ.). It has also been noted in upland communities, which have been historically burned with a two to three year fire frequency (J. Huffman, 2007, pers. comm.). In general, the plants do well on sandy, acidic soil, with no litter, and low organic and moisture content (Peterson & Campbell 2007).

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 telephus spurge, and remains the main threat to date for this plant. The long history of timbering, urban development, and fire management and suppression in this region has changed the ecosystems. The threats are discussed in more detail below:

1. Development of the outer Coastal Plain in the Apalachicola for pulpwood production

This industry is no longer considered a primary threat. The timber industry in North Florida became well established in the 1850s (FNAI 2005). It started in Franklin County in the 1870s and supported a large portion of the economy for decades. It continued to be a prominent industry until the mid-1990s (Howell and Hartsell 1995). The St. Joe Paper Company in Port St. Joe was sold and shut down in 1999. The Company has changed its emphasis to residential and

¹Xeric pine flatwoods has about a meter of well-drained dry soil, and becomes inundated during significant precipitation such as during hurricanes (Abrahamson and Hartnett 1990). Mesic pine flatwoods are less well-drained, seasonally inundated flatlands distinguished by an open canopy of broadly distributed slash pine, with nutrient poor sandy soils (Ecological Resource Consultants 2007). Scrubby flatwoods, a variant of the flatwood association, is considered an ecotone between flatwoods and scrub, and it is found on well-drained white sand (Abrahamson and Hartnett 1990).

commercial development.

2. Coastal real estate, road development, and powerline maintenance

Urban development continues to threaten telephus spurge since most *E. telephioides* documented locations are found in private land (Tables 1-3). The St. Joe Company owns extensive areas of land in Northwest Florida, including tracts near Tallahassee and Panama City, with Gulf of Mexico beach frontage and waterfront properties. The Company focuses on commercial and residential development along roadways and near or within business districts in the region. In 2013, the Company sold more than 380,000 acres of its land to AgReserves, Inc., a tax-paying company owned by the Mormon Church. The land sold, which will maintain timber and agriculture uses, included timberlands in Bay, Calhoun, Franklin, Gadsden, Gulf, Jefferson, Leon, Liberty and Wakulla counties.

Many *E. telephioides*' locations are found along US 98, and powerline ROW maintenance (removal of existing and installation of new transmission poles), road widening and new roads continue to negatively affect plant abundance and habitat loss (Figs. 2-4; Tables). Urbanized land in Florida, statewide, is projected to double by 2060 along with doubling of the population to 36 million (<http://www.1000friendsofflorida.org/connecting-people/florida2060/>). According to the study, much of the new development will be focused along roadways. In addition, growth is projected for Bay County, particularly in West Bay and east along SR 22 toward Callaway.

3. Fire suppression

Suppression of fire during the dormant 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 telephus spurge. Lack of fire, and subsequent growth of shrubs (particularly encroachment of *Cyrilla racemiflora* L., commonly known as swamp titi) and saplings in the understory, inhibits *E. telephioides* emergence (Negrón-Ortiz, 2007-2014 pers. observ.; FNAI 2007). Declining fire frequency reduces *E. telephioides* abundance in areas where it was previously observed in great quantities (FNAI 2007; J. Huffman, 2007, pers. comm.). In recently burned areas, however, plant emergence is prolific (Negrón-Ortiz, 2007-2014, pers. observ.).

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., 3-5 year intervals, are needed to maintain optimal *E. telephioides* populations (Negrón-Ortiz, 2014, unpublished data).

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

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

c. Disease or predation:

There is no evidence to suggest that disease or predation are threats. However, biocontrol agents have been released to control the weed leafy spurge, *Euphorbia esula*, an invasive native to Eurasia, which is widely distributed throughout the U.S. Fifteen different insects have been tested, approved and released for biological control of leafy spurge. *Euphorbia esula* has not been documented to occur in Florida since our 2008 5-year review, but if this weed reaches this area and one or more of the biocontrol agents is released (or dispersers naturally), these insects could threaten *E. telephioides* populations, unless their diets are so selective that they do not feed on it.

d. Inadequacy of existing regulatory mechanisms:

Section 7(b)(4) and 7(b)(2) of the Act generally do not apply to listed plants 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. Several populations of *E. telephioides* occur on private timberland and road rights-of-way (ROW). 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. Neither section of the Act provides protection for plants on private lands. The State requires permission of private landowners for collecting of state-listed plants from their property.

Telephus spurge is protected under Florida State Law, chapter 85-426, which includes preventions of taking, 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>). Gulf and Franklin Counties do not have such regulations.

Highway ROW maintenance activities are not always reviewed for threatened and endangered species impact. However, if there is an activity affecting protected

species, then the Service can request a consultation with the Florida Department of Transportation under the Act. According to Harrison (2014), ROWs represent a potentially underutilized area for rare plant conservation and could augment species preservation and recovery efforts.

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 to telephus spurge because mowing is now the common practice to maintain ROWs in Florida (M. Mittiga, 2007, pers. comm.). Franklin County allows only “spot treatment” due to impacts concerning the Apalachicola National Forest and waters within Apalachicola Bay and River

Sea Level Rise. Sea level rise (SLR) as a result of climate change is a growing concern for much of Florida’s coastline and the endemic species that occur there because about 10% of Florida is less than 1 meter (m) above current sea level. The IPCC (2013) predicts SLR to be 0.26 - 0.82 m by year 2100, which will likely cover most of Florida’s land mass less than 1 m in elevation (Noss 2011). Satellite data shows that average SLR in the Gulf of Mexico, however, is increasing faster than the global average (Bilskie et al. 2014). Using the NOAA Sea Level Rise and Coastal Flooding Impacts Viewer (<http://www.csc.noaa.gov/digitalcoast/tools/slrviewer>), Wolf and Lopez (2014) estimated the potential for inundation of habitat areas for the Telephus spurge at sea level rise projections from 0.305 to 1.83 m (one to six feet) within this century. The projections indicated that coastal habitat areas in Escambia, Bay, Franklin, and Gulf Counties would be largely inundated beginning at 0.305 m (one foot) of SLR. The populations of *E. telephioides* in Bay and Franklin counties are approximately 3 m above sea level, and 3,960 m and 2,890 m from the coast, respectively. The Gulf County population, however, is only about 2 m above sea level as it is closer to the coast (1,772 m). Therefore, SLR projections of changes, under above all scenarios, will most likely affect several coastal populations specifically those located in Gulf and Franklin counties (Fig. 3 and 4).

Euphorbia telephioides is at risk of further decline from SLR because its seeds are not dispersed over large distances (Negrón-Ortiz, 2014, pers. observ.), so sea level may rise more quickly than the species can establish populations further inland. In addition, *E. telephioides* does not respond well to transplantation (Ecological Resource Consultants 2006; Negrón-Ortiz, 2010, pers. observ.). Another major concern is that as more coastline is inundated with water, urban development will expand, decreasing the amount of suitable habitat for *E. telephioides* and impeding the ability of these species to move landward.

D. Synthesis

Euphorbia telephoides is mainly threatened by habitat destruction and modification. Urban development, timbering, and inadequate fire management, i.e., fire suppression, are the main pressures reducing or eliminating individual populations. Where fire management is implemented, it stimulates the emergence of individuals and maintains healthy, stable populations. In general, the plants seem to be well adapted to fire-prone habitats and no problems have been detected with disease, predation or reproduction. However, seedling survival and establishment is low

Recent surveys throughout the three counties have increased the number of occurrences. In many of these populations, the total numbers of plants are numerous and can be maintained with adequate management and conservation. The plant's distribution has remained stable, and few long-term extirpations have been documented (Figs. 2-4). Consultation under section 7 of the Act has resulted in minimizing impacts from powerline maintenance and a few developments.

The species occurs on both private and public lands. Plants occurring on US 98 ROWs are maintained by the Florida Department of Transportation, and recent surveys found the species in excellent condition in a few Bay and Franklin County sites. Most of the private land has been converted to pine plantation and urban development. Since fire has been suppressed from these lands, a dense hard wood understory is present, inhibiting this species. As an endemic species restricted to three counties with populations occurring on private lands and ROWs, telephus spurge is threatened by intense development pressures where urbanized land is projected to increase two-fold in the near future, focusing new development along roadways especially in Bay County. Since the telephus spurge is restricted to coastal flatwoods and pinelands habitat, populations are also threatened by flooding and habitat loss from projected SLR. Therefore, locating new populations and identifying prospective sites for reintroductions such as areas that will not be affected by SLR and future development are necessary to conserve this species.

Euphorbia telephoides should remain as a threatened species, because the present threat of habitat modification via development and road construction and maintenance remains significant. In addition, the criteria for delisting the species, i.e., protect and manage 15 populations distributed throughout the species' historical range for 10 years, have not been met. For the reasons summarized here, telephus spurge meets the definition of a threatened species.

III. RESULTS

A. Recommended Classification:

 X **No change is needed**

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Establish monitoring program
 - i. Identify additional populations of conservation importance based on information from the genetic studies (ongoing).
 - a. Establish permanent plots on at least three additional protected locations throughout the species' historical range. For each plot:
 - a. Estimate the sex ratio, density, and abundance of individuals.
 - b. If possible, investigate basic ecological questions (e.g., pollinators; flowering period; annual variability in flowering; seed production and seedling survival).
 - c. Monitor the effect of fire (if the areas are burned) on density, fecundity, and size structure.
 - ii. Conduct a demographic population viability analysis to assess whether the species is declining, increasing, or stable, and where in the life cycle the management should be targeted. This is an ongoing action conducted by Ms. Natali Miller, a graduate student from FL State University.
2. Collect voucher specimens (e.g., herbarium specimens, samples for DNA analyses, preserve material, seeds and whole plants) from areas proposed to be developed and 1) transplant to suitable sites, and 2) distribute to herbaria, botanical gardens, and interested scientists.
3. Expand germination studies.
 - i. Determine seasonal fluctuations that influence germination timing and recruitment and identify traits that correlate with seed viability and dormancy
 - ii. Conduct *ex situ* germination studies and clarify limits of seed desiccation and cold tolerance.
 - a. Look at historical data, such as herbarium specimens recorded observations and to understand what abiotic and biotic factors influenced germination timing and recruitment in the past.
4. Develop a Species Distribution Model (SDM) to assist with locating new populations and identifying prospective sites for reintroductions such as areas that will not be affected by SLR and future development. Sites should be validated or inspected for plants, and then protected by land acquisitions, conservation easements. This is an ongoing action conducted by Ms. Alexa Mainella, a graduate student from Miami University, OH.
5. Phenological data (timing, duration and abundance of recurrent biological processes, including reproductive events such as flowering, fruiting, seed dispersal and germination) have emerged as useful tools for studying the impact of climate change on plants. Lacking phenological adaptability may require a

stronger signal or may be unable to adapt to climate warming, and therefore may experience greater stress or even extinction during extended climate change. Therefore, phenological studies should include both long-term observations coupled with herbarium specimens' records.

6. Since *E. telephioides* occurs in fire prone habitats, the effect of this disturbance on survival and fecundity should be monitored to determine the best frequent fire regimes, on selected areas to maintain optimal conditions of *E. telephioides* populations.
7. Continue fostering a working partnership with the St. Joe Company, AgReserves, Inc. and other developing companies and consulting agencies, such as Flatwoods Consulting Group to address and minimize potential impacts associated with development and fire suppression.
8. Outreach: Promote the implementation of the recovery actions via academia, private landowners, and public agencies. Develop and distribute information to the general public.
9. The recovery plan should be updated to define objective measurable criteria and better address the five factors.

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APPENDIX 1: RECOVERY CRITERIA AND ACTIONS ADDRESSING FACTOR A: PRESENT OR THREATENED DESTRUCTION, MODIFICATION OR CURTAILMENT OF ITS HABITAT OR RANGE

The plan identified several recovery actions for each recovery criteria, and the progress for each action is addressed below:

Recovery Criterion 1: Protect population in Apalachicola National Forest and on other public lands.

Recovery action 1.3. *Conduct botanical inventories on public land, possible purchase areas, & selected private land.*

This action has been partially met (see below). This species does not occur in Apalachicola National Forest.

1.33. Euphorbia telephioides surveys

This is an ongoing action conducted primarily by the Service and FNAI. Botanical surveys have been conducted throughout the species' historical range including the following locations suggested by the Plan (see below).

Location	Survey information	Presence of plants
St. Joseph Peninsula	Service	No
Eglin Air Force Base	FNAI	No
St. Joseph Peninsula State Park	Service	No
St. Vincent National Wildlife Refuge	Service	No

Recovery Criterion 2: Manage rights-of way

Management of rights-of-way has been partially met (see section: Inadequacy of existing regulatory mechanisms).

Recovery Criterion 3: Protect and manage these plants outside Apalachicola National Forest.

Recovery action 3.1. *Secure protection*

To date, seven protected populations have been secured (USFWS 2008): four populations on the St. Joseph Bay Buffer Preserve (SJB, Gulf County); the North Glades and the Breakfast Point Mitigation Bank (BPMB) populations (Bay County); and a population at the Carrabelle-Eastpoint transmission corridor (Franklin County).

No land acquisition has been completed.

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

Management and collection of baseline data of three protected locations were conducted in 2004 and 2006 populations at North Glades and BPMB, and transplant population at BPMB. Collection of baseline data for three protected sites (BPMB, SJB, and Box-R

WMA) were initiated in 2010; data will determine the response of telephus spurge to prescribed fire. Prescribed fire is the controlled management for populations on the SJB (Gulf Co.), BPMB, and the Box-R WMA. But mowing is the only management strategy at North Glades due to close proximity to highway and residential areas.

Flatwoods Consulting Group developed a Telephus spurge Protection Plan (Plan) for the 2013-2014 pole-replacement project at the Carrabelle-Eastpoint transmission corridor (Franklin County). The plan included the use of protective fencing and matting during the project duration, post-construction surveys during 2014 and 2015, and the installation of four educational signs restricting herbicide use in the transmission corridor-area occupied by telephus spurge.

No monitoring program has been established for other populations of telephus spurge.

Recovery Criterion 4: Conduct systematic and other studies (ongoing)

a. Population genetic studies: completed; see section II.C.1.b.

b. Establish and implement monitoring: ongoing

The Service botanist has been collecting baseline data on growth and reproduction of *E. telephioides* since 2010 to help inform management and population trends. A portion of the data will be used to conduct a demographic population viability analysis by Ms. Natali Miller, a graduate student from FL State University, to assess whether the species is declining, increasing, or stable, and where in the life cycle the management should be targeted.

c. *In-situ* germination studies: ongoing

On May and June 2011 *in-situ* seed germination studies were initiated by Service botanist to determine whether a seed bank is present in addition to seedling recruitment and survivorship. Preliminary data suggest that seed germination and seedling survival are low with only 14 % germinating during the first year and 7 % surviving the second year. Data also suggest a lack of seed bank since non-germinated seeds were not persistent in the soil.

Recovery Criterion 5: Garden propagation and reintroduction

This recovery action has been partially met:

Propagation: Seed collection and plant transplantation experiments were conducted by Historic Bok Sanctuary, Lake Wales, Florida (Peterson and Campbell 2007, 2011). In 2005, only 1.2% of 165 plants survived after being collected from a private property owned by St. Joe Company (North Glades) (Peterson & Campbell 2007). From the same private land (North Glades) owned by St. Joe Company, 15.4% of the 1,000 plant rhizomes survived transplantation to BPMB in 2004 (Ecological Resource Consultants 2006). In general, Peterson & Campbell (2007) concluded that this species is difficult to propagate and maintain.

In 2010, seeds were collected from Bay and Gulf counties and some were sent to Ft.

Collins, Colorado for long-term storage. Germination studies were not conducted due to lack of funding (Peterson & Campbell 2011).

Reintroduction/Augmentation: The genetic study by Trapnell et al. (2012) can inform reintroduction (establishment of *E. telephioides* in an area which was once part of its historical range) and augmentation (addition of *E. telephioides* plants to an existing population with the goal of strengthen numbers or provide a more varied genetic). According to the study, samples should preferably be taken from populations within each county rather than from other counties. Genetic diversity at more adaptive genes (BPMB, one population of SJB, and one from Box-R) could also be included in the propagules used to augment or restore populations.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of *Euphorbia telephioides*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review

No change is needed

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 Cath J. Phillips Date 1-22-15

**APPENDIX A: Summary of peer review for the 5-year review of
Euphorbia telephoides (Telephus spurge)**

A. Peer Review Method:

The document was peer-reviewed internally by field supervisor, Dr. Catherine Phillips of the Panama City Field Office. 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

Overall, the reviewers found the review to be complete, thorough and balanced.

Mr. Dylan Shoemaker, Manager of St. Joseph Bay State Buffer Preserve, provided one editorial comments; he corrected the name of the preserve. He also asked to the Preserve Specialist, Allix North, to review the document. Allix provided updated information related to prescribed burn for the zone 9D.

Dr. Alice Winn, Fl. State University, provided two minor editorial suggestions. She suggested clarifying that it is the presence of pure males and females rather than monoecious individuals that promotes outcrossing and reduces effective population size. The second suggestion is that in the discussion of Sea Level Rise, all estimates should be in metric units.

D. Response to Peer Review

All peer reviewer comments were evaluated and incorporated where appropriate.