RECOVERY PLAN

Small-anthered bittercress

U.S. Fish and Wildlife Service

RECOVERY PLAN

for

Small-anthered Bittercress (*Cardamine micranthera* Rollins)

Prepared by

Nora Murdock
Asheville Field Office
U.S. Fish and Wildlife Service
Asheville, North Carolina

and

Alan Weakley
North Carolina Natural Heritage Program
Raleigh, North Carolina

for

Southeast Region
U.S. Fish and Wildlife Service
Atlanta, Georgia

Approved: _____
Regional Director, U.S. Fish and Wildlife Service

Date: July 10, 1991

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to the modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1991. Small-anthered Bittercress Recovery Plan. Atlanta, GA. 22 pp.

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EXECUTIVE SUMMARY

Current Species Status: Cardamine micranthera is listed as endangered. There are 9 populations remaining, all within North Carolina and Virginia; 12 sites have been destroyed. Most of the surviving populations are small, and many have been adversely altered by impoundments; channelization; and residential, industrial, and agricultural development. None of the populations are permanently protected. Aggressive exotic weeds threaten all populations.

Habitat Requirements and Limiting Factors: This small perennial herb is native to small streambank seeps, adjacent sandbars, and stream edges in the Dan River drainage of the North Carolina and Virginia piedmont. Most of the remaining populations are extremely small (some containing less than half a dozen plants). Many are in close proximity to fields and pastures, where they are vulnerable to herbicides, erosion, and siltation. More research on management and the biological requirements of small-anthered bittercress is needed.

Recovery Objective: Delisting.

Recovery Criteria: Six self-sustaining populations must be permanently protected.

Actions Needed:

1. Survey suitable habitat for additional populations.
2. Monitor and protect existing populations.
3. Conduct research on the biology of the species.
4. Establish new populations or rehabilitate marginal populations to the point where they are self-sustaining.
5. Investigate and conduct necessary management activities at all key sites.

Total Estimated Cost of Recovery: Because so little is known about actions needed to recovery this species, it is impossible to determine costs beyond estimates for the first few years' work (in $1,000's):

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Total
1991	20	5.5	54	5	5	89.5
1992	10	4.5	38	25	5	82.5
1993	10	2.5	23	11	5	51.5
1994						
1995						
1996						
1997						
1998						
1999						
2000						
2001						

Date of Recovery: Impossible to determine at this time.

PART I

INTRODUCTION

Small-anthered bittercress (Cardamine micranthera) is an extremely rare perennial herb historically found along a few small streams in Stokes and Forsyth Counties, North Carolina, and Patrick County, Virginia. Due to its rarity and vulnerability to threats, the species was federally listed as endangered on September 21, 1989 (U.S. Fish and Wildlife Service 1989). Cardamine micranthera is officially listed as endangered by the North Carolina Department of Agriculture's Plant Conservation Program (Sutter 1990). The species was only recently discovered in Virginia and currently is being considered for addition to that State's official list of endangered and threatened species (Chris Ludwig, Virginia Division of Natural Heritage, personal communication, 1990).

Current and Historical Distribution

Small-anthered bittercress is endemic to the Dan River drainage in north-central North Carolina and south-central Virginia. Only nine populations are currently known to exist--five are on Peter's Creek and its tributaries in Patrick County, Virginia; the four North Carolina populations are all within Stokes County, on Little Peter's Creek, Peter's Creek, Elk Creek, and on another unnamed tributary to the Dan River.

Although the species also was known historically from Forsyth County in North Carolina, the single population there was destroyed when the site was converted to cattle pasture in the early 1960s. At that time, only one additional population was known, from Stokes County. After repeated unsuccessful searches for this single Stokes County population, the species was presumed extinct (Cooper et al. 1977). In 1985, nearly 30 years after the species had last been seen, it was again located in Stokes County by S. W. Leonard (1986). Subsequent searches by A. Weakley (North Carolina Natural Heritage Program), N. Murdock (U.S. Fish and Wildlife Service), and T. Wieboldt (Virginia Polytechnic Institute and State University) resulted in the discovery of the eight additional populations currently known.

Description, Ecology, and Life History

Cardamine micranthera is a member of the mustard family (Brassicaceae), and one of 13 species in the genus Cardamine native to the Carolinas (Radford et al. 1968).

Cardamine micranthera was first described by R. C. Rollins (1940) from material collected in North Carolina in 1939. It is an erect slender perennial herb with fibrous roots and one (or rarely more) simple or branched stem(s) growing 2 to 4 decimeters tall. Basal leaves are 1 to 5 centimeters long (occasionally longer), 0.5 to 2.0 centimeters wide, crenate, with one (or rarely two) pairs of small lateral lobes or leaflets. The stem leaves are alternate and

mostly unlobed, 1 to 1.5 centimeters long, crenate and cuneate. Flowering and fruiting occur in April and May. The flowers, subtended by leafy bracts, have four white petals, six stamens, and small, round anthers. The fruit is a silique, 0.8 to 1.2 centimeters long and approximately 1 millimeter in diameter, with a beak 1 to 1.2 millimeters long. The brown seeds are approximately 1 millimeter long.

Cardamine micranthera can be distinguished from its most similar relative, Cardamine rotundifolia, by its much smaller, nearly orbicular (instead of oblong) anthers, smaller flowers, and more angulate and nonclasping leaves. In Cardamine micranthera the anthers are about 0.5 millimeter long, and the petals are 1.2 to 2 millimeters wide; whereas in Cardamine rotundifolia, the narrowly oblong anthers measure from 1.2 to 1.6 millimeters long, and the petals are 2.5 to 3.5 millimeters wide. Stem leaves of Cardamine micranthera are typically broadly cuneate (rarely narrowly cuneate, oblique, or cordate) and never cordate-clasping. Cardamine rotundifolia has cordate stem leaves that generally clasp around the stem. Growth habits of the two species differ as well. Cardamine rotundifolia is typically branched from the base, the decumbent stems later developing proliferating branches from the main axes and often from the inflorescences. Cardamine micranthera is typically erect, or occasionally has decumbent stems, but these do not develop proliferating branches. Also, the siliques and styles of Cardamine micranthera are only about half as long as those of Cardamine rotundifolia (Rollins 1940, Cooper et al. 1977, and Radford et al. 1968).

Cardamine pennsylvanica can sometimes resemble C. micranthera, but C. pennsylvanica typically has three to five pairs of lateral leaflets with the terminal leaflet comprising one-fourth to one-third of the total length of the leaf. By comparison, C. micranthera has only one to two pairs of lateral leaflets (or none), with the terminal leaflet being nearly one-half the total length. Cardamine pennsylvanica leaflets, although quite variable, tend to be more slender and to have more definitely toothed margins. The pedicels of the fruits of C. pennsylvanica are 5 to 8 mm long, with the pods (siliques) being 15 to 28 mm long (three to four times the length of the stalk. Cardamine micranthera has pedicels 9 to 15 mm long and siliques 14 to 22 mm (pods only one and one-fourth to one and one-half times the length of the stalks). The beak of the fruit corresponds to the style in the flower and is that portion of the pod extending beyond the seed-bearing part. In C. pennsylvanica the beak is only about 1 mm and is barely noticeable at the tip of the pod. Cardamine micranthera's beak is about 2 mm long and can be readily seen as a sharp, spindle-like tip on the pod (T. Wieboldt, personal communication, 1991).

The habitat of Cardamine micranthera consists of seepages, wet rock crevices, streambanks, sandbars, and wet woods along small streams. Although soils mapping is not complete, preliminary indications are

that Cardamine micranthera occurs on soils of the Rion, Pacolet, and Wateree series, where slopes are 25 to 60 percent (David C. Clapp, U.S. Department of Agriculture, Soil Conservation Service, personal communication, 1990).

The variety of habitats occupied by this species are all fully to partially shaded by trees and shrubs typical of moist soils of the upper piedmont, including azalea (Rhododendron nudiflorum), mountain laurel (Kalmia latifolia), viburnum (Viburnum prunifolium), spicebush (Lindera benzoin), birch (Betula spp.), ironwood (Carpinus caroliniana), beech (Fagus grandifolia), tulip poplar (Liriodendron tulipifera), red maple (Acer rubrum), and white pine (Pinus strobus). Herbaceous associates vary with the different habitats. However, on sand and gravel bars Cardamine micranthera often grows alone or occasionally with its similar relative, C. rotundifolia. On streambanks, it is often found with yellow root (Xanthorhiza simplicissima) and bluets (Houstonia caerulea). In seepages, typical associates include jewelweed (Impatiens capensis), soft rush (Juncus effusus), and branch lettuce (Saxifraga micranthidifolia). In wet woods or stream flood channels, it is found with sedges and rushes, including Carex laevivaginata, C. prasina, J. effusus, and poison hemlock (Cicuta maculata), often under the shade of spicebush. All of the sites, except active sand and gravel bars, are being invaded by Japanese honeysuckle.

Very little is known of the life history of this species, including the identity of its pollinators; however, ants have been observed visiting the flowers. Another difference between Cardamine micranthera and Cardamine rotundifolia may give evidence of the two species' different pollination mechanisms and reproductive strategies; in Cardamine rotundifolia, the anthers are held in a spreading position, whereas in Cardamine micranthera, the anthers are appressed to the stigma (possibly indicating a tendency toward self-pollination in the latter species).

Threats and Population Limiting Factors

Locally endemic to an area heavily impacted by agriculture and residential development, Cardamine micranthera is inherently vulnerable to extinction. Most of the remaining nine populations are extremely small (some consisting of less than half a dozen individuals). All populations are located on privately owned lands and are unprotected. Activities that could further threaten the continued existence of Cardamine micranthera include impoundment, channelization, conversion of the habitat for agriculture or silviculture, flooding, and encroachment of exotic species such as Japanese honeysuckle. Japanese honeysuckle is an aggressive invader that is present at all the occupied sites, and it heavily dominates some.

The natural habitat of this species consists of small streambank seeps and, secondarily, adjacent sandbars and stream edges. At

several of the remaining populations, the original seep habitat can no longer be found, and the surviving plants now exist only in the streambed on small sandbars. In this situation, the species is highly vulnerable to natural catastrophes, such as floods, which could scour the streambed and eliminate the few remaining plants. In unaltered habitat, where most of the plants occupy the seepages above the actual stream channel, flooding and scouring of the streambed is not as potentially threatening to the species as in altered habitats. In unaltered habitats, scoured areas where plants have been eliminated are readily recolonized by the parent populations in the seeps.

Severe drought is another potential threat, since this species inhabits moist areas with an abnormally cool microclimate. However, no data are available on the actual effects of drought on this species.

Many of the remaining sites are in close proximity to agricultural fields and pastures. Accidental herbicide drift or runoff from these areas, or from adjacent power line maintenance operations, could result in damage or destruction of these tiny populations. Also, where cattle are allowed free access to occupied sites, the plants could be eliminated by trampling and associated erosion. As mentioned earlier in the plan, at least one population is known to have been extirpated when the habitat was converted to cattle pasture. In addition to direct threats from runoff and livestock, agricultural use of a watershed usually results in the removal of most of the native vegetation. For a rare streambed species like small-anthered bittercress, the chances of extinction are increased by rapid, dynamic responses to stochastic storm events in unbuffered watersheds (Bowles and Apfelbaum 1989).

Conservation Efforts

All nine of the remaining populations of this species are located on privately owned lands. The U.S. Fish and Wildlife Service, along with the North Carolina Natural Heritage Program, the North Carolina Plant Conservation Program, the Virginia Division of Natural Heritage, and The Nature Conservancy are working with these private landowners to protect and manage the sites. Surveys of potential habitat are being conducted in both States in hopes of finding and protecting additional populations of the species.

PART II

RECOVERY

A. Recovery Objectives

Small-anthered bittercress (Cardamine micranthera) will be considered for delisting when there are at least six self-sustaining populations which are protected to such a degree that the species no longer qualifies for protection under the Endangered Species Act (see criteria below). A self-sustaining population is a reproducing population that is large enough to maintain sufficient genetic variation to enable it to survive and respond to natural habitat changes. The number of individuals necessary and the quantity and quality of habitat needed to meet this criterion will be determined as one of the recovery tasks.

This recovery objective is considered an interim goal, because of the lack of specific data on biology and management requirements of the species. It may be adjusted up or down at a later date as additional information is acquired which allows for refinement of the estimate of the number of populations required to ensure the continued survival of small-anthered bittercress. Due to the species' extremely limited geographic range and the possibility of catastrophic storms and other stochastic events, it may not be possible to completely protect or recover small-anthered bittercress. The recovery objective will be reassessed at least annually in light of any new information that becomes available.

The first step toward recovery will be protection and management of all extant populations of small-anthered bittercress to ensure their continued survival. Little is known about the life history and habitat requirements of this species. Therefore, it will be necessary to conduct detailed demographic studies and ecological research for the purpose of gaining the understanding needed to develop appropriate protection and management strategies. The ultimate effects of various kinds of adverse habitat disruption must be determined and prevented; active management necessary to ensure continued survival and vigor must be defined and carried out. Therefore, small-anthered bittercress shall be considered for removal from the Federal list when the following criteria are met:

1. It has been documented that at least six populations are self-sustaining and that necessary management actions have been undertaken by the landowners or cooperating agencies to ensure their continued survival.

2. All of the above populations and their habitat are protected from present and foreseeable human-related and natural

threats that may interfere with the survival of any of the populations.

B. Narrative Outline

1. Protect existing populations and essential habitat. Only nine populations of small-anthered bittercress are currently known to exist, all in the piedmont of North Carolina and Virginia. Until more is known about the species' biology and specific habitat requirements, and about the measures necessary to protect occupied sites, all existing populations should be protected. The long-term survival of six populations is believed to be essential to the recovery of the species as a whole.

   1.1 Develop interim research and management plans in conjunction with landowners. Little is known about specific management practices necessary to ensure the long-term survival of this species. Therefore, immediate emphasis will be on protection, in cooperation with the landowners, until appropriate management procedures have been developed through research.

   1.2 Search for additional populations. Although several intensive searches for the species have been conducted within the historic habitat, a thorough systematic effort to locate additional populations is still needed (very small populations, consisting of only a few plants, particularly at overgrown sites, are easily missed in less intensive efforts). Searches should be preceded by an examination of soil and topographic maps and aerial photographs to determine potential habitat and to develop a priority list of sites to search.

   1.3 Determine habitat protection priorities. Because of the small number of existing populations and the pervasive threats to the habitat, it is essential to protect as many as possible. However, efforts should be concentrated first on the sites in protective ownership, or where current private landowners are cooperative, and where the largest and most vigorous populations occur. This strategy is being followed in protection efforts currently underway by The Nature Conservancy and the North Carolina Natural Heritage Program.

   1.4 Evaluate habitat protection alternatives. The greatest possible protection should be obtained for those existing populations which are considered critical to the recovery of the species. Fee simple acquisition or conservation easements provide the greatest degree of protection. However, it is unknown as yet how much buffer land around each population is necessary to protect the hydrological integrity of occupied sites. Protection through management agreements or short-term leases may provide adequate short-term protection but

should only be considered as intermediate steps in the process of ultimately providing for permanent protection. Short-term protection strategies may be necessary if private landowners are not willing to sell or monies are not available for acquisition of conservation easements, hydrologic easements, or fee simple title. Conservation agreements with adjacent landowners or owners of rights-of-way (utility companies) should be developed to prevent inadvertent adverse alterations of the habitat.

2. Determine and implement management necessary for long-term reproduction, establishment, maintenance, and vigor. Protection of the species' habitat is the obvious first step in ensuring its long-term survival, but this alone may not be sufficient. Since very little is known about this species, information on its population biology and ecology is necessary before effective management guidelines can be formulated and implemented.

   2.1 Determine population size and stage-class distribution for all populations. Population size and stage-class distribution data are essential to predicting what factors may be necessary for populations to become self-sustaining (Menges 1987). Such data are needed for existing populations and for any newly discovered populations.

   2.2 Study abiotic and biotic features of the species' habitat. An understanding of the hydrology of the habitats occupied by the species is essential to the long-term survival and recovery of small-anthered bittercress. Monitoring studies should include populations within a wide range of habitats, both altered and undisturbed. Permanent plots should be selected and established to determine the relationship between abiotic factors (such as soil depth and type, frequency and depth of inundation, and light intensity) and biotic factors (such as reproduction, germination, and degree of competition and predation). This information is necessary to ensure the continued vigor of existing populations and to accurately select good potential sites for reintroduction.

   The vectors of seed dispersal must be determined and their effectiveness under different ecological and spatial conditions assessed. At least some seed dispersal is by water; however, little else is known, including how far seeds can be dispersed by this vector and others, and what conditions are optimal for dispersal. Major pollinators need to be determined. Ants have been observed visiting the flowers, but little

is known about pollinators and pollination mechanisms of this species. The relative importance of sexual and vegetative reproduction to the long-term survival of the species is unknown and must be determined for effective management and protection to take place.

Relationships with competing species must be investigated. All occupied sites have been invaded by exotic weeds, including Japanese honeysuckle. The effects of and exact interactions between this species and potential competitors are unknown. This information is essential to accurate management prescriptions.

2.3 Conduct long-term demographic studies. Long-term demographic studies should be conducted in permanent plots located within each study site established for habitat analysis. Plots should be visited annually, for at least 4 consecutive years, after seed set has occurred. The locations of individual plants of all stage-classes should be mapped; data should be collected for each mapped plant on sizes of plants and inflorescences and seed set. Larger plots, surrounding each of the smaller, more intensively measured and mapped plots, should be monitored for seed germination and seedling establishment. Seedlings should be mapped and measured. Any changes in the habitat within each plot (soil disturbance, increases or decreases in light intensity, hydrology, etc.) should be noted at each visit (see Task 2.2 on study-site selection).

2.4 Determine the effects of past and ongoing habitat disturbance. Establishment and long-term monitoring of permanent plots may be the most effective means of assessing the effects of disturbance. Appropriate methodology for this must be determined but will likely include measurement of many of the parameters specified in Tasks 2.2 and 2.3.

2.5 Define criteria for self-sustaining populations and develop appropriate habitat management guidelines based upon the data obtained from Tasks 2.2 through 2.4. There is currently insufficient data to determine what this species requires in order for populations to be self-sustaining. Research as described under Tasks 2.2 through 2.4 should provide the information needed to protect and manage occupied habitat so that the continued survival of healthy populations is assured.

2.6 Implement appropriate management techniques as they are developed from previous tasks.

2.7 Develop techniques and reestablish populations in suitable habitat within the species' historic range. Techniques for seed collection, germination, propagation, and transplantation of this species need to be developed. Reintroduction efforts will have to be conducted in cooperation with knowledgeable personnel at botanical gardens and nurseries. Transplant sites in native habitat must be closely monitored to determine success and to adjust methods of reestablishment.

3. Develop a cultivated source of plants and provide for long-term seed storage. There are presently no cultivated sources of this species. Techniques for seed storage, germination, and maintenance of cultivated specimens must be developed.

4. Enforce laws protecting the species and/or its habitat. The Endangered Species Act prohibits taking of Cardamine micranthera from Federal lands without a permit and regulates trade. Section 7 of the Act provides additional protection of the habitat from impacts related to federally funded or authorized projects. In addition, the 1988 amendments to the Act prohibit (1) the malicious damage or destruction of listed plants on Federal lands and (2) the removal, cutting, digging, damaging or destroying of such plants in knowing violation of any State law or regulation, including State criminal trespass law. The State of North Carolina prohibits taking of the species without a permit and the landowner's written permission and regulates trade in the species (North Carolina General Statute 19-B, 202.12-202.19). The State of Virginia prohibits taking and trade of listed species without a permit (Code of Virginia 39:3.1-1020 to 31-030). Federal and State enforcement agents whose jurisdiction includes the known range of small-anthered bittercress should be made aware of the threats to the species and be able to identify specimens.

5. Develop materials to inform the public about the status of the species and the recovery plan objectives. Public support for the conservation of small-anthered bittercress could play an important part in encouraging landowner assistance and conservation efforts. Information materials should not identify the plant's locations so as not to increase the threat of taking or vandalism.

5.1 Prepare and distribute news releases and informational brochures. News releases concerning the status and significance of the species and recovery efforts should be prepared and distributed to major newspapers in the

range of the species, as well as to smaller newspapers in the vicinity of the species' habitat.

5.2 Prepare articles for popular and scientific publications. The need to protect the species in its native habitat and cooperation among local, State, and Federal organizations and individuals should be stressed. Scientific publications should emphasize additional research that is needed and solicit research assistance from colleges and universities that have conducted studies on this or closely related species.

6. Annually assess success of recovery efforts for the species. Review of new information, evaluation of ongoing actions, and redirection, if necessary, is essential for assuring that full recovery is achieved as quickly and efficiently as possible.

C. Literature Cited

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PART III

IMPLEMENTATION SCHEDULE

Priorities in column one of the following implementation schedule are assigned as follows:

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

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

3. Priority 3 - All other actions necessary to meet the recovery objective.

Key to Acronyms Used in This Implementation Schedule

FWS - U.S. Fish and Wildlife Service
FWE - Fish and Wildlife Enhancement
SCA - State Conservation Agencies - State plant conservation agencies of participating states. In North Carolina, these are the Plant Conservation Program (North Carolina Department of Agriculture) and the Natural Heritage Program (North Carolina Department of Environment, Health, and Natural Resources); in Virginia, the Division of Natural Heritage (Virginia Department of Conservation and Recreation) and the Office of Plant Protection (Department of Agriculture and Consumer Services).
CPC - Center for Plant Conservation

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS		Other	FY 1992	FY 1993	FY 1994	
				Region	Division					
1	1.1	Develop interim research and management plans in conjunction with landowners.	2 years	4, 5	FWE	SCA	5.0	5.0	---	
3	1.2	Search for additional populations.	3 years	4, 5	FWE	SCA	20.0	10.0	10.0	
1	1.3	Determine habitat protection priorities.	1 year	4, 5	FWE	SCA	1.0	---	---	
1	1.4	Evaluate habitat protection alternatives.	2 years	4, 5	FWE	SCA	1.0	1.0	---	
2	2.1	Determine population size and stage-class distribution for all populations.	2 years	4, 5	FWE	SCA	15.0	15.0	---	
2	2.2	Study abiotic and biotic features of the species' habitat.	5 years	4, 5	FWE	SCA	10.0	8.0	8.0	

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS						
				Region	Division	Other	FY 1992	FY 1993	FY 1994	
2	2.3	Conduct long-term demographic studies.	5 years	4, 5	FWE	SCA	16.0	6.0	6.0	
2	2.4	Determine the effects of past and ongoing habitat disturbance.	3 years	4, 5	FWE	SCA	8.0	4.0	4.0	
2	2.5	Define criteria for self-sustaining populations and develop appropriate habitat management guidelines based upon the data obtained from Tasks 2.2 through 2.4.	1 year	4, 5	FWE	SCA	---	---	5.0	
2	2.6	Implement appropriate management techniques as they are developed from previous tasks.	Unknown	4, 5	FWE	SCA	?	?	?	

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS						
				Region	Division	Other	FY 1992	FY 1993	FY 1994	
3	2.7	Develop techniques and reestablish populations in suitable habitat within the species' historic range.	5 years	4, 5	FWE	SCA	---	20.0	10.0	
3	3	Develop a cultivated source of plants and provide for long-term seed storage.	3-5 years	4, 5	FWE	SCA, CPC	5.0	5.0	1.0	
1	4	Enforce laws protecting the species and/or its habitat.	Ongoing	4, 5	FWE	SCA	2.0	2.0	2.0	
3	5.1	Prepare and distribute news releases and informational brochures.	Ongoing	4, 5	FWE	SCA, CPC	2.0	1.0	1.0	
3	5.2	Prepare articles for popular and scientific publications.	Ongoing	4, 5	FWE	SCA, CPC	1.0	0.5	0.5	

IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS		Other	FY 1992	FY 1993	FY 1994	
				Region	Division					
3	6	Annually assess success of recovery efforts for the species.	Ongoing	4, 5	FWE	SCA, CPC	0.5	0.5	0.5	

PART IV

LIST OF REVIEWERS

Dr. James W. Hardin
Department of Botany
North Carolina State University
Raleigh, North Carolina 27607

Dr. James Massey
Department of Botany
University of North Carolina
Chapel Hill, North Carolina 27514

Dr. Albert Radford
Department of Botany
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina 27514

Dr. Bob Kral
Biology Department
Vanderbilt University
Box 1705, Station B
Nashville, Tennessee 37235

Mr. Cecil Frost, Botanist
Plant Conservation Program
North Carolina Department of Agriculture
P.O. Box 26747
Raleigh, North Carolina 27611

Mr. Rob Sutter
The Nature Conservancy
101 Conner Drive, Suite 302
P.O. Box 2267
Chapel Hill, North Carolina 27515

Mr. Chris Ludwig
Virginia Division of Natural Heritage
Department of Conservation and
Historic Resources
203 Governor Street, Suite 402
Richmond, Virginia 23219

Mr. Tom Wieboldt
Botany Department
Virginia Polytechnic Institute and
State University
Blacksburg, Virginia 24061

Mr. Marshall Trammell
Virginia Department of Agriculture and
Consumer Services
Bureau of Plant Protection and
Pesticide Regulation
Washington Building
Richmond, Virginia 23219

Director
North Carolina Natural Heritage Program
P.O. Box 27687
Raleigh, North Carolina 27611

Mr. Rob Gardner
The North Carolina Botanical Garden
University of North Carolina at Chapel Hill
Totten Center 457-A
Chapel Hill, North Carolina 27514

Lt. Col. Thomas C. Suermann
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1890
Wilmington, North Carolina 28402-1890

Ms. Peggy Olwell
Director of Conservation Programs
Center For Plant Conservation
Missouri Botanical Garden
P.O. Box 299
St. Louis, Missouri 63166

Environmental Planner
Air Force Regional Civil Engineer - ER
77 Forsyth Street, SW., Suite 291
Atlanta, Georgia 30335-6801

Mr. William H. Redmond
Regional Natural Heritage Project
Tennessee Valley Authority
Norris, Tennessee 37828

Mr. Walt Matia
Director of Stewardship
The Nature Conservancy
1815 N. Lynn Street
Arlington, Virginia 22209

World Conservation Monitoring Centre
219c Huntingdon Road
Cambridge
CB3 ODL
United Kingdom

Mr. Frank Tursi
Science Reporter
Winston-Salem Journal
418 N. Marshall
Winston-Salem, North Carolina 27102

Mr. Jim Burnette, Jr.
North Carolina Department of Agriculture
Pesticide Section
P.O. Box 27647
Raleigh, North Carolina 27611

Ms. Chrys Baggett
The State Clearing House
North Carolina Department of Administration
116 W. Jones Street
Raleigh, North Carolina 27611

Mr. and Mrs. York Tucker
Route 1, Box 1
Westfield, North Carolina 27053

Dr. Dan Pittillo
Department of Biology
Western Carolina University
Cullowhee, North Carolina 28723

Mr. Don McCleod
Biology Department
Mars Hill College
Mars Hill, North Carolina 28754

Dr. James Matthews
Department of Biology
University of North Carolina at Charlotte
Charlotte, North Carolina 28213

Dr. I. W. Carpenter, Chairman
Biology Department
Appalachian State University
Boone, North Carolina 28607

Dr. James Perry, Chairman
Biology Department
University of North Carolina at Asheville
Asheville, North Carolina 28804

Mr. Ed Schell
2514 Browns Mill Road
Johnson City, Tennessee 37601

Department of Botany
National Museum of Natural History
Smithsonian Institution
Washington, DC 20560

Traffic U.S.A.
World Wildlife Fund
1250 24th Street, NW., Suite 500
Washington, DC 20037

The Garden Club of America
598 Madison Avenue
New York, New York 10022

Dr. Susan H. Lathrop
Executive Director
American Association of Botanical
Gardens and Arboreta, Inc.
P.O. Box 206
Swarthmore, Pennsylvania 19081

Natural Resources Defense Council, Inc.
40 West 20th Street
New York, New York 10011

New England Wildflower Society, Inc.
Garden in the Woods
Hemenway Road
Framington, Massachusetts 01701

Dr. James L. Reveal, Chairman
Conservation Committee
American Society of Plant Taxonomists
University of Maryland
Department of Botany
College Park, Maryland 20742

Mr. Bob McCartney
Woodlanders
1128 Colleton Avenue
Aiken, South Carolina 29801

Mrs. Annie S. Martin
Route 1, Box 465
Lawsonville, North Carolina 27022

Ms. Dora Lee Rorer
Route 1
Lawsonville, North Carolina 27022

Mr. J. O. Slate
Route 2, Box 322
Westfield, North Carolina 27053

Mr. Helon Tucker
Route 1, Box 117
Westfield, North Carolina 27053

Mrs. Charles Stevens
Route 2, Box 330
Westfield, North Carolina 27053

State Director
The Nature Conservancy
Carr Mill Mall, Suite 223
Carrboro, North Carolina 27510

Mr. Marc Bosch
U.S. Forest Service
Wildlife, Fisheries, and Range
1720 Peachtree Street, NW.
Atlanta, Georgia 30367

Mr. Steve Leonard
North Carolina Division of Soil and
Water Conservation
P.O. Box 27687
Raleigh, North Carolina 27611

Mr. Peter Cumbie
Design Engineering Department
Duke Power Company
P.O. Box 1006
Charlotte, North Carolina 28201-1006

Ms. Debra Owen
Woolpert Consultants
8731 Red Oak Boulevard
Charlotte, North Carolina 28217-3958

Dr. Bob Cook
Arnold Arboretum
125 Arborway
Jamaica Plain, Massachusetts 02130

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814