

# **Blue Ridge Goldenrod**

## **Recovery Plan**



RECOVERY PLAN  
for the  
Blue Ridge Goldenrod (Solidago spithamaea Curtis)

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Date:

October 28, 1987



THIS IS THE COMPLETED BLUE RIDGE GOLDENROD RECOVERY PLAN. IT HAS BEEN APPROVED BY THE U.S. FISH AND WILDLIFE SERVICE. IT DOES NOT NECESSARILY REPRESENT OFFICIAL POSITIONS OR APPROVALS OF COOPERATING AGENCIES, AND IT DOES NOT NECESSARILY REPRESENT THE VIEWS OF ALL INDIVIDUALS WHO PLAYED A ROLE IN PREPARING THIS PLAN. THIS PLAN IS SUBJECT TO MODIFICATION AS DICTATED BY NEW FINDINGS, CHANGES IN SPECIES' STATUS, AND COMPLETION OF TASKS DESCRIBED IN THE PLAN. GOALS AND OBJECTIVES WILL BE ATTAINED AND FUNDS EXPENDED CONTINGENT UPON APPROPRIATIONS, PRIORITIES, AND OTHER CONSTRAINTS.

ACKNOWLEDGEMENTS SHOULD READ AS FOLLOWS:

U.S. Fish and Wildlife Service. 1987. Blue Ridge Goldenrod Recovery Plan.  
U.S. Fish and Wildlife Service, Atlanta, Georgia. 30 pp.

ADDITIONAL COPIES MAY BE PURCHASED FROM:

Fish and Wildlife Reference Service  
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## EXECUTIVE SUMMARY

1. Point or condition when the species can be considered recovered?

Blue Ridge goldenrod (*Solidago spithamea*) can be considered recovered when five self-sustaining populations are permanently protected within the species' natural habitat.

2. What must be done to reach recovery?

The three currently extant populations must be protected from trampling and recreational development, and two additional populations must be found or reestablished within the species' historic range. Populations must be determined to be self-sustaining.

3. What specifically must be done to meet the needs of number 2?

One of the currently extant populations is on U.S. Forest Service land. This agency has indicated its willingness to work with the Fish and Wildlife Service to implement necessary conservation measures for the species at this site. These measures include control or diversion of foot traffic to prevent further trampling of the species and its fragile cliff edge habitat. Steps to accomplish this goal have already been undertaken, with natural barriers being used to block bushwhacked trails, and closure orders issued for the most sensitive parts of this site. The remaining two extant populations are on private land which has been or is being developed for commercial recreation facilities. Agreements must be reached with the landowners for permanent protection of the species on these sites. One of the landowners has already signed a conservation agreement with the Service and is committed to protecting the species on his land. The second private landowner has verbally indicated a willingness to work with the Service in designing ongoing development so that the Blue Ridge goldenrod at this site is not impacted. If suitable sites can be found and techniques developed, extirpated populations will be reestablished within the species' historic range.

4. What management/maintenance needs have been identified to keep the species recovered?

Continued monitoring of all populations is necessary to assure that they are indeed self-sustaining. So little is known of the specific requirements of this species that management recommendations cannot be made until the information gathering tasks identified in the recovery plan have been carried out. However, based on a knowledge of the requirements of other species in this genus, it is possible that some limited clearing of competing vegetation might be necessary to assure the species' continued survival. Beyond this, continued protection of the species' habitat from trampling by hikers, climbers, and sightseers, as well as from construction of additional recreation or other facilities which would directly impact the plants, should permit the species, once recovered, to remain so.





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## PART I

### INTRODUCTION

Blue Ridge goldenrod (Solidago spithamaea) is a rare plant endemic to a limited area in the Blue Ridge Mountains of North Carolina and eastern Tennessee. Due to its rarity and vulnerability to threats, the species was federally listed as threatened on March 28, 1985 (Federal Register 50:12306-120309). Blue Ridge goldenrod is officially listed as threatened by the State of North Carolina under the provisions of its Plant Protection and Conservation Act (General Statute 19b106-202.12-202.19, 1979) and by the State of Tennessee as endangered under the provisions of its Rare Plant and Conservation Act (Acts 1985, Ch. 242,1).

#### Current and Historical Distribution

Only three populations of Blue Ridge goldenrod are currently known to exist; two are in Avery County, North Carolina, on Grandfather Mountain and Hanging Rock, and one is on the border between Mitchell County, North Carolina, and Carter County, Tennessee, on Roan Mountain. Although specific data on number of plants at these locations are lacking from historical accounts, declines have been noted in at least one of the three extant sites within the last 10 years. Three additional sites were known to have been occupied by the species historically; however, all three areas have undergone extensive residential and recreational

development since the original collections. Despite numerous searches, no plants have been found at these sites in over 50 years. Reports have been received of three additional sites for this species; however, no voucher specimens exist and no Solidago spithamaea has been found to occur at these locations during searches over the past seven years.

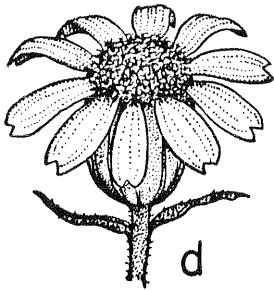
### Description, Ecology, and Life History

Blue Ridge goldenrod is a member of a large and taxonomically complex genus which contains over a hundred species native chiefly to North America, reaching its greatest complexity in the Eastern United States. The name of the genus comes from the Latin solidus and ago, meaning to make solid or firm, referring to reputed healing qualities of members of this genus (Britton and Brown 1970). The genus is within the large and equally complex aster family (Asteraceae).

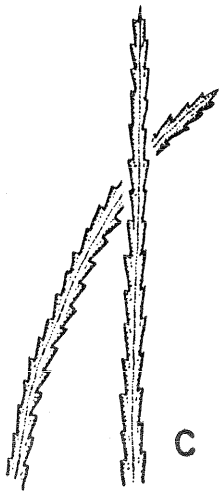
Blue Ridge goldenrod is considered to be one of the few southeastern representatives of a much more widely distributed group of goldenrods, which is particularly abundant in more northern, alpine localities (Small 1933). Taylor and Taylor (1986) consider S. spithamaea to be a holoschizoendemic (defined by Keener [1983] as a stabilized and diversified species of relatively ancient origin which occupies a relatively maximum area but is restricted by habitat and/or geography), similar to the recently described S. ouachitensis of the Ouachita Mountains of Arkansas and Oklahoma, where vegetation and forest dominants

are very similar and closely allied with those of the Appalachian Mountains. According to Taylor and Taylor, "During a cooler, moister time, the goldenrod populations of these mountains occupied much larger ranges and were probably sympatric...the affinity of our plants with those of more northern areas indicates again the relict nature of these populations, persisting and surviving a climate change to warmer and drier conditions."

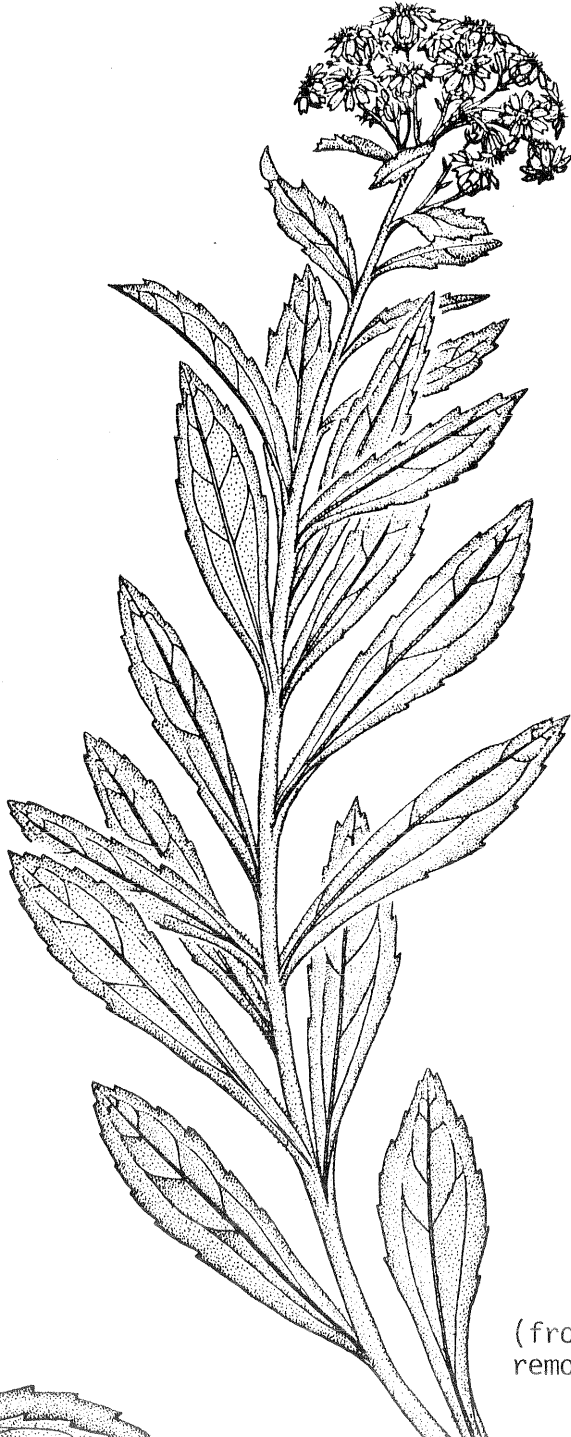
Blue Ridge goldenrod is a perennial herb which grows from a short stout rhizome. The erect stem is 4 to 8 inches tall, terete and longitudinally striate, greenish-brown proximally, distally becoming more strongly ribbed and reddish and usually covered with whitish hairs. The stem is usually unbranched below the inflorescence. The leaves are smooth, oblanceolate or spatulate, and acute with the offshoot and basal cauline leaves being the largest and longest (8 to 15 centimeters); the broader portions of the leaves are coarsely ascending-serrate and up to 3 centimeters wide with the bases long-attenuate. The upper surface is deep yellow-green and conspicuously reticulate; the lower surface is paler and finely but conspicuously reticulate. The cauline leaves are gradually reduced and progressively more sessile as they ascend into the inflorescence. The yellow inflorescence itself is corymbose, with a compact, symmetrical, convex, terminal group of stiffly ascending, leafy-bracted cymes, 3 to 10 centimeters broad. The heads are campanulate and 7 to 10 millimeters high from base to tip of florets at full anthesis. There are 8 to 10 pistillate ray florets (with some



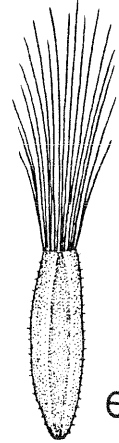
d  
Head (x1)



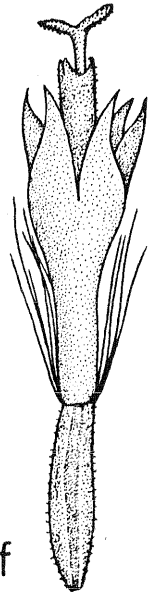
c  
Pappus bristles (x20)



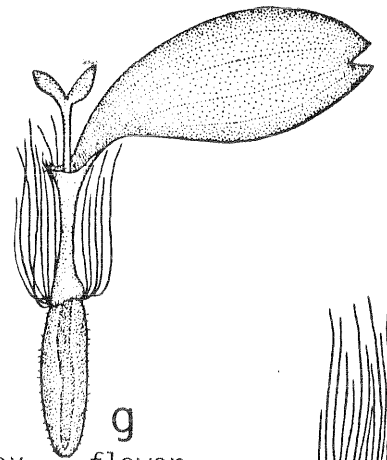
a  
Flowering plant habit (x1)



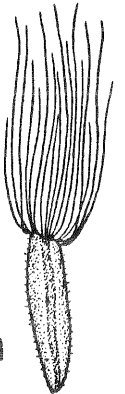
e  
Disc fruit (x10)



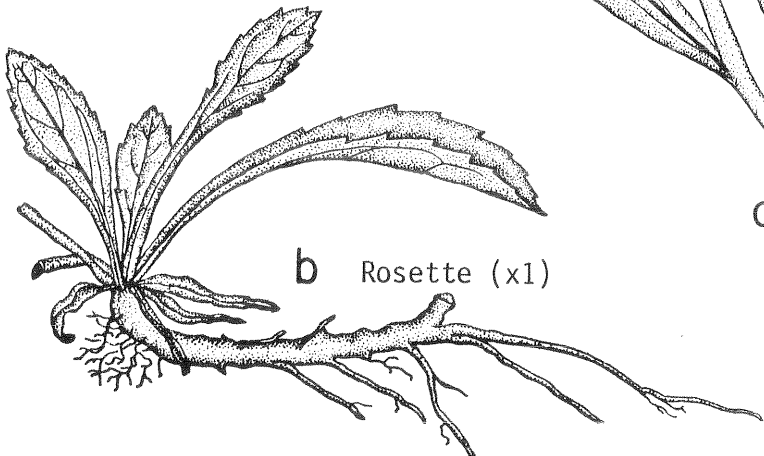
f  
Disc flower (front portion of pappus removed to show corolla tube) (x10)



g  
Ray flower (front portion of pappus removed to show corolla tube) (x10)



h  
Ray fruit (x10)



b  
Rosette (x1)

transitional to disc) and numerous perfect disc florets. Flowering occurs from July to September. The fruit, which is present from July to October, is a cypsela (referred to by some as an achene or nutlet) 2.5 to 3 millimeters long (Kral 1979, Massey et al. 1980, Cronquist 1980). Blue Ridge goldenrod can be separated from the other species of Solidago with which it occurs by its small stature and corymbiform inflorescence, as well as its smoothish foliage and toothed, non-clasping stem leaves (Kral 1979, Massey et al. 1980). S. spithamea has been described as being somewhat mephitic, giving rise to another common name, "skunk goldenrod" (ibid.).

The habitat of Blue Ridge goldenrod consists of rock outcrops, ledges, cliffs, and balds at high elevations (generally above 4,600 feet [1,400 meters], with one population occurring at 6,627 feet [1,910 meters]). The plants grow in humus or clay loams on igneous and metasedimentary rock, including quartz diorite, metagraywacke, metaconglomerates, and metarkoses rich in feldspar and chlorite (Kral 1979, Massey et al. 1980). Soils are generally acidic (pH 4) and shallow (ranging from 0 to 40 centimeters in depth). Observations of the hydrology of occupied sites indicate that most are intermittently saturated but excessively drained to moderately poorly drained (Massey et al. 1980). Sites occupied by the species are generally exposed to full sun. Common associates include Deschampsia flexuosa, Danthonia compressa, Poa spp., Carex spp., Potentilla tridentata, Prenanthes roanensis, Arenaria groenlandica,

Paronychia argyrocoma, Picea rubens, Leiophyllum buxifolium,  
Sorbus americana, Rhododendron catawbiense, Aster acuminatus,  
Saxifraga michauxii, Heuchera villosa, and other species of  
Solidago (ibid.). In addition Solidago spithamaea often occurs  
with other rare species, some of which are candidates or proposed for  
Federal listing, including Liatris helleri, Carex misera, Abies  
fraseri, Hedyotis montana, and Geum radiatum.

Very little specific information is available on the life history  
and population biology of Blue Ridge goldenrod. Various hymenopterans  
have been observed visiting the flowers, but the pollinators have not  
been identified for this species. The plants appear to spread  
vegetatively by extending rhizomes and presumably reproduce by seed;  
however, the relative importance of each mode of reproduction to the  
species is unknown. Although other species of Solidago are known to  
hybridize in nature, producing plants with intermediate characteristics  
and making identification even more difficult, hybridization of  
S. spithamaea with other species has not been documented.  
Information on seed set, germination and survival of seedlings, flowering  
frequency, and response of populations to climatic extremes and various  
forms of disturbance are not available for this species.



### Threats and Population Limiting Factors

Being confined to small areas on a few rocky summits in the Blue Ridge Mountains, this species and many of its rare associates are extremely vulnerable to such seemingly minor threats as trampling by hikers, climbers, and sightseers, as well as to more pervasive threats such as acid precipitation and other forms of atmospheric pollution which have been found to be concentrated at the higher elevations in the southern Appalachians. At one site owned by the U.S. Forest Service, localized destruction of habitat and loss of several clumps of S. spithamaea have been observed as a result of heavy trampling, in spite of Forest Service efforts to block public access to the cliffs where this species occurs. At one of the privately owned sites, development of the area as a ski resort is currently underway. Only a few plants have been found at this site, all occurring on a single rock face, where they are inherently vulnerable to any form of disturbance. The third site, also privately owned, has been developed as a commercial recreation facility. It is particularly interesting that at this third site, despite the foot traffic associated with thousands of annual visitors, the plants appear vigorous and no sign of decline has been noted. Two of the three sites are within a few hundred feet of a heavily traveled, paved road. An additional threat to this species, although not an imminent one, is that of natural succession. S. spithamaea, like most other members of the genus, is a pioneer which is not capable of thriving underneath the spruce-fir forest which is the climax vegetation

of the high mountains within its range. Because of its very limited distribution and the small number of plants at the sites where it occurs, this species is potentially vulnerable to natural climatic extremes such as severe drought, ice and wind damage, and the accompanying erosion of the steep slopes it occupies. Thus far, taking of the plant has not been observed to be a serious problem; however, the rarity of the species and publicity accompanying its addition to the endangered species list may make it more attractive to collectors. Availability of suitable habitat adjacent to sources of seed or rhizomes appears to be the major limiting factor for this species; however, much remains unknown about its specific biology and habitat requirements.

#### Conservation Efforts

In 1983 a conservation agreement among the U.S. Fish and Wildlife Service, North Carolina Department of Agriculture, and Grandfather Mountain, Incorporated, was signed for the purpose of providing for the conservation of Blue Ridge goldenrod as well as Heller's blazing star (Liatris helleri) on the Grandfather Mountain site in Avery County, North Carolina. Mr. Hugh Morton, owner of Grandfather Mountain, has been exceptionally cooperative in conservation efforts for rare species on his property, and the populations of Blue Ridge goldenrod there are the largest and most vigorous known, despite heavy recreational use of the site. Roan Mountain in Mitchell County, North Carolina, and Carter County, Tennessee, is administered by the U.S. Forest Service (Pisgah and

Cherokee National Forests respectively) and managed largely for public recreation. This area is exceptionally scenic and well-known and attracts thousands of tourists each year. Heavy trampling in recent years at part of this site has resulted in the loss of clumps of the species and degradation of the fragile cliff edge habitat. An observation platform was erected immediately adjacent to and above one colony of S. spithamaea. Although this platform served to divert some foot traffic away from the rocks, increased visitation and unauthorized bushwhacking of trails through the area has increased the threat to the species here. Several attempts have been made by the Forest Service to block public access to the cliffs occupied by the plants, but only partial success has been achieved. In 1986, the Forest Supervisor in North Carolina issued a closure order for one particular area of Roan Mountain which supports an exceptionally vigorous and unimpacted population of S. spithamaea. This particular area is inaccessible, but it is very fragile and vulnerable to disturbance by hikers or rock climbers. The third site, Hanging Rock in Avery County, North Carolina, is currently undergoing development as a ski resort. The owner and his contracted developer have been contacted by the U.S. Fish and Wildlife Service and the North Carolina Natural Heritage Program regarding protection of the rare species on the property. The precipitous cliff supporting the species here constitutes a very minor portion of the land involved in the development, and the owner has expressed his willingness to cooperate in this endeavor.

## PART II

## RECOVERY

A. OBJECTIVE

The Blue Ridge goldenrod (Solidago spithamaea) will be considered recovered when there are at least five self-sustaining\* populations in existence which are protected to such a degree that the species no longer qualifies for protection under the Endangered Species Act. (\*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 quantity and quality of habitat needed to meet these criteria will be determined as one of the recovery tasks). In order to accomplish this goal of removing the species from the list of endangered and threatened species, it is necessary to protect existing populations and manage the habitat to ensure their continued survival. Because so little is known about this species, it is also necessary, for the full protection of the plant, to conduct population studies and ecological research for the purpose of developing a management strategy. The ultimate effects of the various kinds of disturbance on S. spithamaea populations must be investigated and means of alleviating adverse effects must be

explored. Therefore, the Blue Ridge goldenrod shall be considered recovered when the following criteria are met:

1. The three populations at Roan Mountain, Grandfather Mountain, and Hanging Rock are protected.
2. Any necessary management actions have been undertaken for these populations by the landowners or cooperating agencies and it has been documented that this management is successfully ensuring the continued survival of these populations.
3. Through introduction and/or discovery of new populations, two additional self-sustaining populations exist within the species' historical range (it is believed that at least two additional populations are required to ensure that the species will not become extinct in the foreseeable future).
4. All five 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. STEP-DOWN OUTLINE

1. Protect existing populations and essential habitat.

- 1.1 Develop interim research and management plans in conjunction with U.S. Forest Service and private landowners.
  - 1.2 Search for additional populations.
  - 1.3 Determine habitat protection priorities.
  - 1.4 Evaluate habitat protection alternatives.
2. Determine and implement management necessary for long-term reproduction, establishment, maintenance, and vigor.
    - 2.1 Determine population size and stage class distribution for all populations.
    - 2.2 Study abiotic and biotic features of the species' habitat.
    - 2.3 Conduct long-term demographic studies.
    - 2.4 Determine the effects of past and ongoing disturbances.
    - 2.5 Investigate potential effects of acid precipitation or other atmospheric pollution.

- 2.6 Define prerequisites for self-sustaining populations and develop appropriate habitat management guidelines based upon the data obtained from Tasks 2.2 through 2.5.
- 2.7 Implement appropriate management techniques as they are developed from previous tasks.
- 2.8 Develop techniques and reestablish populations in suitable habitat within the species' historic range.
3. Develop a cultivated source of plants and provide for long-term seed storage.
4. Enforce laws protecting the species and/or its habitat.
5. Develop materials to inform the public about the status of the species and recovery plan objectives.
  - 5.1 Prepare and distribute news releases and informational brochures.
  - 5.2 Prepare articles for popular and scientific publications.
6. Annually assess success of recovery efforts for the species.

C. NARRATIVE

1. Protect existing populations and essential habitat. There are presently only three known populations of Blue Ridge goldenrod--two in North Carolina and one on the border of North Carolina and Tennessee. Because of the small number of populations and individuals within populations, it is critical to the continued survival of the species that these three populations be protected and their continued survival ensured.

1.1 Develop interim research and management plans in conjunction with U.S. Forest Service and private landowners. Very 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 historic habitat, a thorough systematic effort to locate additional populations is still needed. Searches should be preceded by an examination of soil and topographic maps and aerial photography to determine potential habitat



and to develop a priority list of sites to search. Many of the areas which may support additional colonies or populations of the species consist of vertical cliff faces which may require the employment of experienced rock climbers.

- 1.3 Determine habitat protection priorities. Because of the small number of existing populations, it is essential to protect all three. However, efforts should probably be concentrated first on the site owned by the Forest Service, where protection is mandated by Federal law and cooperation has already been established. The Grandfather Mountain population probably should be next in priority since it supports the largest and most vigorous population of the species known. Last may be the Hanging Rock population where the future of the species is uncertain in the face of ongoing development.
  
- 1.4 Evaluate habitat protection alternatives. The greatest possible protection should be obtained for the three existing populations. Fee simple ownership or conservation easements provide protection in perpetuity and therefore the greatest degree of protection. Protection through management agreements or short-term lease may provide adequate short-term protection but should only be considered

as intermediate steps in the process of ultimately providing for permanent protection. Shorter-term protection strategies may be necessary if present, private landowners are not amenable to, or monies are not available for, acquisition of conservation easements or fee simple title. The U.S. Forest Service, which administers the Roan Mountain site, has indicated its willingness to take measures necessary for the protection and conservation of this species on national forest lands.

2. Determine and implement management necessary for long-term reproduction, establishment, maintenance, and vigor.

Although protection of the species' habitat is the obvious first step in ensuring its long-term survival, this alone may not be sufficient. Management of the habitat may be necessary to allow the species to successfully perpetuate its life cycle over the long term. However, since very little is known about this species, information on its population biology and ecology is necessary before 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 needed for the three existing

populations and for any new populations discovered in the course of additional surveys.

## 2.2 Study abiotic and biotic features of the species' habitat.

Recommended sites for these studies are Grandfather Mountain and Roan Mountain. Grandfather, having the largest and most vigorous population of the species, is an obvious first choice for study. Roan Mountain colonies, on the other hand, have sustained considerable impact from trampling and would provide a contrasting situation and perhaps yield the information to determine why the heavy trampling has been so detrimental at Roan Mountain and not at Grandfather (where numbers of people passing through areas of similar size are probably greater). If possible, the study should include impacted and unimpacted colonies at both sites. Permanent plots should be selected and established to determine the relationship between abiotic factors such as soil depth and type, moisture, light intensity, aspect, and biotic factors such as reproduction, germination, and degree of competition and predation. This information is necessary to determine if any active management is necessary to ensure continued vigor of existing populations and to accurately select good sites for potential reintroduction.

The vectors of seed dispersal must be determined and their effectiveness under different ecological and spatial conditions assessed. It is presumed that at least some seed dispersal is by wind; however, little else is known, including how far seeds can be dispersed by this method and others, and what conditions are optimal for dispersal. Major pollinators need to be determined. Although various hymenopterans have been observed visiting the flowers, the pollinators of the species remain unidentified. The relative importance of sexual and vegetative reproduction must be determined. This species, like others of the genus, is capable of sexual reproduction as well as rhizomatous expansion. However, the relative importance of each of these to the long-term survival of the species is unknown and must be determined for effective management to take place.

Relationships with competing species must be investigated. S. spithamaea is apparently a successional pioneer like other species in the genus. It probably cannot survive under the climax forest (spruce-fir) adjacent to the open areas it occupies. The effects and exact interactions between this species and potential competitors, including Rhododendron spp. and Leiophyllum buxifolium, are unknown.

### 2.3 Conduct long-term demographic studies. Long-term

demographic studies should be conducted in permanent plots located within each study plot established for habitat analysis (Task 3.3). Plots should be visited in late summer at the peak of flowering (early to mid-August) and once after seed set has occurred (October). Visits should be made for at least four consecutive years. The location of individual plants of all stage classes should be mapped; and data should be collected for each mapped plant as applicable on height, leaf length, inflorescence size, fruit size and number, and seed set. Measurement of these characters should provide a reasonable indication of plant stage and vigor. 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, tree fall, increases or decreases in shade, etc.) should be noted at each visit. (See section 2.2 on study-site selection.)

### 2.4 Determine the effects of past and ongoing disturbances.

Establishment and long-term monitoring of permanent plots may be the most effective means of assessing the effects of disturbance. The Roan High Bluff area of the Roan Mountain

population is probably the most likely candidate for this type of study. Appropriate methodology for this must be determined.

- 2.5 Investigate potential effects of acid precipitation or other atmospheric pollution. Abnormally high levels of heavy metals and other atmospheric pollutants as well as unusually low pH readings have been found at higher elevations in the southern Appalachians and are believed to be causing or contributing to a decline of the coniferous forest there. Blue Ridge goldenrod receives much, if not most, of its moisture from mist or fog, which is believed to play a primary role in the deposition of atmospheric pollution at the high elevations where the species occurs. It is unknown whether or how this affects Blue Ridge goldenrod.
- 2.6 Define prerequisites for self-sustaining populations and develop appropriate habitat management guidelines based upon the data obtained from Tasks 2.2 through 2.5.
- 2.7 Implement appropriate management techniques as they are developed from previous tasks.

- 2.8 Develop techniques and reestablish populations in suitable habitat within the species' historic range. Techniques for seed collection, germination, propagation, and transplantation are unknown for this species. This information will need to be developed in conjunction with knowledgeable individuals in greenhouse or nursery facilities. 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 at present no known cultivated sources of this species. Techniques for seed storage, germination, and maintenance of cultivated specimens must be developed in cooperation with botanical gardens, nurseries, and other appropriate facilities. A ready source of cultivated material should ease the threat of taking from wild populations.
4. Enforce laws protecting the species and/or its habitat. The Endangered Species Act prohibits taking of S. spithamaea 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. There is no Federal prohibition against taking of the plants from private land. 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. In Tennessee, taking of listed plants without the landowner's written permission and a State permit is also prohibited. Federal and State enforcement agents whose jurisdiction includes the known range of S. spithamaea should be made aware of the threat to the species and be able to identify it. Signs should be posted near occupied habitat which explain the prohibitions on taking of these plants (without specifically identifying the species, so as not to draw undesirable attention). Signs should be posted wherever taking appears to be a potential problem (this has already been done at Roan Mountain and Grandfather Mountain). Taking is not expected to become a significant threat for the species, since there is little demand for cultivated goldenrod and since the flowers are not exceptionally showy.

5. Develop materials to inform the public about the status of the species and the recovery plan objectives. Public support for the conservation of S. spithamaea could play an important part in encouraging landowner assistance and conservation efforts. Informational materials should be nonspecific in terms of the plant's locations, so as not to increase the threat of taking.



- 5.1 Prepare and distribute news releases and informational brochures. News releases concerning the status and significance of the species should be prepared and distributed to major newspapers throughout western North Carolina and eastern Tennessee, as well as to smaller newspapers in the vicinity of the species' habitat and to larger newspapers in more distant areas as appropriate.
  
- 5.2 Prepare articles for popular and scientific publications. The need to protect the species in its native habitat and the 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 which may have conducted studies on closely related species.
  
6. Annually assess success of recovery efforts for the species. Review of new information and evaluation (and redirection, if necessary) of ongoing actions is essential for assuring that full recovery is achieved as quickly and efficiently as possible.

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## PART III

## KEY TO IMPLEMENTATION SCHEDULE COLUMNS 1 &amp; 4

## General Category (Column 1):

Information Gathering - I or  
Research - R

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

## Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

## Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

## Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Priorities within this section (Column 4) have been assigned according to the following:

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 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.

Implementation Schedule

General Category *1	Plan Task	Task Number	Priority	Task Duration	Responsible Agency *2		Estimated Fiscal Year Costs *3			Comments/Notes	
					FWS	Other	FY 1	FY 2	FY 3		
					Region	Division					
A3, I4, M3	Develop interim research and management plans in conjunction with USFS and private landowners.	1.1	1	2 years	4	FWE	U.S. Forest Service (USFS), State Conservation Agency (SCA) (See note at *4.)	2,000	2,000	---	*1. See attachment: general categories for Implementation Schedules.
I1, I2	Search for additional populations.	1.2	3	1 year	4	FWE	USFS, SCA	4,000 (Will involve hiring rock climbers to search vertical cliffs.)	---	---	*2. Other agencies' responsibility would be of a cooperative nature or projects funded under a contract or grant program. In some cases contracts could be let to universities or private enterprises.
I2, M7	Determine habitat protection priorities.	1.3	1	1 year	4	FWE	USFS, SCA	500	---	---	*3. Note: ALL ESTIMATES ARE FOR FWS FUNDS ONLY.
M7	Evaluate habitat protection alternatives.	1.4	1	2 years	4	FWE	USFS, SCA	500	500	---	*4. SCA - State Plant Conservation agencies of all participating states (N.C. Department of Agriculture [Plant Protection Section] and Tennessee Department of Conservation [Division of Ecological Services]).
I/R6	Determine population size and stage class distribution for all populations.	2.1	2	1 year	4	FWE	USFS, SCA	3,000	---	---	
I/R2, 3, 10	Study abiotic and biotic features of the species' habitat.	2.2	3	4 years	4	FWE	USFS, SCA	3,500	2,000	2,000	
I/R 6	Conduct long-term demographic studies.	2.3	3	4 years	4	FWE	USFS, SCA	4,000	1,500	1,500	
I/R 14	Determine the effects of past and ongoing disturbances.	2.4	2	3 years	4	FWE	USFS, SCA	2,000	1,000	1,000	

Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS Region	Division	Other	FY 1	FY 2	FY 3	
R12	Investigate potential effects of acid precipitation or other atmospheric pollution.	2.5	3	Ongoing	4	FWE	USFS, SCA	4,000	2,000	2,000	
I4	Define prerequisites for self-sustaining populations and develop appropriate habitat management guidelines based upon the data obtained from tasks 2.2 through 2.5.	2.6	3	1 year	4	FWE	USFS, SCA	---	---	3,000	
M3	Implement appropriate management techniques as they are developed from previous tasks.	2.7	2	Unknown	4	FWE	USFS, SCA	---	Unknown	---	
R7, M2	Develop techniques and reestablish populations in suitable habitat within the species' historic range.	2.8	3	5 years	4	FWE	USFS, SCA	---	5,000	2,500	
M1, R7	Develop a cultivated source of plants and provide for long-term seed storage.	3	3	3-5 years	4	FWE	USFS, SCA	1,000	200	200	
O2	Enforce laws protecting the species and/or its habitat.	4	1	Ongoing	4	FWE	USFS, SCA	1,000	1,000	1,000	

Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS Region	Division	Other	FY 1	FY 2	FY 3	
01	Prepare and distribute news releases and informational brochures.	5.1	2	Ongoing	4	FWE	USFS, SCA	1,000	500	500	
01	Prepare articles for popular and scientific publications.	5.2	2	Ongoing	4	FWE	USFS, SCA	1,000	500	500	
04	Annually assess success of recovery efforts for the species.	6	3	Ongoing	4	FWE	USFS, SCA	500	500	500	

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