

**American Chaffseed**  
**(*Schwalbea americana*)**

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

**U.S. Fish and Wildlife Service**  
**Northeast Region**  
**New Jersey Field Office**  
**Pleasantville, New Jersey**

*as of October 2008*

**5-YEAR REVIEW**  
**Species reviewed: American Chaffseed (*Schwalbea americana*)**

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**5-YEAR REVIEW**  
**American Chaffseed (*Schwalbea americana*)**

**1.0 GENERAL INFORMATION**

**1.1 Reviewers**

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**1.2 Methodology Used to Complete the Review**

This 5-year review was primarily conducted as an individual effort by the lead endangered species biologist for American chaffseed. U.S. Fish and Wildlife Service Field Offices, State natural resource agency personnel, and knowledgeable researchers and botanists throughout the species range were contacted for updated information on occurrences, threats, and recovery activities. All pertinent available literature, reports, and other documents on file at the New Jersey Field Office were used for this review. In

conducting this 5-year review, we relied on available information pertaining to historic and current distributions, life history, and habitat of this species. Our sources include the final rule listing this species under the Act; the recovery plan; peer reviewed scientific publications; unpublished field observations by the Service, State, and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists.

### **1.3 Background**

**1.3.1 Federal Register (FR) notice announcing initiation of this review:** January 23, 2008 (Volume 73, Number 15; pages 3991-3993)

#### **1.3.2 Listing history:**

**FR notice:** September 29, 1992 (Volume 57, Number 189; pages 44703-44708)

**Date listed:** October 29, 1992

**Entity listed:** Species

**Classification:** Endangered

**1.3.3 Associated rulemakings / actions:** None

**1.3.4 Review history:** The 1995 recovery plan includes an assessment of the species' status. Annual recovery data calls were conducted in 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, and 2008. Recovery accomplishments and any known changes in threats to the species were evaluated during these annual reviews.

**1.3.5 Species' Recovery Priority Number at start of 5-year review (48 FR 43098):** The recovery priority for American chaffseed is 7, indicative of a species with a moderate degree of threat, high recovery potential, and taxonomic standing as a monotypic genus.

#### **1.3.6 Recovery plan:**

**Name of plan:** American Chaffseed (*Schwalbea americana*)  
Recovery Plan

**Date issued:** September 29, 1995

## **2.0 REVIEW ANALYSIS**

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

**2.1.1 Is the species under review a vertebrate?** No. The Endangered Species Act (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 DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

## 2.2 Recovery Criteria

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?** The plan contains approved downlisting criteria, but not delisting criteria.

**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, the recovery criteria were based on the number of extant sites known at the time of listing and recovery plan preparation. Since that time, some American chaffseed sites have been lost or are degraded and are not suitable for long-term protection and/or management. Forty sites (> 20%) that were known to be historic or extant when recovery criteria were developed have not been surveyed in the last 10 years; the status of these sites is unknown. If a large portion of these sites are no longer extant or suitable for reestablishment of American chaffseed, then the recovery criteria would be unattainable as currently written. Further, new information on the species biology and habitat is available that would allow for reconsideration of current downlisting criteria and development of delisting criteria.

**2.2.2.2 Are all of the relevant listing factors addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

Yes. Listing Factors A (the present or threatened destruction, modification, or curtailment of habitat or range) and E (other natural or manmade factors) are adequately addressed by recovery criteria relative to habitat protection and management, and life history and genetics research. Although not explicit, recovery criteria relative to habitat protection and management would address threats in Listing Factors C (disease or predation) and D (inadequacy of existing regulatory mechanisms). While the recovery criteria do not address Factor B (overutilization), only isolated events of over-collecting for scientific or recreational use were reported prior to the species listing and no new information regarding this threat was found during this review. The magnitude of this threat appears low. The impact of climate change was not specifically considered in the recovery criteria, but would be addressed by recovery criteria relative to habitat protection and management, monitoring, and life history research.

**2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**

### Downlisting Criteria

According to the recovery plan, reclassification of American chaffseed from endangered to threatened will be considered when the following conditions have been met.

1. *“Long-term protection is achieved for 50 geographically distinct, self-sustaining populations. The population sites must be protected from development and other anthropogenic threats that may interfere with the species’ survival. Protection of populations on private lands will be evidenced through landowner agreements or conservation easements. Protection of Schwalbea on public lands will be secured through agreements that ensure the long-range protection, management, and monitoring of Schwalbea. Protected sites will be distributed to include, at a minimum, all of the States currently supporting Schwalbea, with at least four populations in the northern portion of the species’ range. Site protection agreements will cover the immediate occurrence site and, where possible, enough contiguous unoccupied habitat to allow for dispersal and natural colonization and expansion of the species.”*

The recovery criterion presented addresses Listing Factor A (destruction, modification, or curtailment of habitat) and would compensate for threats in Listing Factor D (inadequacy of existing regulatory mechanisms). This criterion has not been met. Table 1 provides a summary of the number of protected extant sites per state. While 32 sites are considered protected because they occur on public or private land and are given some level of protection by the landowner, only 12 of these sites are known to have a formal protection agreement and only 12 have a formal management plan.

**Table 1. Summary of Protected American Chaffseed Occurrences - 2008**

State	Extant Sites	Sites Considered Protected	Sites with Formal Protection Agreement	Sites with Formal Management Agreement or Plan
Alabama	1	1	0	0
Florida	1	1	0	0
Georgia	4	4	1	0
Louisiana	1	1	0	0
New Jersey	2	2	1	1
North Carolina	11	11	10	10
South Carolina	33	12	0	1
<b>Total</b>	<b>53</b>	<b>32</b>	<b>12</b>	<b>12</b>

Re-establishment of American chaffseed within the northern portion of its range has not yet been accomplished; therefore, the goal of protection agreements for at least 4 populations within the northern portion of the range has not been met.

The number of known extant populations of American chaffseed has decreased from 72 known extant sites in 1995 to only 53 extant sites in 2008 (See Section 2.3.1.2 below). Another 40 recorded American chaffseed sites have not been surveyed in over 10 years and it is unknown if the sites still support the species. Many extant sites have declined and support very small populations that may not persist for the long term. Table 2 provides a summary of American chaffseed sites with or suitable for long-term protection agreements. A total of 13 sites currently have a formal long-term protection agreement and/or management plan. An additional 24 sites were identified as suitable for pursuing a long-term protection agreement with the landowner. Thus, only 37 sites have been identified that would contribute to this recovery criterion. Surveys of the 40 American chaffseed sites of unknown status are needed to evaluate whether sufficient extant sites remain that would allow for this criterion to be met.

2. *“Management agreements or plans are developed for the 50 protected occurrence sites with the primary objective of ensuring that an ecosystem capable of supporting viable populations of Schwalbea will be permanently maintained. In the case of private ownership, these management agreements could be part of the conservation easement or landowner agreement.”*

The recovery criterion addresses Listing Factor A (destruction, modification, or curtailment of habitat) and E (other natural or manmade factors). This criterion remains relevant; efforts to achieve this recovery criterion are ongoing. However, as with Criterion 1 above, surveys of the 40 American chaffseed sites of unknown status are needed to evaluate whether sufficient extant sites remain that would allow for this criterion to be met.

In the southeastern United States, management of pinelands and savannas for bobwhite quail (*Colinus virginianus*) on private plantations and public land provides favorable habitat conditions for American chaffseed and opportunity for long-term protection agreements. In addition, use of controlled burning for habitat maintenance and enhancement within mature and old growth pine (*Pinus* spp.) woodlands to benefit the federally listed (endangered) red-cockaded woodpecker (*Picoides borealis*) would also benefit American chaffseed. Where the species co-exist, protection of American chaffseed should be incorporated into Safe Harbor Agreements or Habitat Conservation Plans for red cockaded-woodpecker. In general, to maintain or enhance red-cockaded woodpecker habitat, managers strive for a prescribed burning program of early to mid growing season burns on a 1 to 5 year return interval. This burn regime is compatible with habitat management needs of American chaffseed.

**Table 2. American Chaffseed Sites With or Suitable for Long-Term Protection Agreements**

State	Site ID	Site Name	Managing Entity	Year Last Observed	Last Recorded Population Size
<b>Sites with Current Formal Long-Term Protection Agreements/Management Plans</b>					
GA	----	Wade Tract	Private	2006	100's of plants
NJ	NJ-007	Whitesbog	State / Municipal	2008	<100 plants
NC	NC-005	Fort Bragg	Federal		2 plants
NC	NC-006	Fort Bragg	Federal	2008	350 plants
NC	NC-008	Fort Bragg	Federal	2008	2000+ plants
NC	NC-014	Fort Bragg	Federal	2005	50 plants
NC	NC-015	Fort Bragg	Federal	2008	1000+ plants
NC	NC-016	Fort Bragg	Federal	2005	200+ plants
NC	NC-017	Fort Bragg	Federal	2006	20 plants
NC	NC-018	Fort Bragg	Federal	2008	7 plants
NC	NC-023	Fort Bragg	Federal	2008	72 plants
NC	NC-025	Fort Bragg	Federal	2008	35 plants
SC	SC-028	Longlands Plantation	Private	2008	1000+ plants Multiple populations
<b>Sites with Potential for Long-Term Protection Agreements</b>					
AL	AL-005	Schoy Plantation	Private	2008	33 plants
FL	FL-010	Horseshoe Plantation	Private	2006	5 plants
GA	-----	Freeman Tract	Private	2005	Plants in areas throughout 600 acres
GA	-----	Ichauway Plantation Macrosite	Private	2004	Multiple populations
GA	-----	Wine Cup Plantation	Private	2003	unknown
GA	-----	Quail ridge Plantation	Private	2003	unknown
LA	LA-001	CC Road Savannahs	The Nature Conservancy	2008	300 plants
NJ	NJ-020	Franklin Parker Preserve	New Jersey Conservation Foundation	2008	10 plants (reintroduced)
NC	NC-026	Western Sandhills- Laurel Hill	State	2005	4 plants
SC	-----	Scottswood	Private	2008	100+ plants Multiple populations
SC	-----	Francis Marion National Forest - Southwest	Federal	2008	17 plants
SC	-----	Francis Marion National Forest - Hiking Trail	Federal	2008	13 plants
SC	-----	Francis Marion National Forest - Cypress Pond	Federal	2008	11 plants
SC	-----	Francis Marion National Forest - Roy's Place	Federal	2008	19 plants
SC	SC-007	Francis Marion National Forest - Fish Hook	Federal	2008	4 plants
SC	SC-009 <sup>a</sup>	Francis Marion National Forest - Three Mile Head	Federal	2008	298 plants
SC	SC-020 <sup>a</sup>	Francis Marion National Forest - Witherbee	Federal	2008	-----
SC	SC-021	Lynchburg Heritage Preserve	State	2008	7 plants
SC	SC-029 <sup>a</sup>	Francis Marion National Forest - Witherbee	Federal	2008	-----
SC	SC-063	Francis Marion National Forest - Lethcoe	Federal	2008	33 plants
SC	SC-064 <sup>b</sup>	Francis Marion National Forest - South Side	Federal	2008	62 plants
SC	SC-068 <sup>b</sup>	Francis Marion National Forest - South Side	Federal	2008	-----
SC	SC-069	Francis Marion National Forest - Halfway Creek	Federal	2008	42 plants
SC	SC-071	Black River	Private	2008	3 plants

a - Plant count reported for site SC-009 includes plants found at sites SC-020 and SC-029

b - Plant count reported for site SC-064 includes plants found at site SC-068

3. *“Viable populations of Schwalbea are established at four sites in the northern portion of the species’ range (Massachusetts to Virginia), preferably with genetic material from the only remaining northern population in New Jersey.”*

This criterion remains relevant; efforts to achieve this recovery criterion are ongoing.

Numerous attempts were made by the New Jersey Department of Environmental Protection, Office of Natural Lands Management (NJONLM) to propagate American chaffseed under controlled greenhouse conditions. Although seeds tended to germinate without difficulty, most seedlings reached no more than a few centimeters in height and few survived beyond the first growing season. Similar difficulties were encountered in efforts to propagate American chaffseed from seed in the field (Obee 1995, pp.8-9; Yurlina 1998, pp. 4-6; Van Clef 2000, pp. 6-7; Kelly 2006, pp. 9-8.).

In 1999, assistance with controlled propagation of American chaffseed was sought from Atlanta Botanical Garden in Georgia using seeds, soil, and host plants from the New Jersey site (Kelly 2006, p. 10; Cartica 2007, p. 1). Initially, the Atlanta Botanical Garden experienced similar difficulties with long-term seedling survival over winter and failure of seedlings to develop haustorial connections with host plants (Kelly 2006, p. 10). These issues were overcome, and in October 2006, 12 American chaffseed plants raised at the Atlanta Botanical Garden were reintroduced to a historic site in Chatsworth, Burlington County, New Jersey (Cartica 2007, p. 1). In 2007, 10 of the 12 outplanted American chaffseed plants survived (83%), but none flowered. In 2008, all 10 of the plants found the previous year reappeared, and 7 of the 10 plants had flowering stems (J. Kelly, Round Mountain Ecological, pers. comm. 2008; Cartica 2008, p. 1).

Approximately 50 more American chaffseed plants are being propagated in greenhouses by the Atlanta Botanical Garden and the Greenbelt Native Plant Center in New York. These plants will be available in late fall 2008 and 2009 for outplanting to other sites within the northern portion of species historic range (J. Kelly, Round Mountain Ecological, pers. comm. 2008).

4. *“Biennial monitoring shows that 50 protected populations are viable as well as stable or increasing over a 10-year period. Demographic population data will be required to meet this condition.”*

This criterion remains relevant, but has not been achieved. Less than 50 sites are considered “protected” through either formal or informal agreements. Further, while a few sites are monitored annually or biennially, the majority of sites are not regularly monitored. No comprehensive monitoring of the species status has been conducted to allow for an informed assessment of population trends. More than 20% of occurrences known in 1995 have not been surveyed within the last 10

years; therefore, continued presence of the species or its habitat is undetermined at these sites.

5. *“Life history and ecological requirements are understood sufficiently to reliably predict the effectiveness of protection, management, and monitoring.”*

This criterion remains relevant; efforts to achieve this recovery criterion are ongoing. Field and greenhouse trials are ongoing to determine life history and habitat needs of the species. New information is summarized in Section 2.3.1 below.

#### Delisting Criteria

Recovery criteria to delist American chaffseed were not established within the recovery plan. The recovery plan calls for a delisting objective to be defined when research activities identified under recovery plan tasks 4 (investigate the species biology) and 5 (investigate genetic variability) have been completed. Considerable progress has been made under recovery task 4 (see Section 2.3.1.1) and recovery task 5 (see Section 2.3.1.3) that would allow for development of delisting criteria.

### **2.3 Updated Information and Current Species Status**

#### **2.3.1 Biology and habitat:**

##### **2.3.1.1 New information on the species' biology and life history:**

#### Germination

In a study conducted by the NJONLM, seeds germinated using wet-cold stratification treatments had a >90% germination rate, whereas <2.5% of seeds undergoing dry-cold stratification treatment germinated (Obee 1995, p. 8). In subsequent greenhouse work, American chaffseed seeds have similarly shown high germination rates following wet-cold stratification.

#### Seed Longevity in the Soil

Field trials to determine seed longevity were initiated by the NJONLM in September 1998. Fifteen nylon mesh bags containing 100 seeds each were buried along the perimeter of the New Jersey Whitesbog site. In subsequent years, bags were retrieved and the contents were placed in a controlled germination chamber. Seeds showed high viability after 1 year with a mean percentage of 89.7% of seeds germinating (Van Clef 2000, pp. 2, 6) and retained viability after 2 years, but at a significantly lower rate (72.7% germination) (Van Clef 2001, pp. 8, 39). Of the seeds exhumed after 5 years, an empty seed coat was all that remained on all but 7 of 300 seeds; none of the seeds germinated. It appears likely that

American chaffseed seeds are not capable of long-term dormancy within the soil (Kelly 2003, pp. 5, 7).

### Haustorial Development

American chaffseed is a hemiparasite plant that photosynthesizes in addition to acquiring food from a host species through haustoria (modified roots that serve as a bridge between the vascular system of the host and that of the parasite) (Kirkman and Helton 1998, p. 1). In a greenhouse study using 5 known host plants, haustorial development in American chaffseed seedlings was found to be low during the first year of growth regardless of host; however, all host species were parasitized. Of the 5 host species examined, haustorial attachment was greatest in *Ilex glabra* and *Pityopsis graminifolia*. These 2 hosts exhibited the most diffuse root systems which may have been a factor in haustorial attachment. These hosts also appeared to encourage greater growth in American chaffseed seedlings than did *Aristida stricta*, *Pinus palustris*, or *Panicum tenue*. However, the percentage of American chaffseed plants that successfully overwintered did not differ by host. Further, few surviving seedlings had formed a haustorial connection to a host. Therefore, it appears that American chaffseed does not require a host to survive to its second year (Kirkman and Helton 1998, pp. 5-6; Helton *et al.* 2008, pp. 302-303).

Although American chaffseed can form haustorial connections with a wide range of species, Kelly (2006, p. 82) found a consistent correlation of American chaffseed with composites and grasses. This correlation may be due to composites and grasses having a higher density of roots near the soil surface than many other plants, increasing the likelihood of tiny American chaffseed seedlings coming into contact with roots of these potential hosts and thus being able to form a haustorial connection (Kelly 2006, p. 82).

### Factors Influencing Flowering and Plant Growth

Kirkman *et al.* (1998, p. 124) found that fire induced flowering in American chaffseed in the year in which the burn occurred. This increased flowering could be due to the increase in light from removal of ground cover and / or from an increase in nutrients following a fire (Kirkman *et al.* 1998, pp. 134-135). The duration of the flowering response to fire in American chaffseed is only one year with near absence of flowering in years without fire treatments (Kirkman *et al.* 1998, p. 133). The timing of fire altered the phenology of anthesis (flowering period). In Georgia, flower production occurred in May for plants subjected to a dormant season burn and in late-July to August for plants with a growing season burn (Kirkman *et al.* 1998, p. 124). Prescribed fire in the longleaf/wiregrass system in Georgia does not usually kill larger individuals of American chaffseed; thus, regeneration occurs by resprouting and seeding. Fires in March and May triggered rapid stem elongation following fire (Kirkman *et al.* 1998, p. 131).

Regardless of season, burning resulted in increased population density and expansion of areal extent.

Norden and Kirkman (2004a, p. 19) found that flowering and subsequent viable seed production in American chaffseed is strongly stimulated by a combination of above-ground stem removal during fire and increased light availability following fire. However, flowering is not induced by either of these factors alone. In field studies using several treatments, increased flowering was induced in the absence of fire by mowing combined with raking to remove litter (Norden and Kirkman 2004a, p. 19). Growing season mowing alone does not appear to be an adequate substitute for burning (Kirkman *et al.* 1998, p. 115); however, in areas where burning is not feasible, mowing followed by biomass removal through raking can be used to stimulate flowering and seed production (Norden and Kirkman 2004a, pp. 20-21).

#### Effect of Fire and Disturbance on Seedling Survival

Elevated temperatures associated with fire may reduce germination by destroying seeds (Van Clef 1999, pp. 6-7). To determine seed response to heat, the NJONLM applied 2 heat treatments to seed using a drying oven and compared the germination response to a control treatment of seeds left at room temperature. American chaffseed seed showed differential responses to the temperature treatments. Seeds that were heated to 40°C had equal viability (mean 87%) to seeds that were held at room temperature (mean 85.7%). However, seeds heated to 60°C showed a significant reduction in viability (mean 54%) (Van Clef 2000, pp. 3, 6).

In a study of seedling establishment / response to fire and soil disturbance, the NJONLM, conducted field experiments at Lebanon State Forest, adjacent to the extant American chaffseed site. The entire site was subjected to a controlled burn in February 1999. Seeds were placed at the site within plots with 3 separate soil treatments: no disturbance to leaf litter; raking of top 5 centimeters of soil to remove all leaf litter and living plant material; and raking to remove leaf litter but retaining living plant material. Three hundred seeds were placed in each of the treatment plots. Seedling emergence was very low under all treatments in the field. Seedling emergence was greatest in the plots receiving the strongest disturbance where 28 seedlings emerged. A total of 6 seedlings emerged in undisturbed plots, and only 1 seedling emerged in the plots with light raking. Control plots for each treatment where no seeds were added had 1 seedling each in the 2 disturbance treatments indicating that some natural seed dispersal from the nearby American chaffseed population may be occurring. None of the emerged seedlings lasted past week 13. While seedling emergence was extremely low, the results suggest that disturbance can be beneficial to seedling emergence and that relatively cool controlled burns where leaf litter is not removed are not adequate to create suitable substrate conditions for seedlings (Van Clef 2000, pp. 3, 6-7).

### Longevity and Annual Flower Production

American chaffseed plants at the Whitesbog, New Jersey population have been individually tagged, mapped, and censused annually since 1996. Data collected from individual plants show that American chaffseed plants are long-lived and capable of attaining at least ten years of age (Kelly 2006, p. 131). Overall, the number of flowers produced according to the age of the individual indicates that flowering output appears to peak between 3 to 6 years of age. However, flowering of individual plants tended to fluctuate dramatically over time. Flowering tended to rise and fall annually, often to zero or greatly reduced levels in the year after flowering, rather than increasing or decreasing gradually over time. This suggests that there may be significant energetic costs from flowering, such that most plants are incapable of producing large numbers of flowers in consecutive years (Kelly 2006, pp. 131-132).

### Plant Dormancy

Mounting demographic evidence from studies conducted in Georgia suggests that individual plants are able to remain in the soil in a dormant state for one or more years. Individual plants at the New Jersey site were marked and mapped in 1996 and tracked across several years. The appearance of new adult plants (not seedlings) not present in previous years and absence of known plants in some years provides supporting evidence that American chaffseed plants are capable of below-ground dormancy (Yurlina 1998, pp. 4-5).

### Herbivory

Severe herbivory by deer threatened the New Jersey American chaffseed site in 1994. Soap has been found to be as effective as chemical deterrents in reducing deer browse. Beginning in 1995, bars of soap have been strung along the perimeter of the Whitesbog, New Jersey site when needed to reduce deer browse. The technique has been effective and no adverse affects to American chaffseed or its habitat have been reported (Obee 1995, p. 3).

In 1996, damage to plants consistent with the feeding habits of invertebrates such as gastropods (slugs), orthopterans (grasshoppers), and homopterans (leaf hoppers) was observed at the New Jersey site suggesting that at least one of these invertebrate groups preys upon the plant. The appearance of this new pattern of herbivory was suspected to be related to a wet growing season and presence of leaf litter that could function as an "arthropod refugia" (Yurlina 1996, pp. 6-7). In 1997, insect herbivory increased at the New Jersey site. A long-horned grass hopper in the Family Tettigoniidae and an unidentified type of leaf-rolling lepidotperan larva were observed feeding on the plants. Prescribed burning to reduce leaf litter and was used as a management technique to reduce invertebrate numbers (Yurlina 1998, p. 4).

In 2002, Norden and Kirkman (2004b, p. 67) observed severe insect herbivory at three Ichauway experimental treatment study sites in Georgia where neighboring competing vegetation had been anchored down with landscaping staples and American chaffseed stems were clipped at the soil surface to encourage resprouting. Major to complete herbivory (*i.e.*, all leaves gone or stem completely destroyed) from Buckeye butterfly (*Junonia coenia*) larvae occurred on both vegetative and reproduction portions of 45% of American chaffseed plants in the treatment areas. Only minor herbivory (*i.e.*, holes in leaves or flowers) occurred in treatment plots that were mowed and then raked. No insect herbivory was observed in untreated control plots or areas treated with prescribed fire (Norden and Kirkman 2004b, p. 67). Female butterflies use a combination of visual and chemical recognition cues when searching for suitable host plants on which to oviposit. Thick regrowth of grasses and other ground cover following burning and mowing treatment sites and dense herbaceous ground cover at the control sites likely made American chaffseed plants difficult for female buckeye butterflies to detect. In the vegetation exclusion with stem clipping treatment sites, resprouting American chaffseed plants were visually exposed and thus particularly vulnerable to detection by butterflies (Norden and Kirkman 2004b, pp. 67-68). Management of competing vegetation at extant or potential American chaffseed reintroduction sites should take these findings into consideration when altering the structure of vegetation neighboring American chaffseed plants to prevent an unintentional increase insect herbivory.

### **2.3.1.2 Abundance, population trends, demographic features, or demographic trends:**

#### Abundance and Trends

The last comprehensive review of the species status occurred in 1995 concurrent with development of the species recovery plan. At that time, a total of 72 extant occurrences of American chaffseed were known from locations in 5 states: New Jersey, North Carolina, South Carolina, Georgia, and Florida. Schwalbea was considered extirpated in 12 states: Massachusetts, Connecticut, New York, Delaware, Maryland, Virginia, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, and Texas.

As shown in Table 3, the total number of documented occurrences of American chaffseed increased from 149 in 1995 (as described in the recovery plan) to 174 in 2008. Documentation of these 25 new occurrences is most likely due to additional survey efforts and increased reporting of the species due to its Federal status as an endangered species. Numbers provided in Table 3 represent the best information available at the time of this review. Records reported from various sources in Georgia and South Carolina include new information that has not yet been fully reconciled with previous Natural Heritage Program records, so some

adjustment of the total number of sites or site status may be warranted once record review is complete.

The number of known extant occurrences decreased from 72 (48% of sites extant) in 1995 to 53 (30% of sites extant) in 2008 and the number of known extirpated occurrences increased from 66 (44% of sites extirpated) to 81 (46% of sites extirpated). The status of an additional 40 sites (23% of sites) is unknown, as no surveys of those occurrences have been conducted in 10 or more years and continued presence of the species or its habitat has not been determined. Based on available information, the overall status of the species appears to be declining. However, if sites with currently unknown status are found to be extant, the species status would then be considered stable.

### Summary of Population Changes Since 1995 Recovery Plan

#### Alabama

Three historic occurrences were known from Baldwin, Geneva, and Mobile Counties (USFWS 1995, p. 7). In 1999, a new occurrence was found in Baldwin County, but was subsequently extirpated (A. Schotz, AL NHP, pers. comm. 2008). In 2008, an extant occurrence of American chaffseed was discovered in Alabama within Bullock County (J. Glitzenstein, Tall Timbers Research Station, pers. comm. 2008).

#### Connecticut

Two historic occurrences were reported in the recovery plan from Middlesex and New London Counties (USFWS 1995, p. 7). However, the Connecticut Natural Diversity Data Base has record of only the New London site. No extant sites are known from Connecticut (N. Murray, Connecticut Bureau of Natural Resources, pers. comm. 2008). Information regarding historic occurrence of American chaffseed in Middlesex County could not be verified.

#### Delaware

One historic occurrence is known from New Castle County, where it was last observed in 1875. The site was destroyed by dredging and widening of the Chesapeake and Delaware Canal, agriculture, and road development (USFWS 1995, p.7; McAvoy *et al.* 1999, p. 6). Searches of 10 to 40 acres of suitable American chaffseed habitat were conducted per year in 1998 through 2002. More intensive survey efforts for American chaffseed were conducted in 2003 and 2004 with approximately 1,000 acres and 350 acres, respectively, surveyed within potentially suitable American chaffseed habitat. No plants were found (McAvoy *et al.* 1999, p. 5; McAvoy and Bennett 2000, p. 9; 2001, p. 5; 2002, p. 7; 2003, p. 8; 2004, p. 7).

Table 3. Comparison of Status of American Chaffseed Sites – 1995 vs. 2008

State	1995				2008			
	Total Known Sites	Extirpated	Extant	Unknown Status	Total Known Sites	Extirpated	Extant	Unknown Status <sup>a</sup>
Alabama	3	3	0	0	5	4	1	0
Connecticut	2	2	0	0	2	2	0	0
Delaware	1	1	0	0	1	1	0	0
Florida	10	8	1	1	10	9	1	0
Georgia	15	5	10	0	20 <sup>b</sup>	5 <sup>b</sup>	4 <sup>b</sup>	11 <sup>b</sup>
Kentucky	2	2	0	0	2	2	0	0
Louisiana <sup>c</sup>	1	1	0	0	2	1	1	0
Maryland	2	2	0	0	2	2	0	0
Massachusetts	10	10	0	0	10	10	0	0
Mississippi	2	2	0	0	2	2	0	0
New Jersey	19	18	1	0	20	18	2	0
New York	1	1	0	0	1	1	0	0
North Carolina	24	6	18	0	26	9	11	6
South Carolina	53	1	42	10	67 <sup>b</sup>	11 <sup>b</sup>	33 <sup>b</sup>	23 <sup>b</sup>
Tennessee	2	2	0	0	2	2	0	0
Texas	1	1	0	0	1	1	0	0
Virginia	1	1	0	0	1	1	0	0
<b>Total</b>	<b>149</b>	<b>66</b>	<b>72</b>	<b>11</b>	<b>174</b>	<b>81</b>	<b>53</b>	<b>40</b>

a – Last known survey was 10 or greater years ago

b – Site records need to be reconciled and incorporated in State Natural Heritage Data Base; some sites reported may be duplicates

c – Excludes Louisiana record determined to be invalid – see recovery plan

### Florida

At the time the recovery plan was prepared, a total of 10 occurrences of American chaffseed were known from Brevard, Duval, Highlands, Hillsborough, Levy, Putnam, Volusia, Gadsden, and Leon Counties. All occurrences except two, one in Gadsden County and one in Leon County were extirpated (USFWS 1995, p. 7). The Gadsden site has since been extirpated; only the Leon County site is extant (P. Kelly, USFWS, pers. comm. 2008). Information regarded historic occurrence in Brevard County could not be verified.

### Georgia

Records in the Service's files show that 15 occurrences were known from Baker, Baldwin, Dougherty, Early, Miller, Pike, and Worth Counties during the completion of the 1995 recovery plan. Five occurrences in Baldwin, Baker, Early, Miller, and Pike Counties were considered extirpated. Of 10 extant occurrences, 6 were located on Ichauway Plantation, a private ecological reserve in Baker County; 2 were located on a private quail plantation in Dougherty County; and the remaining 2 occurrences were located on private lands managed for quail in Baker and Worth Counties (USFWS 1995, p. 8). Information in Service files indicates that approximately 20 sites are now recorded from Georgia.

Four extant populations of American chaffseed have been located since 1995: 1 in Mitchell County, 2 in Worth County, and 1 with county information not available. Five sites are documented as extirpated and no information on the current status of the remaining 11 populations was available.

#### Kentucky

Two historic occurrences are known from McCreary County, where the plant was last observed in 1935 (USFWS 1995, p.8). Surveys of these historic sites have been conducted, but no plants were found (D. White, KY Nature Preserves Commission, pers. comm. 2008).

#### Louisiana

At the time the recovery plan was prepared, a total of 2 historic occurrences of American chaffseed were reported. A historic record from Calcasieu Parish is considered valid, but the historic record from Rapides Parish has been dismissed as invalid (the specimen was improperly labeled with the hometown of the collector and not the actual locale of the collection) (USFWS 1995, p. 8). A previously undocumented population of approximately 150 plants was discovered in Allen Parish in 1997 (L. Smith 1998, p. 1) on lands acquired by The Nature Conservancy. In 2001, additional surveys were conducted within western longleaf pine savannah sites in western and central Louisiana; no new populations were found (Leonard and Faulkner 2001, pp. 3 and 9; B. Firmin, USFWS, pers. comm. 2008).

#### Maryland

Two historic occurrences are known, one from Worcester County near Ocean City, and one from Anne Arundel County. The last known surveys for the species in Maryland occurred in 1979; no plants were found (USFWS 1995, p. 9; C. Frye, Maryland DNR, pers. comm. 2008).

#### Massachusetts

Ten historic occurrences are recorded from Barnstable, Bristol, Dukes, Franklin, Nantucket, Norfolk, Plymouth, and Worcester counties (USFWS 1995, p. 9). No extant populations of American chaffseed are known to occur in Massachusetts. No new information was available for Massachusetts.

#### Mississippi

Two historic occurrences are known from Covington and Jackson counties (USFWS 1995, p. 9). No extant populations of American chaffseed are known to occur in Mississippi. No new information was available for Mississippi.

### New Jersey

At the time the recovery plan was prepared, a total of 1 extant and 18 historic occurrences of American chaffseed were known from Atlantic, Burlington, Camden, Cape May, Cumberland, and Ocean counties, New Jersey. An occurrence in Burlington County represents the northernmost extent of the current range of American chaffseed and is the only known occurrence north of North Carolina (USFWS 1995, p. 9-10). In October 2006, American chaffseed was reintroduced to a historic site in Burlington County. The reintroduced population persisted in 2007 and 2008 and will continue to be monitored (J. Kelly, Round Mountain Ecological, pers. comm. 2008).

### New York

One historic occurrence is known from Albany County where the species was last observed in 1865 (USFWS 1995 p. 10; S. Young, New York Natural Heritage Program, pers. comm. 2008).

### North Carolina

At the time the recovery plan was prepared, a total of 18 extant and 6 extirpated occurrences of American chaffseed were known from Bladen, Cumberland, Hoke, Moore, Pender, and Scotland counties. Of the 18 extant occurrences, 17 were located on Fort Bragg and 1 occurrence was known from a roadside in Moore County (USFWS 1995, p. 11). Only 10 of the Fort Bragg sites are known to remain extant; 3 sites are now extirpated, and the status of 4 sites is unknown (J. Gray, DOD, pers. comm. 2008). The status of the Moore County site is unknown with the last known survey occurring in 1993. One new American chaffseed site was discovered in Scotland County in 1997 on State Game Lands and remains extant (M. Buchanan, North Carolina Natural Heritage Program, pers. comm. 2008).

### South Carolina

A total of 53 occurrences were reported from South Carolina in the species' recovery plan from Berkeley, Charleston, Clarendon, Florence, Horry, Jasper, Lee, Sumter, and Williamsburg counties. Forty two sites were considered extant (USFWS 1995, pp. 11-12).

In 2003, a total of 70 American chaffseed sites were reported as known from South Carolina (L. Zimmerman, USFWS, pers. comm. 2003). In a review of American chaffseed sites, Glitzenstein (2008) considered 26 South Carolina sites to be extant with most located in the adjoining counties of Berkeley and Williamstown. During field surveys, Glitzenstein (2008) recorded 73 point locations of American chaffseed to record the spatial distribution of the species (points do not represent individual populations or distinct patches and may

represent multiple points within the same population). These point locations have not yet been fully reconciled with South Carolina Natural Heritage Program occurrence records to determine whether the point locations represent known or new occurrences (T. Baird, USFWS, pers. comm. 2008). A preliminary review of records by the USFWS found some duplication of sites. The number of extant sites in South Carolina is conservatively estimated at 33 sites (J. Ayers, USFWS, pers. comm. 2008).

### Tennessee

Two historic occurrences are known from Tennessee with one each in Coffee and Fentress counties (USFWS 1995, p. 12). No recent searches have been conducted in Tennessee for American chaffseed; the species is considered extirpated (D. Lincicome, Tennessee Department of Environment and Conservation, pers. comm. 2008).

### Texas

One possible historic occurrence is known east Texas (USFWS 1995, p. 12). No new information was available for Texas.

### Virginia

One historic occurrence is recorded from an area between Sussex and Greensville counties, where the species was last observed in 1937 (USFWS 1995, p. 13). American chaffseed remains extirpated in Virginia (M. Drummond, USFWS, pers. comm. 2008).

#### **2.3.1.3 Genetics, genetic variation, or trends in genetic variation:**

Godt and Hamrick (1998, p. 89) sampled 13 American chaffseed populations across the species range to describe allozyme diversity at 15 presumptive loci. Genetic diversity was low for the species. Seven populations (1 in Georgia, 3 in North Carolina, 1 in New Jersey, and 2 in South Carolina) were found to be monomorphic for all 15 loci examined. Thus, no genetic diversity was found among plants within these populations. Polymorphism was detected within some of the larger American chaffseed populations in Georgia and North and South Carolina (Godt and Hamrick 1998, p. 91).

The low genetic diversity found within American chaffseed as a species and the low level of population differentiation suggest that dispersal into the species' present range may have occurred following a genetic bottleneck. The habitat requirements of American chaffseed may predispose the species to the loss of genetic diversity. As a shade intolerant species adapted to early successional habitats opened by fire, American chaffseed may always have been a fugitive

species. Anthropogenic fire suppression probably disrupted metapopulation dynamics (Godt and Hamrick 1998, p. 92).

#### **2.3.1.4 Taxonomic classification or changes in nomenclature:**

There have been no changes in the taxonomic classification or nomenclature of American chaffseed.

#### **2.3.1.5 Spatial distribution, trends in spatial distribution, or historic range:**

Although additional American chaffseed occurrences have been discovered while some have been lost, no overall change in the species distribution or historic range has been identified since the 1995 recovery plan. See Section 2.3.1.2 above.

#### **2.3.1.6 Habitat or ecosystem conditions:**

##### Habitat and Plant Associates

During a project to determine the extent and characteristics of unique botanical natural areas in Clarendon and Williamsburg counties, South Carolina, Townsend (1997, p. 281) found a concentration of American chaffseed populations, predominantly in sandy, open canopied longleaf pine flatwoods. The understories were typified by lack of dense shrub cover and an abundance of grasses and forbes. Common understory plant associates at these sites differed somewhat from previously described sites elsewhere within the species range and included: *Aletris aurea*, *Arnica acaulis*, *Aster squarrosus*, *Aster linariifolius*, *Ceanothus americanus*, *Eryngium yuccifolium*, *Polygala lutea*, *Psoralea psoralioides*, *Pterocaulon pycnostachyum*, *Schrankia microphylla*, *Stylosanthes biflora*, *Tephrosia spicata*, and *Tephrosia virginiana* (Townsend 1997, p. 281).

##### Habitat Conditions

Kelly (2005, pp. 60-61) found a tendency for American chaffseed plants to be clustered within the New Jersey site. There was a positive correlation between presence of American chaffseed and soil pH values of 4.1 or greater and the presence of little blue stem (*Schizachyrium scoparium*), broomsedge bluestem (*Andropogon virginicus*), Maryland golden aster (*Chrysopsis mariana*). There was also a negative correlation with soil pH values less than 4.1 and the presence of wetland ecotonal indicator species, such as sphagnum moss (*Sphagnum tenerum* and *S. compactum*), bushy bluestem (*A. glomeratus*), and orange milkwort (*Polygala lutea*) (Kelly 2005, pp. 60-61). However, in a follow-up lab study conducted by the NJONLM, seeds were found to germinate successfully at similar rates across all pH treatments. This suggests that pH itself is not sufficient to explain the clustered pattern observed in the field (Cartica 2005, p. 2).

### Effects of Fire on Habitat Conditions

Most populations of American chaffseed known at the time of listing occurred in areas that were subjected to frequent fires (USFWS 1995, p.13). This holds true in 2008, with the largest and most vigorous populations occurring in areas subjected to frequent natural or man-made wildfires and in areas managed through frequent controlled burns.

Of 17 occurrences known in 1993 from Fort Bragg, North Carolina, 13 were within training impact areas subject to frequent wildfires caused by military exercises or in areas that are periodically burned to contain wildfires. These populations are large and habitat conditions are maintained by these frequent fires. Outside of the impact areas 4 small occurrences were known. Even on sites with low herbaceous competition, American chaffseed populations at Fort Bragg have declined in the absence of frequent fires, indicating the vegetative competition may be a lesser factor in the species decline than absence of fire (DOD 2007).

Use of controlled burning for habitat maintenance and enhancement within mature and old growth pine woodlands to benefit the red-cockaded woodpecker may also benefit American chaffseed in areas where the species coexist. Prescribed burning prescriptions for red-cockaded woodpecker habitat call for early to mid growing season burns on a 1 to 5 year return interval. Habitat with excessive hardwood midstory is to be restored to one with an herbaceous groundcover, preferably by burning at a frequency of 1 to 3 years. Longer intervals are appropriate only for habitat that can be maintained with recommended herbaceous groundcover at those longer burn frequencies (USFWS 2003, p. 201). Burning prescriptions for red-cockaded woodpecker would enhance habitat conditions for American chaffseed.

Periodic mowing has been suggested as an alternative management technique to burning. Long-term monitoring at the Whitesbog, New Jersey site indicates that in areas that are mowed, but not burned, accumulation of leaf litter may serve as a refugia for invertebrates, increasing incidence of herbivory (Yurlina 1998, pp. 6-7).

### Climate Change

The effect of climate change was not previously considered for this species. More investigation is necessary to fully characterize the effects of climate change on American chaffseed, but changes in temperature, precipitation, and frequency and length of droughts may further decrease availability of suitable habitat for the species. In addition, changes in climate may affect germination and growth of American chaffseed plants.

**2.3.2 Five-factor analysis (threats, conservation measures, and regulatory mechanisms):**

**2.3.2.1 Factor A. Present or threatened destruction, modification or curtailment of its habitat or range:**

Destruction and adverse modification of American chaffseed habitat was cited as a major threat to the species at the time of listing (USFWS 1992, p. 44705). These threats continue today. Loss of habitat from development, fire suppression, and incompatible agriculture and silviculture practices continues as a major threat to the species and accounts for extirpation of additional American chaffseed sites. Despite finding several new occurrences of American chaffseed since the species was listed, the total number of known extant American chaffseed populations has decreased by nearly 25% since 1995.

**2.3.2.2 Factor B. Overutilization for commercial, recreational, scientific, or educational purposes:**

No new information relevant to this threat has been identified.

**2.3.2.3 Factor C. Disease or predation:**

A new herbivory threat to American chaffseed was identified by Norden and Kirkman (2004b, p. 67) at three Ichauway experimental treatment study sites in Georgia where neighboring competing vegetation had been anchored down with landscaping staples and American chaffseed stems were clipped at the soil surface to encourage resprouting. Major to complete herbivory (*i.e.*, all leaves gone or stem completely destroyed) from Buckeye butterfly (*Junonia coenia*) larvae occurred on both vegetative and reproduction portions of 45% of American chaffseed plants in the treatment areas. However, no similar herbivory was observed at untreated control sites or sites with other experimental treatments. Therefore, this appears to be an isolated threat caused by the management technique employed by the researchers and not a new or increased threat to natural populations of American chaffseed.

**2.3.2.4 Factor D. Inadequacy of existing regulatory mechanisms:**

Inadequacy of existing State regulations was identified as a threat to American chaffseed at the time of listing (USFWS 1992, pp. 44705-44706). Existing Federal and State regulations prohibit the removal or destruction of listed plant species on public lands. However, such regulations 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. Existing regulatory mechanisms are inadequate to protect American chaffseed.

### **2.3.2.5 Factor E. Other natural or manmade factors affecting its continued existence:**

Suppression of natural fires was identified as a threat to American chaffseed at the time of listing (USFWS 1992, p. 44706) and continues as a major threat today. Without fire, the open grass-sedge communities favored by American chaffseed proceed through seral stages and become dominated by trees, shrubs, and dense herbaceous growth that shade and out-compete the species. If fire is suppressed for more than 3 years, American chaffseed populations decline. Prescribed burning is most often conducted during winter when fires are easier to control. Such cool season fires where leaf litter is not removed are inadequate to create or maintain suitable habitat conditions for American chaffseed. Prescribed fire regimes to maintain red-cockaded woodpecker habitat are compatible with habitat management needs for American chaffseed and will benefit the plant where these species co-exist. However, most American chaffseed populations occur in areas where natural wildfires continue to be suppressed and where prescribed fires are inadequate to maintain the species habitat. In addition to adverse effects to habitat conditions, fire suppression has likely disrupted metapopulation dynamics, leading to isolation of populations (Godt and Hamrick 1998, p. 92).

Small population size was identified as a threat to American chaffseed at the time of listing (USFWS 1992, p. 44706) and continues today. Of the 53 known extant populations, 21 have less than 100 plants and, of those, 14 have less than 20 plants. These isolated and critically small populations are highly vulnerable to extinction. Isolation of populations prevents influx of new genetic material. Godt and Hamrick (1998, pp. 89-91) found that American chaffseed has very low genetic diversity both within and between populations, suggesting that dispersal into the species present range may have occurred following a genetic bottleneck. Such low genetic diversity may result in a lowered fecundity and / or lower capacity to adjust to changes in environmental conditions such as may occur through climate change.

Climate change was not considered in the recovery plan. Much more investigation would be necessary to begin assessing the potential effects of climate change on American chaffseed. However, potential effects could include changes in drought, temperature, carbon dioxide concentrations, precipitation, stream flow, and water quality.

## **2.4 Synthesis**

The total number of known extant occurrences decreased from 72 in 1995 to 53 in 2008. An additional 40 known sites have not been surveyed in over 10 years. American chaffseed is an early successional species that requires periodic fire or other disturbance for long-term maintenance of its habitat. Of the known extant sites, not all are in areas where fire or management simulating fire is possible or practical. Long term viability of

these sites is low. Therefore, these sites are not suitable for long-term protection and/or management agreements. Surveys of the 40 sites of unknown status are needed to determine if the existing recovery criteria are attainable or remain appropriate.

Surveys in South Carolina found a concentration of American chaffseed populations in areas being managed for red-cockaded woodpecker. However, these records have not been rectified with Natural Heritage Program records, so it is unknown if these are new or previously known populations. Use of controlled burning for habitat maintenance and enhancement within mature and old growth pine woodlands to benefit the red-cockaded woodpecker is compatible with habitat management needs of American chaffseed and would preserve or enhance habitat conditions for the species. Where the species co-exist, protection of American chaffseed should be incorporated into Safe Harbor Agreements or Habitat Conservation Plans for red cockaded-woodpecker.

As new information was obtained on the life history and habitat needs of American chaffseed, initial difficulties in propagating American chaffseed from seed were resolved. American chaffseed has been successfully reintroduced to one site in New Jersey and additional plants are being propagated for future reintroduction into suitable habitats within the northern portion of the species historic range.

Considerable progress has been made in characterizing the life history and habitat needs of American chaffseed. American chaffseed seeds have shown high germination rates following wet-cold stratification, but have been shown to be unlikely to persist for more than 2 years within the soil seed bank. It was found that American chaffseed seedlings did not need to form a haustorial connection to survive to a second year. Although American chaffseed can form haustorial connections with a wide range of plant hosts, a consistent correlation with composites and grasses was found. This correlation may be due to composites and grasses having a higher density of roots near the soil surface than many other plants, increasing the likelihood of American chaffseed seedlings coming into contact with roots of these potential hosts and thus being able to form a haustorial connection.

Fire induces flowering in American chaffseed plants, but this flowering response is limited to the year in which the burn occurs. Flowering production in individual American chaffseed plants tended to fluctuate dramatically, often dropping to zero or greatly reduced levels in the year following flowering. There may be significant energetic costs from flowering such that most plants are incapable of producing large numbers of flowers in consecutive years.

Flowering and subsequent viable seed production in American chaffseed is strongly stimulated by a combination of above-ground stem removal during fire and increased light availability following fire. However, flowering is not induced by either of these factors alone. Growing season mowing alone does not appear to be an adequate substitute for burning; however, in areas where burning is not feasible, mowing followed by biomass removal through raking can be used to stimulate flowering and seed

production. Relatively cool controlled burns where leaf litter is not removed are not adequate to create suitable habitat conditions.

Monitoring of individual American chaffseed plants shows that the plants are long-lived and capable of attaining at least ten years of age. Individual plants were also shown to be capable of remaining in the soil in a dormant state for one or more years.

Destruction and adverse modification of American chaffseed habitat continue as a major threat to the species. Loss of habitat from development, fire suppression, and incompatible agriculture and silviculture practices account for extirpation of additional American chaffseed sites. Despite finding several new occurrences of American chaffseed since the species was listed, the total number of known extant American chaffseed populations has decreased by nearly 25% since 1995.

New patterns of herbivory have been described. Long-horned grasshoppers and Lepidoptera larvae were found to feed on American chaffseed plants. Leaf litter was found to serve as a refugium for invertebrate herbivores. Prescribed fire to reduce leaf litter was found to be an effective management technique to reduce invertebrate predation.

Existing regulatory mechanisms continue to be inadequate to protect American chaffseed and its habitat. The ESA only protects populations from disturbances on Federal lands or when a Federal nexus is involved. State and Federal regulations afford little or no protection to listed plants on private lands.

The small population size of many remaining extant populations is a continuing threat to the species. Of the 53 known extant populations, 21 have less than 100 plants and, of those, 14 have less than 20 plants. These isolated and critically small populations are highly vulnerable to extinction. Seven populations (1 in Georgia, 3 in North Carolina, 1 in New Jersey, and 2 in South Carolina) were found to be monomorphic. Thus, no genetic diversity was found among plants within these populations. Polymorphism was detected within some of the larger American chaffseed populations in Georgia and North and South Carolina. The low genetic diversity found within American chaffseed as a species and the low level of population differentiation suggest that dispersal into the species present range may have occurred following a genetic bottleneck. The habitat requirements of American chaffseed may predispose the species to the loss of genetic diversity. As a shade intolerant species adapted to early successional habitats opened by fire, American chaffseed may always have been a fugitive species. Low genetic diversity may result in a lowered fecundity and / or lower capacity to adjust to changes in environmental conditions such as may occur through climate change.

Climate change was identified as a threat not previously considered for this species. More investigation is necessary to fully characterize the effects of climate change on American chaffseed, but changes in temperature, precipitation, and frequency and length of droughts may further decrease availability of suitable habitat for the species. In

addition, changes in climate may affect germination and growth of American chaffseed plants.

None of the recovery criteria for reclassification have been achieved to date. The continuing and potential continuing threats together with uncertainties about the population status of this species indicate that American chaffseed remains endangered throughout its entire range.

### **3.0 RESULTS**

**3.1 Recommended Classification:** Endangered. No change needed.

**3.2 Recommended Recovery Priority Number:** 7

Brief rationale: The number of populations (albeit many are small) of this species, in conjunction with type and severity of threat as assessed above, lead to the conclusion that the overall degree of threat is moderate as long as abatement efforts continue. The need for management is significant, but management techniques are known and lead to a high potential for recovery as long as they are implemented. Taxonomically, *Schwalbea americana* constitutes a monotypic genus.

### **4.0 RECOMMENDATIONS FOR FUTURE ACTIONS**

#### Regulatory Mechanisms

- Obtain updated information on State regulatory protection for American chaffseed.
- Work with State regulatory agencies to ensure that available regulatory mechanisms are being employed to protect American chaffseed and its habitat.

#### Secure Protection of Occurrences

- Identify sites suitable for long-term protection agreements, ensuring sites are representative of American chaffseed historical range limits and / or genetic variability.
- Pursue formal, long-term American chaffseed protection agreements with landowners.
- Seek opportunities to include American chaffseed protection into Safe Harbor Agreements or Habitat Conservation Plans developed for red cockaded-woodpecker where the species co-exist.

- Determine impact of groundwater withdrawals or changes in surface runoff on American chaffseed populations.
- Develop Best Management Practices to protect American chaffseed habitat, and encourage their adoption by Federal and State regulatory agencies, local governments, and public and private landowners.
- Incorporate protection of American chaffseed into local planning efforts, especially where multiple occurrences are clustered.
- Continue to protect American chaffseed sites through various regulatory processes as necessary and appropriate.

#### Continue to Characterize Species' Biology and Life History

- Continue to conduct applied habitat management to determine the long-term effects of fire, mowing, and other habitat management regimes on the species.
- Study seed dispersal mechanisms.
- Measure fluctuations in site conditions throughout an entire growing season and across years with different climatic conditions to better characterize optimal habitat conditions for the species.
- Characterize the type and degree of habitat disturbance that is beneficial vs. deleterious to the species.
- Investigate the impact of climate change on the species and its habitat.

#### Monitor Populations and Track Recovery

- Compile new or existing records of American chaffseed and ensure information is entered in Natural Heritage Program databases. Compare records to known extant or historic occurrences to resolve potential duplicate records, particularly in Georgia, and South Carolina.
- Survey extant American chaffseed sites to obtain updated information on the species' status and trends and ensure information is entered into Natural Heritage Program databases.
- Survey for previously undocumented populations of American chaffseed in the southeastern United States at sites that have regular prescribed burns such as those managed for red-cockaded woodpecker or quail.

- Investigate records of historic occurrence of American chaffseed and survey areas where suitable habitat remains to look for plants and to identify potential reintroduction sites.
- Verify historic records where supporting information is not available in administrative file.

#### Continue Reintroduction Efforts

- Continue and expand greenhouse propagation of American chaffseed for reintroduction of the species to its historic range in the northeastern U.S.
- Establish partnerships with State agencies, environmental groups and private landowners in the northern portion of the species range to identify suitable reintroduction sites on protected lands, particularly on lands where suitable habitat conditions can be maintained by periodic controlled burning.

#### Delisting

- Within the context of a revised recovery plan, develop a delisting strategy, delisting criteria, and a post-delisting monitoring strategy for the American chaffseed.

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-Year Review of American Chaffseed (*Schwalbea americana*)**

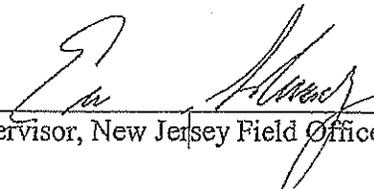
**Current Classification:** Endangered.

**Recommended Classification Resulting from 5-Year Review:** Retain as endangered.

**Recommended Recovery Priority Number:** 7

**Review Conducted by:** Annette Scherer, New Jersey Field Office.

**LEAD FIELD OFFICE APPROVAL:**

Approve  Date 10/16/08  
Field Supervisor, New Jersey Field Office, Fish and Wildlife Service

**LEAD REGION APPROVAL:**

**Acting**  Date AUG 11 2010  
Regional Director, Region 5, Fish and Wildlife Service

**COOPERATING REGION CONCURRENCE:**

 Date AUG 13 2010  
Regional Director, Region 4, Fish and Wildlife Service