RUNNING BUFFALO CLOVER

RECOVERY PLAN

DEPARTMENT OF THE INTERIOR • U.S. FISH & WILDLIFE SERVICE

RECOVERY PLAN

for

RUNNING BUFFALO CLOVER
(*Trifolium stoloniferum*)

prepared by

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Approved: [redacted] Date 6-8-88

Acting Regional Director

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Literature citation should read as follows:

U.S. Fish and Wildlife Service 1989. Trifolium stoloniferum Recovery Plan. U.S. Fish and Wildlife Service, Twin Cities, Mn. 26pp.

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Fish and Wildlife Reference Service

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ACKNOWLEDGEMENTS

In the course of preparing this recovery plan, the following people reviewed previous drafts and provided constructive comments and recommendations: J. Campbell, S. Chaplin, B. Currie, A. Cusick, M. Evans, J. Jacobs, B. McCance, B. McDonald, S. Morgan, S. Packard, D. Perry, A. Pittman, S. Singha, N. Taylor, M. Weisner, and J. Olson. Pat Percy and Sharon Vassar provided word processing expertise and service, and Peg Margosian did the graphics. Our thanks to all of these folks for their time commitment.

SUMMARY

Recovery Goal: To prevent the extinction and enhance the status of Trifolium stoloniferum (Running buffalo clover) by identifying, protecting, and managing populations so the species can be reclassified to threatened and eventually be considered for removal from the endangered and threatened species list.

Recovery Criteria: To protect and bring under appropriate management, thirty secure, self-sustaining naturally occurring or reintroduced populations. Delisting can be considered when additional populations are protected and managed.

Actions Needed: Recovery of this species can be accomplished through (1) protection, management, and monitoring of known populations; (2) inventory of suitable habitat to locate additional wild populations; (3) research on the species biology; (4) maintenance of genetic material of each known population; (5) development of public awareness, and support for the species; and (6) increase private landowner stewardship for the species.

Estimated Costs and Time to Recovery: It is estimated that total recovery will amount to approximately $375,500. If this amount is made available, the recovery goal should be reached by the year 2000.

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PART 1. INTRODUCTION

Running buffalo clover (Trifolium stoloniferum Muhl. ex A. Eaton) was listed as an endangered species under the Endangered Species Act of 1973 on July 6, 1987 (50 FR 21478-21480). This species, once occurring from Kansas to West Virginia, is currently known from 13 small populations; two in Indiana, one in Kentucky, eight in Ohio, and two in West Virginia (Figure 1). The objective of this recovery plan is to outline a strategy for securing and restoring the species.

SYSTEMATICS AND IDENTIFICATION

The genus Trifolium is a large and economically significant genus (Taylor 1980). Running buffalo clover is a perennial species that forms long stolons that root at the nodes. The plants produce erect flowering stems, typically three to six inches tall with two leaves near the summit, topped by a roundish flowerhead one to 1.5 inches in diameter. The shapes of the white flowers and leaves are typical of the clovers (Jacobs and Bartgis 1987). For a detailed discussion of its morphological and distinguishing features, see Brooks (1983). The chromosome number (2n=16) is the same as that of other clovers native to the eastern United States (Campbell et al. 1988).

STATUS AND HABITAT

Running buffalo clover historically has been collected from Arkansas, Illinois, Indiana, Kentucky, Missouri, Nebraska, Ohio and West Virginia. The Arkansas specimen was collected along a railroad and was presumed to be an

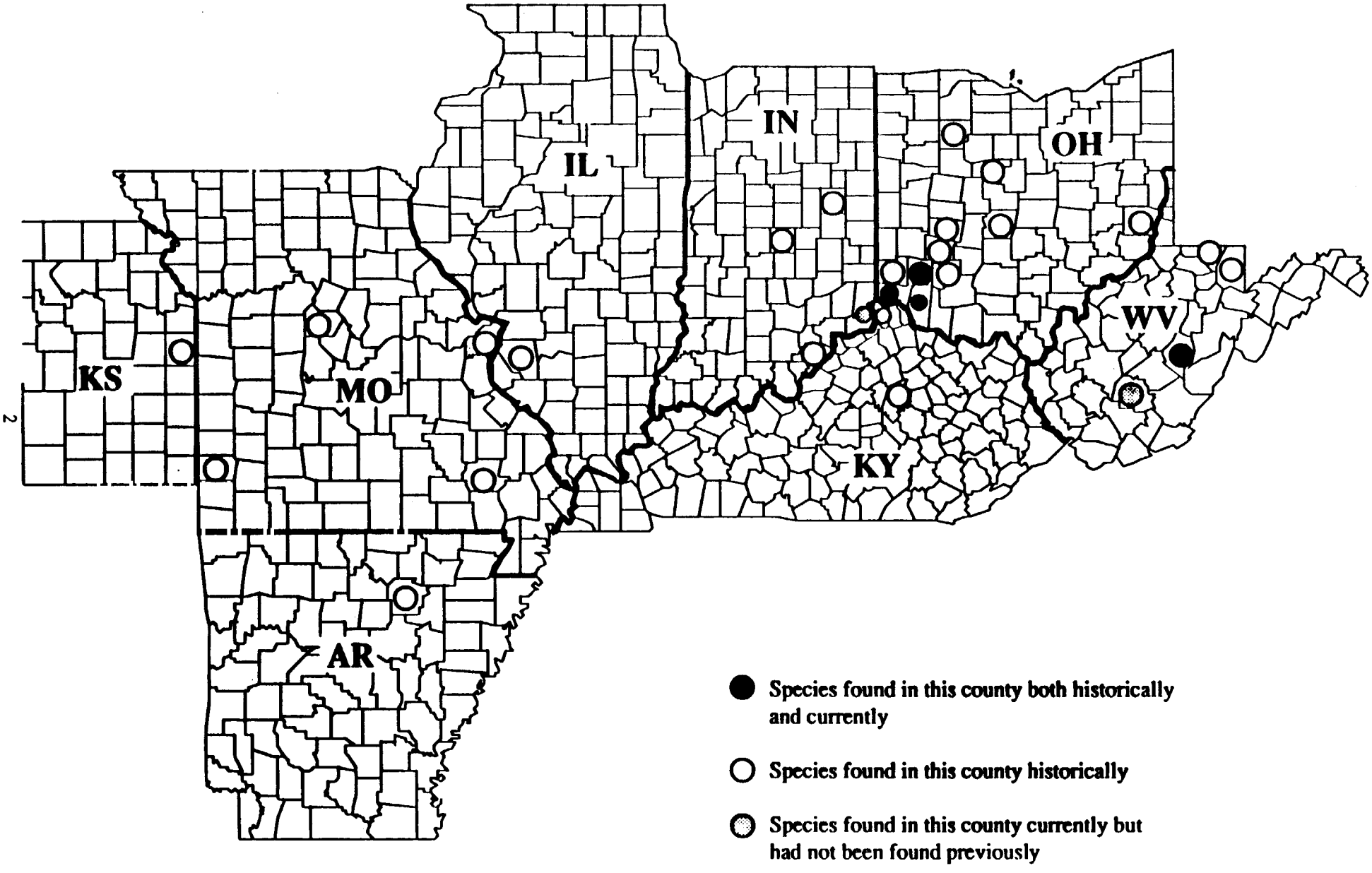

Figure 1. Historic and Current Distribution of *Trifolium stoloniferum*
(adapted from Brooks 1983)

introduction (Brooks 1983). However, based on the current recognition that the species is disturbance-dependent, it appears likely the clover was also native to Arkansas. There were very few reports rangewide after 1910. Prior to 1983, the most recent collection had been made in 1940, in Webster County, West Virginia (Brooks 1983). Two small populations were discovered in 1983 and 1984 in West Virginia (Bartgis 1985).

In 1987, two populations were found in Indiana by Mike Homoya and Jim Aldrich and a population was found in Kentucky by Marc Evans; the Indiana populations consisted of several hundred plants, and the Kentucky populations of a few hundred plants. In 1988 the two West Virginia populations consisted of 20 and 75 individuals (McDonald 1988). At the Indiana and Kentucky sites, the number of individuals is difficult to assess since some stoloniferously produced plants may be independent of the parent and others may not. Because vegetative reproduction appears to predominate in wild populations, the number of genets represented is presumably few.

In West Virginia, the larger population, located in Fayette County, is on a small sandy floodplain of the New River, where the plants occupy an area less than a meter-square along a four-wheel drive trail through a deciduous forest. Associated species at the site in the New River Gorge include Acer negundo, Betula nigra, Fagus grandifolia, Halesia carolina, Liriodendron Tulipifera, and Platanus occidentalis in the multiple-strata canopy. The shrub layer is largely Lindera benzoin and with some Rosa multiflora; herbaceous associates include Alliaria officinalis, Aplectrum hyemale, Cardamine impatiens and Commelina communis. The exotics Lonicera japonica,

Eulalia viminea and Glechoma hederacea are abundant throughout the floodplain; they spatially compete with Trifolium stoloniferum and appear to limit its spread. Eulalia viminea may present a threat to running buffalo clover (A. Cusick, pers. comm.). Flooding of the floodplain has apparently ceased following construction in the 1930's of a dam 0.8 km upstream. The smaller West Virginia population, located in Webster County, is on a floodplain, where it occurs under a large Robinia pseudoacacia. Cultivated ground borders the area with the clover. The field, dominated by Dactylis glomerata and Festuca elatior, is annually mowed but not pastured. Four other clovers were found at this site: Trifolium agrarium, T. hybridum, T. pratense, and T. repens (Bartgis 1985).

The Indiana sites are in narrow, shallow, wooded stream valleys that are grazed by cattle. These stream valleys are along intermittent tributaries of the Ohio River. The clover grows in small scattered stands on loamy soils such as small stream terraces, or rarely on cobbles in the stream bed. The cobble-bottomed stream beds, annually flooded in the spring and dry by early summer, are sparsely vegetated. It is important to note that running buffalo clover habitat is disturbed and at one Indiana site the clovers are found growing in the cattle trails along the slope, above the flood plain (A. Cusick, pers comm.). The few clovers in this habitat occupy the highest, least flooded sections of the stream beds. The canopy includes Acer negundo, Ulmus rubra, Liriodendron Tulipifera and Platanus occidentalis with a Lindera benzoin understory. Groundcover is varied, but includes many exotics and the

natives, Pilea pumila, Impatiens capensis and Amphicarpa bracteata. The running buffalo clover appears to be absent from sections of the stream valleys lacking cattle.

The Kentucky population of running buffalo clover occurs along an annually mowed trail and in a small opening adjacent to a cemetery in a mesic deciduous forest on loamy soil above the Ohio River. Associates are similar to those in Indiana and include Carya cordiformis, Liriodendron Tulipifera, Acer negundo, Fraxinus americana, and Lindera benzoin in the shrub and tree layers. Herbaceous associates include Impatiens pallida, Pilea pumila, Leersia virginica, and Elymus sp. (Campbell et al. 1988). The population is particularly vigorous in an area where a thin layer of soil and vegetation was sliced off the surface by a low-set brush-hog blade. It is not yet known if this reflects a cause-and-effect relationship, but it seems likely since the aggressive exotic Alliaria officinalis is abundant in the areas not mowed (J. Campbell, pers. comm.).

Landowners in Indiana were aware of the searches for running buffalo clover, but at present, are not aware of the occurrence of the clover. Owners of the populations in Kentucky have been informed of the plants' presence on their property and are cooperating in its management. The Fayette County, West Virginia population is on a natural area owned by the State of West Virginia. Plants from the New River, West Virginia, and the Kentucky populations are in cultivation; seeds from the other West Virginia population are in cold-storage. Because of the economic value of clovers in general, the

U. S. Department of Agriculture Appalachian Soil and Water Conservation Research Laboratory has begun horticultural studies of running buffalo clover.

Status surveys for running buffalo clover were conducted in Illinois and Missouri during 1988, however, no plants were found. Additional surveys will be conducted in Missouri in 1989. In 1988 eight populations of running buffalo clover were discovered in three southwestern Ohio counties. Five populations were found in Hamilton County, two in Warren County, and one in Clermont County (Cusick 1988). Population sizes ranged from a single plant to ca 110, with a total population of about 250 (Cusick 1988). Four of these populations are within the Hamilton County Park District which is most willing to cooperate in protection. Another population, in an Ohio Historical Society cemetery, will be considered in the society's new management plan. The population with only a single plant is within a natural area managed by the Ohio Division of Natural Areas and Preserves. The remaining two are on private property, which are both registered as Ohio Natural Landmarks. Thus, the Ohio populations are protected, and management for the plant will be stressed at each site. Associated species at the Ohio sites include: Alliaria petiolata, Elymus virginicus, Oxalis stricta, Glechoma hederacea, Juglans nigra, Ulmus americana, Fraxinus americana, and Celtis occidentalis. All of the Ohio sites have been disturbed, either by mowing, grazing, or flooding (B. McCance, pers comm.). Additional surveys are planned for Ohio in 1989.

Research is needed to determine if the small populations will survive without augmentation. The range and size difference of the Ohio populations should provide an opportunity to observe a pattern between habitat and population size.

LIFE HISTORY

The little that is known concerning running buffalo clover's life history is summarized by Campbell et al. (1988). Germination success is high (90-100 percent) following scarification. Little or no germination occurs in the absence of scarification, even after overwintering on moist cold soils. Winter temperatures of 30-40 degrees F.or less are required to stimulate flowering. After flowering begins in the spring, stolon growth is most vigorous. Stolon growth slows in warmer, drier weather. The stolons root at each node that touches the soil and the plants appear to thrive best in moist, fertile, somewhat shaded soil. Seed production is good on the favorable sites.

THREATS TO SURVIVAL

1. Habitat Destruction

The cause of the range-wide decline of running buffalo clover has not been firmly established. A species of woodland disturbances, the clover may have been tied to disturbances made by large herbivores, particularly bison (Bartgis 1985, Campbell et al. 1988). With the elimination of large

herbivores from the range of the clover, not only was the habitat lost but so were potential routes and mechanisms of dispersal. All known occupied habitat is disturbed regularly but not intensively. As four-wheel drive use increased at the New River population, the population declined to about six plants, at which time the road trail was closed. The population has subsequently increased but has not fully recovered. Maintaining recent disturbance levels at known populations appears essential.

2. Competition

As is typical for disturbance-dependant species, the clover does not do well when faced with competition. Most foliage is 6 inches tall or shorter and if not weeded, competitors, especially exotics, soon overtop it and shade it out in sunnier sites (Campbell et al. 1988). Reintroduction attempts in the New River Gorge National River have, to date, not been successful because of overtopping by competitors; two of three reintroduced patches have died (Bartgis, pers. obs.). In cultivation and at the native New River site, Glechoma hederacea readily overcomes and chokes out the clover in moist, shady spots.

3. Life History

All other clovers that have been studied have a rhizobial associate that nodulates the roots, increasing nitrogen availability to the clover plants. To date, no nodulation has been found on wild plants of running buffalo clover and attempts to induce nodulation in cultivation have been unsuccessful

(D. Perry and N. Taylor, pers. comms.). Small nodules uninfected by Rhizobium have been observed in cultivation, suggesting that running buffalo clover has at least had a rhizobial associate in the past. It is not known whether a suitable rhizobial associate exists and is not infecting wild plants because of life history events or if the rhizobial associate is extinct, either due to the decline of the host or competition from rhizobia introduced with exotic clovers. Adult running buffalo clover plants, in fertile competition-free conditions, appear to thrive without nodulation. However, it is suspected that the establishment of young plants in the wild or the maintenance of plants under competitive or suboptimal conditions would be enhanced by the presence of a rhizobial associate.

The small sizes of running buffalo clover populations are also of concern. The populations appear to be predominantly maintained by vegetative reproduction, suggesting that only a very small number of genotypes have been located. Individual plants in the extremely small West Virginia populations set seed, indicating self-fertilization. Inbreeding depression in self-crossing populations with one or few genotypes may reduce population vigor.

4. Other

A few pathogens have already been observed affecting running buffalo clover. These include peanut stunt virus and powdery mildew (N. L. Taylor, pers. comm.; Campbell et al., 1988). As to be expected with a clover, predation is also frequent, particularly from slugs and rabbits, among cultivated plants (Campbell et al., 1988; Davis 1987). To date, no known wild

populations have declined from disease or predation but the small sizes characteristic of known running buffalo clover populations puts them at a high risk of loss to such events. Fortunately, because clovers are economically important, considerable research has already been completed concerning pathogens that affect clovers. Treatment for peanut mosaic virus, powdery mildew, and other pathogens that probably would be encountered is largely already developed. Additional research will be needed only if an otherwise little understood pathogen significantly impacts wild running buffalo clover populations.

PART II. RECOVERY

A. OBJECTIVE

The primary objective of the recovery plan for running buffalo clover is to identify, protect, maintain and enhance existing populations of the species throughout its range. Reclassification of the running buffalo clover to threatened can be considered when: population size and dynamics and other aspects of life history necessary for a population to be self-maintaining in perpetuity are known; and 30 secure, self-sustaining populations are known to exist, either through management of native populations or the establishment of reintroduced populations. As additional information becomes available on the species' life history and requirements, this goal should be modified as appropriate. Delisting actions for this species are expected to be initiated by the year 2000, contingent upon the protection and management of additional populations in excess of 30.

B. RECOVERY PLAN NARRATIVE

1. Protect occupied habitat and populations of running buffalo clover. Because there are so few known populations, perhaps representing only a few genotypes, each site should be maintained.

   11. Inventory known populations. Population size should be determined, either estimated for larger populations or actual counts for smaller populations. Note evidence of disease or predation, root nodulation, or vandalism. Describe recent disturbance regime and land use. Identify landowner.

   12. Survey for additional wild populations. Each wild population found may represent new genotypes or support an effective rhizobial associate. The most recent discoveries of extant populations in Kentucky, Ohio, and Indiana suggests new populations are indeed likely to be found.

      121. Surveys in eastern part of range. With extant populations in Indiana, Kentucky, West Virginia, and Ohio, searches for additional populations in those states should continue. Emphasis should be placed on surveying disturbed woodlands along narrow stream valleys and on terraces near the Ohio River in the vicinity of the known Ohio River Valley populations and on surveying disturbed woodlands near the extant West Virginia populations. Secondary searches should occur in the Bluegrass of Kentucky and in the vicinity of other historical occurrences.

      122. Surveys in western part of range. Surveys in Arkansas and Kansas should be initiated. Surveys in Missouri and Illinois should

continue and focus on similar habitats as described in 121, in the vicinity of historic records. If extant populations are not found in this region in three years, these surveys should be deemphasized and done opportunistically.

13. Protect occupied habitat. Arrange for protection of known populations through land acquisition, cooperative agreements, or other protection strategies. All private landowners should be notified of the populations on their property, and opportunities for cooperative management discussed. In Kentucky the landowners have agreed to voluntary cooperative management agreements. Such agreements should be sought in Indiana. The West Virginia site is on a State owned natural area. The two privately owned tracts in Ohio are registered as Ohio Natural Landmarks. Four other Ohio sites receive protection. Although in public ownership, permanent protection efforts on the remaining two Ohio populations must be emphasized. Other protection strategies, such as lease or acquisition, should be evaluated on a case-by-case basis.

14. Determine and implement appropriate habitat management techniques for site. Following a determination of the recent disturbance regime for each site, the appropriate management techniques should be selected and utilized. If possible, this should include an experimental application of a potential management practice at the site to assess its value. For nearly all sites, this will include physical removal of some competitors as the need arises. At all sites, should populations decline following the continuance of current disturbance practices, the situation should be reevaluated

and corrective practices taken. This will require frequent monitoring.

141. West Virginia sites. For the Webster County site, management opportunities are considerably limited. Weeding of competitive grasses and poison ivy (Rhus radicans) from around the plants and maintaining adjacent plowing and mowing regimes should continue. At the Fayette County site, the road closure built to prevent off-road vehicles from crushing clover plants needs to be maintained. In the absence of disturbance from vehicles, the site needs to be mechanically disturbed. Competitors need to be weeded throughout the growing season.

142. Kentucky site. The recent disturbance regime needs to be more carefully documented. In the interim, past mowing practices should be continued.

143. Indiana sites. These may be the most difficult to manage since, unlike the Kentucky and West Virginia sites, plants are diffused over a fairly large area. The recent disturbance regime needs to be more carefully documented. In the interim, past grazing practices should be continued to enhance and maintain the vigor of these populations.

144. Ohio sites. All of the Ohio sites are in disturbed areas and are protected either by public ownership or management agreements. Management of these areas can be directed toward running buffalo clover.

2. Augment existing populations of running buffalo clover. Four of the Ohio, and all of the Indiana and West Virginia populations consist of relatively few individuals and are easily subject to loss from relatively minor catastrophes. A single herbivore could easily eliminate several of these populations. Therefore, it is desirable to increase the smaller populations' vigor and size.

21. Produce effective rhizobial associate. It is suspected that an effective rhizobial associate would improve seedling establishment and individual plant vigor during periods of stress.

211. Identify effective rhizobial associate, either from retrieving a Rhizobium that successfully infects the clover from soil taken at the wild populations or from laboratory strains. This may involve several research projects, including research into potential metabolic events that prevent the clover from being successfully infected by common species of Rhizobium.

212. Develop a technique for introducing the rhizobial associate effectively into the wild, should one be isolated. It is thought that the establishment of young plants would be enhanced by the presence of a rhizobial associate.

22. Delineate limiting factors that regulate wild populations. It is currently unknown which factors exert the greatest influence on wild populations and within what parameters wild populations would be most vigorous. Until these parameters are determined, it will probably be impossible to establish vigorous, long-term self-sustaining wild populations. In the process of annually monitoring known populations, determination should be made for:

number of ramets successively established, spatial distribution of individuals, competitors present and their spatial distribution, success of seed set, and seedling establishment.

221. Environmental factors. The primary factors of concern are nutrients, light, and moisture. Until questions concerning the rhizobial associate are addressed, questions concerning other nutrient requirements cannot be adequately addressed. Optimal light and moisture requirements should be determined. This would help address such questions as how much shading in woodland sites is desirable.

222. Biotic factors. Competitive interactions between the clover and its associates, particularly weedy species, needs to be addressed. Timing of life history events relative to competitive and environmental interactions also needs to be more thoroughly documented. For example, timing of disturbance may be more important than intensity of disturbance if disturbance creates potential rooting sites that coincide with peak stolon growth.

223. Genetic factors. Determine if self pollination is potentially detrimental in small wild populations. If so, it may be prudent to outcross with other genotypes to prevent potential inbreeding depression.

23. Develop methods for enlarging population sizes. If after addressing habitat management and other concerns, wild populations decline or do not increase to a stable level, other steps may be taken to enlarge populations, such as planting from cultivated stock. Suitable techniques will continue to develop from

cultivation of the clover. In vitro propagation of running buffalo clover may also be considered as a means of enlarging populations.

24. Monitor and manage reintroduced populations. Reintroduced populations will require monitoring to determine the success of the reintroduction; and to determine the correct management schemes necessary to maintain reintroduced populations.

241. Maintain current reintroductions. Currently there are two reintroduced populations, both created prior to the discovery of populations in Kentucky and Indiana. One is at West Virginia University's Core Arboretum in Monongalia County, WV near a historic collection site. This small population had to be fenced against rabbits and requires removal of Glechoma each growing season. The other is on National Park Service land of the New River Gorge National River near the wild Fayette County, West Virginia population. The only known population on federal land, it is currently the only population to receive protection from take or harm under the Act. Overtopping by competitors is a major problem, with significant loss of clover plants. Management at these sites will continue and should be similar to that used for wild populations.

242. Assess need for additional reintroductions. If after five years thirty wild populations are not found, additional reintroductions should be considered. Currently, too little is known about the species' biology and requirements to justify additional reintroduction attempts. Plantings in the wild independent of

the recovery program should be discouraged and, when known to occur, should be recorded.

3. Enforce protective legislation and take and trade prohibitions. Employ local, State, and Federal regulations to protect habitat containing the clover, and minimize threat to the species from take. Take is currently prohibited from the New River Gorge National River reintroduction site. All sites should be posted with the appropriate signs advising of the protected status of the plants and the prohibitions and penalties for take and removal. Trade is unlikely, except if the clover is shown to have economic value as a forage or cover crop. The Act provides for exceptions in the trade prohibition for special cases such as this.

4. Conserve germ plasm. Until additional populations may be found, it is prudent to maintain the genetic material represented by each population for both research purposes and augmenting wild populations. Cryopreservation methods should be explored.

   41. Seed storage. The University of Kentucky currently has seeds, that are maintained frozen, from the West Virginia populations. The U. S. Department of Agriculture National Plant Germ plasm System facility in Fort Collins, Colorado, should receive running buffalo clover seeds for long-term storage from at least one population in Indiana, Ohio, and Kentucky.

   42. Maintain lines of live plants and increase genetic diversity. Plants from all populations should be maintained in cultivation for purposes of research and augmenting populations.

421. Maintain existing cultivated lines. The USDA currently maintains lines from both West Virginia populations; the University of Kentucky maintains lines from the Kentucky and Fayette County, WV population. A registry of which institutions and individuals have which lines should be developed. The Center for Plant Conservation should be encouraged to develop and maintain populations at arboreta or Botanical Gardens.

422. Bring into cultivation plants from other wild populations. The Indiana populations, and other wild populations that may be found, should be represented in cultivated collections.

423. Determine need for long-term maintenance of all lines. Through isozyme analysis, the degree of genetic variability between populations can be determined, providing information needed to decide the importance of maintaining lines as genetic resources.

424. Improve methodology for maintaining and enlarging cultivated lines. The clover is relatively easy to grow and propagate vegetatively. However, cultivated plants need to be closely managed. For long-term production of living plants, less labor-intensive techniques for producing and maintaining many plants, such as tissue culture and cryogenics, may be required.

5. Provide public information about running buffalo clover. Such information may stimulate public interest and concern about the clover. Benefits could include stimulating a sense of pride and stewardship in landowners and could encourage amateur and professional naturalists to recognize the species and search for new populations.

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PART III

IMPLEMENTATION

The Implementation Schedule that follows outlines and prioritizes actions believed necessary in the Trifolium stoloniferum recovery program for the next three years. It is the guide for meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementations, recovery plan tasks, corresponding outline numbers, task priorities, duration of tasks, ("ongoing" denotes a task already begun, and is expected to continue), which agencies are responsible to perform these tasks, and estimated costs for the tasks. The estimated recovery costs for these first three years is estimated to be about $340,500.

This recovery process will be reviewed every three years until the recovery objective is met. It may be necessary to extend actions identified in this schedule into subsequent years. After all identified recovery actions identified in this plan have been carried out, management actions designed to maintain and enhance existing populations of Trifolium stoloniferum will be conducted at an estimated cost of $5,000 per year for the duration of the recovery period, bringing the total estimated recovery costs for this species to $375,500.

These actions, when accomplished, should bring about the recovery of Trifolium stoloniferum and protect its habitat.

KEY TO IMPLEMENTATION SCHEDULE

General Category (Column 1)

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
8. Public information

Acquisition - A

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

Other - O

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

Priority (column 4)

1 - Those actions absolutely necessary to prevent extinction or to prevent the species from declining irreversibly.

2 - Actions necessary to maintain the species and prevent a significant decline in the species population/habitat quality, or other negative impact.

3 - All other actions necessary to provide a full recovery for the species.

RECOVERY PLAN IMPLEMENTATION SCHEDULE
RUNNING BUFFALO CLOVER

GEN. CAT.	PLAN TASK	TASK #	PRIOR-ITY #	TASK DURATION (STATUS)	RESPONSIBLE AGENCY			FISCAL YEAR COSTS Estimated			
					FWS		OTHER				
					REGION	PROGRAM		FY 1	FY 2	FY 3	Comments/Notes
PROTECT OCCUPIED HABITAT AND POPULATIONS:											
I1	Inventory known populations	11	2	Ongoing	3,4,5	SE	IN,KY, OH,WV	10K	5K	5K	
I1	Survey for additional populations in eastern part of range	121	2	2 yrs.	3,4,5	SE	IN,KY, OH,WV	10K	10K		
I1	Survey for additional populations in western part of range	122	3	Ongoing	3,4,6	SE	IL,KS, MO,AR	15K	10K	5K	
I2	Determine appropriate habitat management techniques for sites	14	1	Ongoing	3,4,5	SE	IN,KY, OH,WV	7.5K	7.5K	7.5K	
M3	Implement appropriate habitat management techniques	141, 142, 143	2	Ongoing	3,4,5, 6	SE	IN,KY, OH,WV	10K	10K	10K	
A3	Protect occupied habitat through management agreements	13	2	Ongoing	3,4,5	SE	IN,KY, WV,TNC, & other private conser-vation organi-zations	10K	10K	5K	
AUGMENT EXISTING POPULATIONS											
I14	Identify effective rhizobial associate	211	2	2 yrs.	3,4,5	SE	USDA		15K	15K	
M7	Develop technique for effectively introducing associate into wild ...ers	212	2	1 yr.	3,4,5	SE	USDA WVU			10K	

RECOVERY PLAN IMPLEMENTATION SCHEDULE
RUNNING BUFFALO CLOVER

GEN. CAT.	PLAN TASK	TASK #	PRIOR-ITY #	TASK DURATION (STATUS)	RESPONSIBLE AGENCY			FISCAL YEAR COSTS Estimated			
					FWS		OTHER				
					REGION	PROGRAM		FY 1	FY 2	FY 3	Comments/Notes
I3	Delineate limiting environmental factors that regulate populations	221	2	2 yrs.	4	SE	UKY, USDA, WVU		5K	5K	
I10	Delineate biotic factors that regulate populations	222	2	2 yrs.	4	SE	UKY		10K	10K	
I6	Delineate genetic factors that regulate populations	223	2	1 yr.	4	SE	UKY, WVU			10K	
M2	Maintain current reintroductions	241	2	Ongoing	5	SE	NPS, WV, WVU	3K	3K	3K	
ENFORCE AVAILABLE PROTECTIVE LEGISLATION											
O2	Enforce protective legislation and take and trade prohibitions	3	3	Ongoing	3,4,5	LE		1K	1K	1K	
CONSERVE GERM PLASM											
M1	Seed storage	41	3	Ongoing	3	SE	USDA-Ft Collins, CPC		3K	3K	
M1	Maintain existing cultivated lines of live plants	421	2	Ongoing	3,4,5	SE	USDA, UKY, CPC		5K	5K	
M1	Bring into cultivation plants from other wild sites	422	2	1 yr.	3	SE	IN, CPC	5K	10K	10K	

RECOVERY PLAN IMPLEMENTATION SCHEDULE
RUNNING BUFFALO CLOVER

GEN. CAT.	PLAN TASK	TASK #	PRIORITY #	TASK DURATION (STATUS)	RESPONSIBLE AGENCY			FISCAL YEAR COSTS Estimated			Comments/Notes
					FWS		OTHER				
					REGION	PROGRAM		FY 1	FY 2	FY 3	
I7	Determine need for long-term maintenance of all lines	423	3	1 yr.	3,4,5	SE	USDA			10K	
I7	Improve methodology for maintaining and enlarging cultivated lines	424	3	2 yrs.			WVU, CPC		15K	15K	
01	Provide public information about running buffalo clover	5	3	Ongoing	3,4,5, 6	SE	All	5K	10K	5K	

Continuous - Tasks that will continue once initiated
Ongoing - Tasks now being implemented

IL - Illinois Dept. of Conservation
IN - Indiana Dept. of Natural Resources
KS - Kansas Biological Survey
KY - Kentucky Nature Preserves Commission
MO - Missouri Dept. of Conservation
NPS - National Park Service
UKY - University of Kentucky
USDA - U.S. Dept. of Agriculture
WV - West Virginia Dept. of Natural Resources
WVU - West Virginia University
CPC - Center for Plant Conservation
SE - Division of Endangered Species
FWS - Fish and Wildlife Service
AR - Arkansas Game and Fish Commission
TNC - The Nature Conservancy
LE - FWS Law Enforcement Division