

AUTUMN

BUTTERCUP

RECOVERY

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AUTUMN BUTTERCUP

RANUNCULUS ACRIFORMIS A. GRAY VAR. AESTIVALIS L. BENSON

RECOVERY PLAN

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DISCLAIMER

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

Literature Citations should read as follows:

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Cover illustration by Kaye Thorne, from Welsh and Thorne (1979).

EXECUTIVE SUMMARY

Current Status: The autumn buttercup is federally listed as endangered and is known from one small population of about 200 plants in a wet meadow on land owned by The Nature Conservancy near Bear Valley Junction in Garfield County, Utah, and four plants at The Arboretum at Flagstaff (Arizona). The species was listed as endangered on July 21, 1989 (54 F.R. 30550). The species has been assigned a recovery priority of 6 which indicates the plant is a subspecies with a high degree of threat with a low recovery potential.

Habitat Requirements and Limiting Factors: The autumn buttercup is restricted to perennially moist soils in wet meadows along the Sevier River. The species has a very small population and is known in the wild from just one site. The species is apparently highly vulnerable to grazing from domestic livestock, which have heavily utilized the entire present known habitat of the species. Heavy livestock grazing is currently occurring throughout the species historic range in the Sevier River valley. While livestock grazing has been eliminated at the known population site, the species continues to receive significant grazing pressure at this site, apparently from small mammals. The species' small population and restricted habitat make it highly vulnerable to any adverse impact to it or its habitat.

Recovery Objective: The goal is to prevent extinction through the protection of the existing population and the introduction of additional populations into suitable habitat.

Recovery Criteria: Increase current population to 1,000 plants on 10 acres. Preserve the species under controlled conditions in greenhouse and botanical gardens. Establish additional populations in suitable natural habitat with a total of at least 20,000 individuals.

Actions Needed:

1. Protect current habitat and potential introduction sites.
2. Inventory potential habitat to locate new populations and introduction sites.
3. Acquire and protect occupied and potential habitat.
4. Develop propagation techniques.
5. Conduct studies on the biology and ecology.
6. Introduce additional plants at the known site and introduction sites.
7. Develop public awareness and appreciation.
8. Develop downlisting criteria.

Total Cost of Recovery: Costs for preventing extinction of the species, which is the goal of this Recovery Plan, are estimated to be approximately \$400,000.

Date of Recovery: It is estimated that by the year 2001, the species can increase to the point where it is protected from extinction.

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PART I
INTRODUCTION

History

Ranunculus acriformis var. aestivalis (autumn buttercup) was first collected by Marcus E. Jones in early September of 1894 in Garfield County, Utah (Benson 1948). According to Jones' diary, he was at Orton's Ranch during this period of time (Jones 1895). Specimens of the buttercup collected by Jones were eventually deposited at Pomona College in Claremont, California, where Lyman Benson recognized its taxonomic uniqueness while preparing a monograph of the genus. In the autumn of 1948, Benson contacted a grandson of Orton who led him to a swampy area along the Sevier River where he discovered the buttercup and collected specimens from a group of 15 or 20 small clumps. Benson's type collection is located about 2.5 miles southeast of the old Orton ranch house and was probably part of the ranch at the turn of the century (Mutz 1984).

The taxon was thought to have become extinct sometime before 1975 (Ripley 1975). In August of 1974, Margaret Palmieri, a graduate student working on the genus Ranunculus for the State of Utah, was unsuccessful in locating the type collection (Palmieri 1976). In June and August 1982, Kathryn Mutz searched for the type location and also was unable to locate the buttercup. Benson's label information gave detailed directions to the type collection. The same directions were included in his Treatise addendum, so there appeared to be no mistake as to the location of the type collection.

On August 23, 1982, Kathryn Mutz located the autumn buttercup in a wetland above the Sevier River about 1 mile north of the type location (Figure 1). This was the first sighting of the species in over 30 years. This location, or the site of Benson's collection in 1948, could have been where Jones made his initial collection in 1894 (Mutz 1984). In 1983, Mutz revisited this site while under contract with the U.S. Fish and Wildlife Service (Service) to prepare a status report, and counted 407 mature plants and 64 seedlings. In 1984, the buttercup was observed and the area had been heavily grazed. In 1985, the area was again heavily grazed and trampled and only eight plants survived. On these eight plants, only one leaf was left intact (U.S. Fish and Wildlife Service 1985). In 1986, the site was moderately grazed and 14 plants were counted, 4 of which were in flower (U.S. Fish and Wildlife Service 1986). In 1987, the site was visited in early August and 12 plants were counted with 2 having floral buds. The area was revisited 3 weeks later and by that time it had been moderately grazed and all the flowering systems had been cropped (U.S. Fish and Wildlife Service 1987). In 1988, most of the 9 mature plants and 13 seedlings counted had been severely grazed by small herbivores, probably voles (U.S. Fish and Wildlife Service 1988). That same year (1988), the Service, with permission of the private landowner, installed cages over the remaining plants to protect them from livestock grazing. Eleven plants were counted in 1989, none of which flowered (U.S. Fish and Wildlife Service 1989). In January 1989, The Nature Conservancy purchased the species' last known habitat in a 44-acre tract of land and has excluded domestic livestock grazing since. In 1990, two additional sites within The Nature Conservancy's autumn

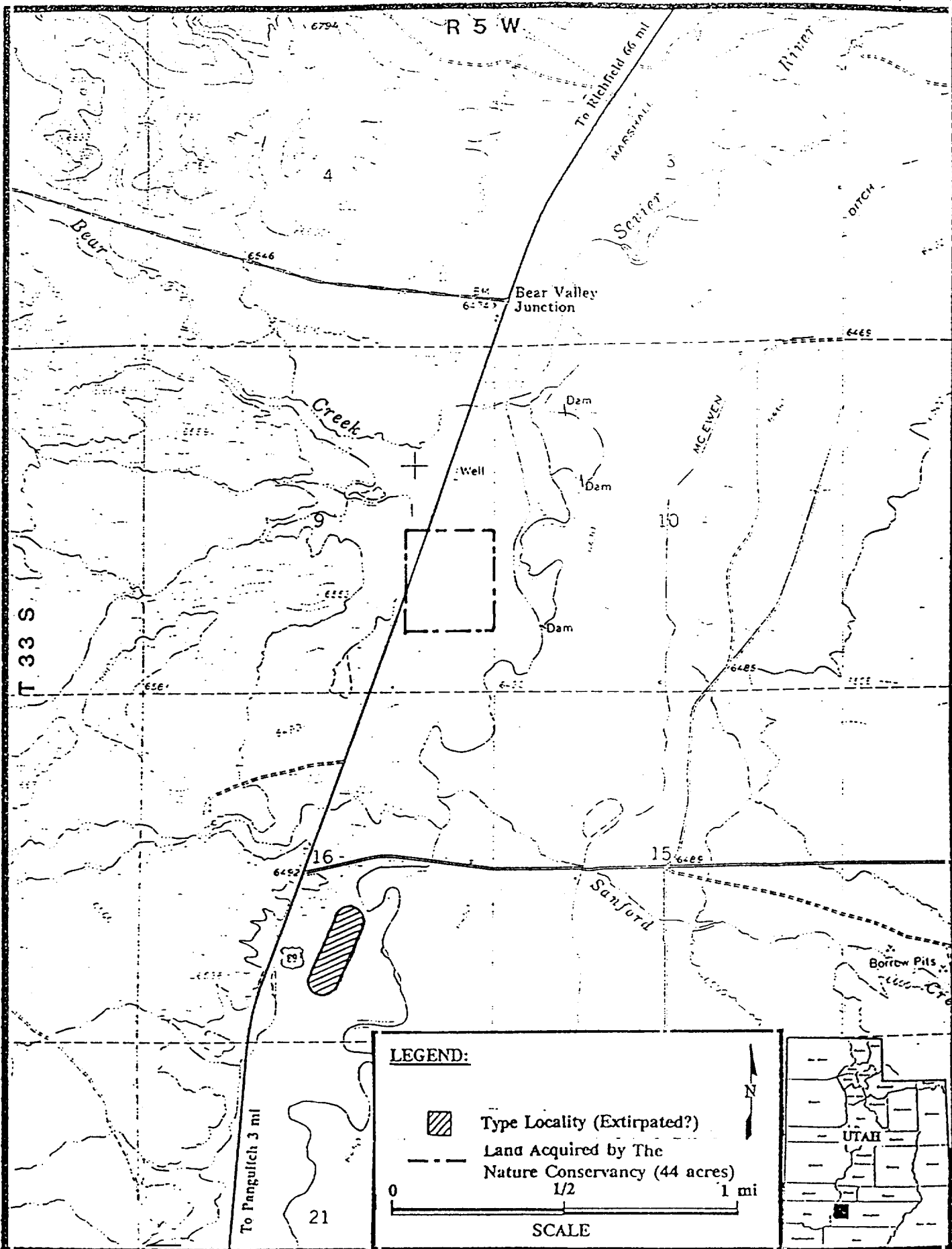


Figure 1: Past and present known locations of the Autumn Buttercup.

buttercup preserve were discovered. The current total known population is estimated at 200 individuals with 42 flowering plants including the previously known occupied site, which has increased to 32 individuals (Callister and Schelz 1990). In the July 21, 1989 Federal Register (54 F.R. 30550), the Service published a final rule to list the species as endangered.

Description and Taxonomy

The autumn buttercup is a herbaceous perennial plant normally growing between 1 and 2 feet (.3 and .6 m) tall. Most of the simple but deeply palmately five lobed leaves are clustered at the base of the stem. Palmately divided leaves with three linear lobes are found higher on the flowering stems. Leaves and stems are covered with fine hairs. Flowers, usually 6 to 10 per plant, are about 0.5 inch (1.2 cm) in diameter with five yellow petals and five reflexed yellow green sepals which fall off soon after the flower opens. Fruits of the buttercup are achenes. Twenty to forty of these small, dry, one-seeded fruits are clustered on the surface of the receptacle of the past flower in the shape of a cylinder or cone from 0.2 inch (.5 cm) to 0.4 inch (1.0 cm) high. For a technical description of the species, see Benson (1948), Palmieri (1976), and Welsh et al. (1987).

Benson (1948) followed a conservative taxonomic approach in his nomenclatural designations for the Ranunculus in his publication containing the scientific description and the naming of the autumn buttercup as Ranunculus acriformis var. aestivalis. In the same publication, Benson stated that by following a moderate policy in taxonomic determination it would be appropriate to designate the autumn buttercup as a species in its own right rather than a variety of R. acriformis (i.e., Ranunculus aestivalis). Ranunculus acriformis var. aestivalis has floral characters similar to typical R. acriformis, although tending to be somewhat smaller. Seed and leaf shape characteristics, however, are markedly different. Welsh (1986) and Welsh et al. (1987) assigned the taxon to R. acris as Ranunculus acris var. aestivalis based mainly on the pentagonal shape of the basal leaves. Thomas Duncan (University of California at Berkeley, pers. comm., 1990) has recently reevaluated the genus Ranunculus preparatory to its treatment in the proposed "Flora of North America" and will establish the autumn buttercup at species rank. Duncan postulates that the autumn buttercup represents a taxonomic bridge between R. acriformis of the interior continental northern Rocky Mountains and R. occidentalis of the more coastal mountains of the western United States and adjacent Canada and Mexico. For the purpose of this recovery plan we will use the current published name: Ranunculus acriformis var. aestivalis.

Distribution

The species was first collected in 1894 at Orton's Ranch in Garfield County, Utah, and initially described by Benson in 1948. It was not until over 30 years later, in 1982, that the species was rediscovered. The population at the type location described by Benson in 1948 is apparently extinct. Currently, there is only one known population found within an area of about 10 acres. With the discovery of two additional sites within The Nature

Conservancy's preserve in 1990, the population consists of approximately 200 individuals, and occurs about 1 mile north of the site of the type location (Figure 1). The first discovered stand within the population has had continual monitoring since its discovery in 1982 and has declined from a total of 407 mature plants and 64 seedlings in 1983 to 32 plants, mostly seedlings, in 1990 (Mutz 1984, U.S. Fish and Wildlife Service 1989, Callister and Schelz 1990).

Potential habitat occurs in areas near the current occupied habitat. It is reasonable to expect that one or more undiscovered populations may still exist. It also is probable that still other populations have been forced into extinction as a result of habitat degradation due to agricultural practices since the area was permanently settled. A number of searches have been conducted to locate new populations of the autumn buttercup. Investigations of potential sites have been made by Palmieri in 1974, Mutz in 1982 and 1983 (Mutz 1984), and by the Service in 1985, 1986, 1987, and 1990. No new populations have been reported. In 1983, Mutz surveyed potential habitat along the Sevier River within 10 miles of the known location, but the area was so severely grazed that it was difficult to survey; autumn buttercup plants may have been overlooked because they were cropped so short or trampled as to not be readily distinguishable. The Nature Conservancy acquired the land in January of 1989.

Habitat and Biology

The autumn buttercup occurs within the Utah Plateaus Section of the Colorado Plateau Floristic Region (Cronquist et al. 1972). The species is located in the upper Sevier River Valley. The valley is flanked by the Pavant, Tushar, and Markagunt Plateaus to the west and the Sevier and Paunsagunt Plateaus to the east. The Sevier fault which formed the valley occurs at the base of the western scarp of the latter two plateaus. The valley bottom is Quaternary alluvium (Mutz 1984).

The taxon occurs on small mounds along the margin of a wet meadow at an elevation of 6,440 feet. The known population grows on the east facing slope of the upper Sevier River Valley bottom. The autumn buttercup inhabits a very small area which is surrounded by a graminoid community. The habitat is a spring-fed wet meadow. It grows on hummocks at the transition zone between a wet *Carex* dominated community and a dry upland meadow. Species frequently associated with it are *Eleocharis rostellata*, *Aster* sp., *Carex nebrascensis*, *Glaux maritima*, *Juncus balticus*, *Ranunculus cymbalaria*, and *Dodecatheon pulchellum*. The hummocks are generally less than 2 feet (.6 m) in diameter and about 7 to 9 inches (17 to 23 cm) high. The soil is friable and very dark above and at the base there is about 2 inches (5 cm) of a lighter brown, loamy soil. The moisture content of the hummocks is very moist to saturated. The hummocks are probably a result of long-term livestock trampling (Mutz 1984).

Reproduction of the autumn buttercup is by seed (Dr. Joyce Maschinski, The Arboretum at Flagstaff, pers. comm., 1991). Specific time of flowering has not been thoroughly documented; plants collected in late July have both flowers and mature seeds. The plants are known to complete their life cycle of flowering

to producing seed between late July and early September. Seedlings with several leaves also have been noted at this time. Seeds are generally dispersed in close proximity to the parent plant, but could be transported by animals and water. The mechanism of pollination is probably insects and/or possibly by wind.

There have been no studies except the status report by Mutz (1984) addressing the habitat requirements and the biology of the species. In the fall of 1988, five seedlings were transplanted to The Arboretum at Flagstaff (Arizona), four of which survived. Four plants in greenhouse cultivation are probably insufficient for purposes of observing the plant and learning more about the life cycle of the species. In late July 1990, the Service and The Arboretum at Flagstaff collected about 100 autumn buttercup seed from one of the newly discovered sites within The Nature Conservancy's preserve. The seeds were collected to enhance the seed reserve and live plant collection at The Arboretum at Flagstaff and to determine germination and other cultural requirements of the species. These seeds germinated after a cold temperature treatment (Dr. Joyce Maschinski, The Arboretum at Flagstaff, pers. comm. 1991).

Threats

Agricultural uses (including livestock grazing) and natural events (including wildlife grazing) are actual and potential threats to the autumn buttercup. The most significant threat to the autumn buttercup is cattle, horse, and sheep activity. These domestic animals could eliminate plants by trampling and grazing. In 1988, the Service placed wire cages over the known remaining plants in an attempt to reduce or eliminate the detrimental effect of livestock activity upon the existing population. Grazing at the known location has been documented by Mutz (1984) and the Service (1985, 1986, 1987). In 1989, The Nature Conservancy repaired the fence surrounding the preserve which eliminated livestock grazing at the known population. The population is still receiving some grazing pressure, apparently from small mammals. It is unusual for a plant of the Ranunculus genus to be so readily grazed; most species of the genus are unpalatable or toxic. The Sevier River Valley is primarily used for irrigated pasture and hayland. Grazing may still pose a potential threat at potential reintroduction sites and possible undiscovered sites not within the preserve. The release of grazing pressure was, almost certainly, responsible for the increased vigor and recent flowering of the newly discovered autumn buttercup plants within The Nature Conservancy's preserve.

The autumn buttercup population is growing in perennial wet to moist soil, a portion of which is associated with a spring. If the spring or its contributing aquifer is developed for irrigation water, the habitat could become desiccated. The precise water requirements of the plant are unknown and any modification of the hydrologic regime of the species habitat could possibly affect the population. Other agricultural developments, such as construction of corrals and outbuildings, could increase activity in the area and cause degradation of potential habitat. The population is so small that it could be eliminated by a series of dry years which may cause the spring to dry up. Unusual weather patterns such as extreme cold may affect the life cycle and cause reduced seed production. If cold weather does affect reproduction of the species and the pattern occurs for a number of years, it could eliminate the taxon (depending on the life span of each plant).

The Nature Conservancy, as a consequence of acquiring the 44 acres of land comprising the autumn buttercup preserve, is protecting the known population from livestock grazing and agricultural development. This does not preclude upslope agricultural development, which could still occur and affect the population. The plant is subject to grazing from wildlife such as rodents (possibly including the federally listed Utah prairie dog (Cynomys parvidens), rabbits, insects, and possibly deer. Furthermore, there is no way to protect the plant from natural events, such as loss of pollinators and extreme weather conditions, which may continue to pose a threat to the species. Maintenance of nonnative garden populations and storage of a seed source in the U.S. Department of Agriculture's National Seed Storage Laboratory will help ensure the continuance of the species in the face of any catastrophic events that may destroy the natural populations.

PART II
RECOVERY

Objective and Criteria

The objective of this recovery plan is to prevent the species' extinction. To achieve this, the only known population must be protected and potential reintroduction areas must be identified and protected. Studies of the buttercup's biological requirements must be initiated in order to provide the appropriate management of the known population and to evaluate sites for the reintroduction of potential populations. Horticultural techniques need to be developed to produce an ample supply of seed and/or seedlings to be used for developing new populations. The development of propagation techniques will be necessary to keep the species from becoming extinct. No downlisting criteria have been developed. When the current criteria have been met, the Service will reevaluate the species' status and revise the recovery plan to include downlisting and delisting criteria.

Because there is only one known autumn buttercup population consisting of about 200 plants, it will take a considerable effort to increase that population to over 1,000 plants. It is unlikely that the autumn buttercup will be downlisted or delisted in the foreseeable future. Following are the conservation criteria necessary to prevent the extinction of the autumn buttercup:

1. Increase the current population to a self-sustaining population of 1,000 plants on 10 acres of land at the present known site.
2. Establish at least two artificial populations of the autumn buttercup at suitable, recognized botanical gardens.
3. Establish viable self-sustaining populations in at least 5 additional sites on land managed to protect the species.
4. Establish an overall self-sustaining population of at least 20,000 plants.

The Service in cooperation with all other parties involved in the conservation of the autumn buttercup will, on at least an annual basis, update and consolidate all information on the conservation, biology, and ecology of the taxon developed during the period. The Service, The Nature Conservancy, and the Utah Natural Heritage Program will incorporate this information into their endangered species and land management data bases.

Stepdown Outline

- 1 Protect the existing population.
 - 1.1 Develop a habitat management plan for the existing population.
 - 1.2 Monitor existing population and conduct minimum viable population studies.

- 1.3 Enforce existing protective regulations.
- 1.4 Rebuild preserve perimeter fence.
- 2 Inventory potential habitat of the autumn buttercup in south-central Utah.
- 3 Acquire and protect occupied and potential habitat of the autumn buttercup.
- 4 Establish artificial autumn buttercup populations.
 - 4.1 Collection of seed.
 - 4.2 Determine horticultural requirements.
 - 4.3 Produce propagules.
- 5 Research the biology and the ecology of the autumn buttercup on known and potential habitat.
 - 5.1 Determine the species' soil requirements.
 - 5.2 Determine the hydrology of the species' habitat.
 - 5.3 Determine the mechanism of pollination.
 - 5.4 Characterize the species' plant community structure.
 - 5.5 Determine the species' interaction with animal populations.
 - 5.6 Determine the phylogenetic relationship of the autumn buttercup and its cogenetic species.
- 6 Establish and maintain additional autumn buttercup populations.
 - 6.1 Reintroduce plants into potential habitat.
 - 6.2 Develop a management plan for introduced populations.
 - 6.3 Monitor introduced populations.
 - 6.4 Provide protection for introduced populations.
- 7 Develop public awareness and appreciation for the autumn buttercup.
 - 7.1 Inform private landowners of the importance of protecting the species.
 - 7.2 Develop public appreciation for and awareness of the significance of the species.
- 8 Develop downlisting criteria.

Narrative Outline

1 Protect the existing population.

Protection of the existing population is of paramount importance for the preservation of the autumn buttercup. The species is perilously close to extinction, and no preventable action which would harm the species' sole remaining population or its habitat should be permitted. All conservation activities directed to the autumn buttercup population on The Nature Conservancy's preserve will be coordinated with The Nature Conservancy's Great Basin Field Office and will be consistent with The Nature Conservancy's planning and management documents including the Element Stewardship Abstract (Callister and Schelz 1990).

1.1 Develop a habitat management plan for the existing population.

A management plan will be developed by the Service in cooperation with The Nature Conservancy. This plan should include protection of the buttercup preserve through the elimination of grazing in areas where the autumn buttercup grows. The elimination of grazing has enabled the discovery of additional autumn buttercup sites within the preserve. The management plan must provide for monitoring of the species population, biological and ecological research of the autumn buttercup and its ecosystem, and horticultural manipulation of the autumn buttercup consistent with maintaining and enhancing a viable population. Further research of the species biology and ecology may reveal the need for additional or modified management techniques which would enhance the autumn buttercup's population and its ecosystem. Grazing, for instance, may be beneficial in certain circumstances; its precise impact on individual autumn buttercup plants, its population, the overall plant community and the wet meadow ecosystem should be thoroughly examined.

1.2 Monitor existing population and conduct minimum viable population studies.

Monitoring will be accomplished by establishing a minimum viable population study on the buttercup preserve population. A minimum viable population is defined as: a demographically stable population that is large enough to maintain genetic variation and to enable it to evolve and successfully respond to natural environmental variation (Menges 1986). This study will document demographic characteristics of the species' population, to determine if it is viable or not. The study also should identify the minimum number of stands needed to ensure long-term survival of the population. The study also will allow monitoring of natural and man-caused impacts to the species and its habitat. If, as a consequence of this study, natural or man-caused factors are identified as possibly having a detrimental effect on the species' population, then those factors will be addressed and the recovery plan revised accordingly. Little is known concerning natural threats such as disease, parasitism, and predation on the autumn buttercup. This study will be coordinated with task 5 and include the

measurement of the biotic and abiotic factors that define the species' ecosystem. It is possible that the autumn buttercup population is at a level that will not ensure its long-term demographic viability. Regular, informal monitoring will note the development of any adverse conditions affecting the species' population or any unauthorized use or change in the species' habitat. The Service will be responsible for this task with assistance from The Nature Conservancy.

1.3 Enforce existing protective regulations.

The autumn buttercup is protected under Section 9 of the Endangered Species Act of 1973, as amended, which makes it unlawful to maliciously damage or destroy any listed threatened or endangered plant species from areas under Federal jurisdiction or to remove, cut, dig up, damage, or destroy any such species in knowing violation of any law or regulation of any State including State trespass law. These activities may be controlled through effective monitoring, law enforcement, and the judicious application of Section 10 penalties of the Endangered Species Act. In addition, Section 7 of the Act requires that all Federal Agencies ensure that activities they authorize, fund, or carry out do not jeopardize the continued existence of any endangered or threatened species. The Nature Conservancy has posted the autumn buttercup preserve. Admittance to the preserve is by explicit permission only.

1.4 Rebuild preserve perimeter fence.

The current perimeter fence is dilapidated and will not be sufficient for long-term protection of the site. Approximately one-half mile of new fencing will be necessary within 5 to 10 years. This task will be a joint responsibility of The Nature Conservancy and the Service.

2 Inventory potential habitat of the autumn buttercup in south-central Utah.

Potential habitat in south-central Utah, especially on public lands, should be identified and surveyed to discover any new populations and to evaluate potential introduction sites. All wet meadow areas, especially spring-fed sites, in the surrounding area will be searched. The surveys will need to be conducted in the absence of livestock grazing. Private landowners should be consulted for information on possible potential habitat. If the Service or other Federal Agencies, and/or private landowners identify a potential autumn buttercup site, deferment of grazing at that specific location should be negotiated by the Service to permit surveying during the autumn buttercup's flowering period on habitat rested a year or more from grazing. It may be necessary to obtain a temporary easement or to provide monetary or other compensation to private landowners in order to accomplish this task. Unoccupied potential autumn buttercup habitat will be identified as a possible reintroduction site. This task will be coordinated by the Service with assistance from the Utah Natural Heritage Program, The Nature Conservancy, and affected land managing agencies.

3 Acquire and protect occupied and potential habitat of the autumn buttercup.

The protection of the species' habitat is of foremost importance. The Service should acquire the existing habitat of the autumn buttercup from The Nature Conservancy, plus any additional discovered habitat on The Nature Conservancy property or on nearby lands, to provide Federal protection and management of the population. The acquisition of secure habitat for the autumn buttercup will be pursued, either through fee title purchase or through the development of conservation easements with private landowners when, and if, new populations of the plant are discovered on private land and also when private land is identified as a potential introduction site. If occupied or potential habitat of the species is identified on Federal or State land, the Service will work with the appropriate land managing agency to provide for either the protection of that site's population or in establishing an introduced population. Special land use designations, such as "Areas of Critical Environmental Concern" on Bureau of Land Management lands or "Research Natural Areas" on U.S. Forest Service and National Park lands, should be pursued for those sites.

4 Establish artificial autumn buttercup populations.

The continued survival of the autumn buttercup will require the intervention of man by establishing the species in an artificial botanical garden and/or greenhouse setting. These captive populations will provide security to the species if a catastrophic event occurred to the wild population. These artificial populations also will provide a source of propagules, either seed or seedlings, to stock potential reintroduction sites. A minimum of two sites are necessary as captive propagation sites. The Arboretum at Flagstaff already has begun conservation work on the autumn buttercup and should continue. The State Arboretum of Utah should become the second participant in this effort. The Service and the Center for Plant Conservation will coordinate this recovery activity.

4.1 Collection of seed.

Autumn buttercup seed will be collected as soon as it becomes available and prudent from the wild population on The Nature Conservancy's autumn buttercup preserve. This seed will be deposited at cooperating institutions of the Center for Plant Conservation (i.e., The Arboretum at Flagstaff and the State Arboretum of Utah) for seed germination requirement studies and the establishment of a captive garden population. Seed also should be deposited at the U.S. Department of Agriculture's National Seed Storage Laboratory to ensure the survival of the species genetic resource. It is important to have a source of seed as protection against an unforeseen catastrophic event, as well as to preserve the genetic material.

4.2 Determine horticultural requirements.

Conduct research to determine the requirements for seed germination and seedling establishment, plant growth requirements, flowering requirements, and seed development requirements. Studies will be

conducted on different soil types, water regimes, light requirements, etc., in both the field and greenhouse experiments, which will reflect the conditions which may be expected to occur in the species' native habitat.

4.3 Produce propagules.

The artificial populations of the autumn buttercup will provide a nursery for the production of propagules, either seed or seedlings, which will be used to establish additional populations of the plant in natural habitat. The seedling transplant or seed sowing techniques will be developed to optimize the probability for success for the species introduction. If seeds or seedlings cannot be produced by standard methods, the development of tissue culture techniques to produce clones of existing autumn buttercup plants may need to be developed to provide plants for introduction into suitable habitat.

5 Research the biology and the ecology of the species on known and potential habitat.

The introduction/reintroduction of autumn buttercup populations will require specific information concerning the biology of the species and its ecological interactions with the biotic and abiotic factors of its ecosystem. The congressional intent of the Endangered Species Act is to "preserve the ecosystems upon which endangered and threatened species are dependent." The current endangerment of the autumn buttercup is a consequence of the altering of its wet meadow habitat (including altering of presettlement grazing patterns). The preservation of the species and any possible recovery will be dependent on restoring that habitat. Restoring that habitat without a knowledge of what constitutes that habitat will be impossible. The Service with assistance from interested parties including The Nature Conservancy, Utah Natural Heritage Program, and affected land management agencies will be responsible for this task.

5.1 Determine the species' soil requirements.

A detailed soil description will be conducted at the site of the existing population and at all potential sites. Soil samples should be collected and analyzed. The spacial parameters of the autumn buttercup's soil environment, including rooting depth and width and its relationship to other members of its plant community, will be determined. The species relationship to microgeomorphological features (i.e., hummocks, etc.) will be investigated to determine the reasons for the species association with them. The species association with soils with saturated and nonsaturated soil moisture regimes will be investigated. This information will assist in selecting sites for the reintroduction of the autumn buttercup and the management for optimum species habitat.

5.2 Determine the hydrology of the species' habitat.

The central question in the ecology of the species concerns the water requirements of the plant. The hydrology of occupied habitat of the

autumn buttercup should be monitored throughout the growing season to characterize the water supply to the plant's habitat. Information collected will include water temperature, water quality (e.g., salinity, alkalinity, nitrogen, pH, etc.), depth to standing water, and spring flow. This information will be compared with climatological information recorded at Panguitch, Utah, and with supplemental information (annual precipitation and maximum/minimum temperatures) taken at the site of the species' population. This information will assist in selecting sites for the reintroduction of the autumn buttercup and management of optimal species habitat.

5.3 Determine the mechanism of pollination.

The identification of the mechanism of pollination is important for the reproductive success of the species. The U.S. Department of Agriculture's Bee Biology and Systematics Laboratory is currently studying the pollinators of rare plants and could be the Agency to determine this species method of pollination. Information from this study may identify any existing or potential problems connected with reproductive failure of this species.

5.4 Characterize the species' plant community structure.

The species structure of the autumn buttercup plant community will provide a useful tool in identifying potential habitat for the species. This knowledge will enable the determination of the interspecific plant relationships such as competition and successional dynamics which may affect the autumn buttercup.

5.5 Determine the species' interaction with animal populations.

A determination of the impact of introduced livestock and natural grazers such as rodents (including the nearby Utah prairie dog colony), rabbits, insects, deer, etc., will be essential in developing a conservation plan for each population of the autumn buttercup. The management of the populations of all or some of these animal species may be essential for the short-term preservation of the buttercup. Information gained by this task and the previous tasks will, in the long term, be useful in defining and restoring the ecosystem of the autumn buttercup.

5.6 Determine the phylogenetic relationship of the autumn buttercup and its cogenetic species.

The phylogenetic relationship of the autumn buttercup is poorly understood. Various taxonomic treatments have proposed this species as varieties of R. acriformis and R. acris. Current speculation by biologists familiar with the genus Ranunculaceae suggest the species has affinities with the R. occidentalis group (including R. acriformis and R. turneri) and may be related to R. acris of the old world through R. turneri of the Nearctic. This question needs to be definitely resolved to ensure that the species has at least the taxonomic

integrity now assumed. Traditional taxonomic approaches have not led to an unacceptable resolution of these phylogenetic questions. Detailed Cytological and/or molecular studies of the species and its near congeners is necessary to resolve this question.

6 Establish and maintain additional autumn buttercup populations.

With only one natural population of the buttercup, the species is extremely vulnerable to any catastrophic act, even of local nature, which may cause the species' extinction. The establishment of additional populations will provide the species the ability to survive localized extinction events.

6.1 Reintroduce plants into potential habitats.

The plants to be introduced will be acquired through task 4 and potential introduction/reintroduction sites will be identified and acquired through tasks 2 and 3. Tasks 4 and 5 will provide the information necessary to establish and maintain a viable autumn buttercup population in a healthy, natural ecosystem. The Service and all associated parties will be responsible for this task.

6.2 Develop a management plan for introduced populations.

Management plans similar to that proposed for The Nature Conservancy's buttercup preserve in task 1.1 will be prepared for all newly discovered or introduced autumn buttercup populations.

6.3 Monitor introduced populations.

All newly discovered and introduced populations of the autumn buttercup will have monitoring studies established for them similar to that proposed for the current proposed population at The Nature Conservancy's autumn buttercup preserve (see task 1.2).

6.4 Provide protection for introduced populations.

All newly discovered and introduced populations of the autumn buttercup will have the same protection mentioned in tasks 1.3 and 3 including possible habitat acquisition.

7 Develop public awareness and appreciation for the autumn buttercup.

Public awareness and concern for endangered species conservation is critical to the success of any effort directed at the preservation of endangered species and their habitat.

7.1 Inform private landowners of the importance of protecting the species.

The Service will contact those private landowners with potential habitat of the autumn buttercup on an annual basis, informing them of the progress and the importance of protecting the species, and soliciting their assistance as appropriate in the conservation of the

species and its habitat. The cooperation of private landowners is vital to the success of the recovery plan.

7.2 Develop public appreciation for and awareness of the significance of the species.

The Service will send annual news releases to newspapers, environmental groups, and the local government on the progress of the autumn buttercup's conservation. The public can be made aware of and gain an appreciation for this species through brochures, slide presentations, and television and radio coverage.

8 Develop downlisting criteria.

Because the species is presently so close to extinction, conservation and protection of the existing population is paramount. Little information is currently known on the species' life history and its stability in the face of current and potential threats. If the identified conservation measures are successful at protecting the species from the imminent threat of extinction and in expanding the population to the point where the species becomes stable, and once life history information is available, then work will begin on identifying the population level and conditions which will need to be met in order to consider downlisting the species.

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III. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide for meeting the objectives discussed in Part II of this plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should prevent the extinction of Ranunculus acriformis var. aestivalis and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the conservation of this plant for the first 3 years following approval of this plan.

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

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 a species' population/habitat quality, or some other significant negative impact short of extinction.

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

Key to Acronyms used in Implementation Schedule

FWE	Fish and Wildlife Enhancement, U.S. Fish and Wildlife Service
LE	Law Enforcement, U.S. Fish and Wildlife Service
RW	Refuges and Wildlife, U.S. Fish and Wildlife Service
TNC	The Nature Conservancy
BBS	Bee Biology and Systematics Laboratory, U.S. Department of Agriculture
BLM	Bureau of Land Management
FS	U.S. Forest Service
NPS	National Park Service
SCS	Soil Conservation Service
CPC	Center for Plant Conservation
UT	State of Utah, including the Utah Natural Heritage Program

RECOVERY IMPLEMENTATION SCHEDULE
AUTUMN BUTTERCUP

PRIORITY	TASK #	TASK DESCRIPTION	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)			COMMENTS/NOTES
				REGION	FWS	OTHER	FY-92	FY-93	FY-94	
					PROGRAM					
1	1.1	Develop habitat management plan	1 year	6	FWE	TNC	1,000	---	---	
1	1.2	Monitor existing populaton	ongoing	6	FWE	TNC, UT	1,000	1,000	1,000	
1	1.3	Enforce regulations	ongoing	6	FWE/LE	TNC, BLM, UT NPS, FS, SCS	1,000	1,000	1,000	
1	1.4	Rebuild preseve fence	1 year	6	FWE	TNC	---	---	5,000	
1	2	Inventory habitat	3 years	6	FWE	BLM, NPS, FS, UT, SCS	5,000	5,000	5,000	Costs for easements to defer grazing are not included
1	3	Acquire habitat	5 years	6	FWE/RW	BLM, NPS, FS UT, TNC	60,000	20,000	20,000	Costs indicated reflect estimated cost of acquiring fee title to 60 acres of private land plus the purchase of the buttercup preserve from The Nature Conservancy.
1	4.1	Collect seed	5 years	6	FWE	TNC, CPC, UT	1,000	1,000	1,000	
1	4.2	Determine horticultural requirements	5 years	6	FWE	CPC, UT	6,000	6,000	6,000	
1	4.3	Produce propagules	ongoing	6		CPC, UT	1,000	1,000	1,000	Cost assumes that plants can be grown without tissue culture.
1	5.1	Determine soil requirements	ongoing	6	FWE	CPC, UT, SCS	1,000	1,000	1,000	
1	5.2	Determine hydrology of habitat	3 years	6	FWE	UT, TNC	3,000	3,000	3,000	

RECOVERY IMPLEMENTATION SCHEDULE
AUTUMN BUTTERCUP

PRIORITY	TASK #	TASK DISCRPTION	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)			COMMENTS/NOTES
				REGION	FWS	OTHER	FY-92	FY-93	FY-94	
					PROGRAM					
1	5.3	Determine pollination mechanism	3 years	6	FWE	BBS, UT	3,000	3,000	3,000	
1	5.4	Determine plant community	3 years	6	FWE	TNC, UT	2,000	2,000	2,000	
1	5.5	Determine animal relationships	3 years	6	FWE	TNC, UT	2,000	2,000	2,000	
1	5.6	Determine phylogenetic relationship	3 years	6	FWE	UT, CPC	10,000	10,000	10,000	
1	6.1	Reintroduce plants into potential habitat	10 years	6	FWE	BLM, FS, NPS TNC, UT, CPC	---	---	5,000	Task 6 will follow the initiation of tasks 2, 3, 4, and 5.
1	6.2	Develop management plan	10 years	6	FWE	BLM, FS, NPS, UT	---	---	1,000	
1	6.3	Monitor new populations	ongoing	6	FWE	BLM, FS NPS, UT	---	---	2,000	
1	6.4	Protect new populations	ongoing	6	FWE/LE	BLM, FS NPS, UT	included in task 1.3			
2	7.1	Inform private landowners	ongoing	6	FWE	---	1,000	1,000	1,000	
2	7.2	Develop public appreciation	ongoing	6	FWE	---	included in task 7.1			
2	8	Develop downlisting criteria	1 year	6	FWE	---	---	---	---	Activity to be deferred until biological and ecological information is sufficient to accomplish.

APPENDIX I

This recovery plan was made available to the public for comment as required by the 1988 amendments to the Endangered Species Act of 1973. The public comment period was announced in the Federal Register (56 F.R. 11458) on March 18, 1991, and closed on May 17, 1991. Seven press releases were sent to the print media located in the State of Utah.

During the public comment period eight letters were received. The comments provided in these letters have been considered, and incorporated as appropriate. Comments addressing recovery tasks that are the responsibility of an agency other than the U.S. Fish and Wildlife Service have been sent to that agency as required by the 1988 amendments to the Act.