AMERICAN CHAFFSEED *(Schwalbea americana)*

RECOVERY PLAN

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for

Region Five
U.S. Fish and Wildlife Service
Hadley, Massachusetts

Approved _____
Regional Director, Region Five

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EXECUTIVE SUMMARY:

AMERICAN CHAFFSEED RECOVERY PLAN

Current Status: American chaffseed (*Schwalbea americana*) was listed as an endangered species on September 29, 1992. Currently, 72 occurrences of this species are known to be extant in New Jersey, North Carolina, South Carolina, Georgia, and Florida. At the time of listing, 19 extant occurrences were known; the increase in the number of known occurrences is the result of extensive searches for the species in North and South Carolina. Threats to the species persist, primarily due to fire suppression resulting in vegetative succession of the ecosystem on which the species depends.

Habitat Requirements: American chaffseed is found in open pine flatwoods, savannas, and other open areas, in moist to dry acidic sandy loams or sandy peat loams.

Recovery Goal: To remove American chaffseed from the Federal list of endangered and threatened wildlife and plants.

Recovery Objectives: The immediate objective of the recovery program is to reclassify the American chaffseed from endangered to threatened based upon improvements in its status. The ultimate objective of the recovery program is to delist American chaffseed by ensuring long-term viability of the species.

Recovery Criteria: American chaffseed will be considered for reclassification when: (1) at least 50 viable sites, distributed throughout the current range of the species, are provided permanent long-term protection; (2) four of the 50 sites are located in the northern portion of the species range (Massachusetts to Virginia); (3) management agreements or plans are in place for all 50 of the protected sites; (4) life history and ecological requirements are understood sufficiently to determine viability of extant populations; and (5) biennial monitoring shows that the 50 sites are viable over a 10-year period.

Actions Needed:

1. Protect extant populations and manage habitats.
2. Expand the extent of American chaffseed in the northern portion of current range.
3. Investigate best management techniques.
4. Investigate the species' biology.
5. Investigate genetic variability.
6. Monitor populations.

Estimated Costs ($000):

	Need 1	Need 2	Need 3	Need 4	Need 5	Need 6	Total
FY1	40	5	8	12	5	13	83
FY2	40	10	8	12	5	10	85
FY3	35	10	8	12		10	75
FY4	25	5	3	4		10	47
FY5	25	5	3	4		10	47
FY6	25	1		4		10	35
FY7		1				10	11
FY8		1				10	11
FY9		1				10	11
FY10		1				10	11
Total	190	40	30	48	10	103	416

Estimated Time Frame: Reclassification may be initiated by the year 2005, if recovery actions are implemented on schedule.

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This recovery plan describes actions believed to be needed to recover and/or protect the endangered American chaffseed *(Schwalbea americana)*. Attainment of recovery objectives and availability of funds are subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities.

Recovery plans do not necessarily represent the views or official position of any individuals or agencies involved in plan formulation, other than the U.S. Fish and Wildlife Service. Approved recovery plans may be modified as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations for this plan should read as follows:

U.S. Fish and Wildlife Service. 1995. American Chaffseed (*Schwalbea americana*) Recovery Plan. Hadley, Massachusetts. 62 pp.

Copies of this plan can be purchased from:

U.S. Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
301-492-6403 or 1-800-582-3421

Fees vary according to number of pages.

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PART I: INTRODUCTION

American chaffseed (*Schwalbea americana* L.) is a monotypic perennial member of the figwort family, Scrophulariaceae, in the tribe Euphrasieae. The species was described by Linnaeus in *Species Plantarum* in 1753, and named for Christian Georg Schwalbe, an eighteenth-century botanical writer. The range of American chaffseed once included all the coastal States from Massachusetts to Louisiana, and the inland States of Kentucky and Tennessee. Although the range was widespread, the historical record shows that the species was always relatively rare and local in distribution. Due to extirpation of the species from over half its historical range and a decline in known occurrences, *Schwalbea americana* was Federally-listed as an endangered species pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) on September 29, 1992 (U.S. Fish and Wildlife Service 1992).

At the time of Federal listing, 19 occurrences of the species were known from the following States (number of occurrences in parentheses): New Jersey (1), North Carolina (1), South Carolina (11), Georgia (4), Florida (1), and Mississippi (1). As a result of recent searches in South Carolina, as well as recent searches and recognition of distinct occurrences on Fort Bragg in North Carolina, 72 occurrences of the species are currently known, as follows: New Jersey (1), North Carolina (18), South Carolina (42), Georgia (10), and Florida (1).

Although the increase in known occurrences since the time of Federal listing is significant, threats to the species' survival remain, primarily due to fire suppression and concomitant vegetational succession of the fire-maintained ecosystems where *Schwalbea americana* occurs. The recovery priority number[1] for this species is 7, based on: (1) a moderate degree of threat, (2) a high potential for achieving recovery, and (3) the plant's taxonomic standing as a monotypic genus.

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[1] Recovery priority numbers from 1 to 18 are determined for all species listed pursuant to the Endangered Species Act based on the recovery priority criteria defined in the Federal Register (Vol. 48, No. 184). A species with a recovery priority number of 1 receives the highest priority for the preparation and implementation of recovery plans.

TAXONOMY AND DESCRIPTION

Monotypic genus

Pennell (1935) recognized a northern and southern species of *Schwalbea*, *Schwalbea americana* L. and *Schwalbea australis* Pennell, respectively. He distinguished *Schwalbea americana* by mostly recurved hairs and leaves up to 1.0 centimeters (0.4 inches) wide or less, and *Schwalbea australis* by a pubescence of mostly upcurved hairs and leaves up to 1.5 cm (0.6 in) wide. *Schwalbea americana* was known from Massachusetts southward to Virginia, and *Schwalbea australis* was known from North Carolina to Kentucky and southward to Florida and Louisiana. Fernald (1937) found characters of the leaves and calyx lobes to vary over the total range so that recognition of two species was unwarranted. Following an examination of herbarium material, Musselman and Mann (1977) concurred that there was little taxonomic merit in recognizing more than a single species. Therefore, the U.S. Fish and Wildlife Service accepts the more recent treatments of Fernald (1937) and Musselman and Mann (1977), which recognize *Schwalbea americana* and *Schwalbea australis* as one species, *Schwalbea americana*. In this plan, *Schwalbea americana* will be henceforth referred to as the monotypic genus *Schwalbea*.

General description

Schwalbea is an erect herb with unbranched stems or stems branched only at the base, growing to a height of 3.0 to 6.0 decimeters (12 to 24 in). The plant is densely albeit minutely hairy throughout, including the flowers. The leaves are alternate, lance-shaped to elliptic, stalkless, 2.5 to 5.0 cm (0.8 to 2 in) long, and entire; the upper leaves are reduced to narrow bracts. The large, purplish-yellow, tubular flowers, 3.0 to 3.5 cm long (1.2 to 1.4 in) are borne singly on short stalks in the axils of the uppermost, reduced leaves (bracts) and form a many-flowered, spike-like raceme. The showy flowers have a high degree of bilateral symmetry elaborated for pollination by bees (Pennell 1935). The fruit is a narrow capsule approximately 10 to 12 millimeters (0.4 to 0.5 in) long, with a septicidal dehiscence. The numerous seeds are pale greenish brown or yellowish-tan, narrowly linear, somewhat flattened or compressed, slightly curved, and enclosed in a loose-fitting, sac-like structure that provides the basis for the common name, chaffseed (Musselman and Mann 1978). Flowering occurs from April to June in the southern part of the species' range, and from June to mid-July in the northern part of its range. Fruits mature from early summer in the South to October in the North (Johnson 1988).

Field identification

This species is distinguished by: (1) a 3.0 to 6.0 dm (12 to 24 in) unbranched stem with alternate leaves, largest at the base, gradually diminishing upwards; (2) two-lipped flowers, 3.0 to 3.5 cm (1.2 to 1.4 in) long and pale yellow suffused with purple near the open end; (3) hairy stems and leaves; and (4) posterior sepal and two bractlets subtending each flower (The Nature Conservancy 1993). The best time to survey for *Schwalbea* is during its flowering period, which is April to June in the South and June to mid-July in the North. Although often obscured by surrounding vegetation, the dark brown, senescing stems are quite distinctive and allow for easy identification after flowering. These stems may persist into the following winter if undisturbed (The Nature Conservancy 1993). During recent surveys in South Carolina, new populations of the species were located by inspecting suitable habitats for the darkened senescing plants, which stand out against greener herbs and grasses (J. Townsend, Clemson University, Clemson, South Carolina, pers. comm. 1994).

DISTRIBUTION AND STATUS

Schwalbea is primarily a coastal plain species of the Atlantic and Gulf coasts (Figure 1). Exceptions to its coastal distribution, all of which are historical records, include: an occurrence in the sandplains near Albany, New York, which Pennell (1935) considered a possible remnant population of glacial migration along the shores of the Hudson River; occurrences from Tennessee and Kentucky on sandstone knobs and ridges of the Cumberland Plateau and Highland Rim; an inland site on the Montague sandplain near the Connecticut River; and a sandplain in Hubbardston, Massachusetts (The Nature Conservancy 1993).

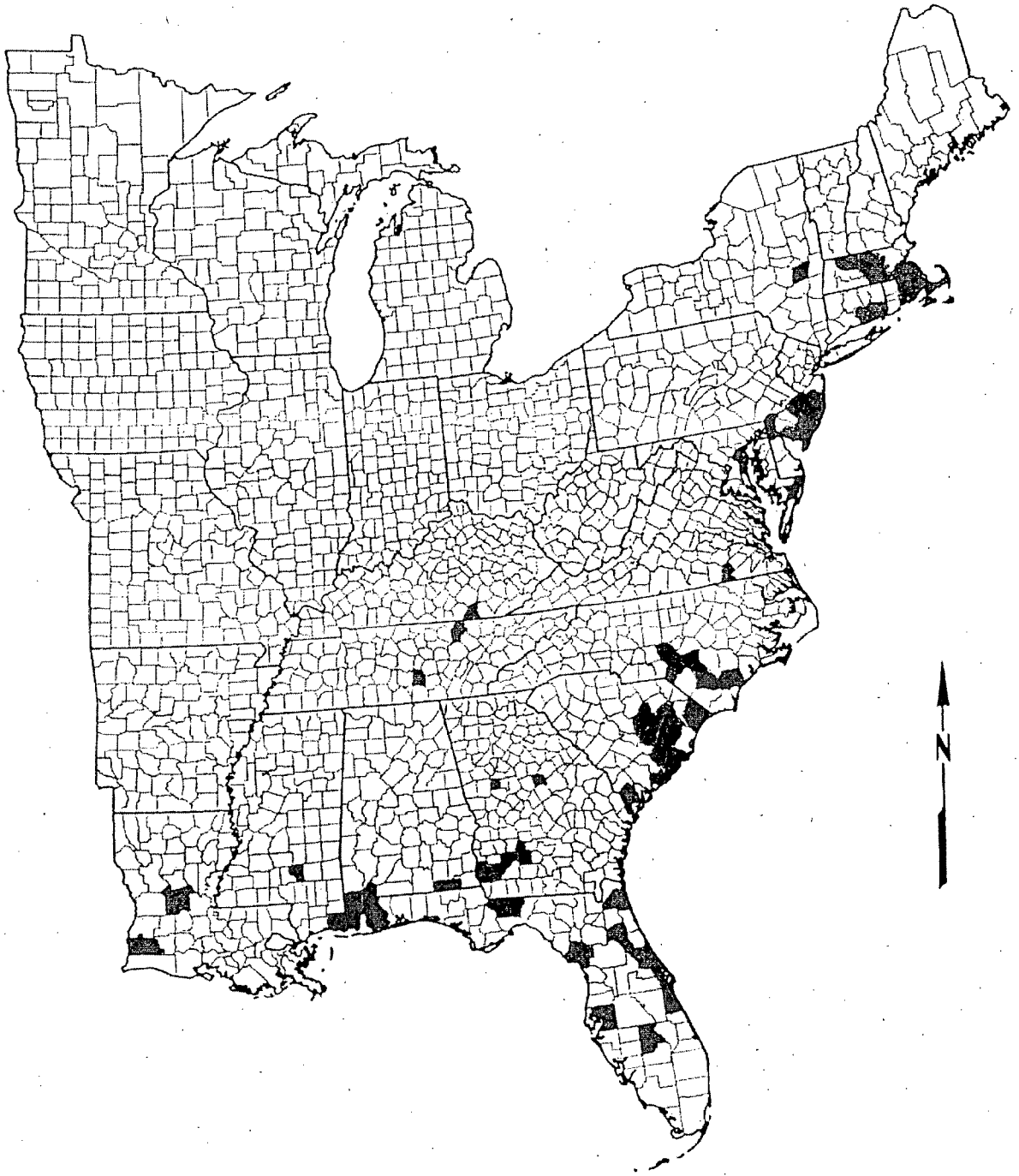
Extant populations of *Schwalbea* are currently known from 72 locations in New Jersey, North Carolina, South Carolina, Georgia, and Florida (an occurrence reported from Mississippi at the time of Federal listing has since been determined not to be *Schwalbea*). States with historic records only are Massachusetts, Connecticut, New York, Delaware, Maryland, Virginia, Alabama, Mississippi, Louisiana, Texas, Tennessee, and Kentucky (Table 1). A description of State-by-State historical and current distribution as well as the current level of protection of extant occurrences follows. Additional information on extant occurrences is provided in Appendix A.

Table 1. Summary of known occurrences (historic and extant)

State	Total known	Extirpated	Extant	Unknown status[1]
Alabama	3	3	0	0
Connecticut	2	2	0	0
Delaware	1	1	0	0
Florida	10	8	1	1
Georgia	14	4	10	0
Kentucky	2	2	0	0
Louisiana	2	2	0	0
Maryland	2	2	0	0
Massachusetts	10	10	0	0
Mississippi	2	2	0	0
New Jersey	19	18	1	0
New York	1	1	0	0
North Carolina	24	6	18	0
South Carolina	53	1	42	10
Tennessee	2	2	0	0
Texas	1	1	0	0
Virginia	1	1	0	0
TOTALS	149	66	72	11

[1] These occurrences in South Carolina are considered suppressed, unable to relocate, or undetermined (Porcher 1994).

Figure 1. General Distribution *of Schwalbea americana* (historic and extant)



■ Counties with extant occurrences

■ Counties with historic occurrences

Alabama

Three historic occurrences are known from Baldwin, Geneva, and Mobile counties (The Nature Conservancy 1993).

Connecticut

Two historic occurrences are known from Middlesex County (The Nature Conservancy 1993) and New London County (Crow 1982).

Delaware

One historic occurrence is known from New Castle County, where it was last observed in 1875. This site was destroyed by the dredging and widening of the Chesapeake and Delaware Canal (The Nature Conservancy 1993).

Florida

A total of 10 occurrences is known from Brevard (Pennell 1935), Duval, Highlands, Hillsborough, Levy, Putnam, Volusia (E.D. Hardin, Florida Natural Areas Inventory, *in litt.*[1] 1985), Gadsden (L. Peterson, Florida Natural Areas Inventory, *in litt.* 1994) and Leon counties (W. Baker, The Nature Conservancy, Tallahassee, Florida, pers. comm. 1994). All occurrences except two, one in Gadsden County and one in Leon County, are extirpated. A recent survey of the Gadsden County site revealed that a residential development is now in place there. This occurrence may thus also be extirpated (L. Peterson *in litt.* 1994), although additional habitat near the site may be suitable for *Schwalbea* and should be searched (W. Baker pers. comm. 1994). The extant occurrence in Leon County is on private property managed for bobwhite quail (*Colinus virginianus*) (W. Baker pers. comm. 1994); current habitat management practices for quail (e.g., prescribed burning) contribute to maintenance of suitable habitat for *Schwalbea*.

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[1] Note: *In litt.* references refer to information received through correspondence, following style guidelines in the Endangered Species Listing Handbook, Fourth Edition, U.S. Fish and Wildlife Service, Division of Endangered Species, March 1994.

Georgia

A total of 14 occurrences is known from Baker, Baldwin, Dougherty, Early, Miller, Pike, and Worth counties. Four occurrences in Baldwin, Early, Miller, and Pike counties are considered extirpated (T. Patrick, Georgia Department of Natural Resources, *in litt.* 1990). Of the 10 extant occurrences, six are located on the Ichauway Plantation, a 28,000-acre private ecological reserve in Baker County (W. Baker pers. comm. 1994). Ichauway is predominantly vegetated with a natural stand of longleaf pine (*Pinus palustris*). All the *Schwalbea* populations on Ichauway are protected, and four of the populations are being included in a five-year research study on the life history, seed banks, and experimental management of the species (Kirkman 1993). Two extant occurrences are located on another private quail plantation in Dougherty County (T. Patrick *in litt.* 1990), one of which is also included in the Kirkman study. The remaining two extant occurrences are located on private lands managed for quail in Baker and Worth counties (W. Baker pers. comm. 1994). Similarly to quail plantations in Florida and South Carolina, management practices for quail on the private plantations in Georgia maintain suitable habitat for *Schwalbea*.

Kentucky

Two historic occurrences are known from McCreary County near the Tennessee border. *Schwalbea* was last observed in Kentucky in 1935 (Kentucky State Nature Preserves Commission 1991).

Louisiana

Two historic occurrences are reported from Rapides Parish (Vincent 1982 as reported in The Nature Conservancy 1993) and Calcasieu Parish (MacRoberts 1989 as reported in The Nature Conservancy 1993). However, it is likely that the record from Rapides Parish is due not to an occurrence of the species in or near Rapides Parish, but to a label on a specimen distributed by Josiah Hale around 1850. Hale put his hometown ("Alexandria"), which is found in Rapides Parish, on his labels but did not cite localities. Thus, the record from Rapides Parish cannot be considered valid (L. Morse, The Nature Conservancy, *in litt.* 1986).

Maryland

Two historic occurrences are reported, one from Worcester County near Ocean City, where it was last observed in 1893, and one from Anne Arundel County. Both locales were searched in 1979, but *Schwalbea* was not found (Broome *et al.*1979).

Massachusetts

Ten historic occurrences are recorded from Barnstable, Bristol, Dukes, Franklin, Nantucket, Norfolk, Plymouth, and Worcester counties (The Nature Conservancy 1993). The species was last observed in Massachusetts in Nantucket County in 1963. Extensive areas of suitable habitat in the State have been searched for *Schwalbea*, without relocating the species. Lack of fire, coupled with intense development pressure, indicates minimal prospects for finding *Schwalbea* in Massachusetts (B. Sorrie, Massachusetts Division of Fisheries and Wildlife, *in litt.* 1990).

Mississippi

Two historic occurrences are known from Covington and Jackson counties (Rawinski and Cassin 1986). The occurrence reported as extant at the time of listing, in Noxubee County on the Noxubee National Wildlife Refuge (U.S. Fish and Wildlife Service 1992), is now considered invalid. The plants previously identified as *Schwalbea* at the Noxubee National Wildlife Refuge have been verified as being *Parentucellia viscosa*, a European native closely related to *Schwalbea* (C. Norquist, U.S. Fish and Wildlife Service, *in litt.* 1993). No extant populations of *Schwalbea* are known to occur in Mississippi.

New Jersey

A total of 19 occurrences, only one of which is extant, is known from Atlantic, Burlington, Camden, Cape May, Cumberland, and Ocean counties (New Jersey Department of Environmental Protection 1994). By the early 1970s there were still four extant occurrences in New Jersey: one in Cape May County, one in Camden County, and two in Burlington County. The Camden County occurrence and one of the Burlington County occurrences were lost, apparently to succession of their habitat resulting, perhaps, from fire suppression. By 1980, only

two occurrences of *Schwalbea* remained in New Jersey. In 1986, the Cape May population was destroyed by the construction of a new road, leaving one extant occurrence in Burlington County (G.A. Marshall, New Jersey Division of Parks and Forestry, *in litt.* 1991).

The Burlington County occurrence is located at the northernmost extent of the current range of *Schwalbea*, and is the only known occurrence north of North Carolina. The site is within Lebanon State Forest, although portions of the road shoulder along the highway remain under the jurisdiction of Burlington County. Additionally, part of the occurrence is on land that the State leases to a cranberry grower under a 25-year lease. The lease was initiated in 1983 and amended in 1984 (New Jersey Department of Environmental Protection and Energy 1993).

The Burlington County site is easily accessible and well known, making it particularly vulnerable to human disturbance. Trampling and removal of plants at the site and mowing at inopportune times for the species have been problems in the past. Throughout the 1980s, the number of plants at this occurrence seemed to be declining (G.A. Marshall *in litt.* 1991). In 1993, the Lebanon State Forest, Burlington County, the cranberry grower, and the New Jersey Office of Natural Lands Management signed a management agreement to provide increased site protection and to implement a coordinated on-site management program for *Schwalbea*. As a result of this agreement, barriers to vehicles have been built in the area to prevent inadvertent disturbance, and coordination has increased to ensure that mowing occurs in the dormant season (i.e., October-November). Although mowing and hand-thinning of shrubby vegetation are conducted on the site, it is suspected that a fire is needed to reinvigorate conditions suitable for *Schwalbea* (R. Cartica, New Jersey Division of Parks and Forestry, Office of Natural Lands Management, Trenton, New Jersey, pers. comm. 1994). Nonetheless, due to the increased management of the site in the past few years, the population does not appear to be declining at this time (T. Hampton, New Jersey Office of Natural Lands Management, *in litt.* 1995).

New York

One historic occurrence is recorded from Albany County in the sandplains, where *Schwalbea* was last observed in 1865 (The Nature Conservancy 1993).

North Carolina

A total of 24 occurrences is known from Bladen, Cumberland, Hoke, Moore, Pender, and Scotland counties (The Nature Conservancy 1993), six of which are considered extirpated and 18 extant. At the time of listing, only one occurrence was reported as extant in North Carolina; the increase is attributed to additional searching and the recognition of separate occurrences on Fort Bragg. Of the 18 extant occurrences, 17 are located on Fort Bragg on or near live-ammunition impact zones in Cumberland and Hoke counties. The other extant occurrence is located next to a roadside in Moore County.

The extent of *Schwalbea* on Fort Bragg appears to be related to military shelling activities on the base, which result in frequent fires in and around the live-ammunition impact zones. The frequent fires (in what were once fire-maintained communities) maintain a strong dominance and high diversity of herbs under widely scattered longleaf pine and pond pine (*Pinus serotina*). Without the frequent fires, most of the areas occupied by *Schwalbea* would be dense, shrub-dominated pocosins or dominated by dense stands of turkey oak (*Quercus laevis*) as is the case under the artificial, fire-suppressed conditions prevailing in the sandhills and coastal plain of North Carolina (A.S. Weakley, North Carolina Natural Heritage Program, *in litt.* 1990).

The occurrences on Fort Bragg are afforded some protection under the Endangered Species Act as well as Army regulation AR 420-74 (Chapter 11 draft), Fort Bragg's range regulation No. 350-6, and Fort Bragg's Draft Endangered Species Management Plan (J. Shipley, Department of Defense, Fort Bragg, *in litt.* 1995).

South Carolina

A total of 53 occurrences is known from Berkeley, Charleston, Clarendon, Florence, Horry, Jasper, Lee, Sumter, and Williamsburg counties (Porcher 1994). According to Porcher (1994), the current status of these 53 occurrences is as follows: one occurrence is considered extirpated, five occurrences are considered suppressed but possibly still extant, four occurrences have not been relocated and are possibly extirpated, one occurrence is undetermined due to inability to gain access to the sites, and 42 occurrences are considered extant (Porcher 1994). At the time of listing, 11 South Carolina occurrences were considered extant. The increase in known

occurrences is attributed to extensive searching for the species, primarily in Clarendon and Williamsburg counties and on the Francis Marion National Forest in Berkeley and Charleston counties.

Of the 42 known extant populations, 10 are on the Francis Marion National Forest, 17 are on private property, one is on South Carolina Heritage property, and eight are of unknown ownership. All management activities on the National Forest are carefully planned by the U.S. Forest Service to protect the *Schwalbea* populations (D.G. Unger, U.S. Forest Service, *in litt.* 1992).

Most of the South Carolina occurrences known to be in private ownership are on plantations managed for bobwhite quail. Quail management in South Carolina includes prescribed burning to maintain the open pine flatwoods and savannas favorable for quail in the Southeast. Since *Schwalbea* also seems to require open pine flatwoods and savannas in South Carolina, quail management is compatible with, and in some areas responsible for, maintaining suitable habitat for *Schwalbea*. In other areas that were once suitable for *Schwalbea*, land use has changed to commercial and residential sites, agriculture fields, or pine plantations, all of which tend to eliminate the open pine flatwood and savanna ecosystems where *Schwalbea* flourishes.

Porcher (1994) has recommended that additional searches for *Schwalbea* be conducted in suitable habitats in Georgetown, Lee, Sumter, Florence, and Hampton counties.

Tennessee

Two historic occurrences are known: one from Coffee County, which was last observed in 1879, and one in Fentress County, which was last observed in 1842 (P. Somers, Tennessee Department of Conservation, *in litt.* 1990).

Texas

One possible specimen record is reported from east Texas (Correll and Johnston 1970 as cited in The Nature Conservancy 1993).

Virginia

One historic occurrence is recorded from an area between Sussex and Greensville counties, where it was last observed in 1937. The species' persistence in this region, which has been heavily affected by agriculture, pine plantations, and highways, is highly doubtful (J.C. Ludwig, Virginia Natural Heritage Program, *in litt.* 1990).

HABITAT / ECOSYSTEM

Description / Associates

Characteristically, *Schwalbea* occurs in sandy (sandy peat, sandy loam), acidic, seasonally moist to dry soils. The species is generally found in habitats described as pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems (Kral 1983). *Schwalbea* appears to be shade intolerant and, therefore, occurs in areas maintained in an open to partially open condition.

Historically, the species was reported to exist on savannas and pinelands throughout the coastal plain. It also occurred inland on sandstone knobs and plains where frequent, naturally-occurring fires maintained open grass and herbaceous communities or partially open forest communities such as those dominated by longleaf pine. Under such conditions, herbaceous plants like *Schwalbea* avoided competition from trees and shrubs. Most of the surviving populations, including the most vigorous, are in areas that are still subject to frequent fire. These fire-maintained habitats include plantations that are burned regularly, often annually, for management of quail and other game species; an army base impact zone that burns regularly because of live artillery shelling; forest management areas that are burned to maintain habitat for wildlife including the endangered red-cockaded woodpecker (*Picoides borealis*); and various other private lands and powerline rights-of-way that experience burning and/or frequent mowing.

In New Jersey, *Schwalbea* occurs in open areas that have been maintained by mowing within a pitch pine (*Pinus rigida*) community. The site is next to a roadcut through a cedar

swamp (Obee 1993a). This site has not burned for at least 32 years (T. Gordon, Pine Barrens Inventories, *in litt.* 1995).

In the Southeast, as reported by Kral (1983), *Schwalbea* occurs in species-rich plant communities where grasses, sedges, and other colorful savanna dicots are especially numerous. Several extant populations of *Schwalbea* co-occur with or are in proximity to species of special concern, including Carolina grass-of-parnassus (*Parnassia caroliniana*), eulophia (*Pteroglossaspis ecristata*), fennel (*Oxypolis ternata*), and Bachman's sparrow (*Aimophila aestivalis*). Additionally, several *Schwalbea* populations are near nesting populations of the red-cockaded woodpecker. Like *Schwalbea*, these species also require open pine woodlands, flatwoods, or savannas.

In South Carolina, Porcher (1994) reports that the predominant habitat for *Schwalbea* differs from the seasonally moist ecotonal areas indicated in the scientific literature. Porcher (1994) describes *Schwalbea* habitat as fire-maintained (or mowed, as under power lines), dry, well-drained, longleaf pine flatwoods. The soil is generally a sandy loam. Regular fire within the flatwoods creates and maintains the open grass-sedge areas interspersed within other herbs and shrubs. Although *Schwalbea* is more common in the grass-sedge areas, it also occurs in the herb-shrub areas of the flatwoods. Associated trees, shrubs, herbs, and grasses in the longleaf pine flatwoods include black jack oak (*Quercus marilandica*), post oak (*Q. stellata*), scrubby post oak (*Q. margaretta*), water oak (*Q. nigra*), running oak (*Q. pumila*), mockernut hickory (*Carya tomentosa*), loblolly pine (*Pinus taeda*), bracken fern (*Pteridium aquilimun*), dwarf huckleberry (*Gaylussacia dumosa*), stagger bush (*Lyonia mariana*), blueberry (*Vaccinium tenellum*), Goat's-rue (*Tephrosia virginiana*), black-root (*Ptercaulon pycnostachyum*), colicroot (*Aletris farinosa*), *Eupatorium rotundifolium*, *Desmodium* spp., *Lespedeza* spp., *Rhynchospora* spp., *Scleria* spp., *Carex* spp., *Andropogon* spp., *Panicum* spp., *Aristida* spp., and *Paspalum* spp. (Porcher 1994).

Only two of the South Carolina *Schwalbea* occurrences are found in the wetter environment of longleaf pine savannas (Porcher 1994). Associated species in the savannas include colicroot, broomstraw (*Andropogon* sp.), and *Heterotheca graminifolia*. In one savanna location, *Schwalbea* co-occurs with trumpet pitcher plant (*Sarracenia flava*) and hooded pitcher plant (*Sarracenia minor*), both of which are indicative of wetland areas.

In North Carolina, the species occurs in moist to dryish pine flatwoods, longleaf pine/wiregrass (*Aristida stricta*) savannas, and on longleaf pine/oak sandhills composed of Upper Cretaceous deep, white sands, at the western edge of the coastal plain (The Nature Conservancy 1993). Habitats for *Schwalbea* on Fort Bragg include: (1) upper ecotones of streamhead pocosins (shrubby headwaters and seepage areas), usually extending well out into longleaf pine/wiregrass savannas and less frequently down to where the ecotone supports moisture-requiring species; (2) sites close to streamhead pocosins or in shallow depressions in the landscape, showing an increase in soil moisture; and (3) drier slopes with sparser wiregrass mixed with bare sand patches (The Nature Conservancy 1993).

In Georgia, *Schwalbea* occurs in ecotonal areas between freshwater wetlands and upland pine forests. Frequent associates include *Panicum* spp., bracken fern, *Pityopsis* (= *Heterotheca*) *graminifolia*, wiregrass, blackberry (*Rubus cuneifolius*), *Dyshoriste oblongifolia*, *Aster adnatus*, and broomstraw. On a site in Dougherty County, Georgia *Schwalbea* occurs on the upper edges of former drainage ditches (Kirkman 1993). Although *Schwalbea* appears to occur within a fairly wide moisture regime, the actual moisture requirements for this species are not well understood. Based on the areas where *Schwalbea* occurs, it is likely that the species prefers conditions of fluctuating moisture availability.

Soils

Soils supporting *Schwalbea* have been described as damp sandy spots in the Pine Barrens (Stone 1911); moist, sandy soil (Gleason and Cronquist 1991); and acidic sandy loams or sandy peat loams (Kral 1983).

In Georgia, *Schwalbea* occurs on soils that, as indicated by U.S. Department of Agriculture soil surveys, generally include poorly-drained Grady soils in the wetlands surrounded by well-drained loamy sands or sandy loams, such as Wagram, Norfolk and Duplin series (Kirkman 1993). In North Carolina, soils include those in the Blaney, Candor, Gelead, Fuquay, Lakeland, and Vaucluse series (The Nature Conservancy 1993).

LIFE HISTORY

Parasitism

The root parasitic behavior of *Schwalbea* has been known since 1856 (Musselman and Mann 1977). As with many Scrophulariaceae, *Schwalbea* exhibits hemiparasitic behavior. Hemiparasites (also called semiparasites) contain chlorophyll and can produce all or part of their own food, as opposed to holoparasites, which lack chlorophyll and are entirely dependent on host plants for food and water. Haustoria developing from *Schwalbea* roots are unique among Scrophulariaceae parasites in that "a well-developed neck, interrupted zone, a sclerotic layer, and a very broad endophyte are present. Tyloses, which arise from neighboring parenchyma cells and grow through pits in the vessels, are abundant in the neck region" (Musselman and Mann 1977).

Schwalbea is considered the rarest root parasitic plant in the South, and, like most parasitic Scrophulariaceae, it is not host-specific. Musselman and Mann (1977) reported pot-grown *Schwalbea* had haustorial connections on tuliptree (*Liriodendron tulipifera*), white pine (*Pinus strobus*), sweetgum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), and tupelo (*Nyssa aquatica*). In the field, haustoria of *Schwalbea* were found attached to and penetrating inkberry (*Ilex glabra*), dwarf huckleberry (*Gaylussacia dumosa*), and St. John's-wort (*Hypericum* sp.) (Musselman and Mann 1977). More recently, Kirkman (1993) obtained *Schwalbea* samples from the field and by clipping the roots of *Schwalbea* from the stems, observed haustorial connections to colicroot.

Reproduction

Pollinators

Schwalbea produces showy, insect-pollinated flowers with a high degree of zygomorphy elaborated for pollination by bees (Pennell 1935). On Fort Bragg, bumblebees were observed visiting *Schwalbea* flowers exclusively (The Nature Conservancy 1993), and observations of insect visitation suggest that probable pollinators of *Schwalbea* are worker bumblebees (*Bombus impatiens* and *Bombus pennsylvanicus*) Kirkman (1993). These bees were the most commonly observed insects on floral structures and the only species that entered the flowers. Kirkman

(1993) covered *Schwalbea* flowers with bags to control insect pollination. On the covered flowers, fruit production remained high, suggesting that pollination does not appear to be a requirement for fruit and viable seed production. The flowers are unusual in their color and morphology and deserve more study (L. Musselman, Old Dominion University, *in litt.* 1994).

Germination

The germination rates of collected *Schwalbea* seeds are high. Kirkman (1993) reported that the germination rate of seeds placed in petri dishes, with and without cold stratification, was approximately 90 percent. Similar high germination rates on several types of media were obtained at the Atlanta Botanical Garden (Kirkman 1993). On the Francis Marion National Forest, similar high germination rates have been observed in greenhouse studies; however, to date, the plants have not grown beyond a small initial stage of approximately 2.0 cm (O. Buckles, U.S. Forest Service, Francis Marion National Forest, Moncks Corner, South Carolina, pers. comm. 1994).

Germination of New Jersey seeds in petri dishes on germination paper was close to 100 percent after a five-month wet cold treatment. Seedlings were transplanted to soil substrates and maintained in a greenhouse under a mist spray to keep the soil continually moist. Seedlings were sown into a series of five soil mixtures differing in soil moisture and water retention capacity. Some seedlings were sown with seeds of little bluestem (*Schizachyrium scoparium*), a potential host species. Seedlings survived for over a month but never grew appreciably larger than 1.0 cm, with 2 to 4 minute leaves. No differences in growth or survival were seen between any of the treatments (T. Hampton *in litt.* 1995).

During field observations, Kirkman and Drew (1995) found that recruitment appears to be associated with microsite soil disturbances such as earthworm casting, pocket gopher activity, and other minor disturbances that expose bare soil. Significant germination has also been observed under thick wiregrass that has fallen over and eliminated other vegetation (L.K. Kirkman, Joseph W. Jones Ecological Research Center, *in litt.* 1994). Examination of *Schwalbea* roots revealed that, although individual plants are multi-stemmed, they do not vegetatively propagate by rhizomes (Kirkman 1993). Additional information is needed regarding the exact time of year when germination occurs (L.K. Kirkman *in litt.* 1994).

Seed banking

Kirkman (1993) collected soil samples adjacent to *Schwalbea* plants prior to seed release. Various treatments, including cold treatment and exposure to various soil moisture regimes were used to encourage germination. No individuals of *Schwalbea* germinated in any of the soil samples. The absence of *Schwalbea* in the seed bank was unexpected, particularly considering the generalized germination requirements. It is possible that the seeds were too deeply buried in the soil following mixing of the samples for germination, or that the sampling technique was not adequate to obtain seeds in the soil sample (Kirkman 1993). Additional seed banking studies are being considered (L.K. Kirkman pers. comm. 1995).

Seed dispersal

The structure of the *Schwalbea* seed, somewhat flattened or compressed, slightly curved, and enclosed in a loose-fitting sac-like structure, suggests wind dispersal; however, no information is available to support this hypothesis. Information is lacking on both the mechanism and distance of seed dispersal. Initial observations in New Jersey determined that ants ignored *Schwalbea* seeds; therefore, ants may be unlikely to function as seed dispersers for this species (T. Hampton *in litt.* 1995).

Population Demography

Kirkman and Drew (1995) report three life stages in the vegetative condition of *Schwalbea* based on leaf length: small leaves ($\leq$ 0.5 cm length), medium leaves (0.5-1 cm), and large leaves ($>$ 1.0 cm). First-year seedlings usually have small leaves, and all reproductive plants (plants with fruits and/or flowers) have large leaves. Reproductive individuals are primarily from the previous-year reproductive stage or large-leaf-vegetative stage. Kirkman and Drew (1995) report that more than a third of the reproductive plants in their study remained reproductive the following year and most of those that did not flower remained in the large-leaf-vegetative class. Few individuals in the small-leaf-vegetative class became reproductive the next year. Recruits were mostly in the small-leaf-vegetative class; however, a large number of

individuals recruited were in the reproductive or the large-leaf-vegetative class, suggesting that plants may have dormant years. Additional demographic analysis of *Schwalbea* subpopulations regarding spatial patterns of reproduction, recruitment, mortality, survivorship, seed banking, and transitions among age classes is needed to understand critical life stages for management of the species and to estimate the minimum viable population size.

Effects of Fire

As with many pine flatwood and savanna species, *Schwalbea* may be adapted to a regular fire regime. Historically, lighting-strike fires that occurred throughout *Schwalbea*'s range, as well as frequent burning as practiced by indigenous, pre-European human populations, maintained the open woodland/savanna conditions. These fires may have occurred frequently enough that fuel did not accumulate, and the fires were generally of low intensity. Herbaceous species would have been favored over tree and shrub species and would thrive in these conditions. With the general suppression of natural fires in the twentieth century, the ecosystems that *Schwalbea* inhabits are declining. Without fire, open grass-sedge communities proceed through seral stages and become dominated by trees, shrubs, and dense herbaceous growth that overtop *Schwalbea*, which appears to be shade intolerant. If fire is suppressed for more than three years, the *Schwalbea* population declines as other species shade *Schwalbea* and compete with it for sunlight (D. Rayner, Wofford College, Spartenburg, South Carolina, pers. comm. 1991).

Musselman and Mann (1977) reported that vigorous growth of *Schwalbea* and abundant seed production were evident after early spring fires at sites in South Carolina. Preliminary results from studies at the Joseph W. Jones Ecological Research Center indicate that *Schwalbea* has a strong flowering response to dormant- and growing-season burns (Kirkman 1993, Kirkman and Drew 1995). Preliminary analyses of the 1993 population data strongly indicate that fire is a requirement for flower production (Kirkman 1993). In general, dormant-season (March) burns result in May flowering, and growing-season (June) burns result in July or August flowering. The proportion of reproductive individuals is greater in both dormant season and growing season burn treatments compared with that of the control plots (Kirkman and Drew 1995). No differences in mean flower or fruit production per stem were detectable between the dormant

season and growing season burns. The highest number of recruits was in dormant season burn treatments.

Observations on the Francis Marion National Forest indicate that *Schwalbea* plants burned during the growing season will reflower. Porcher (1994) reports that mature *Schwalbea* plants in flower will immediately resprout after being burned, resulting in seeds falling on a bare, mineral soil in full sunlight, which may be a key factor in the plant's reproductive biology. Observations on Fort Bragg reveal that, following burns (regardless of season), there is an increase in *Schwalbea* plants the following season. Even on sites where only low herbaceous species occur, *Schwalbea* occurrences on Fort Bragg decline in the absence of frequent fires, which indicates that competition may not be influencing *Schwalbea* populations as much as does fire (The Nature Conservancy 1993). Field observations and experimental studies in North Carolina (Porcher 1994) indicate that fire is essential for maintaining *Schwalbea*. Overall, it appears that *Schwalbea* responds favorably to dormant season and growing season burns. Additional experimentation is necessary to determine if there are substantial advantages to either of these fire regimes.

The current stronghold for *Schwalbea* is in the southeastern States where pinelands and savannas on private plantations are managed for bobwhite quail, and on Fort Bragg around the artillery impact zone. Quail management on the private plantations consists of burning, usually in the dormant season before March, to increase and maintain the open, grassy conditions that provide habitat for quail. This management simulates the natural fire frequency of the past and effectively maintains a fire-dependent ecosystem in the Southeast. Similarly, the impact zones on Fort Bragg experience frequent burning due to fires ignited by military shelling exercises; as a result, a fire-dependent ecosystem that supports *Schwalbea* is maintained.

Kirkman (1993) reports relatively little flower production in the control and mowed treatments (mowed in June). Similarly, observations from the New Jersey *Schwalbea* population indicate that when mowing inadvertently took place during the growing season, flowering diminished considerably. In contrast, however, when a single late-season mowing (October-November) was conducted on the New Jersey site, flowering was relatively abundant during the following year. These observations indicate that while fire may be the ideal management tool, mowing (in the dormant season) could be an alternative to fire in instances where burning might

not be possible or feasible (T. Gordon *in litt.* 1995). Mowing has certainly been responsible for sustaining the remaining population in New Jersey for the last three or more decades.

THREATS TO THE SPECIES

Schwalbea has been, and continues to be, endangered by development and by succession of its habitat. Sandy pineland communities where the species exists have proven to be especially vulnerable to development because soils are level, deep, and suitable for building sites. In addition, many *Schwalbea* populations were or are very near the Atlantic Coast where development pressures are high (Rawinski and Cassin 1986). While the demise of many populations can be attributed to direct loss of habitat to development (Rawinski and Cassin 1986, Johnson 1988, The Nature Conservancy 1993), development also presents indirect threats to the species, as urbanization generally results in total fire suppression, which ultimately leads to the loss of the open ecosystems inhabited by *Schwalbea*.

Threats to the survival of *Schwalbea* also continue on private and public lands managed for recreation, economic, and other uses. Continuing concerns regarding the species' survival on private lands include discontinuation of game management and subsequent cessation of burning resulting in vegetational succession and loss of suitable habitat; conversion of the fire-maintained flatwoods and savannas to commercial pine plantations, which can create dense canopies unsuitable for *Schwalbea*; and direct destruction of *Schwalbea* plants due to the placement of firebreaks or the planting of game food plots or other extensive soil disturbances. Potential threats to the species on public lands include inadvertent disturbance to plants and, possibly, commercial pine straw raking. Additionally, prescribed burning of forest tracts, both public and private, is becoming increasingly restricted due to local regulations that prohibit or limit burning to control air pollution. Due to the apparent need for fire to maintain vigorous populations of *Schwalbea*, reducing prescribed burns where the species occurs would pose a threat to its continued survival.

Occurrences of *Schwalbea* along roadsides are especially vulnerable to disturbance and loss. Besides succession of habitat, actions such as direct trampling, herbicide application, and

road maintenance can adversely affect the plants. In South Carolina, a proposed road widening and improvement project could directly eliminate two small occurrences and indirectly affect others (L. Duncan, U.S. Fish and Wildlife Service, Charleston, South Carolina, pers. comm. 1994).

Another potential threat to the New Jersey population is herbivory. A single white-tailed deer (*Odocoileus virginianus*) herbivory episode in May 1994 severely affected flowering of the population. Most of the *Schwalbea* plants, which were severed at the base, grew back, often in multiple branches, but did not grow to full size and did not flower (T. Hampton *in litt.* 1995).

CONSERVATION MEASURES

Searches

In 1991, a search was conducted of 11 known *Schwalbea* sites in New Jersey. Other than the known extant occurrence at Whitesbog, no populations of *Schwalbea* were found (Gordon 1991).

In 1993, Dr. R. Porcher was contracted by the U.S. Fish and Wildlife Service, through the South Carolina Heritage Trust Program, to conduct searches for *Schwalbea* in South Carolina. As a result of these searches, several additional occurrences of the species have been documented in South Carolina, primarily in Williamsburg County on private lands and within the Francis Marion National Forest in Berkeley County (Porcher 1994).

In 1993 and 1994, a rare plant inventory on Fort Bragg resulted in the documentation of additional populations. It is possible that further inventory work on Fort Bragg would result in the identification of even more populations (E. Hoffman, Department of Defense, Fort Bragg, North Carolina, pers. comm. 1994).

In 1994, a search in Kentucky of historic sites was conducted (T. Bloom, Kentucky Nature Preserves Commission, Frankfort, Kentucky, pers. comm. 1994). No occurrences of

Schwalbea were found, and most of the previously suitable sites were found to be dense and overgrown due to fire suppression. Since the mid-1980s, the U.S. Forest Service has been conducting prescribed burning on some of the sandstone knob and flat barrens in the general areas where *Schwalbea* once occurred. This burn regime could reestablish habitat for *Schwalbea*, and reintroduction of the species may be considered in the future. Additional searches for the species in Kentucky may be conducted in 1995 (T. Bloom pers. comm. 1994).

Research Efforts

In 1992, Dr. K. Kirkman of the Joseph W. Jones Ecological Research Center at Ichauway in Newton, Georgia initiated a five-year intensive study (partially funded by the U.S. Fish and Wildlife Service and contingent on continued funding) on the life history, seed banks, and experimental management of *Schwalbea*. The study is designed to determine: (1) demography of *Schwalbea* populations including population trends, causes of mortality, effects of various prescribed burns on demography, and use of mowing to simulate fire; (2) persistence of seeds in a seed bank and the effect of different moisture regimes on recruitment rates; (3) identification of insect pollinators and seed viability without pollinators; (4) haustorial associates; and (5) determination of additional suitable habitats for *Schwalbea* at Ichauway. Some of the preliminary results of this study have been incorporated into this plan.

In 1993, demographic analysis of the New Jersey occurrence was initiated by recording location, size, and flowering status of each stem of *Schwalbea*. These data will continue to be collected in order to assess rates of survival, growth, and reproduction. Additional research regarding pollination, germination, and reintroduction techniques is planned (Obee 1993a).

In 1992 through 1994, Dr. R. Porcher of The Citadel studied populations in South Carolina to determine habitat requirements for *Schwalbea* and the role of fire in the life history of *Schwalbea*. Although the data are inconclusive, they suggest that *Schwalbea* responds more to a non-growing season rather than to a growing-season burn. Additional studies on the effect of growing-season burns are planned (Porcher 1994).

In 1994, in a study partially funded by the U.S. Forest Service, Dr. M. Godt of the University of Georgia collected *Schwalbea* plant material for genetic analysis to determine intra- and inter-population allozyme variation. Eleven populations are included in the study from sites in North Carolina, South Carolina, and Georgia. Only a limited amount of plant material was acquired from the one extant population in New Jersey, which may limit the statistical analysis from the New Jersey population. Results from the study are expected in 1995 (M. Godt, University of Georgia, Athens, Georgia, pers. comm. 1994).

Germination studies are ongoing at the U.S. Forest Service, New England Wild Flower Society, Atlanta Botanical Garden, and Rutgers University in New Jersey. In New Jersey, an attempt to reestablish *Schwalbea* at historic sites is proposed. Suitable habitat for *Schwalbea* at the sites would be restored through clearing and fire management (Obee 1993b).

Habitat Protection

The occurrences on Federal property (i.e., Fort Bragg and the Francis Marion National Forest) are protected to some extent through the Section 7 provisions of the Endangered Species Act, which requires Federal agencies to consult with the U.S. Fish and Wildlife Service when Federal actions may affect Federally listed species (this and other regulatory authorities are described in Appendix B). In addition to protection under the Endangered Species Act, the Department of Defense at Fort Bragg promulgated the Fort Bragg Range Regulations (350-6), which provide protection to listed species, including *Schwalbea*. Outside of the Fort Bragg impact zone, occurrences of *Schwalbea*, including 200-foot buffer boundaries, are marked with white paint and/or fencing to designate areas of exclusion for military training exercises. Since access to the impact zones is restricted, delineated protection areas are not established within the impact zone (E. Hoffman pers. comm. 1994). The Department of Defense at Fort Bragg is currently developing an endangered species management plan for the base that will further specify management and protection of *Schwalbea* on the base. Protection, management, and monitoring for all *Schwalbea* occurrences, including those inside and outside the impact zone, should be specified in the Fort Bragg management plan in order to effectively document recovery efforts and recovery task completion.

Protection by the U.S. Forest Service on the Francis Marion National Forest includes environmental assessments and Section 7 consultation for all forest activities proposed in areas where *Schwalbea* could be affected. Site-specific management recommendations for the *Schwalbea* populations are specified in timber stand inventory documents. To date, the recommendations for management have been fully supported by the U.S. Forest Service, the U.S. Fish and Wildlife Service, and the public (C. Watson, U.S. Forest Service, Francis Marion National Forest, Columbia, South Carolina, pers. comm. 1994).

RECOVERY STRATEGY

Recovery of *Schwalbea* will be achieved through a combination of the following: habitat protection and management, reintroduction of *Schwalbea* in portions of its former range, research aimed at a better understanding of the species' biology in order to predict viability of populations, and research to determine the best techniques to maintain the species and its habitat. Although many more sites are known for *Schwalbea* than were known at the time of its listing, the species' existence continues to be tenuous because of the general loss of native ecosystems adapted to frequent fire. Decline of the current fire management employed for game lands and forestry practices could result in a rapid decline of the species.

In order to ensure long-term protection for *Schwalbea*, consideration will be given to obtaining commitments or agreements from private landowners that would afford some level of protection and management conducive to maintaining and increasing *Schwalbea* populations on these lands. In most cases, the current management of private properties that support *Schwalbea* includes fire. In such instances, agreements would document existing management practices and provide some assurance of long-term continuance of maintaining a fire regime suited to the native vegetation, including *Schwalbea*. Existing Federal programs (e.g., the Forest Stewardship Program) could, in some situations, provide landowner incentive for protection and maintenance of *Schwalbea* habitat on private property.

To expedite recovery efforts on Federal properties, management plans or other mechanisms that specify protection, management, and monitoring of *Schwalbea* will be

considered (or updated) as necessary. Monitoring will be a required component of both management plans and landowner agreements to ensure that recovery efforts are focused and quantifiable.

In addition to protection and management of existing populations, recovery will include limited reintroduction of the species into historical or other suitable habitats, particularly in the northern and, possibly, western portions of the species' historic range. Recovery will entail continued research on the effects of fire and disturbance. Research is also needed on *in situ* environmental conditions necessary for germination of seeds (e.g., light, moisture, and nutrient requirements, and seedbed conditions), seed banking, seed dispersal mechanisms, detailed demographic analysis of subpopulations, reintroduction techniques, and possibly genetic variability.

PART II: RECOVERY

RECOVERY GOAL

The goal of the recovery program for *Schwalbea americana* is to achieve long-term viability of the species in the wild, allowing the eventual removal of this plant from the Federal List of Endangered and Threatened Plants (50 CFR 17.12). Recovery efforts are expected to include protection of the sites where extant populations of the species exist, continued or increased management of these protected sites to maintain suitable habitat for the species, reintroduction of the species at selected sites in the northern and possibly western portions of its known historic range, research to better understand the species' biology, and research to determine the best management techniques to promote the species. Until more is known about the life history of *Schwalbea* and the viability of its populations, the recovery plan will only address those conditions and recovery activities needed to reclassify the species from endangered to threatened status.

RECOVERY OBJECTIVE

The objective of this recovery plan is to outline procedures that will allow *Schwalbea americana* to be reclassified from endangered to threatened status. Reclassification will be considered after 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.

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.

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.

4. Biennial monitoring shows that the 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.

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

A delisting objective will be defined when the research activities identified under Recovery Tasks 4 and 5 have been completed.

TABLE 2. Outline of recovery tasks

1. Protect extant populations and manage habitat.
   - 1.1 Identify ownership of all known populations.
   - 1.2 Establish contact with landowners and pursue landowner agreements or conservation easements.
   - 1.3 Ensure that activities and management on public lands are consistent with the protection and management of *Schwalbea*.
   - 1.4 Use existing regulatory mechanisms to protect *Schwalbea*.
   - 1.5 Conduct additional surveys.

2. Expand the extent of *Schwalbea* in the northern portion of the current range
   - 2.1 Investigate potential establishment or reintroduction sites in New Jersey, Connecticut, New York, and Massachusetts.
   - 2.2 Conduct trial establishment of *Schwalbea*.
   - 2.3 Establish *Schwalbea* populations at protected locations.

3. Investigate best management techniques.
   - 3.1 Continue experiments to determine the effects of fire.
   - 3.2 Conduct experiments to determine the effects of other disturbances.

4. Investigate the species' biology.
   - 4.1 Conduct research to obtain more comprehensive information on life history.
   - 4.2 Continue research on population demography.
   - 4.3 Determine minimum viable population size.

5. Investigate genetic variability.

6. Monitor populations.
   - 6.1 Develop rangewide consistency in monitoring strategies.
   - 6.2 Monitor known sites and new sites as they are found.

7. Review recovery progress and revise recovery plan as necessary.

RECOVERY TASKS

1. **Protect extant populations and manage habitat.**

   1.1 **Identify ownership of all known populations.** The ownership and status of private lands that support *Schwalbea* populations should be determined in order to pursue appropriate protection of these sites.

   1.2 **Establish contact with landowners and negotiate landowner agreements or conservation easements.** Landowners should be contacted and informed of the presence of the species on their property, and voluntary landowner agreements or conservation easements that will provide for the protection and management of the *Schwalbea* sites should be pursued. Since many of the properties are currently managed for quail – a practice that is compatible with management for *Schwalbea* – fee acquisition of properties is probably unnecessary. Rather, mutually beneficial agreements allowing for game management that is compatible with the long-term protection of *Schwalbea* are preferred. Priority should be given to sites with the largest populations. Additionally, management agreements should be pursued for properties that could serve as colonization sites between extant occurrences to link these sites and prevent further isolation and barriers to genetic exchange between populations.

   1.3 **Ensure that activities and management on public lands are consistent with the protection and management of *Schwalbea*.** Protection and management strategies for *Schwalbea* on public lands (i.e., Francis Marion National Forest and Fort Bragg) should be reviewed and, as necessary, revised to ensure that the protection and management of *Schwalbea* on these lands are consistent with best management techniques as determined by Recovery Task 3.

   1.4 **Use existing regulatory mechanisms to protect *Schwalbea*.** Protection of *Schwalbea* as afforded by the Endangered Species Act and all applicable State statutes will continue to be implemented. The U.S. Fish and Wildlife Service will

emphasize Section 7(a)(1) of the Endangered Species Act, which directs Federal agencies to use their authorities in furtherance of the purposes of the Endangered Species Act by carrying out programs for the conservation and recovery of listed species.

1.5 **Conduct additional surveys.** Additional surveys in States where suitable habitat exists, including those States where the species is considered extirpated, should be conducted. Inventories are being conducted on most military facilities, and National Forest lands are also checked for rare plants. Therefore, survey work should be focused primarily on private and State lands. Survey work may result in the discovery of additional populations, and thus present additional opportunities for the protection and ultimate recovery of *Schwalbea*. Tasks 1.2, 1.3, and 1.4 will be applicable to newly discovered populations, as appropriate.

2. **Expand the extent of *Schwalbea* in the northern portion of the current range.** The New Jersey occurrence of *Schwalbea*, which is critical to maintaining the northern range of the species, will receive continued protection. In addition, populations should be established in New Jersey, Delaware, Maryland, New York, Connecticut, and Massachusetts to guard against the extirpation of the species from the northern portion of its range. Data are not currently available that indicate the genetic significance of the remaining northern population; however, Pennell (1935) considered the northern and southern populations of *Schwalbea* to be distinct species, with the southern species occurring as far north as Virginia (Reveal and Broome 1981). Genetic analyses (Recovery Task 6 below) may further support the significance of maintaining viable populations from the northern gene pool.

2.1 **Investigate potential establishment or reintroduction sites in New Jersey, Connecticut, New York, and Massachusetts.** Those historic sites or other suitable sites that can be protected should be given priority for re-establishment of the species. Sites to be considered are those that: (1) are within the historic range of the species, (2) exhibit habitat characteristics similar to naturally occurring populations or that are known historical sites, and (3) are protected and suitable for management.

2.2 **Conduct trial establishment of *Schwalbea*.** Experimental reintroductions on selected sites with the use of field-sown seeds and greenhouse-grown plants should be conducted in order to refine transplant and establishment techniques.

2.3 **Establish *Schwalbea* populations at protected locations.** Efforts should be made to establish *Schwalbea* populations at the sites identified under Task 2.1.

3. **Investigate best management techniques.**

3.1 **Continue experiments to determine the effects of fire.** Additional research to determine the specific response of *Schwalbea* to fire and other disturbances (e.g., mowing and water level fluctuations) should be conducted. Specific information regarding optimal timing, intensity, and frequency of fire on demographic changes of *Schwalbea* is needed for effective management and enhancement of *Schwalbea* populations. Information is also needed to determine if mowing and other means offer long-term alternatives to fire for maintaining *Schwalbea* habitat and viable populations.

3.2 **Conduct experiments to determine the effects of other disturbances.** Activities such as mowing, herbicide application, soil discing, pine straw raking, timber management, firebreak construction, etc., should be investigated to determine the beneficial and/or adverse effects on *Schwalbea*.

4. **Investigate the species' biology.**

4.1 **Conduct research to obtain more comprehensive information on life history.** Research should be conducted on various aspects of the species' life history, including reproductive strategies; seed dispersal; conditions necessary for germination; nutrient, moisture, and light requirements; timing of haustorial connections; and seed banking abilities.

4.2 **Continue research on population demography.** Research on population dynamics should be conducted in order to better understand critical life stages of *Schwalbea* for management purposes. Information is needed on spatial patterns of reproduction, recruitment, mortality, survivorship, seed banking, and transitions among age classes in various applied fire regimes

4.3 **Determine minimum viable population size.** Using information from Recovery Task 4.2, the minimum viable population size for *Schwalbea* needs to be determined to help in defining further objectives for recovery and eventual delisting.

5. **Investigate genetic variability.** Genetic analyses should be conducted to determine inter- and intra-genetic variability of populations. Differences in the genetic composition of populations may influence site protection and reintroduction priorities. Ongoing genetic analyses may be sufficient to determine if significant variability exists.

6. **Monitor populations.** Meeting the recovery objectives is contingent upon the stabilization of viable populations over time. Consistent monitoring will provide population data necessary to determine if the recovery objectives are being met.

6.1 **Develop rangewide consistency in monitoring strategies.** A uniform method of estimating the extent and viability of *Schwalbea* populations should be developed as a prerequisite to launching a rangewide monitoring program.

6.2 **Monitor known sites and new sites as they are found.** All extant occurrences will be monitored using a consistent protocol (Recovery Task 6.1). Monitoring should be conducted biennially, at a minimum, over a period of at least 10 years.

7. **Review recovery progress and revise recovery plan as necessary.** The overall success of the recovery program should be periodically assessed, and recommendations regarding appropriate changes in recovery objectives or tasks as suggested by research, studies, or monitoring should be implemented.

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PART III: IMPLEMENTATION

The following Implementation Schedule is a guide for meeting the objectives discussed in Part II of this plan. It outlines actions and estimated costs of the *Schwalbea americana* recovery program and includes task priorities, task numbers, task descriptions, duration of tasks, and responsible agencies. These actions, when accomplished, should bring about the recovery of the species and protect its habitat.

KEY TO IMPLEMENTATION SCHEDULE PRIORITIES (COLUMN 1)

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

KEY TO AGENCY ABBREVIATIONS (COLUMN 5)

R5 ES	=	U.S. Fish and Wildlife Service, Division of Ecological Services, Regions 4, 5
FS	=	U.S. Forest Service
DOD	=	Department of Defense
SA	=	State Natural Heritage Programs and natural resource agencies
CO	=	Conservation organizations such as The Nature Conservancy
PI	=	Private institutions such as universities and horticultural facilities

IMPLEMENTATION SCHEDULE
American Chaffseed Recovery Plan

September 1995

Priority	Task Description	Task Number	Duration	Responsible Agency		Cost Estimate			Comments
				USFWS	Other	FY1	FY2	FY3	
1	Identify landowners.	1.1	2 years	R4	SA, CO	5	5		
1	Pursue landowner agreements.	1.2	Ongoing	R4	SA, CO	20	20	20	will continue at 10K/yr as necessary for FY 4-6
1	Manage on public lands.	1.3	Ongoing	FS, DOD					no cost itemized for this task
1	Conduct experiments on effects of fire.	3.1	5 years	R4	FS, DOD, SA, PI	5	5	5	2K/yr for FY 4-5
2	Conduct experiments on other disturbances.	3.2	5 years	R4	FS, DOD, SA, PI	3	3	3	1K/yr for FY 4-5
2	Conduct research on life history.	4.1	3 years	R4, R5	FS, DOD, SA, PI	5	5	5	
2	Conduct research on population demographics.	4.2	Ongoing	R4, R5	FS, DOD, SA, PI	5	5	5	2K/yr for FY 4-6
2	Determine minimum population size.	4.3	Ongoing	R4, R5	SA, PI	2	2	2	2k/yr for FY 4-6
3	Ensure regulatory protection.	1.4	Ongoing	R4					no cost itemized for this task
3	Investigate reintroduction sites.	2.1	2 years	R5	SA, CO	5	5		
3	Conduct trial reintroduction.	2.2	2 years	R5	SA		5	5	
3	Establish new populations.	2.3	8 years	R5	SA, CO			5	5K/yr for FY 4-5, 1K/yr for FY 6-10 (monitoring)
3	Investigate genetic variability.	5.	2 years	R4, R5	SA, PI	5	5		
3	Develop monitoring strategy.	6.1	1 year	R4	SA, PI	3			
3	Monitor known sites.	6.2	Ongoing	R4, R5	FS, DOD, SA, PI	10	10	10	10K/yr for FY 4-10
3	Review recovery progress and revise recovery plan as necessary.	7.	Ongoing	R5	SA				No cost itemized for this task.

APPENDIX A:

STATUS SUMMARY:
EXTANT OCCURRENCES OF *SCHWALBEA AMERICANA*

Status Summary: Extant Occurrences of *Schwalbea americana*

STATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
New Jersey	007 Whitesbog	Burlington County	State/ County	1972	1994	Roadside pine lowland near cedar swamp	58 plants	Succession/ herbivory
North Carolina	005 Fort Bragg - Calf Branch	Hoke County	DOD	1985	1994	Mesic to somewhat xeric pine / scrub oak sandhill; burned frequently (1-3 years); impact zone on Fort Bragg	700 plants in 11 subpopulations over ca. 98 hectares	Military activities
	006 Fort Bragg Juniper Creek/ McKiethan Pond	Hoke County	DOD	1987	1992	Dry to mesic pine/scrub oak sandhill; burned frequently; impact zone	496 plants in three subpopulations	
	007 Fort Bragg Calf Branch	Hoke County	DOD	1987	1990	Near ecotone between pine/scrub oak sandhill and pond pine savanna; burned frequently; impact zone	One to ten plants	Military activities
	008 Fort Bragg Piney Bottom Creek	Hoke County	DOD	1987	1993	Mesic pine flatwoods; depression in open pine/wiregrass uplands; upper edge of ecotone of streamhead pocosin; also in dry upper ecotone; burned frequently; impact zone	Ca. 3,000 shoots in 21 subpopulations	
	009 Hog Island	Moore County	U	1988	1993	Roadbank on edge of pine forest; burned in 1992	Six plants	
	012 Fort Bragg Little Rockfish Creek	Cumberland County	DOD	1990	1990	Open, moist sandy clay soils; ecotone between pine/scrub oak sandhill and pine savanna; burned frequently; impact zone	11-50 plants over 10-100 square meters	Military activities

* Element occurrence number

** Site ownership: DOD = U.S. Department of Defense; U = Unknown

itus summary (continued): Extant Occurrences of *Schwalbea americana*

STATE	EO# Site Name	MUNICIPALITY	SITE OWN	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
Georgia	— Ichauway Parmalee	Baker	Private	1992	1994	Ecotonal area between freshwater wetland and longleaf pine upland	200+ plants	
	—	Baker County	Private	1992	1994	Longleaf pine / wiregrass; burned annually; managed for quail		discing and planting of food plots for quail
	—	Worth County	Private		1994	Longleaf pine / wiregrass; annually burned; managed for quail	200+ plants	
	005 Nilo	Dougherty County	Private	1989	1994	Ecotonal area between freshwater wetland and pine upland	1100+ plants	
	006 Nilo	Dougherty County	Private	1989		Margin of pond		
	— Ichauway	Baker	Private	1993	1994		12 plants	
Florida	001 NNW of Gretna	Gadsden County	Private	1987	1991	Scrub area - Site was checked in 1994 and reported that residential development at the site - probably extirpated		development
	—	Leon County	Private		1994	Longleaf pine; managed for quail	12-15 plants	

Element occurrence number

atus summary (continued): Extant Occurrences of *Schwalbea americana*

STATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
North Carolina	013 Fort Bragg Little Rockfish Creek	Cumberland County	DOD	1990	1991	Pine savanna; lowland draw; open, mid-slope, moist sandy soil; impact zone	1,000 plants in three subpopulations	Military activities
	014 Fort Bragg Black Creek/ Puppy Creek	Hoke County	DOD	1990	1993	Open ecotone between pine savanna and pine/scrub oak sandhill; ecotone between pine/scrub oak sandhill and shrub/sedge-sphagnum bog; burns annually; impact zone	35+ plants in three subpopulations	Military activities
	015 Fort Bragg Little Rockfish Creek	Hoke County	DOD	1992	1994	Well-burned uplands grading into well-burned streamhead pocosin ecotone; also on old fire plowline; burned frequently (1-3 years); impact zone	1,000+ plants in two subpopulations over 7.5 hectares	
	016 Fort Bragg Bull Branch/ Rays Mill Creek	Hoke County	DOD	1990	1994	Moist ecotone between upland sandhill and burned-out streamhead pocosin; impact zone; burned frequently (1-3 years)	150 stems	
	017 Fort Bragg McPherson Impact Area Macrosite	Hoke County	DOD	1994	1994	Frequently burned ecotone of streamhead pocosin; oak canopy	20 stems within a 30x10 meter area	
	018 Fort Bragg Little Rockfish Creek	Hoke County	DOD	1993	1993	Low oak canopy above streamhead pocosin; burned frequently; impact zone	Four plants	
	019 Fort Bragg Juniper Creek	Hoke County	DOD	1991	1994	Streamhead pocosin ecotone; longleaf pine/ wiregrass savanna; pine/scrub oak sandhill; frequently burned (1-3 years); impact zone	600+ plants in two subpopulations over 3.5 hectares	

* Element occurrence number
** Site ownership: DOD = U.S. Department of Defense

Status summary (continued): Extant Occurrences of *Schwalbea americana*

STATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
North Carolina	021 Fort Bragg Rockfish Creek	Hoke County	DOD	1992	1993	Pine/scrub oak sandhill	One plant	
	022 Fort Bragg Little Rockfish Creek	Hoke County	DOD	1992	1992	Pine/scrub oak sandhill; burned frequently (1-3 years)	55 shoots over ca. 1,000 square meters	
	023 Fort Bragg Rockfish Creek	Hoke County	DOD	1992	1992	Pine/scrub oak sandhill; burned in 1993	75 shoots/increase noted from 13 shoots in 1992	
	024 Fort Bragg	Hoke County	DOD	1992	1992	Pine/scrub oak sandhill	One plant	
	025 Fort Bragg Rockfish Creek	Hoke County	DOD	1992	1993	Mesic herb-grass zone along upper ecotone of well-burned streamhead pocosin	14 plants in two subpopulations	
South Carolina	006 Harleston Road	Berkeley County	USFS	1979	1979	Longleaf pine flatwoods; dense undergrowth, burning occurred in 1993	Unable to relocate in 1993 or 1994	Succession
	007 Fish Hook Road (Fresh Quarter Creek Road)	Berkeley County	USFS	1979	1993	Sandy longleaf pine flatwoods; decline in population noted; burned sufficiently to ensure open, grassy areas	Three plants/ declining	
	008 Highway 402	Berkeley County	USFS	1979	1994	Powerline ROW adjacent to sandy, longleaf pine flatwoods that is unburned and dense	78 small plants/ increasing	

* Element occurrence number
** Site ownership: DOD = U.S. Department of Defense; USFS=U.S. Forest Service

tus summary (continued): Extant Occurrences of Schwalbea americana

TATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
outh Carolina	009 Three Mile Head Road	Berkeley County	USFS	1973	1994	Sandy, longleaf pine flatwoods; plants mostly confined to road bank; site burned in September 1992	220+ plants/ increase since first observed	Plants heavily browsed and insect damage noted
	— Watson's *Schwalbea*	Berkeley County	USFS	1993	1994	Longleaf pine flatwoods; about 60% grassy and 40% shrubs; site burned in 1993 and 1994 while plants were in bloom	700+ plants/ stable	
	— Fish Hook Road (French Quarter Creek Road)	Berkeley County	USFS	1992	1993	Longleaf pine flatwoods; 50% grassy and 50% shrubs; burned in winter of 1992/93	30+ plants / stable	
	016 Koppers Company	Berkeley County	Private	1972	1994	Sandy pine flatwoods; plants on timber path; planted in longleaf after Hurricane Hugo	3 plants / declining	Planting of pines
	017 Highway 41	Berkeley County	USFS	1981	1994	Sandy, open longleaf pine flatwoods; site was burned in Sept. 1993	69 plants; increase after growing season burn / stable	
	— Craven Road	Berkeley County	USFS	1994	1994	Young longleaf pine flatwoods; ground cover sparse due to closed canopy	10 plants in a 20 x 20 meter area / stable	succession; evidence of pine straw raking
	— Green Bay Road	Berkeley County	Private	1994	1994	Powerline ROW; adjacent to unburned flatwoods	30-40 plants	
	— Lethcoe Road	Charleston County	USFS	1991	1994	Sandy, longleaf pine flatwoods; burned in summer of 1992	34 plants / stable	
	— Halfway Creek Road	Charleston County	USFS	1994	1994	Longleaf pine flatwoods; burned on a regular basis	98 plants / stable	

Element occurrence number
Site ownership: USFS = U.S. Forest Service

tatus summary (continued): Extant Occurrences of *Schwalbea americana*

STATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
South Carolina	010 Forest Route 211	Charleston County	USFS	1974	1974		Unable to relocate in 1992	
	018 Ball Park	Charleston County	USFS	1980	1994	Abandoned ball field and adjacent flatwoods	Ca. 200 plants/ declined from 1980, but now stable	
	— Clarendon County Line	Clarendon County	Private	1994	1994	Sandy, longleaf pine flatwoods that have been plowed; burned regularly	17 plants/stable	
	014	Florence County	U	1983	1983		unable to relocate in 1985 or 1993	
	015	Florence County	U	1983	1983	Longleaf pine flatwoods with dense understory of shrubs and saplings	unable to relocate in 1985 or 1993	suppression; recent ditch work may have buried plants
	004	Horry County	U	1954	1954	Savanna	unable to relocate in 1985 or 1994	
	005 Socastee Savanna	Horry County	Private	1954	1985	Savanna	40 plants; unable to relocate in 1993	succession; development
	011	Jasper County	U	1982	1982	Mesic pine flatwoods	unable to relocate in 1994	succession
	012 3.65 miles Northeast of Pineland	Jasper County	Private	1984	1984	Mesic pine flatwoods	unable to relocate in 1994	succession

* Element occurrence number
** Site ownership: USFS = U.S. Forest Service; U = Unknown

tus summary (continued): Extant Occurrences of *Schwalbea americana*

TATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
outh arolina	012 4.2 miles Northeast of Pineland	Jasper County	Private	1984	1984	Mesic pine flatwoods	unable to relocate in 1994	succession
	— State Highway 327	Lee County	U	1994	1994	Longleaf pine flatwoods; now mostly loblolly; plants found along road bank in grassy area	10 plants	succession
	— Lynchburg Savanna Heritage Preserve	Lee County	S.C. Heritage	1993	1994	Longleaf pine flatwoods; dense ground cover	7 plants	
	002	Sumter County	U	1978	1993	Grassy longleaf pine flatwoods; burned during winter of 1992/93; 95% grassy; main site adjacent to road	Hundreds / stable	
	— Cades	Williamsburg County	U	1993	1994	Longleaf pine savanna; plants also found in an old adjacent cultivated field	1,000+ / stable	
	003 Blakely	Williamsburg County	Private	1978	1993	Sandy, longleaf pine flatwoods; site burned during winter of 1992/93; 80-90% open; grassy; regularly burned for quail	1,000+ plants in 1993; 6,000+ in 1978 / stable	discing and planting of food plots for quail
	013 Heineman	Williamsburg County	Private	1984	1994	Originally found in pine flatwoods; now only found in powerline	6 plants / declining	plowing of firebreaks; loblolly pine planting
	— Clarkson Flatwoods	Williamsburg County	Private	1987	1993	Longleaf pine flatwoods; 90% grassy; site now two subpopulations	9 plants; 150 plants / stable	

Element occurrence number
Site ownership: U = Unknown

tatus summary (continued): Extant Occurrences of *Schwalbea americana*

STATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
South Carolina	— Middle Road, Scotswood	Williamsburg County	Private	1993	1993	Sandy, open longleaf pine flatwoods; 80% grassy; burned during winter of 1992/93 as part of quail management	56 plants / stable	possible competition from lespedeza bicolor
	— St. Mary's Church	Williamsburg County	U	1993	1993	Pine flatwoods; burned winter of 1992; probably annually burned	9 plants in a 5x5 meter area / stable	
	— South of Heineman railroad	Williamsburg County	U	1987	1987	Pine Flatwoods; site checked in 1994, flatwoods with dense understory; no sign of burning	100 plants in 80x20 meter area; unable to locate plants in 1993 or 1994	succession
	— Friendfield 1	Williamsburg County	Private	1993	1993	Sandy, open loblolly flatwoods, longleaf originally present but timbered; plants confined to open, grassy area; burned annually	300+ plants / stable	
	— Friendfield 2	Williamsburg County	Private	1993	1993	Open, grassy longleaf-loblolly pine flatwoods; burned annually; probably 5 distinct colonies	500+ plants / stable	
	— Longlands Plantation 1	Williamsburg County	Private	1993	1993	Open, sandy oak-hickory/pine flatwoods; grassy understory; burned annually	107 plants / stable	
	— Longlands Plantation 2	Williamsburg County	Private	1993	1993	Pine/oak-hickory flatwoods; plants in open, grassy area; burned annually	13 plants / stable	
	— Chaney Swamp	Williamsburg County	U	1987	1994	Longleaf pine savanna	declining	succession

* Element occurrence number
** Site ownership: U = Unknown

:us summary (continued): Extant Occurrences of *Schwalbea americana*

TATE	EO#* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE	THREATS
outh arolina	— Scotswood 1	Williamsburg County	Private	1993	1993	Sandy, longleaf pine flatwoods; site partially burned		
	— Scotswood 2	Williamsburg County	Private	1993	1993	Longleaf pine Flatwoods; also interspersed with savanna; burned regularly		
	— Scotswood 3	Williamsburg County	Private	1993	1993	Sandy longleaf flatwoods; grassy understory; burned annually for quail		
	— Longlands Savanna	Williamsburg County	Private	1987	1994	Longleaf pine grass/sedge savanna / mowed powerline		
	— Road 674	Williamsburg County	Private	1994	1994	Longleaf pine flatwoods consisting; 10-15 acres; burned annually		
	— Hobcaw Hunt Club	Williamsburg County	U	1994	1994	Mowed powerline ROW adjacent to longleaf pine flatwoods; site burns frequently		
	— Hobcaw Hunt Club/Chaney Swamp	Williamsburg County	Private	1994	1994	Sandy, longleaf pine flatwoods; burned regularly	80-120 plants / stable	
	— Indiantown	Williamsburg County	U	1994	1994	Powerline ROW adjacent to loblolly pine plantation; regular mowing	70-80 plants / stable	
	— Friendfield 3	Williamsburg County	Private	1994	1994	Sandy, longleaf pine flatwoods; burned regularly; 80% grassy	500-1,000 plants / stable	
	— Trio	Williamsburg County	Private	1994	1994	Powerline ROW adjacent to sandy, longleaf pine flatwood	ca. 50 plants / stable	

* Element occurrence number
** Site ownership: U = Unknown

Status summary (continued): Extant Occurrences of *Schwalbea americana*

STATE	EO #* Site Name	MUNICIPALITY	SITE OWN**	FIRST OBS.	LAST OBS.	DESCRIPTION	SIZE/TREND	THREATS
South Carolina	— SC-16	Williamsburg County	U	1994	1994	Mowed powerline adjacent to longleaf pine flatwoods; burned in 1994 by wildfire; probably not burned on a regular basis	ca. 30 plants / stable	
	— Salters	Williamsburg County	U	1994	1994	Sandy, open longleaf pine flatwoods; burns on regular basis	1,000+ plants; one of the largest concentrations; plants are tall; some 2 feet / stable	
	— Hobcaw Hunt Club - Lane Site	Williamsburg County	Private	1994	1994	Sandy, longleaf pine flatwoods; 90% grassy; burns regularly	30-50 plants / stable	
	— Ox Swamp	Williamsburg County	U	1994	1994	Powerline ROW; regularly mowed	80-85 plants/ stable	
	— Highway 375	Williamsburg County	U	1994	1994	Powerline ROW; regularly mowed	7 plants	
Georgia	001 Ichauway	Baker	Private					
	— Ichauway King site	Baker	Private	1992	1994	Ecotonal area between freshwater wetland and longleaf pine upland	600+ plants	
	— Ichauway Pond 32	Baker	Private	1992	1994	Ecotonal area between freshwater wetland and longleaf pine upland	500+ plants	
	— Ichauway Jericho	Baker	Private	1992	1994	Ecotonal area between freshwater wetland and longleaf pine upland	500+ plants	

* Element occurrence number
** Site ownership: U = Unknown

APPENDIX B:

AVAILABLE REGULATORY AUTHORITIES

FEDERAL AUTHORITIES

Endangered Species Act of 1973
(87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*)

Section 9 prohibits import and export; removal, damage and possession of listed species from lands under Federal jurisdiction; removal, cutting, digging, damaging, or destruction of such plants on other areas in knowing violation of any state law or regulation or in the course of violating state criminal trespass laws; transport in course of commercial activity; or sale of the species. Section 7 requires Federal agencies to ensure that their actions do not jeopardize the continued existence of listed species or result in adverse modification of critical habitat. Section 7(a)(2) requires consultation with the U.S. Fish and Wildlife Service when a Federal action may affect listed species or critical habitat. Section 7(a)(1) directs Federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out conservation and recovery activities for listed species.

Clean Water Act of 1977
(86 Stat. 884, 33 U.S.C. 1344)

This Act regulates the discharge of dredged or fill material and effluent in waters (including wetlands) of the United States. Individual permits and many nationwide permits that authorize activities pursuant to the Act receive review by the U.S. Fish and Wildlife Service to determine if the activities will adversely affect Federally-listed threatened or endangered species. No activities are authorized under Clean Water Act permits that are likely to jeopardize the continued existence of Federally-listed threatened or endangered species. Some occurrences of *Schwalbea* may be in locations that are jurisdictional wetlands pursuant to this Act and, therefore, receive protection from certain detrimental activities regulated pursuant to the Clean Water Act.

STATE AUTHORITIES

New Jersey

In New Jersey, *Schwalbea* is listed as endangered on the Endangered Plant Species List authorized by the Endangered Plant Species List Act (N.J.S.A. 7:5C). This list provides recognition to listed plants, but does not provide regulatory protection to the species from collection, habitat loss, or degradation. Pursuant to the policy to preserve, protect, and enhance the diversity of plant communities through regulation of development, the Pinelands Protection Act (N.J.S.A. 13;18-1

et seq.) states that no development within the Pinelands Reserve shall be carried out unless it is designed to avoid irreversible adverse impacts to the survival of populations of threatened or endangered plants listed therein.

North Carolina

In North Carolina, *Schwalbea* is officially recognized as endangered. The North Carolina Plant Protection and Conservation Act (General Statute 19B, 202.12-202.19) provides State listed plants protection from intra-State trade without a permit, provides for monitoring and management of listed populations, and prohibits taking of plants without written permission of landowners.

South Carolina

In South Carolina, *Schwalbea* is recognized as "of national concern" by the South Carolina Advisory Committee on rare, threatened, and endangered plants; however, this State offers no legal protection to recognized species.

Georgia

In Georgia, *Schwalbea* is currently being proposed as endangered on the official State list and if listed will receive protection under the Georgia Wildflower Preservation Act of 1973. This Act prohibits digging, removal, or sale of State listed plants from public lands without the approval of the Georgia Department of Natural Resources, and prohibits sale and transport of listed species without the landowner's written permission.

Florida

In Florida, *Schwalbea* is listed as endangered in the "Regulated Plant Index" in Rule Chapter 5B-40 of the Florida Administrative Code. The Index is maintained and administered by the Florida Department of Agriculture and Consumer Service, Division of Plant Industry, under the Preservation of Native Flora of Florida Act, Section 581.185-187 of the Florida Statutes. The law prohibits removal of plants on the Index from public lands or from private lands without written permission of the landowner and a permit from the Division of Plant Industry.

APPENDIX C:

LIST OF REVIEWERS

The following individuals submitted comments on the technical/agency draft *Schwalbea americana* recovery plan. All comments were considered during final plan preparation and incorporated into this document as warranted. Letters of comment are retained on file in the New Jersey Ecological Services Field Office of the U.S. Fish and Wildlife Service.

The Service wishes to thank those who took the time to review and comment on the draft recovery plan. Effective recovery of *Schwalbea americana* ultimately hinges on the shared expertise and continuing interest of professionals and concerned parties.

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