ASHY DOGWEED

(*Thymophylla [=Dyssodia] tephroleuca*)

5-Year Review:
Summary and Evaluation

Photograph: Chris Best, USFWS

U.S. Fish and Wildlife Service
Corpus Christi Ecological Services Field Office
Corpus Christi, Texas

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FIVE YEAR REVIEW
Ashy dogweed/*Thymophylla tephroleuca* Blake

1.0 GENERAL INFORMATION

1.1 Reviewers

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1.2 Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service or USFWS) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species once every five years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing as endangered or threatened is based on the species' status considering the five threat factors described in section 4(a)(1) of the Act. These same five factors are considered in any subsequent reclassification or delisting decisions. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process including public review and comment.

1.3 Methodology used to complete the review:

The public notice for this review was published in the Federal Register on February 11, 2009 (74 FR 6917). This review considers both new and previously existing information from Federal and State agencies, non-governmental organizations, academia, and the general public. Information used in the preparation of the review include the Recovery Plan, section 7 consultations, the Texas Parks and Wildlife Department's (TPWD) Natural Diversity Database, section 6-funded endangered plant surveys in south Texas, monitoring reports, unpublished documents, personal communications from botanists and biologists familiar with the species, and Internet web sites.

The 5-Year review document was prepared by staff in the Corpus Christi Ecological Services Field Office (ESFO) in cooperation with the Texas State botanist without peer review.

1.4 Background

1.4.1 FR Notice citation announcing initiation of this review:

74 Federal Register 6917; February 11, 2009

1.4.2 Listing history

Original Listing
FR notice: 48 Federal Register 33501-33503
Date listed: July 22, 1983
Entity listed: *Dyssodia tephroleuca* (Ashy dogweed)
Classification: Endangered without critical habitat

Final Listing
FR notice: 49 Federal Register 29232-29234
Date listed: July 19, 1984
Entity listed: *Dyssodia tephroleuca* (Ashy dogweed)
Classification: Endangered without critical habitat

1.4.3 Associated rulemakings: None

1.4.4 Review History:

No previous 5-year review has been conducted for this species. Other review documents include:

Status Report [*Dyssodia tephroleuca*, Blake], August 15, 1980.
Update to Status report on [*Dyssodia tephroleuca*, Blake] 1980.
Strother, J. 1986. Systematics of Dyssodia Cav. (Compositae: Tageteae). Univ. Calif. Publ. Bot. 48: 1 – 87.
Ashy Dogweed (*Thymophylla tephroleuca*) Recovery Plan 1988.
Price, D., G. Janssen, and P. Williams. 2006. Final Report: Lower Rio Grande Valley Candidate Plant Conservation Agreement, TPWD, November 2006.
Poole, J. 1992. Final Report: Habitat Factors and Reproductive Biology of the Ashy dogweed, TPWD, January 1992.
Williamson, P. 2002. Final Report: The Effects of Disturbance on the Ashy Dogweed (*Thymophylla tephroleuca*) and the Prostrate Milkweed (*Asclepias prostrata*), TPWD, July 2002.

1.4.5 Species' Recovery Priority Number at start of 5-year review: 5

Species are assigned priority numbers ranging from 1 – 18 based upon degree of threats, recovery potential, and taxonomic distinctiveness (48 FR 43098). The recovery priority

number of *Thymophylla tephroleuca* is 5, indicating that this is a full species with a high degree of threat and a low recovery potential.

1.4.6 Recovery Plan or Outline

Name of plan or outline: Ashy Dogweed (*Thymophylla tephroleuca*) Recovery Plan
Date issued: July 29, 1988

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy:

Thymophylla tephroleuca is a plant species and therefore the DPS policy does not apply.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved Recovery Plan? Yes.

2.2.1.1 Does the Recovery Plan contain objective, measurable criteria? No.

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat? No.

When the Recovery Plan was completed in 1988, limited data regarding much of the species' biology, abundance, and distribution made the task of identifying measurable downlisting or delisting criteria difficult. However, since the publication of the Recovery Plan in 1988, new biological research has been conducted on *Thymophylla tephroleuca*. A recovery team was approved in June 2010 to work on recovery efforts for the nine federally-listed plants occurring in southern Texas, including *T. tephroleuca*. The South Texas Plant Recovery Team (Team) will be tasked with updating recovery plans, including the establishment or revision of objective and measureable recovery criteria. The Team is composed of agency representatives, academics, conservation biologists from non-governmental organizations (NGOs), and local landowners who provide recommendations on recovery actions and objectives for these plant species and aid in reviewing and/or updating current recovery plans for these species.

Although quantitative recovery criteria were not given in the Recovery Plan due to a lack of information about the species, a list of four Actions Needed were given in the 1988 Recovery Plan. These are given in italics and discussed below.

1) Maintain present populations through landowner cooperation and habitat management (Factors A, C, D, E).
One of six extant populations is found partially on state-owned ROW lands that are maintained by the Texas Department of Transportation (TXDOT).

Maintenance of ROWs includes mowing and/or spraying with herbicides; however, the timing and frequency vary along the U.S. Hwy 83 ROW in part due to changes in drought conditions and available funding (R. Gelston, pers. comm., September 16, 2011). The TXDOT Resource Signing System (signs to notify maintenance staff to avoid impacts to the plants) has been used in the past to minimize potential impacts to the species during routine maintenance; however, the current use of this program on this ROW site is unknown. The five remaining sites are found on private lands and management practices on these sites are unknown and unregulated. Three of these landowners (LOs) have entered into Voluntary Conservation Agreements (VCAs) with TPWD indicating that these LOs are aware of *T. tephroleuca* and that they have agreed to take actions to conserve it. Future efforts should be made to contact and form partnerships with the remaining two private landowners to manage for the species and its habitat. Cooperation with TXDOT regarding management along the ROW should be continually reviewed if and when more information on the species biology becomes available. Although this recovery action has not been fully achieved, sound efforts have been undertaken and some progress achieved.

2) Establish new populations in suitable habitats (Factor A).
When listed in 1984, *T. tephroleuca* was only known from Starr County. Since then an additional five populations have been found and the species' known range has expanded from Webb County into Zapata County, Texas. An ex-situ population of *T. tephroleuca* is currently being maintained by the San Antonio Botanical Gardens (SABG). The plants in the SABG came from a site where placement of a fiber optic cable in 1995 destroyed all plants. Ex-situ refugia can be used as a tool for future reintroduction into suitable habitat and should be established for the species' preservation and to ensure recovery. These refugia should be established prior to emergency situations. In the case of the SABG plants, the relationship of the original plants and propagules was not recorded completely and accurately when collected in 1995, and therefore their use for reintroduction is cautioned. With the potential of climate change to alter fire regimes and intensify drought, and with knowledge of the species' response to these factors lacking, the future of these wild populations is unknown. Therefore, although the groundwork for introducing plants has been initiated with creation of at least one refugium, *T. tephroleuca* has not been introduced or reintroduced into the wild to date.

3) Obtain biological information needed for effective management (Factors A, C, E).
Recovery Action 3 listed in the 1988 Recovery Plan has been partially completed. Research has found that *T. tephroleuca* is a sexually reproducing perennial that positively responds to some level of disturbance (see section 2.3.1.1). However, in order to effectively use this biological information to manage for the species, further studies should uncover more specifically the intensity, frequency, and type of disturbance regimes that are most effective for managing natural populations of the species. The response to fire has not been studied.

4) Develop public support for preservation of ashy dogweed (Factors A, D, E). Although a formal South Texas Plant Recovery Team is now in place, and *T. tephroleuca* is among the species that will be addressed by the team, they have not yet dealt with this species. No specific public support actions for this species have been undertaken.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

Thymophylla tephroleuca is a short, woody-based, perennial sub-shrub plant, growing 10 – 30 centimeters (cm) (3.9 – 11.8 inches [in]) in height. *Thymophylla tephroleuca* belongs to the Asteraceae (sunflower) family. *Thymophylla tephroleuca* has mostly alternate, linear leaves with ashy-white pubescence due to fine, short hair glands that emit a pungent odor when crushed (U. S. Fish and Wildlife Service 1988). Flower heads are yellow to bright yellow and flowering typically occurs between March and May; however, such events are dependent on rainfall (USFWS 1984) and can occur as early as February (Correll and Johnston 1979). *Thymophylla tephroleuca* is an obligate out-crosser that has non-specialist pollinators from members of the families Buprestidae (beetles), Bombyliidae (bee flies), and Megachilidae (bees) (Dodson 2001, Williamson 2002, Poole et al. 2007; see section 2.3.1.3).

Thymophylla tephroleuca is endemic to southern Texas; currently it is found only in Webb and Zapata counties. A historical occurrence of *T. tephroleuca* in Starr County, near Rio Grande City, was found in 1932; however, it has not been re-verified (see section 2.3.1.2). The status of *T. tephroleuca* in Mexico is unknown (see Figure 1).

This species inhabits grassland and scattered shrub-dominated habitats with fine, sandy-loam soils (USFWS 1984). The plant is found predominantly on private lands, but one large, extant meta-population of *T. tephroleuca* occurs along the U.S. Highway 83 right-of-way (ROW) on both state and privately-owned land. Several *T. tephroleuca* populations are considered meta-populations based on relative distance between sites; therefore threats to the plants from the loss, fragmentation, and/or alteration of habitat may be exacerbated at these sites as opposed to plants in populations that are farther apart. Invasion by non-native grasses, oil and gas development, highway development and roadside projects, and climate change (e.g. more frequent and/or extended droughts) threaten the species.

2.3.1.1 New information on the species' biology and life history

This is the first 5-year or status review completed since the species' final listing in 1984. New information available for *T. tephroleuca* has been garnered from research on seeds and seedlings, as well as from work on pollinators and the species' response to varying disturbance levels.

Seedling viability and germination

In 1992, Poole examined seed viability, germination rates, pre-treatment of seeds related to germination, and seedling mortality of *T. tephroleuca*. During these studies, Poole (1992) examined percent germination of seeds and investigated the effects of cold and heat on seedling mortality. Comparison of pretreated, cold-stratified seeds (at 40ºF in refrigerator) and heat-stratified seeds (100ºF in growth chamber) showed that heat increased germination totals by more than two times over that of the control (no heat or cold pretreatment). To further investigate this response, Poole compared the control versus heat-stratification for seven days at 38ºC (100ºF) during the day and 29ºC (85ºF) at night. Although germination rates were higher in seeds that were pretreated with heat than the control, Poole believed that this was not necessarily an indication that heat is required for germination but instead showed that seeds may be more viable when heat is applied (Poole 1992). Increased seed viability in the face of heat application may indicate an adaptation to wildfires that frequent the south Texas brushland habitat (Kuvlesky et al. 2002).

Also in 1992, a population of *T. tephroleuca* was successfully grown at the Lady Bird Johnson Wildflower Center (LBJWC) in Austin to examine the plant's seedling mortality rates and reseeding potential (Poole 1992). The results of the reseeding study are unknown, but apparently the plants did not survive at the LBJWC and no longer exist in this refugium (J. Poole, pers. comm., 2011).

Breeding system and pollinators

Following Poole's germination studies, Dodson (2001) and Williamson (2002) examined life history traits of *T. tephroleuca* including the breeding system, phenology, pollen and achene viability, and pollinators. The study was conducted using three known populations of *T. tephroleuca* in both Webb and Zapata counties. Their study sites included the Webb County population at the northernmost extent of the species' range. A second study site, in Zapata County, included plants from the most southern extent of *T. tephroleuca's* range. The ownership was unknown for this property; however, this site may be part of the meta-population containing Populations 6 or 8 (Table 1). This site may also represent a totally separate population but this could not be confirmed because investigators lacked access to intervening lands (Dodson 2001). Seeds collected in May 1999 from the three populations were taken to the herbarium of TSU-San Marcos for propagation. Descendants of these plants were used for pollen viability studies. Seventy-three percent of herbarium plants had viable pollen compared to 82.5 percent and 86 percent of plants in the field in 2000 and 2001, respectively (Dodson 2001). Data on summer seed viability of wild plants were collected from 1999 to 2001, with averages of 36.5, 7.5, and 22.0 percent viability seen each year, respectively (Williamson 2002). Plants only set seed when xenogamously crossed (cross-pollinated; physical transfer of pollen from one plant to another), and had an 88.8 percent seed set. Pollinators were identified from the non-specialist members of the Buprestidae (beetle), Bombyliidae (bee fly), and Megachilidae (bee) families (Dodson 2001, Williamson 2002).

Response to anthropogenic disturbance

Williamson and Dodson conducted a study between February and June 2001 to determine *T. tephroleuca*'s response to disturbance using three site treatments and a control. Treatments included root-plowing, root-plowing and seeding with buffelgrass (*Pennisetum ciliare*), and blading. Nothing was done to the control site. The study was conducted on Population 3 (Table 1) in Zapata County, starting at a point 0.8 kilometers (km) (0.5 miles [mi]) south of the Webb/Zapata county line and continuing south for 2.4 km (1.5 mi) along the U.S. Highway (Hwy) 83 ROW (Dodson 2001, Williamson 2002). All treatments used a tractor to mimic true vegetative-removal techniques common to the South Texas region. Treatment areas were also fenced off to prevent herbivory.

For the root-plow treatments, the soil was disturbed using a tractor attachment that dug as deeply as 0.5 meter (m) (1.6 feet [ft]) into the soil. The blading treatment used a tractor attachment to scrape off all vegetation near ground level. Dodson and Williamson found a post-treatment decline in the number of plants/m² of 49.1, 58.1, and 45.7 percent for root-plowing, root-plowing with reseeding, and blading, respectively; however, they also found a 78.4 percent decline in the control plots. Subsequently, they found that the mean density of emergent seedlings was greater in plots that were root plowed than any of the other treatments or the control. Dodson and Williamson attributed this increase in seedling numbers to soil disturbance that may have provided an increase in soil aeration, an increase in available nutrients within the soil, a decrease in competition for soil nutrients from surrounding resident vegetation, and a decrease in competition for light and nutrients.

Blading removed the top 3-5 cm (1.2-2 in) of soil and showed the highest survival of plants/m^2 post-treatment. These researchers speculated that this might be due to decomposing cut vegetation that was reintroduced into the soil; thereby providing increased soil nutrients (Dodson 2001).

Of special note was the result showing that root-plowed plots seeded with buffelgrass had the lowest number of emergent seedlings among the treatments, except for the control. This has implications for the *T. tephroleuca* because forage grasses are most frequently seeded into areas where brush and other native vegetation have been removed. Buffelgrass on the study site did not appear to be out-competing mature *T. tephroleuca* plants, however this invasive grass may impact smaller plants (P. Williamson, pers. comm., November 2010). This research suggests that *T. tephroleuca* may survive some level of soil disturbance that potentially increases soil nutrients and decreases competition, at least in the short term. However, the results of this study are not definitive due to a lack of replication of the frequency and duration of the disturbance activities, therefore the correlation among soil nutrient levels, disturbance, and soil structure (i.e. compactness) is still unknown. The appropriate management practices for *T. tephroleuca* need further investigation prior to selection or implementation.

2.3.1.2 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, etc.), or demographic trends

There are six populations of *Thymophylla tephroleuca* that are considered extant as of 2011 in Webb and Zapata counties. At the time of listing in 1984, only one population was known therefore the known range of the species has increased from Webb to southern Zapata County. Five of these six sites are found on private lands and the other occurs, at least in part, on state-owned highway ROW (USFWS 1988, see Table 1). Four additional populations were known in both counties, but have not been verified since 2001. The number of individual plants has also increased from what was known at the time of listing; for example, from the Hwy 83 ROW metapopulation, the site has increased from approximately 1,300 to hundreds of thousands of individual plants (USFWS 1984, Turner 1980). There are no documented Mexican populations of *T. tephroleuca*; however, the habitat type (soils and associated plant communities) does occur in Mexico, so the species may potentially occur there as well (Flora of North America online 2009).

Much of the occurrence and/or abundance data available for *T. tephroleuca* are tracked in the state's Natural Diversity Database (NDD). The NDD database is managed by TPWD and compiles data on target plant and animal species that are submitted by a vast consortium of Federal, State, academic, non-governmental organizations (NGO), private researchers, and consultants. The database tracks 232 rare, threatened, and endangered plant species in Texas including all 33 federally-listed endangered (24), threatened (6), and candidate (3) plant species. The geographic, population, and other relevant data for each species are tracked as Element Occurrences. "An Element Occurrence (EO) is an area of land and/or water in which a species or natural community is, or was, present" (NatureServe 2009). The NDD is an essential tool for the long-term conservation and management of species at risk, and the USFWS frequently refers to the database to aid in listing actions, for planning and tracking recovery of listed species, for section 7 consultations, and for Section 10 permits for Habitat Conservation Plans (HCP).

A plant population is a spatially discrete group of conspecific individuals (Ellstrand 1992) that sustains gene flow between individuals through seed dispersal and pollen transfer. A population can exist at a single site, or a collection of sites that occurs in relatively close proximity to one another (separated by a distance of less than one km [0.6 mi]) where the group of sites becomes known as a meta-population (NatureServe 2009). A meta-population is a natural population consisting of multiple local subpopulations (Andrewartha and Birch 1954) with dispersal between these populations (Hanski 1991), in this case via pollen transfer. Two such populations of *T. tephroleuca* exist: one on the U.S. Hwy 83 ROW and one on adjacent private lands. Edaphic endemic plants are prevalent on or restricted to particular localities or areas of specific soil types. *Thymophylla teproleuca* and its associates thrive on similar environmental characteristics such as the deep, sandy-loam soils of the Hebbronville series in

South Texas. Within a given population site, *T. tephroleuca* plants are usually found in close, clustered patterns reflecting the distribution of their preferred edaphic conditions and dispersal tendencies.

To preserve the opportunity of genetic exchange within meta-populations, connectivity between subpopulations needs to be maintained. If management along ROWs and on private lands does not actively suppress invasive grasses, mainly buffelgrass in this part of the state, these non-natives could further invade population sites and serve as potential barriers for continued gene flow for this species (NatureServe 2009). Threats to *T. tephroleuca* from invasive grasses have not been fully investigated therefore it is unknown how the species responds to competition from invasive grasses. Furthermore, oil and gas exploration and development activities are ubiquitous throughout southern Texas and have fragmented and decreased available habitat on appropriate soils, including the Hebbronville soils that *T. tephroleuca* prefers (G. Janssen, pers. comm., 2010).

Historic population
Starr County; *Population 1, EO 2 - Table 1*

Elzada Clover (1932) reported the first record of *T. tephroleuca* in Starr County (USFWS 1984, 1988). The site location was described as "north of Rio Grande City" and has not been re-verified (Table 1, EO 2). In the 1990s, Joe Ideker, a biologist with the Native Plant Project, surveyed FM 3167 along the highway ROW from Rio Grande City to El Sauz in Starr County, but found no *T. tephroleuca* (C. Best, pers. comm., 2010). Since then no further surveys have been conducted for *T. tephroleuca* in Starr County. Much of the Lower Rio Grande Valley, including Starr County, has become developed, increasing the chances that *T. tephroleuca* may have been lost under the footprint of developments. Confounding the question of *T. tephroleuca*'s current distribution and abundance, with respect to potentially undiscovered populations, is the lack of access to private lands that constitute the bulk of the county.

Extant populations
Zapata County; *Populations 2a, 2b – Table 1*

The largest meta-population of *T. tephroleuca* is found near the Webb/Zapata County line and includes plants on both private and state-owned ROW lands (Table 1, Populations 2a and 2b). This occurrence was originally documented by Dr. S. Correll in 1965 (USFWS 1988). This large meta-population extends from the southernmost portion of Webb County and stretches 24 km (15 mi) south to the town of San Ygnacio in Zapata County. This meta-population also extends onto a large residential development known as the Dolores Subdivision that includes 12 private tracts along the east side of U.S. Hwy 83.

Reports of individual plant numbers within this meta-population vary because estimates were taken from different locations along the U.S. Hwy 83 ROW. In the 1984 final rule listing the species, 1,300 plants were noted from this

population; 300 on the western portion of the meta-population (both along the Hwy ROW and on private land) and 500 - 1,000 plants to the east on adjacent private ranchland (USFWS 1984, 1988). Poole (1993) estimated in 1989 that this population consisted of several thousand plants, but increased this estimate to 20,000 plants in 1993. In 1992, 284 additional plants were found on the west side of the U.S. Hwy 83 ROW near the town of San Ygnacio and 82 more plants were later found on the east side of the highway (USFWS, Anonymous memo to file).

Limited and/or restricted access to private lands adjoining this highway ROW and other roads has made surveying and abundance/density investigations difficult at most *T. tephroleuca* populations. In 1989, the Nature Conservancy of Texas (TNC) undertook a landowner initiative for rare plants that included *T. tephroleuca*; landowners were contacted on both sides of Highway 83 but this effort did not produce any long-term benefits such as conservation easements or enhanced access.

In 2001, TXDOT, in conjunction with the Federal Highway Administration (FHWA), proposed to widen Hwy 83 from the Webb/Zapata County line to San Ygnacio. A survey of private land on the west side of the highway and in the ROW in 2003 found *T. tephroleuca* to be in good condition, with an estimated 460,000 plants in the proposed ROW. To avoid these plants, TXDOT proposed to move the location of the proposed roadway onto adjacent private lands, requiring additional surveys 61 m (200 ft) outside the proposed ROW. These surveys turned up 750,000 more plants. The Service's Texas State botanist has indicated that a population size estimate for this meta-population may be as high as one million plants (C. Best, pers. comm., 2009). Consultation between the Service and TXDOT on the Hwy 83 project is ongoing with the project potentially impacting an estimated 330,000 plants (TXDOT 2007).

Zapata County; *Population 4 – Table 1*

Dodson and Williamson (2001, 2002) surveyed and conducted research on the southernmost extant population of *T. tephroleuca*, located east of U.S. Hwy 83, located 16 km (10 mi) northeast of the town of Zapata. At this site, *T. tephroleuca* plants were found in an area of 66 hectares (ha) (163 acres [ac]). Dodson noted an extensive amount of *T. tephroleuca* individuals visible on adjacent private land; however, access to that property was restricted and no population estimates were obtained. Plants from the accessible part of this population were collected and stored at TSU in 1999 and used by Dodson and Williamson in their genetic studies (2001, 2002). Since 1999, no efforts have been made to regain access to the land where Population 4 occurs. This population may be part of a larger meta-population located approximately 3.2 km (2 mi) away that was documented by Janssen in 2006 on two private ranches in Zapata County (in Price et al. 2006, Populations 6 and 8) if indeed there are *T. tephroleuca* plants in the intervening area. Genetic studies have not been undertaken to determine if this population is part of the private ranch Populations 6 and 8.

Zapata County*; Populations 5, 6, 7, 8, and 9 – Table 1*

In 2004, as part of a collaborative section 6-funded project, Janssen conducted extensive plant surveys in Zapata County. She located 22 new *T. tephroleuca* sites; all on privately-owned land (Price et al. 2006) of which are all accounted for in Populations 6, 7, and 8 in Table 1. Population 5 occurred on a large 14,164-ha (35,000-ac) ranch, although only 7689 ha (19,000 ac) of this was surveyed by Janssen (Table 1). Also in 2004, a population (Population 9, Table 1) of *T. tephroleuca* was found along Chevron Road, near the entrance to a privately-owned ranch (Price et al. 2006). Three 10-year TPWD VCAs, covering 15 parcels of land where *T. tephroleuca* occurs, were signed by TPWD and the ranch owners in 2004 (Price et al. 2006).

Populations with Status Unknown
Webb County*; Populations 3 and 10 – Table 1*

Prior to 1992, one population of *T. tephroleuca* was reported from Webb County but specific location and biological information for this population were not documented. This Webb County population was previously considered an erroneous record, but is now considered a potentially viable occurrence due to its suitable soil and habitat for *T. tephroleuca* (A. Brooks, pers. comm., 1992). This population occurs on privately-owned land and has not been verified (G. Janssen, pers. comm., 2011).

When the FHWA initiated planning for their U.S. Hwy 83 ROW widening project in 2001, Webb County was included in the project bounds. As of 2007, project planning changed to a shorter segment - the Webb/Zapata county lines from Loop 20 in Laredo south to Farm to Market (FM) 3169 in Zapata County. Therefore plants in Webb County will not be affected by this project.

In 1999, a TPWD biologist located another *T. tephroleuca* population approximately 19.3 km (12 mi) southeast of Laredo. To date, this is the northernmost occurrence of *T. tephroleuca* (Dodson 2001). Land management practices at this site are unknown since the site is privately-owned and not accessible. Dodson used this population in his 2001 master's study and collected measurements on canopy diameter, height, and inflorescences for each plant along a 50-meter belt transect. He also used these transect lines to collect seedling recruitment and population density information (see section 2.3.1.1). A herbarium specimen was collected in 1999 and continues to be stored at TSU.

Thymophylla tephroleuca plant community associates were found in one newly surveyed Webb County site although *T. tephroleuca* was not. During her 2004 surveys, Janssen found that much of the southwestern part of Webb County with potential for *T. tephroleuca* had been converted to pastures and cropland.

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

J. L. Strother (1967) determined the chromosomal count of *T. tephroleuca*, which led him to place the species into the genus *Dyssodia*. He later reclassified the species into the genus *Thymophylla* in 1986. No further genetic analyses have been conducted on *T. tephroleuca*.

2.3.1.4 Taxonomic classification or changes in nomenclature:

Blake (1935) first described *T. tephroleuca* from the holotype collected in Zapata County. It was later classified as *Dyssodia tephroleuca* by Strother in 1967. Strother determined that the chromosomal count (n=8) placed the species in the genus *Dyssodia*, subgenus *Hymenatherum*, and section *Gnaphalopsis* based on this chromatographic evidence (USFWS 1988). The final rule published in 1984 listed ashy dogweed as *Dyssodia tephroleuca*. However, in 1986, Strother acknowledged that his classification of ashy dogweed into the genus *Dyssodia* was incorrect and recommended reclassifying as *Thymophylla.* Based on further observations of morphology and chromosome numbers, both within *Dyssodia* and across the tribe (taxonomic rank between family and genus) Tageteae, Strother determined that the species is more closely related to Tageteae than to other subgenera in the genus *Dyssodia* (Tropicos online 2010). Ashy dogweed is currently known by most botanical authorities as *Thymophylla tephroleuca* (Blake) Strother and is listed in its 1988 Recovery Plan and documents thereafter as such (USFWS 1988, Poole et al. 2007).

Table 1. All recorded populations of ashy dogweed (*Thymophylla tephroleuca*).

Population Numbers	EO #	First Obs.	Observer/s	Last Obs.	County	Population Description	Voucher	Population Size and Observations	Status	Land Ownership	VCA signed ?
1	2	1932	Elzada Clover	1932	Starr	Eight miles north of Rio Grande City.		Unknown.	H	Unknown	No
2a	1	1965	Dr. S. Correll, G. Janssen, C. Best	2007	Zapata/Webb county line	Within U.S. Hwy 83 ROW and adjacent private properties. Extending from northern part of county south to San Ygancio. Includes the Dolores subdivision on the east side of Hwy 83 (12 separate tracts) with large ranch to the east. Heads south from Hwy 83. Private ranch is on both east and west sides of Hwy 83, between 18-19 miles south of Laredo.	TSU (formerly SWTSU) (1999)	1,000 individuals (1980); 250 individuals (1984); 500 individuals. (1986); 1,300 individuals (1987); several thousand plants (1989); 284 plants on west sides and 82 plants on east side of Hwy 83; 20,000 plants (in 1993).	E-Uv.	Private	No
2b	1	1965	Dr. S. Correll, G. Janssen, FWHA	2007	Zapata	Within U.S. Hwy 83 ROW; on 425 acres approx 1.2 miles south of Webb/Zapata line, extending south 1.5 miles.		Over 440,000 plants in existing and proposed ROW (1998).	E	State owned (ROW)	No
3		1992	A. Brooks, J. Poole, D. Dodson, P. Williamson, G. Janssen		Webb	3.5 acre lot north of Webb/Zapata County line and east of U.S. Hwy 83.	TSU (1999)	Site originally considered erroneous report; however, the soils and habitat were suitable. Now considered a true population; no surveys to verify since the late 1990s.	U	Private	No
4		2001	D. Dodson, P. Williamson	2001	Zapata	164 acre population northeast of town of Zapata (southernmost known population).	TSU (1999)	In Dodson and Williamson's published work. Unknown if this is part of the meta-population containing Populations #6 and/or 8.	U	Private	No
5			G. Janssen	2004	Zapata	Population on 2 parcels of land totaling 35,000 acres along U.S. Hwy 83; about 3 miles north of San Ygnacio.		Survey was conducted on both parcels of land on only 19,000-acre parcel of 35,000 acres due to limited access.	E-Uv.	Private	No.
6			G. Janssen	2004	Zapata	Private ranch in northeastern part of the county.		From Dodson's 2001 thesis, this appears to be the same population on which he and collected seeds.	E-Uv.	Private	Yes
7			G. Janssen	2004	Zapata	Private ranch in northern Zapata County in the vicinity of Hwy 83 ROW.			E-Uv.	Private	Yes
8			G. Janssen	2004	Zapata	Private ranch in northern Zapata County in the vicinity of Hwy 83 ROW.			E-Uv.	Private	Yes
9		1999	G. Janssen	2001	Webb	Twelve miles southeast of Laredo.		Dodson collected seeds from this site for his genetic work, published in 2001.	U	Private	No
10		2003	G. Janssen	2004	Zapata	On Chevron Road, a caliche road – to the gate entrance of neighboring private ranch.			U	Unkonwn/ Private	No

Herbarium- SWT: Southwest Texas State University

Key- E: Extant; EO: Element of Occurrence; E-Uv: Believed to be not verified in recent year due to lack of access on property
H: Historical; ROW: Right-of-way; VCA: Voluntary Conservation Agreement

EO#s are Element Occurrences listed in the Texas Natural Diversity Database by TPWD (1990). ***Note:*** Populations are numbered chronologically according to the date of discovery or rediscovery.

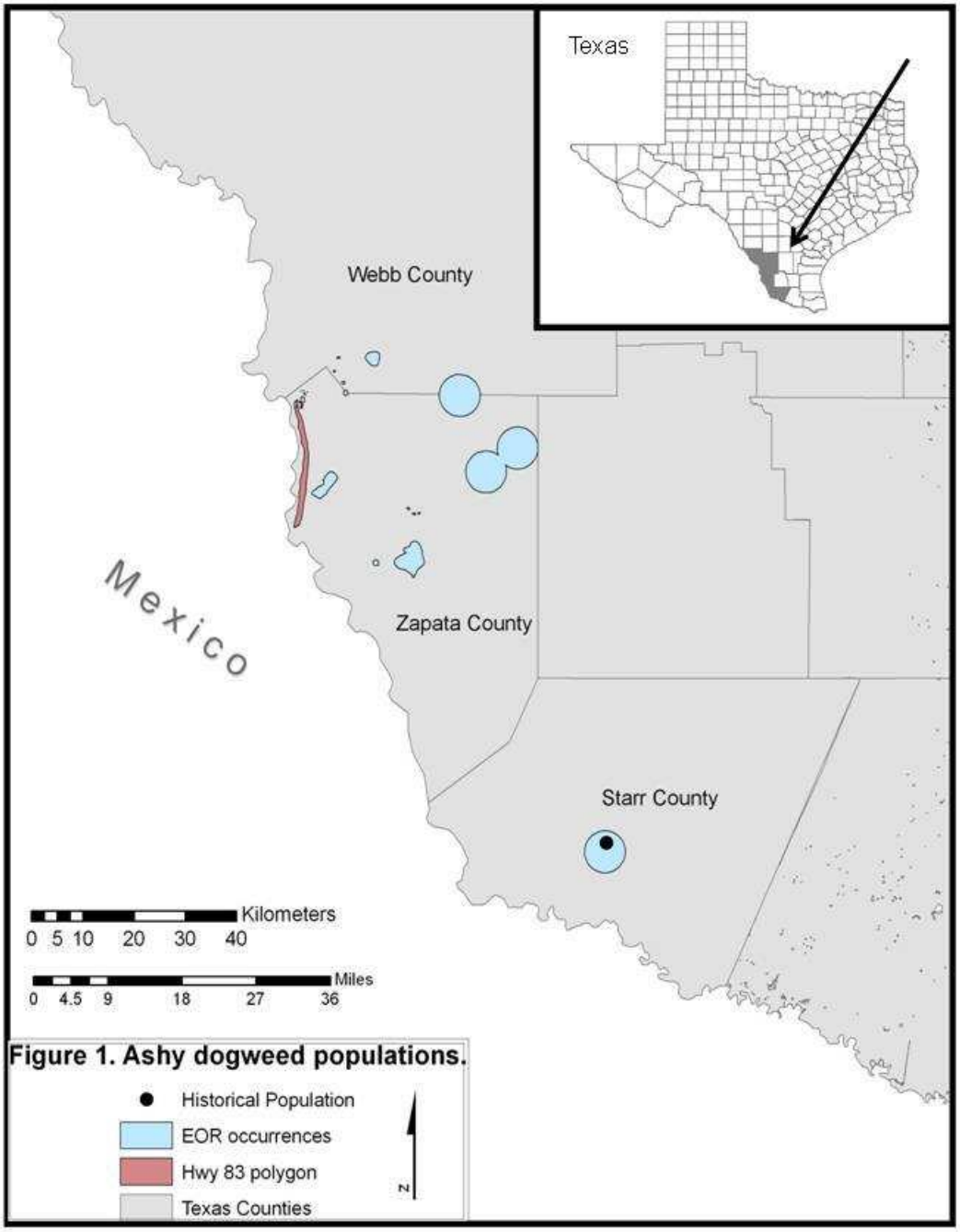

Figure 1. Ashy dogweed (*Thymophylla tephroleuca)* populations

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

Thymophylla tephroleuca is categorized as a narrow endemic in fine, sandy-loam soils in open areas. The largest population occurs within and parallel to the U.S. Highway 83 ROW, where all individuals grow in disturbed areas. Most known, extant populations of *T. tephroleuca* are within 8 km (about 5 mi) of the Hwy 83 ROW. Three occur on private ranches (populations 6, 7, and 8 in Table 1) located in southern Zapata County, extending the known range of the species as far as 16.5 km (about 10 mi) east of the U.S. Hwy 83 ROW. The distribution of populations does not appear to be linked with drainage features but does appear colonial, linked with a certain soil type and potentially associated with some level of disturbance (Figure 1).

The Webb County population forms the northernmost point of the species' known range. Current knowledge of population locations indicates that Zapata County is the epicenter of *T. tephroleuca* occurrence, with the majority of extant populations known from this county.

In Starr County, a population of *T. tephroleuca* was found in 1932 near Rio Grande City, but is now considered extirpated. Competition from invasive grasses, oil and gas activity, lack of proper management, and/or inadequate surveying efforts following the initial discovery, may be the reason that the species is no longer documented in Starr County.

Other areas of south Texas with similar soil types and/or Tamaulipan thornscrub habitat may support undiscovered populations of *T. tephroleuca*. However, since 95 percent of Texas is privately-owned and access is limited, the true status of the species on unsurveyed land is unknown.

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

Thymophylla tephroleuca is found in habitats located within open, flat areas of the South Texas Plains among Tamaulipan thornscrub associates (Turner 1980, USFWS 1988). Turner (1980) described the soil type at the only known locality in 1980 as fine, sandy-loam of the Laredo geological formation. In 1990, a soil scientist tested four of the *T. tephroleuca* sites; three of which were identified as Hebbronville sandy loam, with the remaining site being Aguilares series (Poole 1990). Since that time, additional soil types have been identified underlying *T. tephroleuca*

including Maverick-Catarina, Copita-Zapata, and Nueces-Comita soils in southern Webb and northern Zapata counties (TPWD online 2009).

The annual precipitation for Zapata County averages 48 cm (19 in) (Handbook of Texas Online 2009), with maximum amounts of precipitation between August and October (Bomar 1983). There can be wide variations from the average in this region; for example, the month of September, 2009, was exceptionally wet with 9.3 cm (3.6 in) of rain near the town of Zapata in Zapata County. Annual precipitation in Webb County averages 50.8 cm (about 20 in). Droughts are common in the South Texas Plains region, so precipitation amounts are variable (USFWS 1987). The average annual temperature is 23ºC (73ºF) (Larkin and Bomar 1983).

The southern part of Webb, Zapata, and Starr counties, near the Rio Grande River, historically supported several types of grassland-savannah vegetation communities. Currently, most of the plants in the area are tap-rooted perennial species (Turner 1980) indicating deeper root systems that require deep penetration of water (D'Antonio and Mahall 1991). A list of *T. tephroleuca* associated species is included in Table 2, below.

Table 2. Associated species found within *Thymophylla tephroleuca* habitat.

Scientific Name:	Vegetative Type	Common Name:	Key	Special status
Acacia rigidula	W	blackbrush	2	
Acalypha radians	H	cardinal's feather	1	
Allionia incarnata	H	trailing windmills	1	
Aristida sp.	G	threeawn	1	
Asclepias prostrata	H	prostrate milkweed	2	
Billieturnera helleri	H	coppery false fanpetals	1	
Bouteloua sp.	G	grama	1, 2	
Castela texana	H	goatbush	2	
Cercidium sp.	W	paloverde	2	
Chloris sp.	G	windmill grass	2	
Cordia boissieri	W	anacahuita	2	
Croton sp.	G	croton	1, 2	
Cynanchum barbigerum	W	bearded swallow-wort	1	
Desmanthus velutinus	H	velvet bundleflower	1	
Dyssodia pentachaeta	W	common dogweed	2	
Eragrostis sp.	G	lovegrass	2	
Evolvulus sericeus	H	silver dwarf morning-glory	1	
Eysenhardtia texana	H	Texas kidneywood	2	
Frankenia johnstonii	W	Johnston's frankenia	1	endangered
Froelichia floridana	H	plains snakecotton	1	
Gaillardia pulchella	H	firewheel	1	
*Gutierrezia*sp.	G	broomweed	2	
Helianthus annuus	H	common sunflower	2	
Heliotropium confertifolium	W	leafy heliotrope	1, 2	
Hermannia texana	H	Texas burstwort	1	
Houstonia correllii	H	Correll's bluet	1	rare
Indigofera miniata var. *miniata*	H	coastal indigo	1	
Jatropha cathartica	H	jicamilla	2	
Leucophyllum frutescens	W	cenizo	2	
Linum imbricatum	H	tufted flax	1	
Melampodium leucanthemum	H	blackfoot daisy	2	
Microrhamnus ericoides	W	javelina brush	2	
Mimosa aculeaticarpa var. *biuncifera*	W	catclaw mimosa	1	
Mimosa latidens	H	Kairn's sensitive-briar	1	
Nama hispidum	H	bristly nama	1	
Opuntia sp.	O	prickly pear cactus	2	
Palafoxia sp.	H	palafox	2	

Pennisetum ciliare	G	buffelgrass	1, 2	
Portulaca pilosa	H	kiss me quick	1	
Prosopis glandulosa	W	honey mesquite	2	
Senna pumilio	H	dwarf senna	1	
Sida abutifolia	H	spreading fanpetals	1	
Tetraneuris scaposa	W	stemmy four-nerve daisy	1	
Thelesperma megapotamicum	H	bighead greenthread	2	
Thymophylla pentachaeta var. *pentachaeta*	W	fiveneedle pricklyleaf	1	
Tiquilia canescens	W	woody crinklemat	1	
Yucca sp.	O	yucca	2	
Zexmenia hispida (=*Wedelia texana*)	W	hairy wedelia	2	

KEY - 1: Poole et al. 2007 2: USFWS 1988

G: Grass H: Herbaceous O: Other W: Woody

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

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range (Factor A):

Non-native, invasive grasses

The final listing of *Thymophylla tephroleuca* in 1984 suggested that clearing land for grazing and cultivation caused the most extensive curtailment of the species distribution. Subsequently, *T. tephroleuca* habitat was further fragmented by agricultural activities that led to the encroachment by non-native, invasive grasses, especially buffelgrass. Conversion to buffelgrass became a prominent land cover change in the area where *T. tephroleuca* occurs (Poole et al. 2007). Currently, all known populations of *T. tephroleuca* are found on private ranch lands or on highway ROWs where buffelgrass has been extensively planted to provide either livestock forage (Gould 1978) and/or to prevent soil erosion (Southwest Climate Change Network online 2008).

Buffelgrass is native to Africa, Asia, and Europe and was introduced into Texas in the 1940s (Global Invasive Species online 2009). Buffelgrass is fire adapted and can withstand droughts that occasionally occur in the south Texas. This invasive grass species has the capability to alter fire regimes due to its high fuel capacity and ability to recover post-fire. It is also capable of sustaining healthy populations after recurrent fire events (GISD online 2009). Fire is a natural occurrence in this region, or in some cases may be used as a management tool. Whether accidental or intentional, fire can produce lush growth of buffelgrass resulting in monotypic habitats of this grass. The response of *T. tephroleuca* to fire has not been studied. Although one in situ experiment partially investigated the effects on *T. tephroleuca* from buffelgrass competition, results were somewhat inconclusive due to lack of replication of the experiment. We do know that much

of the area within the range of *T. tephroleuca* has been planted with non-native grasses, but the extent to which these grasses impact this species is unknown. Monocultures of non-native, invasive grasses are known to be established along Hwy ROWs but it is unknown whether they are present on the private lands that support extant populations of *T. tephroleuca* due to a lack of access to these sites. Studies have not been conducted to determine the response of *T. tephroleuca* to fire, however, it's predicted that the species cannot respond and regrow as quickly as the non-native grasses which are highly fire adapted. For this reason encroachment by these grasses is considered a severe threat and is likely to increase in the future.

Disturbance (grazing, ROW maintenance activity, residential and commercial development)

Due to its strong odor and bitter taste, most cattle do not directly consume *T. tephroleuca* (USFWS 1988). However, heavy grazing pressures may eventually cause soil surface compaction (Williamson 2002), thereby decreasing seedling establishment of *T. tephroleuca* (USFWS 1988).

Ranchers or rangeland managers in this part of Texas may try to enhance occupied or potentially occupied *T. tephroleuca* habitat by clearing with activities such as chaining, blading, dozing, and disking (USFWS 1988). Deep soil disturbance could abate *T. tephroleuca* seedling growth; an observation that may help to explain why most plants appeared alongside or near the undisturbed fence line of unbladed habitat. Janssen (1999) found that root-plowing of the area surrounding the Webb population was causing soil disturbance and erosion. Dodson's (2001) and Williamson's (2002) research suggests that some disturbance may be important for this species' colonization, spread, and/or growth; however, the level of preferred disturbance is unclear.

Highway construction and improvements have adversely impacted *T. tephroleuca* populations (USFWS 1988). Since the largest, extant meta-population of *T. tephroleuca* occurs along U.S. Hwy 83, roadway improvement projects, highway maintenance, and potential urban development have the potential to continue to impact the species. The potential for development exists on private lands as well but due to the inaccessibility of these properties, we are unaware if development has indeed impacted any extant *T. tephroleuca* populations on private lands. For instance, in 1995, the placement of a fiber optic cable destroyed an entire population along U.S. Hwy 83 (Flege 1995). Although the number of plants affected was not quantified, some plants were dug up at the time and moved to San Antonio Botanical Gardens (SABG). These plants were later used to establish reintroduction plots on-site of disturbance (Flege 1995). The SABG still maintains *T. tephroleuca* plants but due to unclear records, the staff is unsure of the relationship between currently existing plants and the propagules collected in 1995 (Debbie Benesh, SABG, pers. comm., April 2011).

In 2001, TXDOT proposed widening Hwy 83 from Loop 20 to FM 3169, changing from an existing two-lane highway to four-lanes of divided highway and

thus requiring an additional 400 acres of new ROW. Over 460,000 *T. tephroleuca* plants occur in both the proposed and existing ROW, 75 percent of which will be paved (J. Wicker, pers. comm., 2005). Subsequent estimates since 2005 lowered the number to 330,000 plants that may be affected by the development (TXDOT 2007). Although this is a large number of individual plants impacted at one site, it constitutes a relatively small portion of this population. One portion of the population that extends into the ROW is protected as part of the Pharr District Resource Protection Signing System agreement with TPWD (TXDOT 2007); this is the only subpopulation that is currently under some level of protection.

The threat from disturbance has continued steadily since the 1988 Recovery Plan was published and is projected to increase in the foreseeable future. Although the 2001 TXDOT project to expand Hwy 83 has not been completed, the projected increase of the human population in all of the southern Texas counties along the Rio Grande indicates that there will be continuing need for this ROW expansion. Human population growth likely indicates that residential and commercial development along Hwy 83 will increase as the highway is expanded. Although studies have suggested that *T. tephroleuca* responds to levels of disturbance, these studies were not definitive in determining the frequency and type of disturbance activity (ie, mowing, chaining, blading) that has positive effects on the species. An expansion in development projects will increase the rate at which these populations are exposed to construction-related disturbance activities. With little available data on the species' response, we project that the threat from disturbance is severe and will likely increase in the future.

Pesticides

The use of herbicides to maintain ROW species may inadvertently cause species mortality (USFWS 1988), but the response of *T. tephroleuca* to herbicides and the extent of herbicide use in occupied habitat is unquantifiable. Should pesticides, including herbicides or insecticides, be used within a distance that could contact *T. tephroleuca*, pesticides could directly harm a plant, but also could indirectly kill pollinators of *T. tephroleuca* or their host plants (Service 1984). Herbicides are commonly used for noxious weed control, but no documentation has been provided on herbicide application occurring and whether any *T. tephroleuca* populations have been directly or indirectly affected. Pesticide application to control crop pests, particularly aerial spraying and drift impacts, is considered a potential threat, particularly if *T. tephroleuca* populations are situated near agricultural areas.

Pesticides, particularly insecticides, are linked to bee declines (Kearns et al. 1998, Kremen et al. 2002, National Academy of Sciences 2007), with the abundance and diversity of wild bee communities negatively correlated with increasingly intensive chemical applications of pesticides (Tuell and Isaacs 2010). Although the toxicity of pesticides to pollinators is challenging to quantify in a field setting and varies depending on the chemistry, quantity applied, degree of contact, area treated, and seasonal timing (Mineau et al. 2008, Tuell and Isaacs 2010), some

pesticides cause immediate mortality to bees if applied upon crops while bees are actively foraging (Johansen 1977). Both wild and honey bee (*Apis mellifera*) declines have been found in areas adjacent to sprayed fields, suggesting a wider spatial impact to the pollinator community than just a targeted area (Kevan 1975, Kevan et al. 1990). Furthermore, depending on the seasonal timing of pesticide application, effects to pollinator communities may be chronic and cumulative, yet difficult to assess due to the different phenologies and nesting situations of pollinator species (Desneaux et al. 2007, Tuell and Isaacs 2010). Due to the lack of information, we are uncertain whether pesticides directly or indirectly affect the survival of *T. tephroleuca*.

In the past, much of the private land in Starr, Zapata, and Webb counties in the area where *T. tephroleuca* occurs was used for row-crop agriculture; however, much of this land has been converted to ranchlands. With this conversion, there is less likelihood that herbicides and pesticides will be used on these properties. Because we do not have open communication with the landowners, and some have been unwilling in the past to allow surveys on their properties, management activities are unknown. To the best of our knowledge, herbicide drift incidents have not occurred at *T. tephroleuca* sites, but it is possible that any such instances were simply not reported. The projected threat from pesticides is projected to be minimal at best and is not likely to increase in the future.

Oil and Gas Activity

The first oil and gas was discovered in this region in 1919, centering around the Escobas oilfield in the Mirando Valley located in northern Zapata County (Zapata County Economic Development Center 2010). Although ranching and farming dominated the local economy historically, crop and livestock prices fell as unemployment rose in the 1930s (The Handbook of Texas online 2010). The oil and gas industry in Zapata County, however, continued to grow, and by the 1980s it became a leading supplier of natural gas for the state of Texas (Zapata County EDC 2010). When *T. tephroleuca* was listed in 1984, oil and gas activity was not mentioned as a threat to the species. Since 1984, oil and natural gas activities have steadily increased in Zapata County with sales reaching almost 20 million dollars in the 1990s and 50 million dollars in 2006 (Zapata County EDC 2010). This economic impact has been associated with high levels of exploration and production that have impacted land cover, with an ever-increasing potential to affect *T. tephroleuca*.

In recent years, the advent of hydraulic fracturing or "fracking" processes, in conjunction with horizontal and directional drilling, has increased access to natural gas deposits. Increased access has led to an associated increase in exploration and production activities with unknown impacts to land cover and therefore to *T. tephroleuca*. There are also concerns about possible impacts associated with leaching since fracking chemicals may leach into soils near oil wells and potentially impact nearby plant populations. At this time, the reality of this threat is unclear; however, the Environmental Protection Agency (EPA) is

conducting a study examining the pollution effects of hydraulic fracturing on ground and surface water (RCC 2010b). The Eagle Ford Shale formation, a "hotbed" of oil and gas activity, extends into Webb County. Zapata and Starr counties also continue to be focal areas for both oil and gas exploration. As an example of the level of this activity, well pads within 1.5 km (0.93 mi) of the Hwy 83 ROW population were mapped (see Figure 2).

Although the *T. tephroleuca* population along Hwy 83 does not currently have oil and gas activity within the ROW, most *T. tephroleuca* plants occur on private lands. The extent of oil and gas activity on privately-owned land within the *T. tephroleuca* range is not quantified. In order to adequately determine the magnitude and immediacy of this threat to *T. tephroleuca*, investigations of the number of oil wells, area of impact from the well pads and oil and gas roads (footprint of surface disturbance), and associated impacts from increased vehicular traffic, hydraulic fracturing, or other drilling methods are needed. Impacts from oil and gas extraction are considered significant threats to the fate of this species.

Oil and gas activity has not occurred along Hwy 83 where the largest meta-population of *T. tephroleuca* is known; however, the extent of development of oil and gas on private lands in the species' range has not been calculated. Both Webb and Zapata counties continue to be areas where oil and gas activity is ongoing at high levels. Given this knowledge and our lack of information about the extent of these on private lands within the distribution of *T. tephroleuca*, we consider this threat to be significant and likely to increase in the future. It is even possible that as we learn new information about the level of energy exploration and production in this region, this threat may be revealed as being more serious than anticipated.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

No known effects from overutilization or collection have been documented for *T. tephroleuca*. Overuse was not listed as a threat in the final rule to list the species nor in the Recovery Plan. Potentially, publication of any known localities could increase the chances for vandalism, as noted in the final listing rule of 1984 (USFWS 1984, 1988). The threat to *T. tephroleuca* from overutilization has never been documented. This species is not a member of a taxon known to be heavily collected, therefore, this threat is potentially negligible and is not likely to increase.

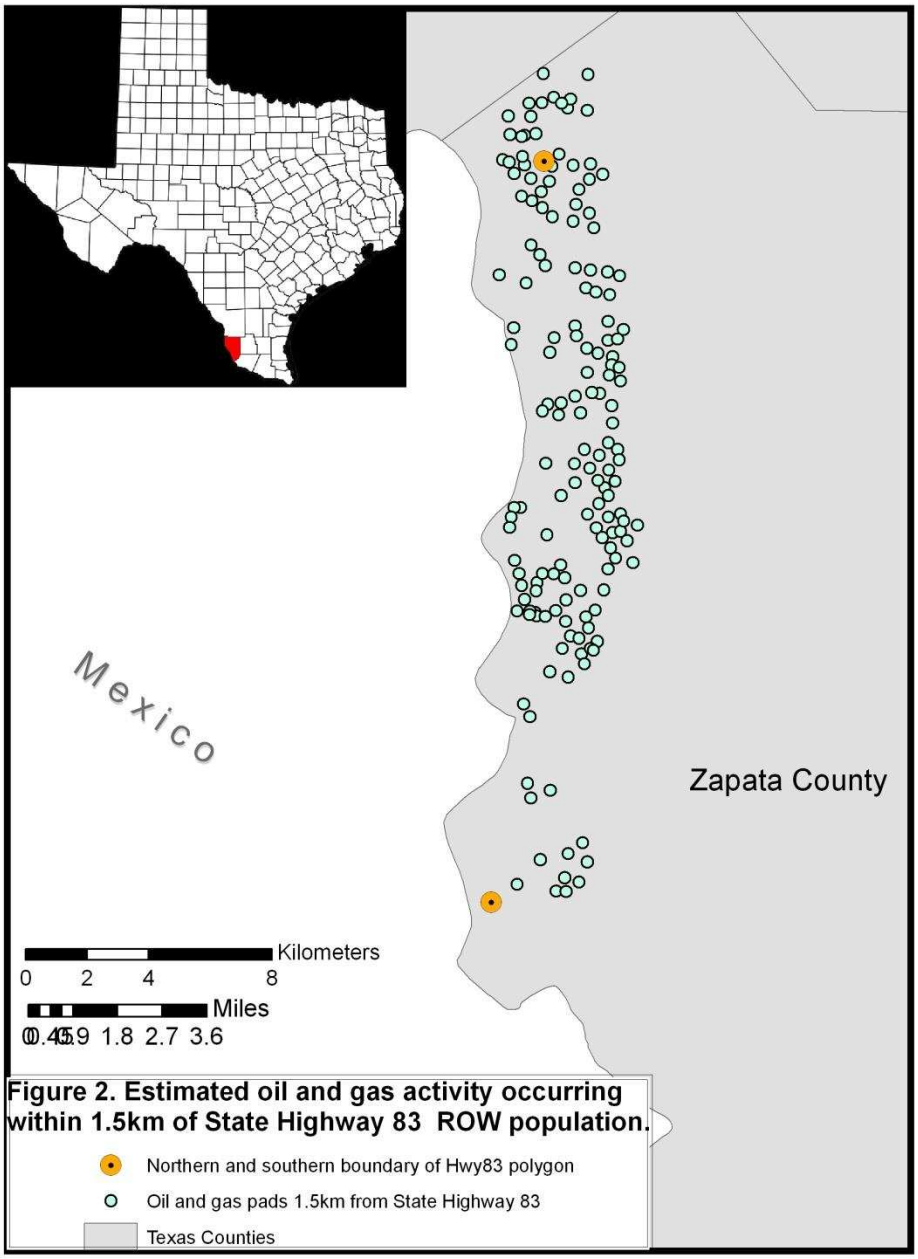

Figure 2. Estimated oil and gas activity occurring within 1.5 km of State Highway 83 ROW *Thymophylla tephroleuca* population

2.3.2.3 Disease or predation:

There are no known sites where *T. tephroleuca* plants are affected by disease. Disease or predation was mentioned in the final listing rule as a threat due to potential grazing impacts on known habitat. Grazing has not been shown to directly affect *T. tephroleuca* plants; however, concerns remain about effects of trampling and soil compaction from heavy grazing pressure. Due to limited and/or restricted access to private lands, the extent and effect of grazing on existing populations remains unquantified and undescribed. Disease has not been verified as a threat to *T. tephroleuca* and impacts from grazing have not been documented. Therefore, this threat is considered minimal and not likely to increase. However if information regarding activities on private lands becomes available, it is possible that this threat could be more serious than anticipated.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Listing *T. tephroleuca* in 1984 as endangered under the 1973 Endangered Species Act (ESA), gave the species protection from activities permitted, carried out, or funded by any Federal agency. Therefore, for any activity with a Federal nexus, the Service has an opportunity through section 7 of the ESA to make recommendations to the action agency that would protect the species. To carry out these recommendations or conservation measures, the action agency may work with the landowner, whether Federal, State, or private. Currently, there are no *T. tephroleuca* populations known to exist on Federally-owned land.

Prior to the 1984 Federal listing of *Dyssodia tephroleuca* as endangered, the State of Texas did not have any statute protecting *T. tephroleuca*. Since Chapter 88 of the Texas Parks and Wildlife Code requires that any Texas plant listed as a Federal entity also be listed by the State of Texas, *T. tephroleuca* was given endangered status by TPWD in January 9, 1987.
State regulations prohibit taking and/or possessing state-listed plants for commercial sale, or sale of all or any part of an endangered, threatened, or protected plant from public (state-owned) land. Scientific permits are required for purposes of collection of endangered plants or plant parts from public lands for scientific or education purposes.

As of 2009, only one of six *T. tephroleuca* populations extended partially onto state-owned land: the Hwy 83 ROW subpopulation. Since highway ROWs are maintained and regulated by the State (TXDOT), we are generally aware of activities and management that could potentially impact the species along Hwy 83 ROW from where it is known. Activities (including herbicide applications) that might affect populations in State highway ROWs require prior coordination between TXDOT and TPWD, and potentially may require TPWD-issued permits. A 1992 Memorandum of Understanding (MOU) between TXDOT and TPWD governs management actions targeting conservation of listed species on State highway ROWs. The TXDOT's Pharr District uses a Resource Protection

Signing System and has posted signs along the ROW to help workers minimize potential impacts when carrying out activities, such as digging and laying cable, and from vehicular and pedestrian damage.

The other five extant *T. tephroleuca* populations are found on private property (TXDOT 2007). At various times TNC and TPWD have made efforts to contact private landowners regarding protection of rare plants (Ballew 1989). Texas Parks and Wildlife Department designed Voluntary Conservation Agreements (VCAs) for use with private landowners to provide a level of protection for plants on their lands. To date, there are 3 VCAs for *T. tephroleuca* signed by TPWD and landowners, covering a total of 15 parcels of land (multiple parcels may be owned by 1 landowner). Overall, VCA goals are to conserve species by reducing threats, stabilizing populations, and maintaining habitat.

Since roughly 95 percent of Texas is privately-owned (Jahrsdoerfer and Leslie, Jr. 1988), and much of the private land within the known range of *T. tephroleuca* was not surveyed for the species due to lack of access, the probability of finding new populations of *T. tephroleuca* on private lands is high. Actions that affect plants on private land in Texas are not regulated except for projects with a Federal nexus. Communication between the Service and the landowners in Zapata and Webb counties is not well-established, so we lack a mechanism with which to regularly assess the status of the species on private land.

In western South Texas, in the range of *T. tephroleuca*, inadequate regulation primarily figures into the species' ongoing vulnerability because State and Federal regulations have very little control over energy exploration and production on private land. These energy-related activities are one of the primary activities affecting land cover in this region at this time. For the species where it occurs on State highway ROWs, the section 7 consultation process does apply. However, regulation for *T. tephroleuca* on private lands remains nonexistent, apart from the three VOCs, leaving five of the populations vulnerable to land use change activities by private landowners, particularly the two populations without any VOC. The lack of regulatory mechanisms on private lands for *T. tephroleuca* is a significant threat to the long-term fate of the species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

The 1984 final listing of *T. tephroleuca* happened at a time when little was known about the species' biology, including its phenology and reproduction, and only one known population was extant. The final listing rule and the Recovery Plan expressed concerns about the limited number of individuals known to exist and suggested the species may be susceptible to natural factors that would push it toward extinction. The Service also lacked information about habitat requirements, the extent of suitable habitat (as defined by the one known population) available, reproductive mechanisms, and pollinators (USFWS 1984). These gaps in information have been investigated since the 1984 listing of *T.*

tephroleuca and have included habitat preferences and associated species, habitat needs such as disturbance, its identification as an obligate out-crossing species, and its use by non-specialist pollinator species (Dodson 2001, Poole et al. 2007, Williamson 2002; see section 2.3.1.3).

Climate Change

Climate change is considered to be a potential threat to *T. tephroleuca*. "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (Intergovernmental Panel on Climate Change 2007). For the next two decades a warming of about 0.2°C (0.4°F) per decade is projected. After that time, temperature projections increasingly depend on specific emission scenarios (IPCC 2007). Various emissions scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.6°C to 4.0°C (1.1°F to 7.2°F) with the greatest warming expected over land (IPCC 2007). Localized projections suggest the southwest U.S. may experience the greatest temperature increase of any area in the lower 48 states. The IPCC describes the likelihood that hot extremes, heat waves, and heavy precipitation events will increase in frequency. There is also high confidence that many semi-arid areas like the western United States will suffer a decrease in water resources due to climate change (IPCC 2007).

Climate change may act alone or synergistically with the invasion of non-native invasive species to increase their spread and their ability to out-compete native varieties (Archer and Predick 2008). Temperature and precipitation changes, along with increases in atmospheric CO_2 (carbon dioxide) and nitrogen, can enhance dispersal pathways for non-natives (Smith et al. 2000), allowing exotic plants to invade new areas and causing range reductions or possibly local extirpations of rare plant populations. Invasion of *T. tephroleuca* habitat by buffelgrass has been described earlier in section 2.3.2.1. Due to its limited geographic distribution, and the fact that the largest number of individual plants occur in one meta-population, *T. tephroleuca* is vulnerable to localized catastrophic events, such as flooding or drought, as well as to broader climate changes that could decrease suitable habitat, while simultaneously making conditions conducive to further exotic grass invasion.

Extended periods of drought, becoming more common in South Texas also play a role in fire ecology by increasing the frequency, and potentially severity, of fires. *Thymophylla tephroleuca*'s response to fire is unknown, however most of the invasive grass species in South Texas appear to be positively fire adapted, so consequences of increasing drought conditions may include increasing the competiveness of these non-natives (Kuvlesky et al. 2002). Intensified and more frequent fire regimes can allow exotic grasses to form dense monocultures where native species are able to persist. The increased amount of biomass and understory produced by these grass monocultures adds to the fuel load, and this

combined with a lack of precipitation forecast to be a result of future climate change, could change affect fire regime characteristics including frequency, intensity, extent, type, and seasonality of fires (Brooks and Pyke 2001).

Climate change may also alter pollinator phenology (USFWS 1988). Since *T. tephroleuca* appears to be insect pollinated, alterations in environmental conditions related to climate change, including precipitation and temperature, could alter the phenology of *T. tephroleuca* such that the current blooming and fruiting patterns may not match the timing of pollinators that currently visit these plants, thereby stalling pollination (Sherry et al. 2007). Although it is reasonable to assume that *T. tephroleuca* may be affected by climate change, we lack sufficient certainty to know how climate change will affect the species and if so, to what extent. Therefore, the threat from climate change is moderate but is likely to increase.

2.4 Synthesis

Although no measurable, objective recovery criteria were developed when the Recovery Plan was written due to a lack of specific information on *T. tephroleuca*, the Service did emphasize the need for protection of the species' existing populations and its habitat in the Recovery Plan. Surveys conducted by TNC, TPWD, and TSU in the years since listing have uncovered five other extant populations in addition to the one known at the time of listing. These populations have increased the known range of the species from Webb to southern Zapata County. The number of individual plants has also increased from what was known at the time of listing; from approximately 1,300 at the Hwy 83 ROW population site 1984 to hundreds of thousands within the same population when last surveyed (USFWS 1984, Turner 1980). This species is an obligate out-crosser which means that it requires pollen transfer between individuals for fertilization, and the plants are not vegetatively produced.

With regard to protection of the species at known population sites, the Service and TPWD have worked with TXDOT to protect *T. tephroleuca* where it occurs within the Hwy 83 ROW. Unfortunately, occurrence in the ROW does not totally protect the species from highway improvement projects, although all project plans are subject to Federal ESA Section 7 consultation, wherein recommendations, conservation measures, and reasonable and prudent alternatives can be designed to alleviate or minimize adverse impacts to the species. For populations on privately-owned land, TPWD has signed 3 VCAs with private landowners that cover *T. tephroleuca* populations on 15 separate parcels of land. These VCAs provide for protective actions to conserve the species by reducing threats, stabilizing populations, and maintaining habitat. However two populations on private property have no VCA for protection.

Land cover conversion to improved pasture and cropland played a large role in destroying or degrading *T. tephroleuca* habitat in the past. As a consequence of deliberate planting of non-native grasses into plowed rangeland or their use for erosion control along the highways, these non-native invaders, especially buffelgrass, have become established and pervasive throughout the range and habitat type of *T. tephroleuca*. Although some level of short-term disturbance may benefit *T. tephroleuca* possibly because of increased soil nutrients and aeration (Dodson 2001),

competition from buffelgrass, which aggressively invades disturbed areas as well and is fire-adapted, is a serious on-going threat to the short and long-term persistence of *T. tephroleuca*.

High levels of oil and gas exploration and production throughout the range of *T. tephroleuca* have intensified in recent years and the extent of damage to, and loss of, *T. tephroleuca* populations, or portions of populations, is unquantified. The vast majority of *T. tephroleuca* individuals, as well as parts of all the known populations, occur on private land. Lack of accessibility to many areas of private land has meant that comprehensive surveys for the species across its preferred habitat (based on soil types) throughout the range (as we know it) have not been undertaken.

The projected effects of climate change in this portion of the county mean drier, hotter conditions and increased chance of fires, with occasional flooding rain events. The long-term effects of these environmental shifts on *T. tephroleuca* are unknown. However, the climate changes may also lead to potential shifts in pollinator phenology that may not match timing of *T. tephroleuca* flowering. In sum, much biological information remains unknown about this narrow endemic plant.

Although the species' known distribution has increased from solely Zapata County to include Webb County, and the observed number of individual plants from each population has also increased, *T. tephroleuca* populations continue to be threatened by the widespread and expanding presence of non-native, invasive grasses as well as rapidly increasing levels of oil and gas activity within the species' range. These current threats were not as prevalent when the species was listed in 1984. Five of the six known populations of *T. tephroleuca* are located on private land and three of these five landowners have signed VCAs with TPWD. Although VCAs have been signed for these sites, it is unclear whether TPWD is conducting annual monitoring, so the status of the plants and the level of management at each site is unknown. Nothing is known about management and land use practices on the other two sites, leaving them unprotected from a lack of regulatory mechanisms. Comprehensive biological and ecological studies of *T. tephroleuca* at these sites have not been undertaken due to lack of access. The magnitude and immediacy of existing threats to *T. tephroleuca* from high levels of oil and gas activities that are occurring within the species' range, the fact that five of six total known sites occur on private land for which we have no information on management, land use, or levels of threats, along with the uncertainty of impacts to the species due to climate change, leads us to recommend that *T. tephroleuca* remain classified as endangered.

3.0 RESULTS

3.1 Recommended Classification:

___ Downlist to Threatened
___ Uplist to Endangered
___ Delist
    ___*Extinction*
    ___*Recovery*
    ___*Original data for classification in error*
_X_ No change is needed

3.2 New Recovery Priority Number: No change; remain at 5.

The species remains exposed to possibly increasing threats from exotic grass invasion, oil and gas development, and climate change and lack of access and management of the majority of the populations due to their location on private lands. Although the recovery potential may be somewhat greater than was believed at the time of listing, the potential for recovery remains low based primarily on a lack of information about the biology of this species, but also on the specialized nature of the growing substrate.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The Ashy Dogweed (*T. tephroleuca)* Recovery Plan should be revised to include relevant information from the five-factor threats analysis and updated information on the species biology and spatial distribution, including new population locations and sizes, life history, and reproductive biology. Objective and measurable criteria should be developed and may include, but are not limited to the following:

- Determine a Minimum Viable Population (MVP) for this species.
- Determine the number of self-sustaining populations needed for recovery.
- Establish five landowner agreements along with conservation mechanisms to further recovery on private land.
- Develop at least two botanical garden populations for reintroduction studies.
- Develop measures of long-term persistence/health (i.e., individual plant numbers) on public land populations.

Recovery actions should include the following;

- Meet Recovery Criteria of self-sustaining populations:
  - Conduct MVP analysis. Once a MVP size is determined, compare existing populations against this standard.
  - Target areas for additional surveys for new populations based on soils and results of previous surveys.
  - Use results to calculate the number of additional populations needed and potential locations for introduced populations.
- To meet Recovery Criteria for long-term protection on privately-owned land:
  - Develop an education/outreach campaign targeting private landowners
    - Gain access for surveys.
    - Develop management guideline for *T. tephroleuca* to protect existing plants and encourage spread of the species.
- As part of survey work, determine locations of suitable habitat for reintroductions/introductions to create new populations or augment existing populations.
- Determine threats specific to each extant population and develop management plans to ameliorate these threats. Coordinate VCAs with private landowners for the ongoing protection of *T. tephroleuca*.
- *Thymophylla tephroleuca*'s response to transplantation is not known; therefore, reintroduction studies should be designed, implemented, and monitored to examine effectiveness. No sites have been designated for reintroduction and therefore, this must become a priority.
- A reintroduction and monitoring plan should be developed for *T. tephroleuca*.

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5.1 PHOTO CREDIT:

Provided by: Chris Best, USFWS, from private property in Webb County, Texas, 2004.

5.2 ACRONYMS:

BLM: Bureau of Land Management
EPA: Environmental Protection Agency
IPCC: International Panel on Climate Change

LO: landowner
NRCS: Natural Resource Conservation Service
RCC: Railroad Commission of Texas
ROW: right-of-way
SABG: San Antonio Botanical Gardens
SWTSU: Southwest Texas State University
TSU-San Marcos: Texas State University – San Marcos
TXDOT: Texas Department of Transportation
USDA: U.S. Department of Transportation
USFWS: U.S. Fish and Wildlife Service

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of
Ashy Dogweed (Thymophylla [=Dyssodia] tephroleuca)

Current Classification: Endangered, 5, without Critical Habitat

Recommendation resulting from the 5-Year Review:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
__x__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: N/A

Review Conducted By: Amber Miller and Robyn Cobb, Fish and Wildlife Biologists, Corpus Christi Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service, Corpus Christi Ecological Services Field Office

Approve _____ Date 09-23-11

REGIONAL OFFICE APPROVAL:

for **Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 2**

Approve _____ Date 10/7/11