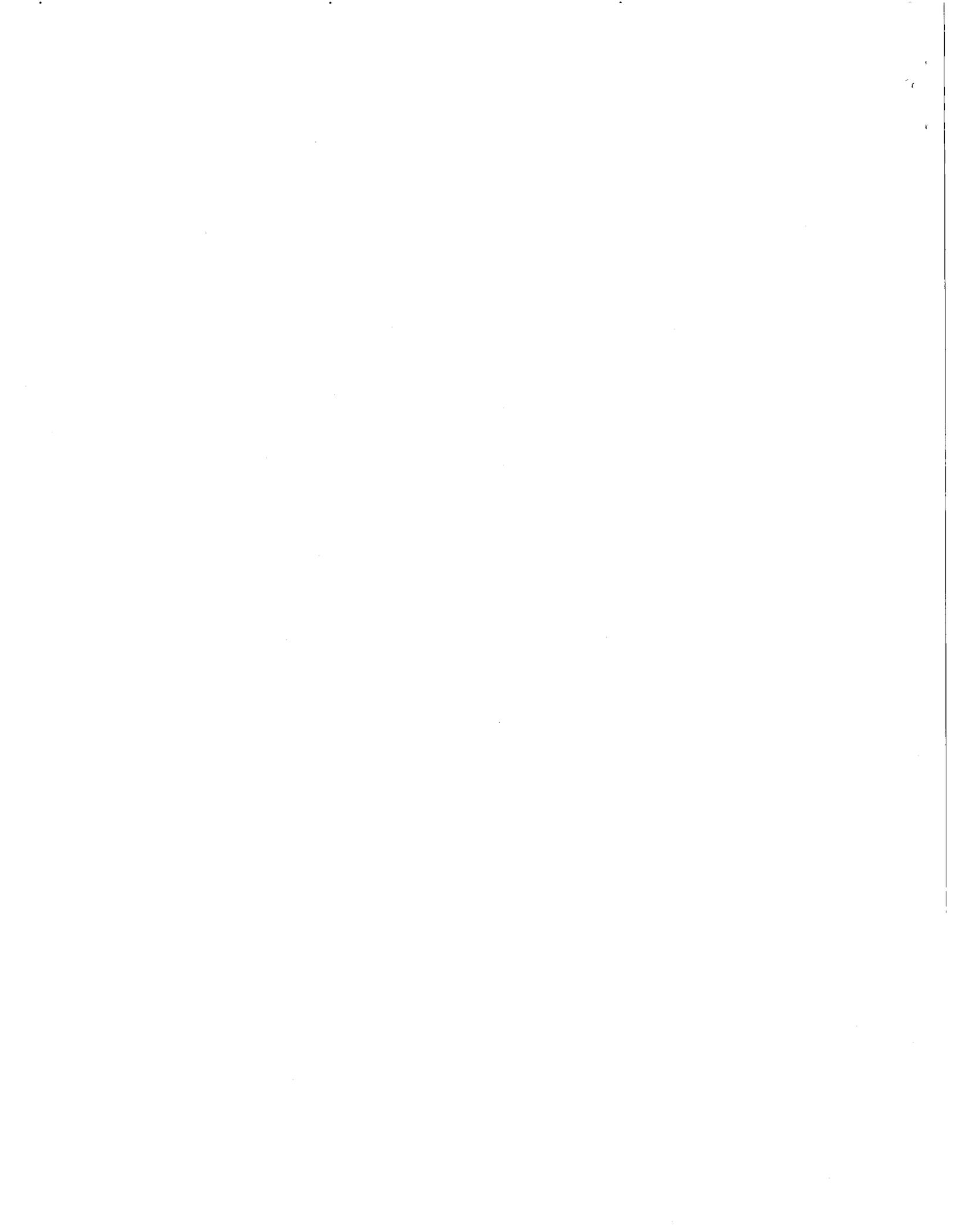


CLAY PHACELIA
PHACELIA ARGILLACEA ATWOOD
RECOVERY PLAN





PHACELIA ARGILLACEA ATWOOD

RECOVERY PLAN

Prepared by

Phacelia argillacea Recovery Committee

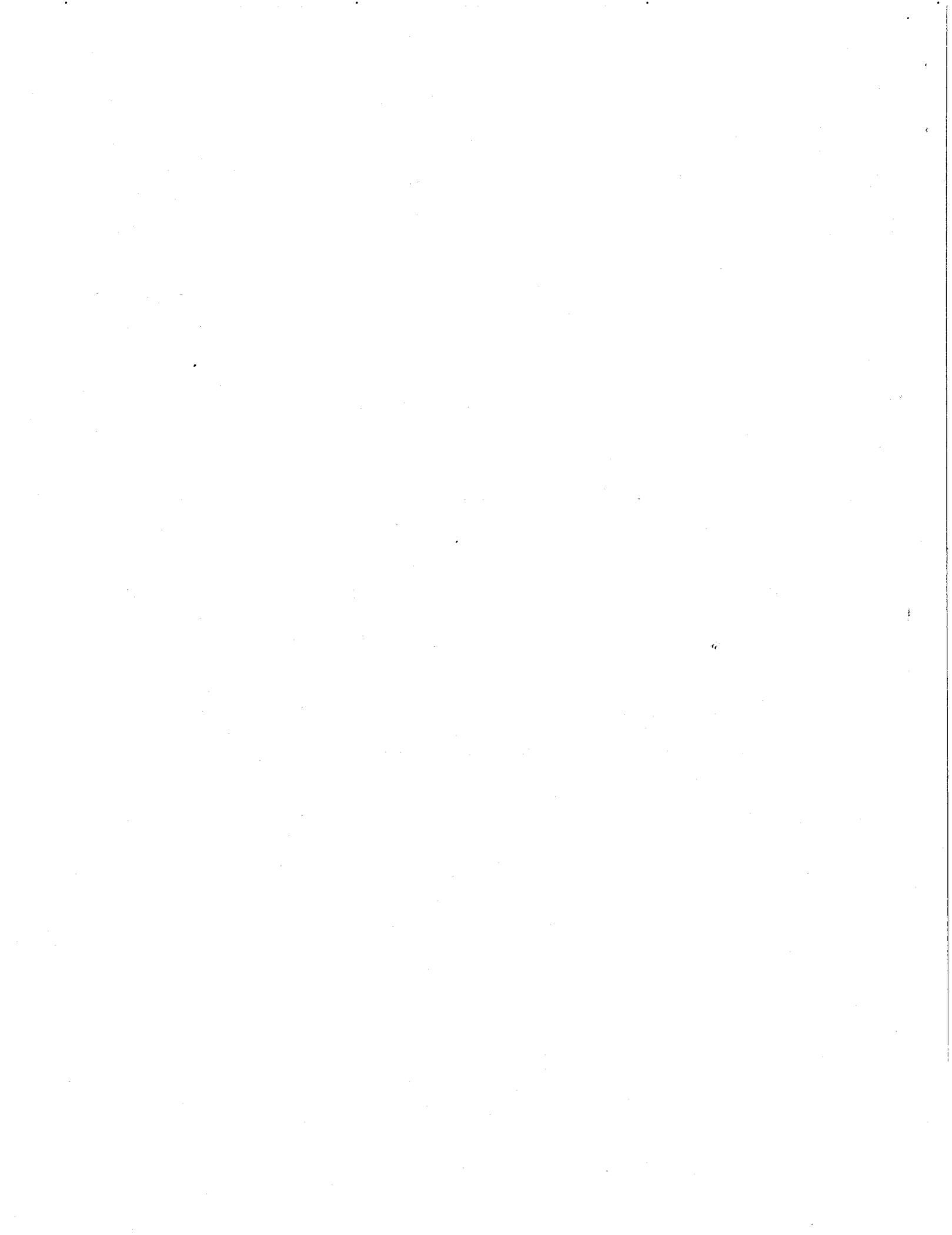
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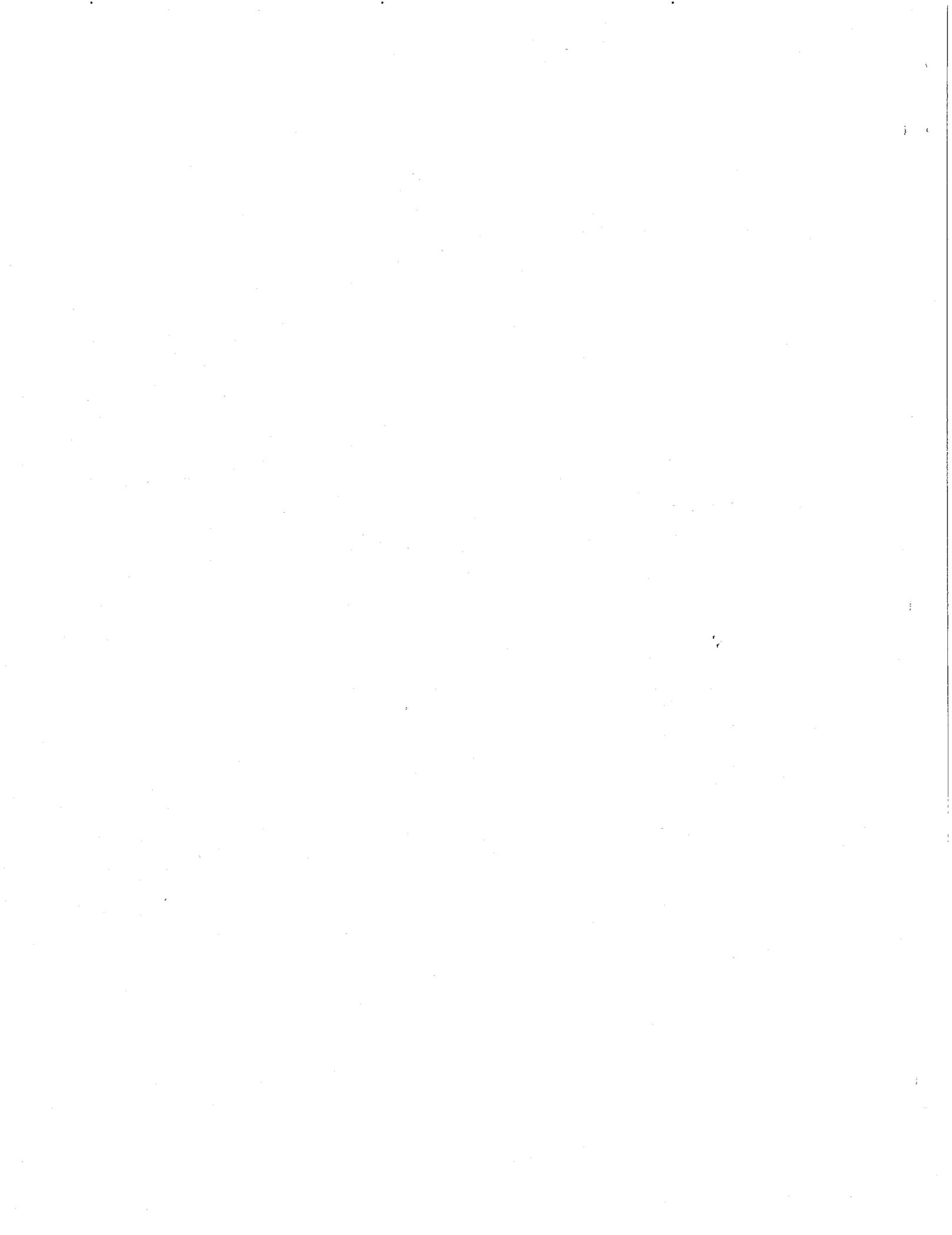
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Director, U.S. Fish and Wildlife Service

Date: 12 APR 1982



DISCLAIMER

THIS IS A COMPLETED PHACELIA ARGILLACEA 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 RECOVERY TEAM MEMBERS/ INDIVIDUALS), WHO PLAYED THE KEY ROLE IN PREPARING THIS PLAN. THIS PLAN IS SUBJECT TO MODIFICATION AS DICTATED BY NEW FINDINGS AND 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 BUDGETARY CONSTRAINTS.



ACKNOWLEDGMENTS

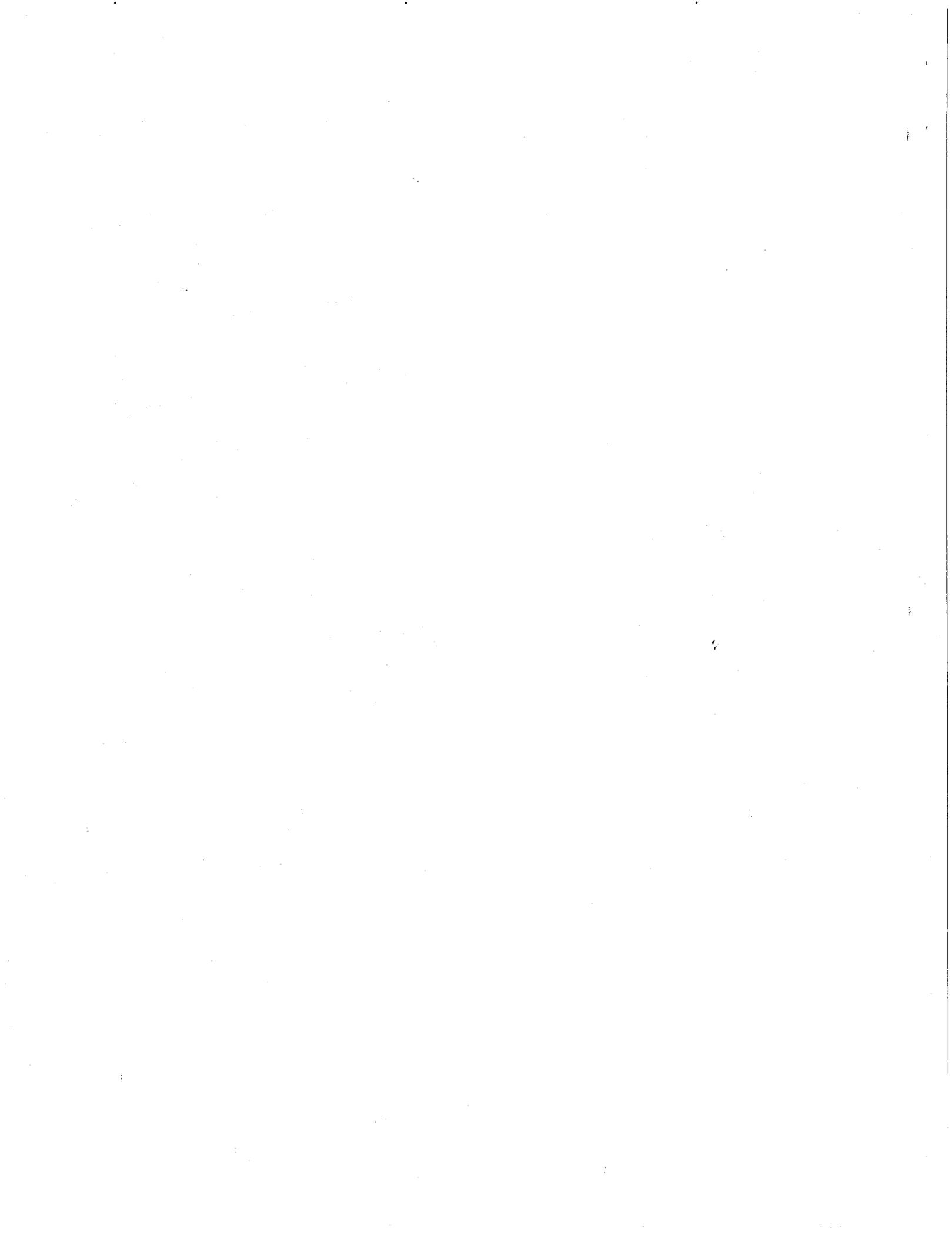
The following consultants provided valuable expertise, criticisms, and technical review as this recovery plan was developed: Dr. Stanley Welsh, and Dr. N. Duane Atwood.

The picture of the clay phacelia used on the cover was drawn by Kaye Thorne, Technical Illustrator at the Brigham Young University Herbarium.

Additional copies may be obtained from:

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PREFACE

The Phacelia argillacea Recovery Plan is intended to serve as a guide for research and management activities in Utah which will lead to the preservation and enhancement of the species and its habitat. This plan identifies specific objectives, timetables, and activities. It also suggests funding responsibilities for a 3-year period. The cooperation of Federal and State agencies, university personnel, and concerned citizens is vital to the success of the planned recovery effort.

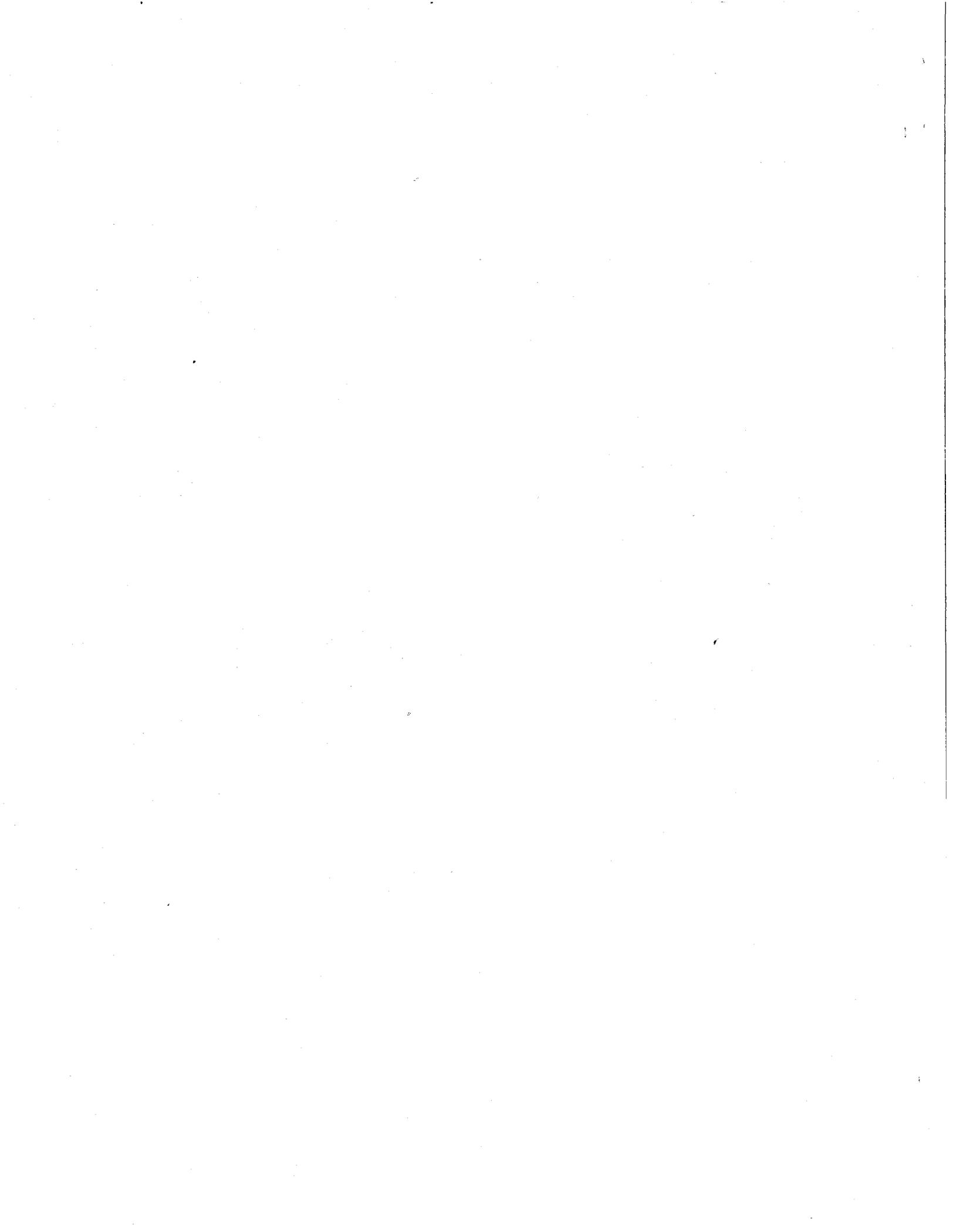
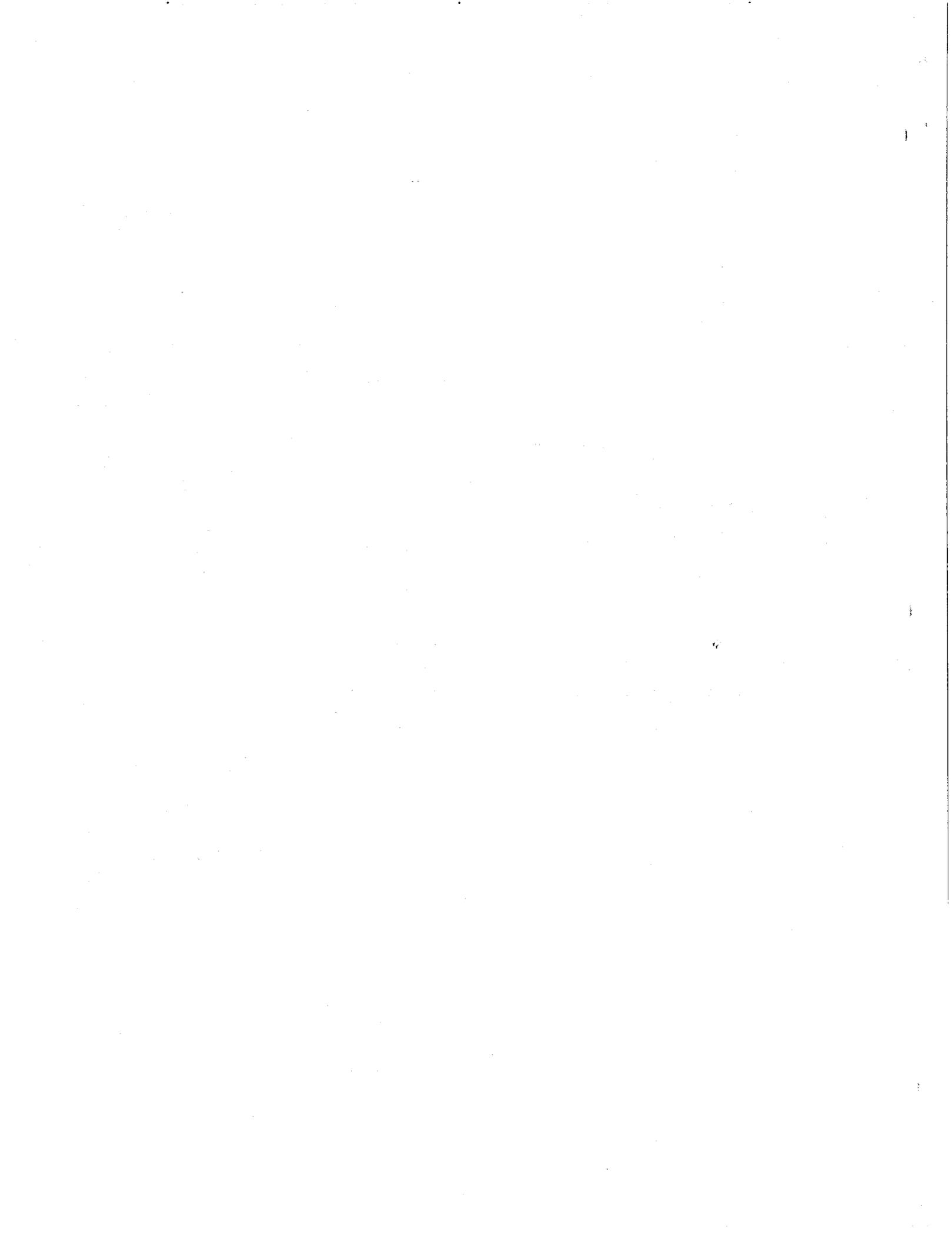


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PART I

INTRODUCTION

Description

The clay phacelia is a winter annual, 1 to 3.5 dm tall; stems finely pubescent; leaves pinnatifid, 0.8 to 6 dm long, 0.5 to 1.5 cm wide, petioles strigose; inflorescence a compound scorpioid cyme, with stipitate-glandular to hirsute pubescence; pedicels 0.7 to 1 mm long; sepals elliptic to oblanceolate, 2 to 3.8 mm long, 1 mm wide, with stipitate-glandular pubescence; corolla campanulate, blue to violet, 5 mm long and as wide, with exerted stamens and style; capsule subglobose, 3.5 mm long and 2.4 mm wide, with glandular and setose pubescence; four mature seeds, these brown, ovate to elliptic, with a single groove on one side of the ventral rib.

History

The clay phacelia (Phacelia argillacea Atwood) was initially collected by Marcus E. Jones at Pleasant Valley Junction (near present Colton siding), Wasatch County, Utah, in 1883. The species was collected by Jones a second time at Clear Creek near Soldier Summit, Utah County, Utah, in 1894. Jones did not recognize it as a new species. Any added knowledge of this species in Utah languished for the next three-quarters of a century. Rediscovered by N. D. Atwood in 1971, the plants were initially identified with the closely related P. glandulosa Nutt. The Utah County materials were found to differ in substantial ways from populations of P. glandulosa and were described and named as a new species in 1973 (Atwood 1973).

Search for the two localities known by Jones has turned up only the Clear Creek population. The Colton locality has not been rediscovered, or the plants may have been eradicated since the initial discovery in 1883. The one known population has fluctuated from a high number of about 15 plants in 1971 to a low of two plants by mid-summer of 1979. In 1980 potential habitat areas were surveyed within a 2-mile linear area southeast and a 3-mile linear area northwest of the existing population. The Clear Creek population was found to extend to the southwest across highway 50 and now numbers approximately 200 plants.

The region is not well known botanically. Population data and additional inventory work are needed. This recovery plan attempts to identify the requirements of the species, and proposes a practical approach to achieve the goals of inventory and knowledge of soil peculiarities, life history, and other requirements. This plan will be updated as information is developed on population dynamics and management needs of the plant.

The clay phacelia was originally known from two localities, as indicated above. The plants were collected in flower in July and August some eleven years apart by Marcus E. Jones. They were identified by Jones as P. glandulosa Nutt. Size of the populations discovered by Jones is unknown. Only by intuitive sleuthing was Dr. N. D. Atwood able to rediscover the Clear Creek population in 1971. Jones was known to have traveled by horse and buggy, bicycle, and railroad. Locality data on his labels are meager, and often misleading or cryptic. The Colton location was indicated merely as "P. V. Junction." Also, he tended to accumulate specimens between geographic localities and to assign them to the location they were nearest. Thus, the P. V. Junction materials could have been collected as far removed as the Clear Creek locality and still have been designated as from P. V. Junction. Atwood (personal communication, 1979) found the Clear Creek plants by walking for several miles along the Denver and Rio Grande Western (D & RGW) railroad right-of-way west of Soldier Summit.

The clay phacelia was recommended for endangered status in the 1975 Smithsonian publication "Report on endangered and threatened plant species of the United States," and by Welsh, Atwood, and Reveal (1975). A proposed rule of Endangered status for the species was published in the Federal Register by the United States Fish and Wildlife Service in June 1976. A final rule in which the clay phacelia was designated as endangered was published in the Federal Register on September 28, 1978. The recovery committee was established in December of 1978.

Past and Present Status

The clay phacelia apparently arose from an ancestral prototype of wide distribution in Colorado, Idaho, Wyoming, and Utah. Phases of that supposed prototype exist in those regions today under the name of Phacelia glandulosa. Populations in Utah were isolated on peculiar edaphic substrates, presumably following climatic changes. Of the many modes of speciation it appears that the isolated populations accrued mutations and became specifically adapted to the local peculiar interaction of substrate and climate. Label data provided by Jones does not include information on demography. Habitat destruction resulted during the period of construction of the D & RGW railroad in the 1880's. The Clear Creek population was bisected by the railroad. The Pleasant Valley or Colton population, if the plants reputed for the location came from there, may have been extirpated. The Clear Creek population is apparently declining.

In 1971, about 15 plants were observed by N. D. Atwood (personal communication, 1979). That same number was present in the summer of 1977, but by 1979 only seven plants were seen at the beginning of the season (S. L. Welsh, personal communication, 1980). That number was reduced to four by

trampling from a flock of sheep which crossed the region in May. Two of the four surviving plants were damaged by the sheep, and only two persisted in production of flowers late into the summer season. These were further damaged by rock squirrels which chewed branches from the plants in late summer. An inventory in the summer of 1980 disclosed a new site with approximately 200 plants 1/4 mile to the southeast across the highway from the previous site which still numbered less than 10 plants. The coincidence of this plant being a winter annual and its habitat being restricted by climatic changes and edaphic factors has made this species vulnerable to extinction. The impress of human activities and features on the habitat has led to degradation of the region and loss of essential habitat.

Distribution

Phacelia argillacea is known only from one small population in Utah County, Utah; specifically near Tucker, in T.10S., R.6E., SW $\frac{1}{4}$ Sec. 24. Plants were known historically from a second area, presumably in the vicinity of Pleasant Valley Junction, southeast of Soldier Summit. The second locality has not been relocated since its initial discovery in 1883. The entire region must be surveyed intensively to ascertain whether other populations exist.

Threats

Destruction of portions of the population and modification of habitat have jeopardized the clay phacelia. The D & RGW railroad and a maintenance road bisect the only known population. Construction activities by the railroad company such as stabilization of cuts and fills, control of runoff, and storage of material have further modified the habitat. The company is aware of the plant and has a positive attitude toward its protection. Sheep have moved through the population area, trampling some of the plants, and squirrels have grazed portions of the plants.

The species grows on a sequence of strata in the Garden Gulch and Douglas Creek members of the Green River Formation. These members are of limited distribution in the portion of Utah where there might be dispersal of the species. Still, the substrate is of sufficient breadth that very large populations could presumably be supported if there were no other limiting factors on the species.

Population Dynamics and Life History

The clay phacelia is a winter annual. In nature, germination takes place in late summer or early autumn, stimulated by late summer or early autumn storms. Following germination, the cotyledons enlarge and become photosynthetic. Initial foliage leaves are small, but by early to mid-

October they have formed into basal rosettes from 1 to 7 cm in width. The rosettes continue to grow slowly beneath the cover of winter snow, and begin to bolt only after the snow melts and soil and air temperatures increase sufficiently in May. By late May, the first flowers are opened. As the size of plants increases, the number of flowers displayed by each plant becomes greater, until a climax is reached in late June or early July. Size of plants seems to be a function of amount of soil moisture available to the plants. Spring and early summer rains appear to be important in allowing plants to continue flowering through the summer and into the autumn. Last flowers were observed in mid-October on a short branch of the skeleton of one of the survivors in the 1979 flowering season.

Substrate of the clay phacelia is a shaley clay colluvium of Green River Shale. The present population persists in two quite different phases of that formation. The plants east of the railroad grow mainly on a fine-textured clay derived from a poorly consolidated shale member of the formation. Those from west of the railroad grow on a platey slope, with roots penetrating into a buff-to-gray colored clay beneath the platey shingle. Exposure of both portions of the population is to the east and southeast. The sites are xeric because of steepness of slope and exposure. Both of the population areas are free of snow at one or more times during the winter, and dry early in the spring. The plants are included within a pinyon-juniper and mountain brush ecotone. Species from both of those types grow in close proximity to the clay phacelia, but none of those grow directly on the exposed shaley slopes with this species. The yellow-flowered buckwheat, Eriogonum brevicaule grows with it; however, Mentzelia laevicaulis and the adventive houndstongue; Cynoglossum officinale, are known from the steep shaley slopes.

The known populations are precariously situated on property of the D & RGW railroad, the Utah Department of Transportation and John H. Aagard and Vance W. Aagard.

PART II

RECOVERY

OBJECTIVE: To establish a self-sustaining population of 2,000 to 3,000 individuals on 120 acres of protected habitat and possibly establish at least one new population.

The following jobs are necessary to obtain the above objective: (1) the protection of individual specimens which grow in the known habitat area so as to assure continuation of the meager seed supply; (2) to survey the Green River Formation and adjacent areas in order to ascertain the presence of additional populations; (3) to introduce plants into suitable habitat(s); (4) to conduct a public information program; and (5) to monitor existing and new populations.

The clay phacelia is endangered because its known distributional area is very small, sheep trample the plants, squirrels cut branches from the plants, and the habitat is jeopardized by continuing activities along the railroad. Perpetuity of this species is in doubt. Only if the population can be protected in its limited habitat, propagation measures determined, and the species successfully reestablished at its known population area can the survival of this aesthetically pleasing plant be assured. The establishment of an adequate self-sustaining population of 2,000 to 3,000 individuals on protected and suitable habitat consisting of 120 acres will assure the continued survival of this plant. Once the objective is achieved, the clay phacelia can possibly be downlisted, depending upon the nature of the threats to the species.

STEP-DOWN OUTLINE

OBJECTIVE: To establish a self-sustaining population of 2,000 to 3,000 individuals on 120 acres of protected habitat and possibly establish at least one new population.

1. Protection of individual specimens and habitat.
2. Inventory of Green River Formation and surrounding areas.
3. Introduce plants into new habitat.
 31. Determine various biological measurements.
 311. Climatological measurements.
 312. Determination of soil requirements.
 32. Develop cultural procedures.
 321. Seed selection for harvest.
 322. Field testing.
 323. Establishment of a seed source.
 324. Propagation by meristemming.
 33. Establishment of seeds and seedlings in the natural setting.
4. Conduct a public information program.
 41. Annual news releases.
 42. Liaison with railroad company and Utah Department of Transportation.
 43. Public display in local botanical gardens.
5. Monitor existing and new populations.
 51. Visual checks of existing populations.
 52. Visual checks of new populations.
 53. Delisting.

NARRATIVE

1. Protection of individual specimens and habitat. As an initial phase of the recovery plan, those plants which are known should be protected by covering them with a utilization cage similar to those used by Federal land management agencies, modified to prevent animals from digging beneath them. The mesh should be of such size as to exclude squirrel-size animals. The goal of this proposed action is to allow plants to produce a maximum amount of seeds. Protection of the smaller northeast portion of the Tucker population (only about 1 acre in size) seems impractical due to the topography, land ownership, and activities in the region. The land is owned by the D & RGW railroad. The activities include domestic and wildlife grazing and herbicide spraying, which make protection of the area impractical, the larger portion of the Tucker population southwest of U.S. highway 50 is owned by John H. Aagard. The Nature Conservancy has consented to approach Mr. Aagard in order to acquire the land on which the plant occurs with the aim of setting it aside as a botanical preserve.
2. Inventory of Green River Formation and surrounding areas. Concurrent with establishment of a monitoring station at the existing population and with the collection of soil samples, an intensive inventory should be undertaken to ascertain the presence of additional populations. The area to be inventoried should include the Green River Formation and Colton Formation from the Sheep Creek-Red Narrows area of Spanish Fork Canyon to the head of Price Canyon east of Soldier Summit. The area to be investigated is about 30 miles long and up to 2 miles wide. Surveys should be conducted during June and early July when the plants would be most visible. A follow-up survey should be undertaken during a second and third years to allow for areas where plants did not mature during the previous year because of weather patterns. The second and third surveys need not cover the entire region, but only those locations determined to be likely candidates during the first-year investigation.
3. Introduce plants into new habitat.
 31. Determine various biological requirements.
 311. Climatological Measurements. Concomitant with protection of individual plants could be the establishment of climatological equipment at the population site. Temperature, humidity, precipitation, and other factors should be measured. Climatological measurements should be taken for at least 3 years to provide some understanding of fluctuations in the weather patterns. Such measurements should provide a predictive capacity for establishment of the species at sites other than the one now occupied.

312. Determination of soils requirements. Soil should be taken from the vicinity of the known population, within the same strata as the plants are currently known to grow. Soil samples should be analyzed for the standard parameters, including texture, pH, and mineral nutrients. Initial germination tests and establishment of seedlings should be tried in soil taken from the known population area. Subsequent tests should involve other soils, but only after seed is obtained from plants grown in culture.

32. Develop cultural procedures.

321. Seed selection for harvest. An individual plant in good vigor might produce several hundred to several thousand seeds during a growing season. It seems best to leave a large number of the seeds within the general population area. Careful harvest of a small proportion of the seed production should enable experimentation on survival techniques. Germination needs to be studied, and substrates tested to ascertain kinds suitable for growth in the greenhouse and common garden. Day-length requirements should be investigated since the plants have been observed in germination only under a short-day regimen. A cooperative agreement should be developed between the Fish and Wildlife Service and the USDA-National Seed Storage Laboratory in Fort Collins, Colorado. Perhaps long-term gene-pool storage of endangered species would be possible and desirable at this facility. In addition experts at the laboratory may be able to determine optimum temperature germination parameters or other problems related to viability and germination.

322. Field testing. Other cultural requirements should include trials in field situations. Success shall be measured only if the plants can be brought to self-reproducing populations of sufficient size to allow removal of the species from the list of endangered and threatened plants. Field trials should include both seeds and transplanted seedlings from greenhouse culture.

323. Establishment of a seed source. A seed source should be maintained until it has been ensured that viable populations will continue to grow in the wild. Research should be carried out to determine whether seeds from clay phacelia can be germinated under domestic conditions and whether the plants can be grown in common garden settings.

324. Propagation by meristemming. This process is used in the culture of some vegetables and flowers and might be examined as a supplement to growing plants from seed. This process will not be used unless all other methods of propagation fails. The limited selection, of the gene pool used in this method is not sound because of already low diversity due to use of only a few individuals. These few plants once cloned will add no diversity to the species gene pool.

33. Establishment of seeds and seedlings in the natural setting.

Establishment of populations in the natural setting shall be the primary goal of the recovery plan. Propagation of individuals in gardens and greenhouses shall be considered as an adjunct to that goal. New populations will only be established in strict accord with Service policy. Sufficient seed production from cultivated plants to allow for field trials is a necessary requisite. Techniques will have to be developed which will allow adequate survival in the present habitat. Field tests will necessitate trials on different exposures, in different shale-to-clay mixtures, and on different slopes. Cooperation with local landowners and managers will be sought with the aim of establishing additional populations on their lands.

4. Conduct a public information program.

41. Annual news releases. The Public Affairs Office of the Fish and Wildlife Service should prepare an annual news release on the recovery progress of clay phacelia. Copies will be sent to the American Association of Botanic Gardens and Arboreta.

42. Liaison with railroad company and Utah Department of Transportation. The recovery committee and the Fish and Wildlife Service will maintain close liaison with the Denver and Rio Grande Railroad Company and the Utah Department of Transportation and will encourage each to publicize its actions to conserve this species.

43. Public display. A specimen will be placed in at least one local botanical garden for public information and education.

5. Monitor existing and new populations.

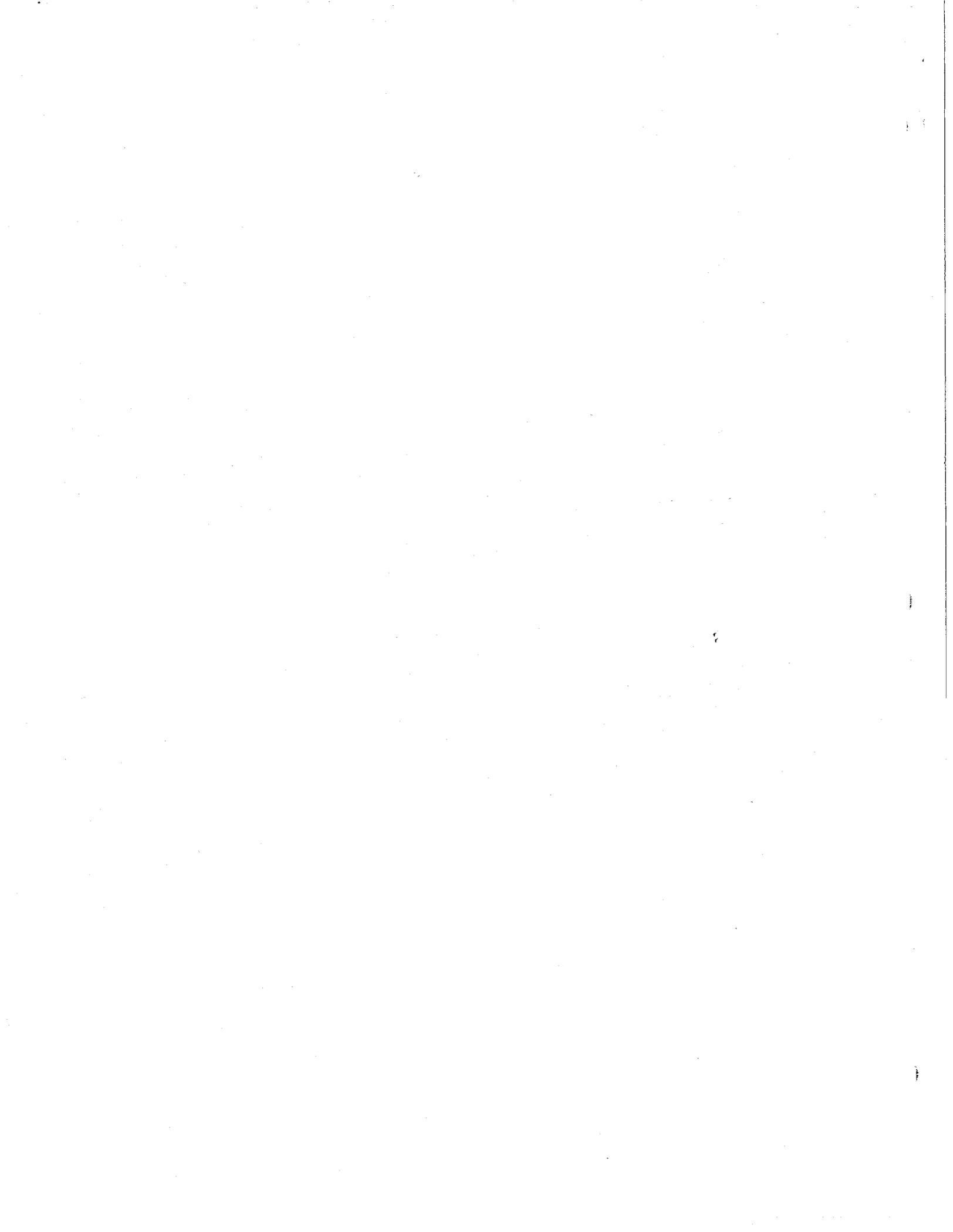
51. Visual checks of existing populations. The existing population will be checked quarterly to assure adequate conservation (species will not be checked during winter).

52. Visual checks of new populations. Newly established populations also will be monitored quarterly to determine survival and any conservation needs.

53. Delisting. Clay phacelia will be delisted when the Fish and Wildlife Service through collaboration with professional botanists, including the Utah Native Plant Society, is satisfied that adequate self-sustaining populations have been established.

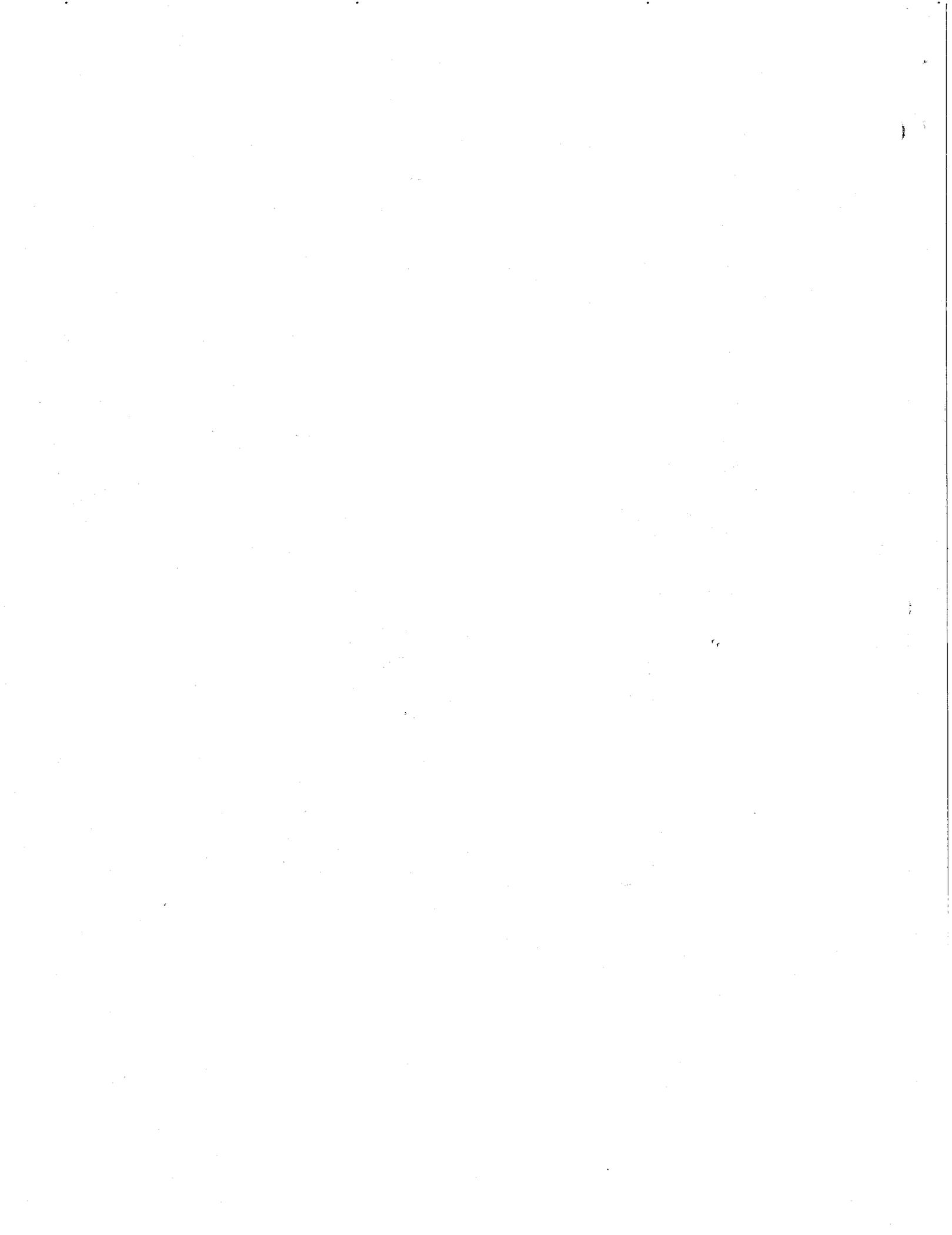
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PART III
IMPLEMENTATION SCHEDULE

PHASE: GENERAL CATEGORY	PLAN TASK #	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)			COMMENTS / NOTES
					REGION (6)	PROGRAM (6a)	OTHER (7)	FY-82 (8)	FY-83 (8)	FY-84 (9)	
(1)	(2)	(3)	(4)	(5)	(6)	(6a)	(7)	(8)	(8)	(9)	
M-3	Protection and recovery	1	1	on going	6	SE	None	500			
I-1	Inventory of surrounding area	2	2	3 years	6		None	5000			
I-3	Climatological measurements	311	3	2 years	6		None	1000			
I-3	Determination of soil requirements	312	3	1 year	6		None				
R-7	Seed selection for harvest	321	3	2 years	6		None				
R-7	Field testing	322	3	unknown	6		None				
M-2	Establish a seed source	323	3	unknown	6		None				
R-7	Propagation by meristemog	324	3	2 years	6		None	10,000		Five tasks are interrelated.	
M-2	Establish seeds/seedlings in natural setting	33	3	unknown	6		Forest Service				
O-1	Annual news releases	41	3	ongoing	6		None	minimal			
O-1	Liaison with railroad co. and Utah Dept. of Trans.	42	3	ongoing	6		Utah Dept. of Trans.	minimal			
M-3	Visual checks of existing populations	51	3	annually	6		None	volunteer			
M-3	Visual checks of new populations	52	3	annually	6		None	volunteer			
O4	Bulleting	53	3		6		None		2000	Preparation of de-Listing package	



Appendix A

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