

**Pygmy fringe-tree**  
*(Chionanthus pygmaeus)*

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



**May 2021**

**U.S. Fish and Wildlife Service**  
**South Atlantic-Gulf Region**  
**Florida Ecological Services Field Office**  
**Vero Beach, Florida**

## 5-YEAR REVIEW

### Pygmy fringe-tree (*Chionanthus pygmaeus*)

#### I. GENERAL INFORMATION

**A. Methodology used to complete the review:** In conducting this 5-year review, we relied on the best available information pertaining to historical and contemporary distributions, life histories, genetics, habitats, and threats of this species. This review includes information from the previous 5-year review (Service 2010) that is still applicable to the species, with updated or new information incorporated, as appropriate. We announced initiation of this review and requested information in a published *Federal Register* notice with a 60-day comment period in 2019 (84 FR 14669). We received public comments from one commenter during the open comment period. We evaluated and incorporated comments as appropriate in this review. We also used a variety of information resources, including monitoring reports, surveys, and other scientific and management information, augmented by conversations and comments from biologists familiar with the species. Specific sources included the final rule listing this plant under the Endangered Species Act of 1973, as amended (ESA) (52 FR 2227), the Recovery plan (Service 1999), the last 5-year review (Service 2010), peer reviewed scientific publications, and unpublished field observations by Federal, State, and other experienced biologists. The review was contracted to an Archbold Biological Station (ABS) plant ecologist and finalized by the lead recovery biologists for pygmy fringe-tree in the Florida Ecological Services Field Office (FESFO), Vero Beach. Literature and documents used for this 5-year review are on file at the FESFO. All recommendations resulting from this review are a result of thoroughly reviewing the best available information on pygmy fringe-tree. The Service did not seek additional peer review for this updated 5-year review.

#### B. Reviewers

**Lead Region:** South Atlantic-Gulf Region, Carrie Straight, [Carrie\\_Straight@fws.gov](mailto:Carrie_Straight@fws.gov), (404) 679-7226

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## C. Background

**1. FR Notice citation announcing initiation of this review:** April 11, 2019. 84 FR 14669.

**2. Listing history:**

Original Listing

FR notice: 52 FR 2227

Date listed: January 21, 1987

Entity listed: Species

Classification: Endangered

**3. Associated rulemakings:** There are no associated rulemakings for this species.

**4. Review History:** Each year the U.S. Fish and Wildlife Service (Service) reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we performed a yearly recovery data call. The last 5-year status review conducted in 2010 showed this species as uncertain with no change recommended to the species' status due to the probability of continued population losses at unprotected sites and the lack of adequate fire management at existing protected sites (Service 2010).

Recovery Plan: 1999

Previous 5-year Reviews: 1991 and 2010

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

2. A recovery priority number of "2" indicates that this is a species with a high degree of threat and high recovery potential.

**6. Recovery Plan:**

Name of plan: South Florida Multi-Species Recovery Plan (MSRP) (Service 1999)

Date issued: May 18, 1999

Dates of previous plan: June 20, 1996 (Recovery Plan for Nineteen Florida Scrub and High Pineland Plant Species) and January 29, 1990 (Recovery Plan for Eleven Florida Scrub Plant Species)

## II. REVIEW ANALYSIS

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

**1. Is the species under review listed as a DPS?** No. The ESA defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPSs to

only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

## B. Recovery Criteria

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

**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. Criterion 3 identifies xeric oak scrub as the only habitat of pygmy fringe-tree. The species also occurs in other xeric upland habitats including sandhill, scrubby flatwoods, and xeric hammock. These habitats have different fire regimes, species composition, and vegetation structure.

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

**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.**

The recovery criteria as presented in the 1999 recovery plan are broken down into four parts ([1-4] in bold below) for clarity purposes. These criteria address factors A) the present or threatened destruction, modification, or curtailment of its habitat or range; D) inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors affecting its survival. Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not currently considered relevant to the species, and Factor C (disease or predation) was not addressed in the recovery plan.

**Pygmy fringe-tree may be delisted when:**

**[1] enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to assure 95 percent probability of persistence for 100 years;**

This criterion has not been met. No demographic studies have been conducted that are sufficient to produce a population viability analysis (PVA) to determine the number of populations needed to meet the probability of persistence stated in this criterion. Overall, demographic data on this species are extremely limited.

**[2] these populations, within the historic range of pygmy fringe-tree, are adequately protected from further habitat loss, degradation, and fire suppression;**

Pygmy fringe-tree is endemic to central Florida and found mainly on the Lake Wales Ridge (LWR) and to a smaller extent on the Winter Haven and Mount Dora ridges. The species is vouchered in Desoto, Highlands, Hillsborough, Lake, Manatee, Osceola, Polk, Sarasota, and Seminole counties (Menges et al. 2019, Wunderlin et al. 2021). Florida Natural Areas Inventory (FNAI) (2019) reported additional unvouchered occurrences in Hardee and Orange counties. FNAI reports a total of 49 Element Occurrence Records (EORs), 26 of which occur on conservation lands. Although pygmy fringe-tree is protected in 15 conservation sites, protection of pygmy fringe-tree is inadequate in the northern limit of its range in Lake, Orange, and Osceola counties. Only one of five known occurrences at the northern end of the species range is currently protected, and the species may be extirpated from Osceola County. Therefore, while progress has been made, this criterion has not been met.

**[3] these sites are managed to maintain the seral stages of xeric oak scrub to support pygmy fringe-tree;**

Although this criterion has been partially met, it does not account for other xeric upland habitats including sandhill, scrubby flatwoods, and xeric hammock where the species is known to occur. Pygmy fringe-tree does not appear to be particularly sensitive to fire frequency and is known to persist at sites that have not experienced recent or frequent fires. However, fire is a natural disturbance that maintains scrub and sandhill habitat and is necessary to manage these habitats. Active management to maintain habitat is unlikely at unprotected sites on private land. Fire management may be inadequate even though sites are protected for conservation. Many sites are not burned frequently enough to maintain habitat, and mechanical vegetation treatments might not provide the same benefits as fire (Menges and Gordon 2010).

**and [4] monitoring programs demonstrate that these sites support sufficient population sizes, are distributed throughout the historic range, and are sexually or vegetatively reproducing at sufficient rates to maintain the population.**

This criterion has not been met. The Service assumes that “sufficient population sizes...reproducing at sufficient rates to maintain the population” refers to a number that would be arrived at through a PVA. Since no PVA has been conducted, these numbers are not known. This species receives less monitoring than many other listed LWR endemic plants, with different levels of monitoring conducted at some sites. For example, the Florida Department of Agriculture

and Consumer Services (FDACS) has performed level 1 (location or occupancy) and 3 monitoring (demographic data collection involving individually marked plants (Menges and Gordon 1996)) at the Lake Wales Ridge State Forest (LWRSF) Arbuckle and Walk-in-Water tracts since 2011 (H. Rosner-Katz, FDACS, pers. comm. 2019). Archbold has conducted level 2 (counting individuals in defined areas) monitoring at several sites. Jack Stout (retired from the University of Central Florida) has conducted level 3 monitoring at Tiger Creek Preserve. Level 1 monitoring of pygmy fringe-tree to evaluate responses to management activities is recommended every five years (Menges et al. 2019).

## **C. Updated Information and Current Species Status**

### **1. Biology and Habitat**

**a. Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate), or demographic trends:**

*Life History* - The pygmy fringe-tree is a long-lived, clonal, woody perennial whose lifespan is unknown but is likely measured in decades. Data on the phenology of the pygmy fringe-tree are sparse. The species is deciduous, with leaf-out occurring mid-March and flowering peaking in March and April (Menges et al. 2019). Fruits mature in late summer, with seed dispersal in the fall (Gill and Pogge 1974), but fruits may remain on the plants well into winter (Stout 1989). Seed dormancy is complex with some seeds having long-term viability (Eads 2010).

Little is known about pygmy fringe-tree seed dispersal (Stout 1989). In the wild, seeds have been observed to germinate in late summer (J. Stout, University of Central Florida, pers. comm. 2010). Pygmy fringe-tree can also reproduce clonally via shoots that arise from the plant's rootstock.

*Reproduction* - The reproductive biology of pygmy fringe-tree has not been thoroughly investigated. Pygmy fringe-tree reproduces most often by root sprouts, and seedlings are rarely encountered (Service 1999; Stout, pers. comm. 2019). In the closely related American fringe tree (*C. virginicus*), flowers appear to be functionally dioecious (individual plants are either male or female) (Gill and Pogge 1974), and female flowers have reduced, usually non-functional anthers (Goodrum and Halls 1961). Preliminary research by Weekley (1999) found that this is likely true for pygmy fringe-tree as well. Flowers of female plants had fully developed ovaries, but anthers lacked pollen. Flowers of male plants produced

pollen, but some also had ovaries and produced fruit. Based on these observations, Weekley (1999) suggested that the species is either polygamous (having a mix of male, female, and hermaphroditic flowers on separate plants) or polygamodioecious (having bisexual and male flowers on some plants, and bisexual and female flowers on others).

Insect pollinators are important to dioecious plants because pollen must be transported from one plant to another to achieve fertilization. Wunderlin et al. (1980) observed honeybees (*Apis mellifera*) and Stout (pers. comm. 2010) observed bee flies (*Exprosopa* sp.) visiting flowers of pygmy fringe-trees; both are likely pollinators. There are little data specific to the pollination biology of pygmy fringe-tree, and therefore, research is needed in this area.

*Demographic Features and Trends* - There have been no published demographic studies of pygmy fringe-tree, although there have been unpublished monitoring reports on some protected pygmy fringe-tree populations (Stout 1989; Weekley 1999; The Nature Conservancy [TNC] 2002; Rosner-Katz, pers. comm. 2019). Monitoring at TNC's Tiger Creek and Saddle Blanket preserves showed stable populations (Stout 1989; TNC 2002). Stout (1989) observed high annual survival rates for individuals and small annual fluctuations in the number of clonal shoots per plant at Tiger Creek Preserve (1985-1989). TNC (2002) found extant pygmy fringe-tree populations at 12 of 13 revisited locations at Tiger Creek and Saddle Blanket preserves (1992-1998). Based on the stability of areal extent and survival of pygmy fringe-tree populations, TNC discontinued monitoring at the two preserves (TNC 2002). Monitoring at the LWRSF has also shown high survival rates for pygmy fringe-tree (Weekley 1999; Rosner-Katz, pers. comm. 2019). Rosner-Katz (pers. comm. 2019) reported that populations at the LWRSF had very high survival, up to 97 percent, among the 1,314 individually tracked plants in monitoring from 2011 to 2019.

Recruitment from seed is apparently very rare for pygmy fringe-tree, but the limiting factor is not clear (Weekley 1999). Seed production is variable from year to year, but fruits are observed in most years (Stout 1989). Stout (1989) reported an average of 13.85 fruits per plant for one study population and counted as many as 33 fruits on some plants. Under nursery conditions, seed germination rates can be high (60 to 70 percent) (Service 1999). Thus, neither seed production nor seed viability appear particularly limiting. Research is needed to determine the reason for low recruitment from seed in populations of pygmy fringe-tree. Stout (1989) determined that mature trees may not flower every year and found significant variability between years in the number of trees that flowered.

*Abundance* – Abundance estimates are not available for all the EORs, but those that are available have remained similar to the estimates provided in the previous 5-year review (Service 2010). FNAI (2019) data suggested most populations of pygmy fringe-tree with abundance estimates available are small or moderate in size. Seven EORs have less than 10 plants, 10 EORs have 10–99 plants, 3 EORs are estimated in the hundreds, and the EOR at Carter Creek was estimated at over 1,000 plants. In addition, there are thousands of plants at Flamingo Villas (Menges, personal observation). The last observations for most FNAI (2019) data are in the 2010s (19 EORs) or the 1980s (17 EORs), with fewer from the 1990s (7 EORs), 1960s (4 EORs), and 2000s (2 EORs).

Most of the large populations are located in protected areas, including the Flamingo Villas unit of the Lake Wales Ridge National Wildlife Refuge (LWRNWR), Carter Creek unit of the Lake Wales Ridge Wildlife and Environmental Area (LWRWEA), and the TNC Saddle Blanket and Tiger Creek preserves (FNAI 2009).

Schultz et al. (1999) surveyed 29 sites targeted for conservation on the LWR in Lake, Osceola, Polk and Highlands counties in Florida. Pygmy fringe-tree occurred on 10 of the 29 sites (Schultz et al. 1999). To date, 7 of the 10 sites with pygmy fringe-tree occurrences identified by Schultz et al. (1999) have been acquired for conservation.

Christman (1988) surveyed 216 scrubs in Polk and Highlands counties and found 39 separate scrub sites where pygmy fringe-tree was present. Christman (2006) re-surveyed 200 of the 216 scrubs in 2004 to 2005, but this study only reported data for a subset of species, and pygmy fringe-tree was not included. However, 43 of 216 scrubs (20 percent) surveyed were considered ‘lost’ by Christman (2006) because they had been mostly developed and were unlikely to support viable populations of rare endemic species. Ten of the ‘lost scrubs’ formerly supported pygmy fringe-tree.

At the time of the last 5-year review, FNAI (2009) documented 63 EORs for pygmy fringe-tree. As of 2019, FNAI reported 49 EORs. However, this change is not necessarily due to a decline but changes in EOR criteria which combined nearby EORs (FNAI 2019). Twenty-six (53 percent) EORs occur on protected areas. Sizes of these EORs range from 0.02–9,238 acres (ac). The median size of an EOR is 4.2 ac, and the mean is 323 ac; the skewed distribution is representative of many small and few large EORs. The reporting accuracy presented in the FNAI (2019) data is high or medium for 87 percent of EORs. Highlands (21 EORs) and Polk

(20 EORs) counties have the most EORs; other counties with pygmy fringe-tree EORs include Hardee, Lake, Orange, and Osceola. All these counties have land on the LWR, and pygmy fringe-tree is considered primarily a LWR endemic.

The largest EOR includes Highlands Hammock State Park. However, this record is quite old (not observed since 1966), and the reporting accuracy presented in the FNAI (2019) data is very low.

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

The genetic structure of pygmy fringe-tree populations has not been studied. Elfers (1989) conducted a phylogenetic study of *Chionanthus* in the Western hemisphere, including *C. pygmaeus* and *C. virginicus*. Hybrids between these two species are known to occur at a few sites, and these plants exhibit intermediate morphological traits and low pollen viability.

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

None. The taxonomy of pygmy fringe-tree is reviewed in the MSRP (Service 1999). Elfers (1989) concluded that *C. pygmaeus* was a distinct species from *C. virginicus*. Wunderlin and Hansen (2011) used floristic characteristics to separate the two species: anther shape (acuminate in *C. virginicus* versus blunt-tipped in *C. pygmaeus*), corolla lobes (1 centimeter [cm] in *C. pygmaeus* versus 2–3 cm in *C. virginicus*), and fruit length (1–1.5 cm in *C. virginicus* versus 2–2.5 cm in *C. pygmaeus*). Likewise, Arias et al. (2011) found molecular markers that could differentiate between the two species. The Integrated Taxonomic Information System (ITIS) recognizes *Chionanthus pygmaeus* Small as a valid taxon (ITIS 2020).

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

Pygmy fringe-tree is known from Citrus, Desoto, Hardee, Highlands, Hillsborough, Lake, Manatee, Orange, Osceola, Polk, Sarasota, and Seminole counties (Menges et al. 2019) and occurs on the Lake Wales, Winter Haven, and Mount Dora ridges. Pygmy fringe-tree is similar to the widespread fringe-tree, *C. virginicus*, whose range extends into central Florida. The two *Chionanthus* species appear to hybridize in cultivation

and in habitats other than scrub, though the two are distinct species as discussed above.

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

The pygmy fringe-tree is endemic to central Florida. It occurs in a range of upland habitats including scrub, sandhill, xeric hammocks, scrubby flatwoods, and mesic flatwoods (Christman 1988; Weekley 1999; Menges et al. 2019), primarily on yellow sands (Menges et al. 2007). It is known from Citrus, Desoto, Hardee, Highlands, Hillsborough, Lake, Manatee, Orange, Osceola, Polk, Sarasota, and Seminole counties (Menges et al. 2019). A detailed discussion of the habitat of the pygmy fringe-tree is provided in the MSRP (Service 1999).

FNAI (2019) data on habitats, while not consistent, provide information on what habitats support pygmy fringe-tree. A variety of habitats are mentioned, including oak scrub/scrubby flatwoods (12 EORs), rosemary scrub/white sand scrub (6 EORs), sand pine scrub (6 EORs), yellow sand scrub (5 EORs), sandhill (3 EORs), and xeric hammock (3 EORs). Often, pygmy fringe-tree is described as growing in multiple scrub types or on ecotones between scrub and sandhill.

Weekley et al. (2008) estimated that approximately 85 percent of the xeric upland habitat on the LWR was destroyed by 2006, mainly due to development (commercial and residential), agriculture (largely citrus), and cattle ranching. The few hundred acres of remaining sandhill on the LWR are generally degraded from a history of logging, fragmentation, and fire-suppression (Peroni and Abrahamson 1986). By county, the greatest percent loss of habitat was in Lake County. By soil type, areas of yellow sand suffered the greatest loss because they were favored for citrus production (Weekley et al. 2008).

*Fire Ecology* - Pygmy fringe-tree occurs in fire dependent habitats and is a strong resprouter after fire (Small 1924; Stout 1993; Weekley 1999); however, it can persist for many decades without fire, including in xeric hammocks. It is not as sensitive to fire frequency as other endemic species (Stout 1989) and can tolerate a wide fire return interval, anywhere from 10 to 50 years (Menges et al. 2019). Height and flowering are reportedly reduced after fire (Stout, pers. comm. 2019).

Fire may provide indirect benefits to pygmy fringe-tree by reducing competition from other tree and shrub species. At sites described as

overgrown, plants of the species have been described as ‘feeble’ looking (FNAI 2009). Scrub areas that lack an overstory canopy of trees supported the largest number of plants (TNC 1986), and plants in these sites tended to produce more flowers (Stout 1989), suggesting that fire may be important to maintaining robust and vigorous populations. Because the pygmy fringe-tree evolved in Florida’s fire-maintained scrub and sandhill communities, it has most likely developed adaptations that allow it to persist, if not take advantage of, periodic disturbances like fire or mowing (Stout 1989; Weekley and Menges 2003; Menges et al. 2019).

Scrub on yellow sands, a main habitat of pygmy fringe-tree (Menges et al. 2007), is characterized by a dense canopy of oaks, pine, and hickory that is periodically top-killed by fire. Scrub vegetation tends to burn infrequently (every 10 to 60 years) and intensely (Myers 1985; Menges 1999, 2007). Oak hickory scrub on yellow sands probably has a natural fire return interval of 5–12 years (Menges 2007). Yellow sand scrubs become extremely dense after 30 years (Menges 1992). Fire opens shrub canopies and consumes litter. Most perennials in this vegetation, including pygmy fringe-tree, resprout vigorously after fire, re-establishing the canopy. Pygmy fringe-tree tolerates high intensity fires. One population being monitored was covered with cuttings from live oaks removed from a roadside nearby (Stout, pers. comm. 2019). The pile was burned after drying out. Individual fringe-trees resprouted, with new stems remaining attached to previously marked, top-killed stems (Stout, pers. comm. 2019).

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

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

*Development* - Despite the acquisition between 1985 and 2005 of over 45,500 ac of undeveloped land on the LWR, primarily through State programs such as Preservation 2000 and its successor Florida Forever, natural areas have continued to be destroyed (Weekley et al. 2008). Turner et al. (2006) estimated that 87 percent of upland habitat had been lost on the LWR by 2006; Weekley et al. (2008) estimated losses of over 85 percent, with areas of yellow sand substrate experiencing greater loss (84.9 percent) than white sand areas (46.7 percent).

In addition to the habitat loss that has already occurred, increasing population growth is likely to result in further loss of these habitats in the

future. Carr and Zwick (2016) analyzed existing land use and landscape patterns to identify areas, including Central Florida, most likely for development to accommodate a growing human population. They suggested that Florida's 2070 population will be nearly 15 million persons greater than in 2010, for an estimated total of 33,721,828. Using these figures, they estimated relative losses to agriculture, open space, and conservation to other land uses. If trends continue, they estimate 34 percent of land will be developed by 2070, up from 19 percent in 2010. At the same time, conservation lands will increase less than 1 percent (from 9,269,000 ac in 2010 to 9,525,000 ac by 2070). Overall, loss of habitat to development, primarily on private lands, will likely continue in central Florida, eliminating populations and reducing the area of suitable habitat for pygmy fringe-tree and other scrub plants. Therefore, habitat on protected lands are critical for the recovery of these scrub plants.

*Acquisition History* - In the mid-1980s there were only four large conservation sites on the LWR. In 1991, the state launched a \$3 billion land acquisition program, Preservation 2000. Its successor, Florida Forever, was launched 10 years later. Since 1992, the State of Florida has spent more than \$68 million to acquire nearly 24,710 ac of land on the LWR, with plans to acquire an additional 24,710 ac (Florida Department of Environmental Protection 2008). In 1990, the Service established the first National Wildlife Refuge in the country designated primarily for plants, the LWRNWR. Acquisition projects known as megaparcel sites, which include extensive areas of scrub habitat that were previously subdivided and sold to numerous lot owners, have been particularly problematic and challenging. Through 2006, land acquisition placed nearly half (21,596 ac or 48.9 percent) of the remaining 44,157 ac of xeric upland habitat on the LWR within protected areas (Turner et al. 2006).

A recent analysis of Florida scrub conservation progress based on land acquisition included pygmy fringe-tree among the 36 rare species of the LWR. Turner et al. (2006) calculated protection indices for each species based on number of locations, extent of occurrence, and area of occupancy. The overall protection index of approximately 1.7 identified pygmy fringe-tree as 'endangered' in their ranking system (Turner et al. 2006).

*Inadequate Fire Management* - Fire suppression started on a regional scale on the LWR between 70 and 120 years ago. Long-unburned sandhill sites have dense shrub layers and slowly undergo succession to xeric oak hammock. Long-unburned oak scrub sites have dense shrub growth and litter accumulation. In both communities, gap specialists and

shade-intolerant endemics tend to decline with time-since-fire (Menges 2007), but this relationship has yet to be established for pygmy fringe-tree. Research is needed to determine the effect of fire on vital rates (growth, survival, recruitment, and flower and fruit production) of the species.

Fire management may be inadequate even though sites are protected for conservation. Fire suppression is often mentioned in FNAI habitat descriptions. However, fire management has become more consistent in many conservation lands, especially those managed by the Florida Fish and Wildlife Conservation Commission (Menges, personal observation) and the FDACS (Rosner-Katz, pers. comm. 2019). The fire management condition of most privately owned parcels is unknown. Fire management is highly unlikely on private properties unless they are designated conservation areas. Undeveloped private sites are likely to be overgrown due to fire suppression. Because there is little chance of prescribed fire being implemented to maintain habitat suitability in fragments on private land, imperiled species on unprotected sites will almost certainly disappear over time (Turner et al. 2006). Furthermore, some land managers now utilize mechanical treatments along with fire (or as a surrogate for fire), and the long-term effects of these novel disturbances are unknown (Menges and Gordon 2010).

*Non-native plant species* - Bahia grass (*Paspalum notatum*), cogon grass (*Imperata cylindrica*), and natal grass (*Rhynchelytrum repens*) may colonize scrub habitats and have negative effects through direct competition and by altering fire behavior. These species are reported at numerous sites supporting pygmy fringe-tree (Schultz et al. 1999). Mechanical treatments of vegetation, such as rollerchopping, logging, or mowing, have been linked to increased presence of these and other invasive species, primarily due to the high degree of soil disturbance associated with the heavy machinery that are used to apply these treatments (Menges and Gordon 2010).

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

The final rule that listed pygmy fringe-tree as endangered identified it as vulnerable to over-collection as an ornamental for the horticulture trade (52 FR 2227). However, there is no evidence to suggest that overutilization for commercial, recreational, scientific, or educational purposes has occurred, and the Service does not consider overutilization to be a threat to pygmy fringe-tree at this time.

**c. Disease or predation:**

Pygmy fringe-tree seeds are lost to a variety of animals. Small mammals appear to partially remove the seed coat and consume the seed (Service 1999). Many animals, including white-tailed deer, turkey (*Meleagris gallopavo*) and quail (*Colinus virginianus*), consume the seed of *C. virginicus* (Gill and Pogge 1974; Goodrum and Halls 1961) and may also consume seeds of pygmy fringe-tree (Stout 1989). Stout (pers. comm. 2010) indicated that white-tailed deer frequently browse the new leaves and shoots of pygmy fringe-tree.

Researchers have documented infestation of pygmy fringe-trees by insects (Stout 1989; Weekley 1999; Stout, pers. comm. 2010; and Rosner-Katz, pers. comm. 2019). Fruits are known to be predated on by an unidentified species of weevil (Stout 1989; Weekley 1999; Rosner-Katz, pers. comm. 2019). Predation rates were sometimes high (40 percent or more), but the fate of these seeds was unclear because seeds were undamaged in some weevil-infested fruits. In addition, the caterpillar of the moth *Palpita illibalis* was identified as one of the most common species responsible for pygmy fringe-tree leaf herbivory at LWRSF (Rosner-Katz, pers. comm. 2019). In conclusion, more research is needed to identify these pests and evaluate their potential as threats to pygmy fringe-tree.

No research on disease in pygmy fringe-tree is available. At this time, disease is not considered a threat to the species.

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

Pygmy fringe-tree is listed as endangered by the State of Florida on the Regulated Plant Index (FDACS Rule 5B-40). This law regulates the taking, transport, and sale of listed plants. It does not prohibit private property owners from destroying populations of listed plants on their property nor require landowners to manage habitats to maintain populations.

Existing Federal (ESA) and state (FDACS Rule 5B-40) regulations prohibit the removal or destruction of listed plant species on public lands. However, they afford no protection to listed plants on private lands. The ESA only protects populations from disturbances on Federal lands or when a Federal nexus is involved. In addition, state regulations are less stringent than Federal regulations toward land management practices that may adversely affect populations of listed plants. In conclusion, there are no existing regulatory measures that reduce or remove the threat of loss

of populations or removal/destruction of plants on private property and existing mechanisms are inadequate to protect this species.

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

*Climate Change* - There is currently no evidence of negative impacts to pygmy fringe-tree from climate change factors, but this could change in the future. Florida is vulnerable to changes in rainfall and temperatures expected due to climate change. While the strong influence of ocean currents make projecting regional climate in Florida difficult (Kirtman et al. 2017), estimates project that Florida's average annual temperatures will increase approximately 1.5 to 5.5°F (0.8 to 3.1°C) by 2050 and from 2 to 11.5°F (1.1 to 6.4°C) by 2100 depending on the greenhouse gas emission rates and the region in Florida (Runkle et al. 2017). In addition, it is predicted that for Central Florida summer rainfall (wet season) will decrease up to 5 percent by 2050 (Runkle et al. 2017). Higher temperatures and changes in precipitation patterns could alter relative humidity levels and evapotranspiration rates, leading to the potential for more frequent and intense droughts and wildfire events. Scrub species, in general, can tolerate drought conditions, but it is unclear how this threat will fully affect species like pygmy fringe-tree. In addition, it is unknown how these changes will influence pollinators, seed bank, or the ability to implement prescribed fire.

In addition to changes in precipitation and temperatures patterns, there are also anticipated changes to the severity of tropical storms and hurricanes. Sweet et al. (2017) predicted a 20 percent increase in both rainfall rates and wind speeds near the center of storms due, in part, to higher sea surface temperatures.

Sea-level rise is another anticipated consequence of climate change in Florida. The Central Florida ridges will be spared from the direct impacts of sea level rise that are anticipated for coastal and low elevation areas. However, as sea level rises in coastal regions, development is likely to move inland, further increasing the threat of development in the higher elevation areas, such as the Central Florida ridges (Volk et al. 2017).

*ORVs* - ORV impacts have been observed on natural areas on the LWR (Schultz et al. 1999) and throughout central Florida. ORVs crush, uproot and tear plants as they drive over them. Roads can also facilitate and intensify illegal collection of rare plants and serve as corridors for exotic plant invasion. However, there are insufficient data to accurately assess

the level of threat to pygmy fringe-tree posed by ORV disturbance. The threat is likely to be more prevalent at unprotected sites.

*Ex situ measures* - Bok Tower Gardens maintains living plants and seeds of this species as part of the Center for Plant Conservation National Collection of Endangered Species. There are currently 67 plants in the collection from two sites. Seeds have a better representation. There are about 5,000 seeds collected from 1987 to 2013, from 13 collections representing three unique sites (P. Gonsiska, Bok Tower Gardens, pers. comm. 2020). More populations should be represented to capture an adequate sample of the genetic diversity of the species. Improved propagation and seed storage techniques have also been recommended for pygmy fringe-tree (Bayer and Stewart 2011). These include investigating the influence of varying levels of smoke and heat, plus the manipulation of other factors such as temperature and plant growth regulators on breaking seed dormancy. In related congeners, low temperature conditions combined with low seed moisture content in addition to pericarp removal may result in improved long-term storage conditions.

#### **D. Synthesis**

Pygmy fringe-tree is a long-lived shrub or small tree endemic to the LWR, Winter Haven Ridge, and Mount Dora Ridge in Central Florida. Unlike several other listed species endemic to this same region, the pygmy fringe-tree has received little attention from the research community. Aspects of the species biology and ecology are not well understood, including its breeding system, seed dispersal, and barriers to seedling recruitment. Demographic studies suggest high survivorship of individual plants with variable rates of stem mortality, clonal recruitment, flowering, and fruiting. Seedlings have rarely been documented in the wild, suggesting that recruitment from seed is a limiting factor. Fruits are taken by birds and mammalian herbivores. Fruits can be heavily infested with an unidentified weevil, but its overall effect on seed production and viability are undetermined.

Pygmy fringe-tree occurs in scrub, sandhill, xeric hammocks, and related habitats. All these habitats have been severely impacted by development, citrus production, and inadequate fire management. Weekley et al. (2008) estimated that 85 percent of these habitats on the LWR were destroyed by 2006. Observations suggest that pygmy fringe-tree may be somewhat tolerant of the overgrown conditions that have been promoted by decades of inadequate fire management in Central Florida. The species resprouts readily post-fire. Flowering is more abundant, and plants appear more vigorous in sites that have an open canopy, suggesting that fire may be useful in reducing competition from surrounding vegetation.

Minor progress has been made in meeting the recovery criteria for pygmy fringe-tree. While the species is protected at 26 EORs (53 percent) on 15 conservation sites, protection of pygmy fringe-tree is inadequate in the northern limit of its range in Lake, Orange, and Osceola counties. Only one of five known EORs at the northern end of the species range is currently protected, and the species may be extirpated from Osceola County. In addition, many sites are not burned frequently enough to maintain habitat for the species, especially at unprotected sites.

The demographic status of extant populations is not well known. Research is needed to better understand the species' ecology and to develop management guidelines. Survey and monitoring programs are limited, and no PVA for pygmy fringe-tree has been produced to date. Destruction and modification of xeric upland habitat in Central Florida is ongoing. Anticipated climate change factors such as alteration to temperature and precipitation patterns and sea-level rise will only exacerbate these threats. For these reasons, pygmy fringe-tree continues to meet the definition of endangered under the ESA.

### **III. RESULTS**

#### **A. Recommended Classification:**

**X** **No change is needed**

### **IV. RECOMMENDATIONS FOR FUTURE ACTIONS**

- Work with State, Federal, and non-profit partners to ensure adequate fire and invasive species management is achieved at sites that support pygmy fringe-tree.
- Determine limiting factors and preferred microsites for seedling recruitment.
- Develop a standard methodology for monitoring pygmy fringe-tree on conservation lands.
- Acquire or secure permanent easements on private sites with existing populations from willing sellers, and restore scrub habitat on these sites, including implementing prescribed fire and vegetation thinning by hand.
- Work with private landowners to conserve extant populations.
- Initiate detailed demographic monitoring (Level 3 monitoring *sensu* Menges and Gordon 1996) at multiple sites throughout the species' range.
- Conduct a prescribed fire in one or more of the study populations at Tiger Creek Preserve to better understand the response of pygmy fringe-tree and to integrate fire management into population viability models.
- Determine the overall level of threat posed by seed and fruit predators, especially the unidentified weevil.
- Determine the overall level of threat to pygmy fringe-tree posed by the moth larva *Palpita illibalis* and white-tailed deer.

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- Conduct basic research on the breeding system and pollination biology of pygmy fringe-tree.
- Initiate studies to determine the genetic structure of pygmy fringe-tree populations throughout the species' range.
- Ensure representation of pygmy fringe-tree at the National Center for Genetic Resources Preservation in Fort Collins, Colorado.
- Strengthen *ex situ* conservation measures by including a wider sample (from numerous sites across the species range) of this species at Bok Tower Gardens, in both stored seed and living collections.
- Conduct germination trials on stored seed to determine their long-term viability and factors that affect seed dormancy.

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of Pygmy Fringe-Tree (*Chionanthus pygmaeus*)**

**Current Classification:** Threatened.

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

- Downlist to Threatened**
- Uplist to Endangered**
- Delist**
- No change needed**

**Review Conducted By:** Emily Bauer, Florida Ecological Services Field Office, Vero Beach.

**FIELD OFFICE APPROVAL:**

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

Approve \_\_\_\_\_ Date \_\_\_\_\_

\* Since 2014, Southeast Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.