

Recovery Plan
for
HAIRY RATTLEWEED

Baptisia arachnifera, Duncan

Arden Parker

HAIRY RATTLEWEED RECOVERY PLAN

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for

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LITERATURE AND CITATIONS SHOULD READ AS FOLLOWS:

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PART I

INTRODUCTION

The hairy rattleweed (Baptisia arachnifera), also known as hairy wild-indigo, was first described in 1944 by Dr. Wilbur H. Duncan, presently Professor Emeritus at the University of Georgia. Duncan had discovered the plant the summer before and had realized it to be a different species of Baptisia. This plant is a perennial legume (family Fabaceae). It is from 50-80cm tall, with simple heart-shaped leaves 2-8cm long. The yellow flowers are terminal, alternately arranged on the flowering stem, and 5-petaled. The fruit is 8-15mm long. The entire plant, except parts of the flower, is covered with hairs. The hairy rattleweed is endemic to portions of Brantley and Wayne Counties in southeastern Georgia. After studying stands of the plant and making collections in 1955, Roland M. Harper was convinced he had seen the same taxon as early as 1903 while on a train trip through the area.

The hairy rattleweed was considered endangered in the Smithsonian Institution Report of January 9, 1975, presented to Congress in compliance with Section 12 of the Endangered Species Act of 1973. The U.S. Fish and Wildlife Service subsequently treated the Smithsonian Report as a listing petition, and the hairy rattleweed was listed as endangered pursuant to the Act on May 27, 1978 (43 FR 17910 - 17916). Georgia's Protected Plants (1977), an official publication of the Georgia Department of Natural Resources, also designated the hairy rattleweed as a State endangered species.

Documented locations for the hairy rattleweed are scattered over a 125-square mile area, including a southeastern portion of Wayne County and a north-central part of Brantley County. Within this area, this species is restricted to low sandy ridges in open pine-palmetto woods. Most of the hairy rattleweed's habitat is rapidly being clear-cut and replanted in pines. Unless aggressive management and protection efforts are implemented, the hairy rattleweed could become extinct.

The objectives of this report are to outline a plan for the recovery of the hairy rattleweed, and to incorporate recommendations on protection, management, and research.

Distribution and Status

Dr. Wilbur H. Duncan first collected the hairy rattleweed in the summer of 1942, and suspected that it was distinct from Baptisia perfoliata and Baptisia simplicifolia, other unifoliolate species which occur in the coastal plain of Georgia and Florida. His original collections were lost, but subsequent collections made July 4, 1943, confirmed his suspicion and provided the type material (Duncan 5693) from which the hairy rattleweed was described.

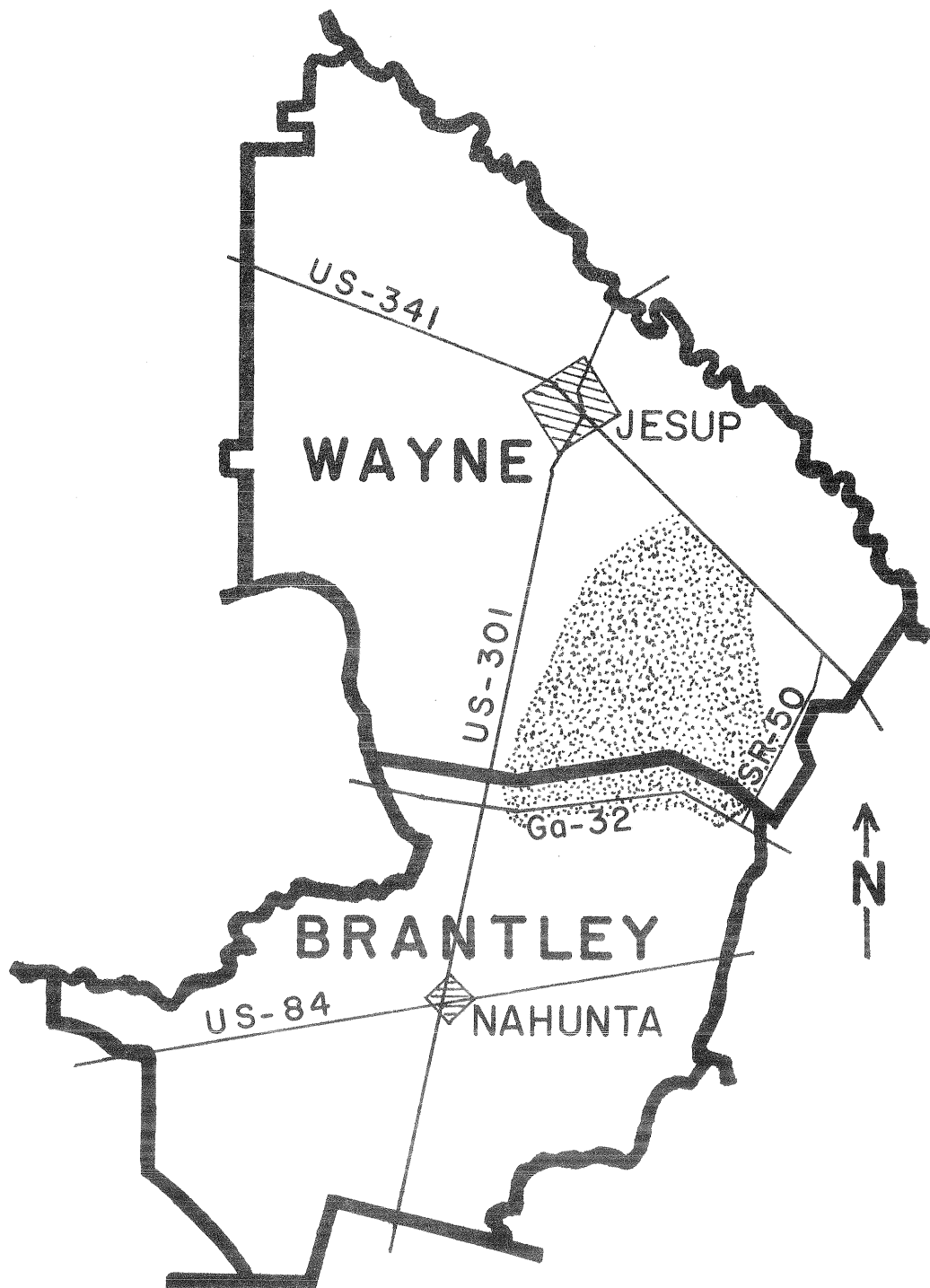
The type locality was designated as "sandy soil in open pine woods, 10 miles south of Jesup, Wayne County, Georgia". Duncan and other botanists have since recorded additional

locations for Wayne County within an area roughly bounded by highways US-301 on the west, US-341 on the north, and SR-50 on the east. Known locations also extend south into Brantley County for a distance of 1.5 - 2.0 miles, mostly paralleling highway Ga-32 (Figure 1).

Although the range of the Hairy Rattleweed covers approximately 125 square miles, its distribution is restricted. The entire range lies within the Lower Coastal Plain of Georgia, a region characterized by swamps, marshes, ponds, and poor drainage. Scattered among these poorly drained areas are sandy, broad terraces of low relief which produce better-drained "interstream" areas. Topography varies little within these better-drained areas, commonly known as "flatwoods", but changes in elevation of even a few feet are accompanied by pronounced changes in soil and moisture conditions and in vegetational patterns. These higher, drier, sites support a vegetation resembling a sand-hill community including the most thriving populations of the hairy rattleweed.

FIGURE 1

DISTRIBUTION OF BAPTISIA ARACHNIFERA



Range of the Hairy Rattleweed is indicated by the stippled area.

Phytogeographers and ecologists believe that the vegetation of pine flatwoods represents a fire subclimax community. Reoccurring fires, coupled with soils low in fertility and moisture content, eliminate a distinct shrub zone from the forest and maintain widely spaced trees, mostly pines and scrubby oaks. This allows good light penetration to the understory plants, which in spite of low moisture and nutrient regimes, are able to survive with minimum competition from other plants. The perennial B. arachnifera appears to require these conditions for survival.

Population Status and Trends

Duncan (pers. comm.) has continued to survey the hairy rattleweed and has noticed a large reduction in population size since his original work in the 1940's. The species' range does not appear to have decreased appreciably, but other botanists have confirmed Duncan's observations that populations are noticeably dwindling. Regrettably, no statistical data are available to document this trend.

Perhaps the greatest factor contributing to the sharp decline in hairy rattleweed populations is clear-cutting of the overstory pines for lumber and pulp, followed by clearing and replanting the sites. There is evidence that the plant is capable of surviving the cutting practices; however, the subsequent methods of site preparation, particularly chopping and bedding with heavy machinery prior to replanting pines is too drastic to maintain populations. In areas so treated, once-thriving populations are now reduced to a few individual plants along access roads, highway rights-of-way, or other less disturbed sites. Large forest products companies own most of the land within the hairy rattleweed's range. Unless these companies modify their reforestation practices to protect hairy rattleweed sites, the range, number, and density of its populations will continue to diminish. The plant is already seriously impacted.

Another factor contributing to the decline of populations is the influence of fire. Decline can possibly be attributed to competition from natural succession

because of altered practices of fire control; i.e., diminishing or eliminating fire from the sites where the hairy rattleweed grows. Fire is generally used in forest management. However, the frequency, intensity, and time of year that burning is used for managing pine plantations is not necessarily the best regime for management and maintenance of the hairy rattleweed. There are several depauperate stands of the species in pine plantations that could probably be restored to a vigorous condition if the sites were burned at suitable intervals.

Habitat Description

The hairy rattleweed occurs in sandy soils of open pine flatwoods. Two separate but contiguous regions support different plant associations on the flatwood terraces. The most extensive regions occupy a slightly lower elevation with soils characterized by an organic hardpan 18-24 inches below the surface. Moisture level in these soils ranges from near saturation in early spring to dry by late summer and fall. The tree overstory is almost exclusively pines

(Pinus elliotii and P. serotina). Undergrowth consists of a distinctive shrub zone composed mostly of saw palmetto (Serenoa repens), gallberry (Ilex glabra), poor-grub (Lyonia ferruginea), blueberries (Vaccinium), gopherberries (Gaylussacia sp.), wicky (Kalmia hirsuta), and wax myrtle (Myrica cerifera).

Higher elevations are considerably less extensive. The soils generally lack the organic hardpan, and the moisture level is low all year. The overstory is dominated by pines (Pinus elliotii and/or P. palustris), but usually there are a few scattered oaks (Quercus laevis, Q. chapmanii, Q. margaretta, Q. marilandica, and Q. geminata). Except for scattered saw palmetto, the conspicuous woody shrub zone is absent from these drier areas. The hairy rattleweed grows best in these higher, drier areas. It also grows in the ecotone between the wet and dry phases of the flatwoods, especially where there are openings in the canopy.

Extending well beyond the known range of the hairy rattleweed are extensive regions vegetatively

indistinguishable from the sites where it grows naturally. There are probably unknown factors, other than fire, which control its distribution.

Reproductive Status

Apparently, there is considerable variation in time of flowering for the hairy rattleweed. Herbaria data indicate that flowering begins as early as June (Duncan, June 1, 1949) and extends well into August (Palmer, August 8, 1954). Late June - early July appears to be the flowering peak. Viable seeds have been collected as early as August 10 (Allen, 1981) and as late as October 16 (Faircloth, 1982).

The reproductive biology of the species has not been studied adequately. However, one known factor influences its reproductive potential. A widespread North American weevil, Apion rostrum Say, may destroy a considerable percentage of the seed. As with most species of Baptisia, Say's weevil deposits eggs in the young flower

buds; the larvae feed on the developing seeds, and mature in the capsules. They ultimately chew through the capsule wall and emerge as adults. Dr. Andrew F. Robinson, Jr. (pers. comm.) reports the following data for seeds collected from three populations on August 23, 1979:

Populations

	<u>Al4C</u>	<u>F11A</u>	<u>M14i</u>
Range of number of seeds per capsule	0 - 7	0 - 6	0 - 6
Mean number of seeds per capsule	2.42	2.07	1.75
Percentage of capsules with weevil	6.25%	57.10%	28.00%
Number of capsules sampled	432	112	359

These preliminary figures indicate that up to 35% of the potential seed may be destroyed by the weevil. Robinson also reports a seed germination percentage of 50% for the populations sampled in 1979. Mr. Randall Allen of Callaway Gardens (pers. comm.) reported a value of 70% germination for seeds collected in 1982.

The hairy rattleweed is also capable of asexual reproduction. When the long, horizontal underground roots are cut, plants may appear at the end of the cut roots (Robinson, pers. comm.).

Suspected and Known Limiting Factors

The factors most important in limiting the hairy rattleweed cannot be determined without considerable research. The populations may be limited by both site requirements and by competition with other plant species. Limiting factors may be climatic, edaphic, or biotic.

Threats to Future Existence

The hairy rattleweed does not possess any qualities that would tend to arouse public interest. It is not of horticultural interest and it is not exploited by overcollecting as are many rare plant species.

The destruction of populations by rampant clear-cutting, site preparation, and replanting of pines is unquestionably the most serious threat to its future existence.

Parties Presently Conducting Recovery Actions or
Actions Proposed for Such

Recovery actions for the hairy rattleweed are currently minimal or almost nonexistent. No formal commitment has been made, but Brunswick Pulp and Land Company is cooperating in protecting a stand (1-2 acres in size)

alongside Fourhouse Camp Road in the southwestern part of their Tyler tract public hunting area. The site was clear-cut about four years ago and has not been replanted in pines. No maintenance efforts are in progress, but the site serves to monitor the recovery of a population that has been subjected to clear-cutting. The site could be easily adapted into an experimental test plot.

In cooperation with the State of Georgia's Protected Plant Program, Callaway Gardens and the USDA Forest Service's National Tree Seed Laboratory are involved in research on the species. Specific plans and research objectives are presently unavailable.

PART II

RECOVERY

Recovery Objective

The hairy rattleweed could be considered for delisting when the following conditions are met: (1) there are at least eight self-sustaining populations secured and maintained within its historic or current range (eight would provide a reasonable degree of security against catastrophic loss and/or site alteration); (2) the number of individuals in the various populations has reached an optimum level of cover percentage and frequency occurrence, as established by management studies; (3) its biology is sufficiently understood to allow perpetuation of the species should circumstances require immediate or drastic alteration of populations and/or sites; (4) continuing protection and management after delisting are assured.

Reclassification of the hairy rattleweed from federally endangered to threatened status could be considered when four self-sustaining populations are secured as described above.

It should be noted that the terms "populations" and "stand" are sometimes used interchangeably in this recovery plan. In a strict sense, a population implies a collective group of individuals of the same species, occupying a particular space, among which there is evidence of reproduction. Evidence of reproduction is characterized by an obvious distribution of age classes, namely seedling, juvenile, mature, and senescent individuals. The term stand may be used synonymously with population but it may also imply a persisting group of individuals without obvious age classes represented.

Step-down Outline

1. Protect habitat and existing populations of the hairy rattleweed.

11. Encourage private landowners to protect existing stands.
12. Alert the Georgia Department of Transportation and county highway departments to locate and protect stands of the plant on road rights-of-way.
13. Alert Georgia Power Company, or any other public utility owning rights-of-way within the plants' range, to locate and protect existing stands.
14. Encourage State or Federal protection of one or more tracts of land that contain vigorous populations of the hairy rattleweed.
2. Monitor populations and their habitats.
 21. Determine methods for monitoring populations.
 22. Monitor habitat trends.

23. Periodically check sites for evidence of disturbance.
24. Gather data on population size and reproduction.
25. Determine minimum population size for self-sustaining populations.
3. Conduct searches for new stands of the hairy rattleweed.
31. Identify potential habitats using aerial photography.
32. Conduct ground investigations of potential habitats to determine presence or absence of the hairy rattleweed.

33. Train personnel to accurately identify the hairy rattleweed (also known locally as hairy wild-indigo).
4. Preserve existing germ plasm through cultivation and storage.
 41. Propagate the hairy rattleweed, maintaining representative populations.
 42. Continue to maintain fresh seeds and pollen in established germ plasm banks.
 43. Establish stands at academic institutions, public botanical gardens, or in areas of state or federal jurisdiction.
5. Conduct autecological research.
 51. Study in detail the life history of the hairy rattleweed.

- 511. Map vegetation at natural sites.
- 512. Establish permanent monitoring plots at one or more natural populations.
- 513. Assess changes in population size and distribution of age classes.
- 514. Determine the plant's reproductive and breeding systems.
- 515. Identify pollinators or vectors of dissemination.
- 516. Study germination and establishment processes.
- 52. Identify limiting factors.
 - 521. Define edaphic requirements.

- 522. Define light relations.
- 523. Examine effects of competition by other vegetation on survival and reproduction.
- 524. Determine and study other types of biological competition; e.g., parasitism, predation, etc.
- 53. Determine effective management options.
 - 531. Conduct experimental burning.
 - 532. Conduct experimental reforestation.
 - 533. Assess the effects of pesticides and herbicides on the plant.
 - 534. Prepare management recommendations.
- 6. Develop public awareness and support.

Narrative

Recovery Objective:

The hairy rattleweed could be considered for delisting when the four conditions outlined initially in PART II - Recovery of this Plan are met. The narrative section which follows includes proposals and approaches to serve as reasonable actions for meeting the conditions set forth for possible delisting in the future.

1. Protect habitat and existing populations of the hairy rattleweed.

Protecting existing populations and the habitat upon which it depends probably represents the first and best opportunity for assuring survival of the hairy rattleweed. This will require a diligent and cooperative effort by the various

landowners and management agencies. Any other alternative to in situ perpetuation of a species is less than satisfactory; therefore, it is imperative that every effort be made to secure eight or more populations within its historic range.

Efforts should also be made to encourage natural regeneration in its current localities, and to determine the habitat factors essential to maintain and expand the populations.

11. Encourage private landowners to protect existing stands.

Most of the land which supports stands of the hairy rattleweed is owned by two large forest products corporations; Brunswick Pulp and Land Company, and Rayonier Corporation. These corporations use their lands for profit,

harvesting timber, then reforesting to provide future timber supplies. Every effort must be made to obtain a formalized, contractual agreement with one or both of these corporations to protect a sufficient number of populations to insure survival in the natural habitat. Cooperative agreements to protect representative stands of the hairy rattleweed should be obtained as early as possible. The companies should be encouraged to implement management practices beneficial to the species; e.g., controlled burning.

12. Alert The Georgia Department of Transportation and county highway departments to locate and protect stands of the plant on road rights-of-way.

The vulnerability of the hairy rattleweed on highway rights-of-way is not as acute as in the adjacent pinelands. However, as the

species declines as a result of reforestation practices, the road sites become more significant. State and County highway departments should be contacted, made aware of the importance of locating existing stands on their rights-of-way, and encouraged to initiate maintenance practices that will protect existing stands. Highway departments should be informed of this preservation effort in writing, and encouraged to keep updated maps of stand locations. Highway maintenance personnel should be trained in the identification of the species and encouraged to protect it whenever possible.

13. Alert Georgia Power Company, or any other public utility owning rights-of-way within the plants' range, to locate and protect existing stands.

Georgia Power Company owns a right-of-way for an electrical transmission line, basically paralleling the north side of highway GA-32 in Brantley County. The same principles apply here as in task 12 above. Similar efforts should be made to elicit their cooperation, or that of any other utility company, in protecting the hairy rattleweed.

14. Encourage State or Federal protection of one or more tracts of land that contain vigorous populations of the hairy rattleweed.

There is a need for the responsible State and Federal agencies to assess the most appropriate means of habitat protection. Easements, memoranda of understanding, conservation agreements, and acquisition are among the possibilities. State or Federal protection of sufficient hairy rattleweed habitat should be initiated and strongly supported. This should receive top priority for the preservation of existing stands.

2. Monitor populations and their habitats.

Known populations as well as any new ones that may be located should be monitored to determine changes that may occur in size, number, and location. The status of populations in response to successional changes and any manmade disturbances should be monitored both before and after "recovery".

21. Determine methods for monitoring populations.

Monitoring may be done in several acceptable ways; transects, grids, plots, prominent photo points, etc.

22. Monitor habitat trends.

Establish a systematic approach to monitoring. A designated system of permanent markers should be installed so that accurate records

can be maintained. Records should be made at least annually, and preferably on a seasonal basis, being performed about the same dates each year. Record documentation should include photographs of designated check points.

23. Periodically check sites for evidence of disturbance.

Site monitors should be assigned to briefly examine populations on a frequent basis and report disturbances, either manmade or natural, to the appropriate management official.

24. Gather data on population size and reproduction.

With the use of permanent transect lines, or other accepted sampling techniques, gather

information relative to population fluctuations. Decline in reproductive levels can be used as early indicators that habitat improvement work may be necessary.

25. Determine minimum population size for self-sustaining populations.

Research on the biology of the hairy rattleweed should provide a basis for determining the population size and characteristics necessary for a self-sustaining population.

3. Conduct searches for new stands of the hairy rattleweed.

Although the hairy rattleweed (as a distinct species) has been known since 1943, it has only been searched for sporadically. Many botanists have visited the Brantley-Wayne County sites but most of their specimens indicate that they were collected along easily accessible routes.

There needs to be a thorough systematic search made to locate new stands of this rare legume. Since virtually all the region in the Lower Coastal Plain of Georgia has habitats and plant associations that appear to match the requirements of the hairy rattleweed, it is possible that other sites could be found by a concerted search effort.

31. Identify potential habitats using aerial photography.

Many aerial photographs, including remote sensing mosaic imagery, are available. Common sources of aerial photos include the U.S.D.A. Forest Service, Agriculture Stabilization and Conservation Service, U.S. Geological Survey, Georgia Geological Survey, and the National Aeronautics and Space Administration. Use of aerial photos to identify potential habitats would greatly minimize land reconnaissance.

32. Conduct ground investigations of potential habitats to determine presence or absence of the hairy rattleweed.

Priority should be given to searching suitable sites in the vicinity of its known range. From there, additional searches should be made of all the likely sites as time and resources permit.

33. Train personnel to accurately identify the hairy rattleweed (also known locally as hairy wild-indigo).

Anyone associated with monitoring areas that are likely sites for the hairy rattleweed should be informed of the plant's rarity and trained to recognize it in the field. Persons likely to receive such instruction would include foresters, game wardens, farmers,

hunters, etc. Trained personnel could greatly assist the identification efforts, and enhance the possibility of finding new populations.

4. Preserve existing germ plasm through cultivation and storage.

A well designed and developed plan for cultivation will greatly improve the chances that the hairy rattleweed does not become extinct. Cultivation efforts should include plants produced from seeds as well as those which are propagated vegetatively. Making cultivated plants available to private and public agencies for research will greatly strengthen all preservation and recovery efforts. The continued maintenance of pollen - seed banks is very important to the preservation of this species. Any cultivation program is secondary to efforts to maintain and expand populations; it is, however, potentially

valuable. Should circumstances require it, reestablishment of the taxon in its natural range would depend on cultivated material.

41. Propagate the hairy rattleweed, maintaining representative populations.

Efforts should be initiated aimed at systematically propagating the species both by vegetative and sexual means. Some preliminary work has been done with each of these types of reproduction, but the initial results are insufficient to understand the best techniques that should be used for propagating the plant in quantity. As techniques are refined, propagation material should be obtained from as widely ranging populations as possible to ensure retention of a full complement of the taxon's gene pool.

42. Continue to maintain fresh seeds and pollen in established germ plasm banks.

Pollen - seed banks established by the Forest Service and/or other agencies will promote the conservation of the hairy rattleweed. The Forest Service's cold storage bank in Macon, Georgia, already has seeds, and perhaps pollen, in storage. New supplies of germ plasm should be deposited in this repository and perhaps others. Complete records should also be kept that catalog pertinent collection data, and the receipt and distribution of all pollen and seeds.

43. Establish stands at academic institutions, public botanical gardens, or in areas of state or federal jurisdiction.

Propagules should be made available to institutions interested and equipped to do research on the hairy rattleweed. These institutions should also be encouraged to

establish and maintain stands in test plots or gardens. Records derived from cultivation of the species will augment those obtained from its natural habitat. Callaway Gardens and the Botanical Garden at the University of Georgia are ideal places within Georgia where cultivation of the hairy rattleweed should be encouraged. Similar institutions throughout the southeast which show interest in the plant should also be utilized. Attempts to introduce the hairy rattleweed back into its natural habitat should also be encouraged, but there would need to be sufficient evidence that new locations were within the species' historic range and preferably in areas of state or federal jurisdiction to promote long-term protection.

5. Conduct autecological research.

Autecological research on the hairy rattleweed is lacking and is very much needed. The kinds of data it will produce are essential for implementing successful management and recovery efforts.

51. Study in detail the life history of the hairy rattleweed.

The biology of most endangered species is poorly understood. Obtaining and synthesizing baseline data on all aspects of the species' life cycle and its habitat are required before management, and ultimately recovery, can be sensibly approached.

511. Map vegetation at natural sites.

Detailed mapping of vegetation in its natural habitats will probably indicate

more about the hairy rattleweed habitat requirements than has formerly been understood or suspected.

512. Establish permanent monitoring plots at one or more natural populations.

The purpose of permanent sampling stations is to document changes which occur in populations. Unless such data are available, management efforts are aimless.

513. Assess changes in population size and distribution of age classes.

Early detection of increases or decreases in colony size should dictate the urgency and speed of implementing the various aspects of this recovery plan.

514. Determine the plant's reproductive and breeding systems.

In addition to the obvious aspects of flowering - fruiting times and percent of seed set, the more subtle aspects of the hairy rattleweed's breeding system should be determined. For example, is the plant self-fertilized (autogamous) or cross-fertilized (allogamous)? If autogamous, does syngamy involve gametes from a single flower, or from different flowers on the same plant (geitonogamy)? Does the plant reproduce asexually (apomixis)? Knowledge of these systems may determine the degree of success in cultivating the species, and also prescribe the use of very specific management procedures.

515. Identify pollinators or vectors of dissemination.

In both autogamous and allogamous breeding systems, the mechanism of pollen transfer from anther to stigma is significant, pollination being a crucial stage in the plant's life history. What type of pollination does the hairy rattleweed require; wind, water, insect, bird, snail, etc.? The same information is also needed for mechanisms or agents of seed dissemination and dispersal. Life history studies are incomplete without this kind of information.

516. Study germination and establishment processes.

It is well known that success in seed germination may be improved by

manipulating light, water, temperature, and oxygen regimes. In addition, germination involves breaking seed dormancy which may require scarification or stratification. The factors required for successfully germinating hairy rattleweed seeds need to be determined. Reproduction should be conceived only when seeds have germinated and the seedlings have become established. Establishment is here defined as that period beginning with the end of germination and ending with a seedling independent of accumulated food in the seed. Germination and establishment are crucial periods in the life history of a plant, for it is in these stages (of any species) that the greatest number of individuals are lost. Virtually nothing is known about these vulnerable stages in the life history of the hairy rattleweed.

52. Identify limiting factors.

Management of the hairy rattleweed would be greatly improved if growth limiting factors were known. The physical, chemical, or biological factors which may limit its growth need to be determined.

521. Define edaphic requirements.

Identification and description of soil requirements will assist in circumscribing the plant's habitat more accurately. Knowledge of soil series and hydrology requirements will also help identification of potential new locations.

522. Define light relations.

The hairy rattleweed seems to thrive best in diffuse light produced by

widely-spaced pines having small crowns. An evaluation of light requirements would aid in understanding the physical conditions necessary for survival and growth. For example, is the diffuse light incidental or actually required for proper growth?

523. Examine effects of competition by other vegetation on survival and reproduction.

Increased competition seems to result in weakened populations. The degree of competition the hairy rattleweed can tolerate, and which plants are most competitive with it, are not known. Data obtained by experimentally testing various aspects of competition by other vegetation could suggest some of the most immediate and cost-effective management strategies.

524. Determine and study other types of biological competition; e.g. parasitism, predation, etc.

Symbiotic relationships affecting the hairy rattleweed need investigating, particularly those which produce adverse effects such as amensalism and exploitation by parasitism and predation. For example, the effect of Say's weevil on the hairy rattleweed's reproductive potential is unknown.

53. Determine effective management options.

Since its discovery, the hairy rattleweed has become more scarce, apparently due to two major factors: (a) increased habitat destruction by modern reforestation practices; and (b) increased competition by other vegetation caused by less frequent fires throughout its range. Current information

indicates that maintenance of this species depends on management of these two factors. Studies are needed to resolve the uncertainties as to the appropriate type and frequency of habitat management.

531. Conduct experimental burning.

The large perennial rootstock of the hairy rattleweed is characteristic of a fire tolerant species and suggests that fire is important in maintaining a favorable habitat. Experimental burns need to be done to ascertain if fire is necessary. If fire is required, the time of year when burning is most effective for reducing competition and promoting reseeding and establishment of new individuals should be determined.

532. Conduct experimental reforestation.

Kral (1980) and others feel that the hairy rattleweed might survive the conventional practices of clear-cutting trees from its habitat, but agree that the current methods of chopping, raking, and bedding with heavy machinery prior to replanting is very destructive. In addition to the preservation of undisturbed colonies as proposed in task 11 of this outline, the forest products corporations should be encouraged to use experimental reforestation alternatives to their practices. Their findings could lead to utilization of their lands and still augment the efforts directed toward recovery of this species.

533. Assess the effects of pesticides and herbicides on the plant.

There is an increasing tendency to use these compounds for management purposes. The effects (including tolerance thresholds) of these materials on the hairy rattleweed should be assessed before they are used in managing populations. The risk is too great otherwise. Cultivated, rather than natural, stands should be employed first in the experimental testing of pesticides and herbicides.

534. Prepare management recommendations.

Using data gathered from tasks 2, 3, and 5, recommendations should be made concerning the optimum management of the hairy rattleweed. The recommendations should be made available to all agencies or individuals with management authority

over the species and its habitat, and should be included in any management agreements.

6. Develop public awareness and support.

Public opinion can be influential in spurring both public and private sectors into action. The public needs to be educated about the desirability and the necessity of preserving the hairy rattleweed from extinction. Since the species does not possess unusual attributes that would arouse public interest, perhaps the appeal of its intrinsic value as a biological entity needs emphasis in developing interest in protection.

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PART III.

IMPLEMENTATION SCHEDULE

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

- Priority 1 - Those actions absolutely necessary to prevent extinction of the species.
- Priority 2 - Those actions necessary to maintain the species' current population status.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

IMPLEMENTATION SCHEDULE

Hairy Rattleweed

General Category	Plan Task	Task		Priority	Duration	Task	Responsible Agency		Estimated Fiscal Year Costs			Comments/Notes
		Number	Task				FWS	Other	FY1	FY2	FY3	
A3	Encourage private landowners to protect existing stands	11		1			4	DNR GBS				DNR has 3k for technical assistance in FY84
A3	Encourage Georgia DOT to protect existing stands	12		1			4	GDOT, Co.				
A3	Encourage Georgia Power Company to protect existing stands	13		1			4	GPC DNR				
A3	Encourage State or Federal protection of one or more sites	14		2			4	DNR				

IMPLEMENTATION SCHEDULE

Hairy Rattleweed

General Category	Plan Task	Task		Priority	Duration	Task	Responsible Agency		Estimated Fiscal Year Costs			Comments/Notes
		Number	Task				FWS	Other	FY1	FY2	FY3	
II	Determine population monitoring methods	21		2			4	DNR	2k	1k	1k	
II	Monitor habitat trends	22		2								
I2	Check sites for disturbance	23		2								
I6	Gather data on population size and reproduction	24		2								
I6	Define self-sustaining population	25		2			4	DNR				

IMPLEMENTATION SCHEDULE

Hairy Rattleweed

General Category	Plan Task	Task Number	Priority	Duration	Task	Responsible Agency		Estimated Fiscal Year Costs			Comments/Notes
						FWS	Other	FY1	FY2	FY3	
II	Identify potential habitat	31	3				DNR GBS	2.5k			
II	Conduct ground search	32	3								
01	Train personnel to identify hairy rattleweed	33	3								
M1	Propagate hairy rattleweed	41	3				FS, CG	1k			
	Maintain in germ plasm banks	42	3								
M2	Establish new stands	43	3				DNR BPL, RC				
II4	Study life history	51	3				DNR	3k	2k	2k	

IMPLEMENTATION SCHEDULE

Hairy Rattleweed

General Category	Plan Task	Task Number	Priority	Task Duration	FWS	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
						Region	Program	Other	FY1	FY2	FY3	
I3	Map vegetation	511	3									
I6	Establish monitoring plots	512	3									
I6	Assess population changes	513	3									
I14	Determine reproductive and breeding systems	514	3									
I14	Identify pollinators	515	3									
I14	Study germination and establishment	516	3									
I3	Define edaphic requirements	521	3									
I3	Define light relations	522	3									

IMPLEMENTATION SCHEDULE

Hairy Rattleweed

General Category	Plan Task	Task Number	Task	Priority	Duration	Task	Responsible Agency		Estimated Fiscal Year Costs			Comments/Notes
							FWS	Other	FY1	FY2	FY3	
I10	Examine competition by vegetation	523	3									
I9	Examine other competition	524	3									
I4	Determine effective management	53	3				4	DNR, DOT, BPL, FS, FC, RC				
I4	Conduct experimental burning	531	3									
I4	Conduct experimental reforestation	532	3									
I12	Assess effects of pesticides, herbicides	533	3									
M3	Prepare management recommendations	534	3				4	DNR, DOT, BPL, RC				

IMPLEMENTATION SCHEDULE

Hairy Rattleweed

General Category	Plan Task	Task		Priority	Duration	Task	Responsible Agency		Estimated Fiscal			Comments/Notes		
		Number	Year				FWS	Region	Program	Other	Year Costs			
											FY1		FY2	FY3
01	Develop public awareness and support	6	3											

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES *

Information Gathering - I or R (research)

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

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

Acquisition - A

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

Other - 0

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

* (Column 1) - Primarily for use by the U.S. Fish and
Wildlife Service

APPENDIX

LIST OF REVIEWERS FOR THE HAIRY RATTLEWEED RECOVERY PLAN

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