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Management Plan for Racine Prairie Scientific and Natural Area Mower County

# W2 NW4 Section 23 E2 NE4 Section 22 Township 104 North Range 14 West

"A portion of the former railroad bed and right-of-way of the Chicago and Northwestern Railroad"

> Prepared by The Scientific and Natural Areas Program Section of Fish and Wildlife Minnesota Department of Natural Resources

> > May 1983

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## PREFACE

Scientific and Natural Areas are established to protect and perpetuate natural features which possess exceptional scientific or educational value. Nominated areas must substantially satisfy a set of rigorously drawn criteria to qualify for designation. Scientific and Natural Areas serve many purposes. They are places for the quiet appreciation and study of nature. They serve as outdoor classrooms for teachers. They are areas against which the effectiveness of resources management techniques employed elsewhere can be evaluated. They also serve as control areas for scientists engaged in furthering our knowledge of natural processes.

i

However, acquisition alone does not assure long term preservation of natural areas and their endangered species. Many natural areas are declining in quality because they are not properly managed. Management of vegetation, control of foreign species, and management of visitors are important concerns.

Comprehensive planning is the key to effective and successful management. In 1975 the Minnesota legislature passed into law the Outdoor Recreation Act (86A), establishing the Outdoor Recreation System. This act directed managing agencies to prepare master plans for units of the system. This document is part of a planning effort to satisfy the mandates of that act. The goal of this plan is to coordinate a strategy for stewardship that addresses biological management, obligations of ownership, and visitor management.

This plan was prepared by the Department of Natural Resources, Scientific and Natural Areas Program with the assistance of the Commissioner's Advisory Committee on Scientific and Natural Areas. It was based on a resource inventory prepared by the Natural Heritage Program. Funding was provided by the Legislative Commission on Minnesota Resources.

# SUMMARY OF MANAGEMENT PROGRAMS

## General Management Considerations

Racine Prairie SNA will receive a moderate level of management activity. A local resident will be solicited to be a SNA volunteer steward for the unit. The Department of Transportation will cooperate in managing the U.S. Highway 63 right-of-way adjoining the west boundary of the SNA to protect the prairie. Several railroad ties must be removed from the tract before burning.

# Structures and Facilities

The fence on the east side of the SNA needs to be repaired. Eventually it may need replacement. Access to the SNA is satisfactory. Visitors can park safely on the highway shoulders. There is one farm crossing in the center of the unit. A lease providing for this crossing will be executed. Additional signing will include: entrance sign, rules and regulations, and an interpretive sign.

# Vegetation Management

The SNA has been divided into two management units. Prescribed burning will be a major management activity. The primary safety consideration is smoke management relating to the highway. Problem plants that require management attention include smooth brome grass (Bromus inermis), bluegrass (Poa sp.), quackgrass (Agropyron repens), reed canary grass (Phalaris arundinaceaeI), white sweetclover (Melilotus alba), yellow sweetclover (Melilotus officionales), wild parsnip (Pastinaca sativa) and Canada thistel (Cirsium arvense). There are only a few isolated patches of Canada thistle on the highway right-of-way and these are being treated. It is not clear what level of management is justified to control the other problem species. The actual threat to the native plant community will be studied. Rare plants occurring on the SNA will be periodically censused.

### Additional Inventory Needs

The faunal groups of Racine Prairie have not been inventoried. Small mammals and insects should receive the highest priority for survey work.

# TABLE OF CONTENTS

PRF	PACEi
SUM	MARY OF MANAGEMENT ACTIONS
I.	GENERAL MANAGEMENT CONSIDERATIONS A. Level of Management Activity
II.	STRUCTURES AND FACILITIESA. FencingB. Access7C. Farm Crossings7D. Signs8
UII.	VEGETATION MANAGEMENT A. Fire Protection and Management
IV.	ADDITIONAL INVENTORY NEEDS14
v.	EFFECTS OF MANAGEMENT ON SIGNIFICANT RESOURCES 15
VI.	MANAGEMENT COSTS AND IMPLEMENTATION

iii

# OVERVIEW

# Introduction

The Racine Prairie Scientific and Natural Area is located in north-eastern Mower County. The SNA is part of the former railroad bed and right-of-way of the Chicago and Northwestern Railroad between Racine and Stewartville. U.S. Highway 63 forms the west boundary of the SNA.

The right-of-way is ½ mile long, 75 feet wide and consists of a railbed, shoulders, and adjoining prairie. The ties and rails were removed in 1980, leaving a 10-12 foot wide bare corridor down the middle of the right-of-way. The shoulders on either side of the railbed are 5-10 feet wide and are also disturbed. The remainder, between the shoulders and edge of the right-of-way, contains several rare plants and excellent remnants of a tall grass prairie community that once covered much of SE Minnesota.

# Preservation Value

Racine Prairie occurs within the Southern Oak Barrens landscape region. This  $\frac{1}{2}$  mile long prairie corridor preserves a small sample of the original prairie region. Several highly significant natural features have been identified on the SNA by the DNR's Natural Heritage Program. The Natural Heritage Program maintains the most comprehensive data base available on Minnesota's rare plant and animal species, and biotic communities. These biological entities (species and communities) are known as "elements" and are ranked according to their endangerment in the state. One critically endangered plant community and 2 plant species of special concern occur on the Racine Prairie.

# Plant Communities

The Racine Prairie is an excellent example of a plant community type called the (SE MN) Tallgrass Prairie. This plant community is ranked as threatened throughout its entire range and as critically endangered in Minnesota. Less than 500 acres of intact (SE MN) Tallgrass Prairie are known to exist.

The (SE MN) Tallgrass Prairie occurs on deep, fertile silt-loam soils and harbors upwards to 300 species of native plants, it is the most diverse prairie community type in Minnesota. The dominant grasses, big bluestem (Andropogon gerardi) and Indian grass (Sorghastrum nutans) reach heights of six to eight feet, due to favorable moisture and soil conditions. Broad-leaved plants restricted to, or modal to the (SE MN) Tallgrass Prairies include prairie wild indigo (Baptisia leucophaea), white false indigo (Baptisia leucantha), rattlesnake master (Eryngium yuccifolium), wild quinine (Parthenium integrifolium), and Indian plantain (Cacalia tuberosa).

# Rare Plant Species\*

Two species occurring on Racine Prairie are listed as "special concern" in Minnesota because they are declining throughout the state and may become threatened in the foreseeable future.

1. Rattlesnake master (Eryngium yuccifolium) -- special concern species.

2. Wild indigo (Baptisia leucophea) -- special concern species.

# ORA Classification

The Racine Prairie fully meets the designation criteria for a scientific and natural area as outlined in the Outdoor Recreation Act of 1975 (86A.05 Subd. 5). The preserve includes: (1) natural features wich significantly illustrate an undisturbed plant community; (2) habitat supporting the following rare, endangered or restricted plants: prairie wild indigo (Baptisia leucophaea) and rattlesnake master (Eryngium yuccifolium), and (3) an area large enough to permit effective research and educational functions and to preserve the inherent natural values of the site.

# Management Philosophy

The two most important attributes of Racine Prairie are (1) the high natural quality and diversity of the plant community, and (2) the presence of several rare species. The major management problems are controlling woody encroachment and exotic herbaceous plants, stagnation of native species due to cessation of fire, and the impacts of adjacent agricultural and highway activity. The inherent dynamic nature of a prairie community necessitates an active management policy for this SNA.

\*"Rare" in this report is defined as a species proposed as endangered, threatened or special concern in: Endangered and Threatened Plant species of Minnesota. Recommendations of the Endangered Species Technical Advisory Committee, presented to the Commissioner of the DNR, Nov. 1982.

## I. GENERAL MANAGEMENT CONSIDERATIONS

# A. Level of Management Activity

The amount of management that takes place in an SNA is dependent on need and practicality of implementation. The level of management activity at Racine Prairie SNA will be moderate. Some of the geographical considerations are discussed below.

# a. Distance from St. Paul and regional officers.

Racine Prairie SNA is approximately 100 miles from the St. Paul based SNA staff. Day trips are possible but do not allow for much time in the field. Wild Indigo SNA is about 20 miles from DNR regional offices in Rochester. Because of this proximity, a considerable amount of management will be coordinated out of the Rochester office through the Area Wildlife Manager.

# b. Proximity to university or college campuses and research facilities.

Racine Prairie SNA is not particularly close to any major educational institutions (Mankato State Univ.--100m., Winona State Univ.--50 mi., Univ. of Minnesota Twin Cities--100 mi.). There are community colleges in Austin and Rochester. The University of Minnesota Hormel Institute is also locted in Austin. This research facility is reknown for its work with lipids. Students wishing to do technical chemical research on Racine Prairie may be able to coordinate some of their activities with this facility.

c. Proximity to other SNAs.

Wild Indigo SNA is a 14 mile railroad right-of-way prairie approximately 15 miles west of Racine Prairie. Some coordination of management effort may be possible between these two units.

# B. Surveillance and Enforcement

Nonconforming uses can damage natural conditions and the aesthetic appearance of natural areas. Because of the value and fragility of nature preserves, their continuing protection and maintenance should be provided on a systematic, rather than haphazard basis. Racine Prairie is particularly susceptible to nonconforming uses because of its long narrow configuration and small size (4.6 acres). Help in protecting Racine Prairie's resources can be accomplished by developing local support and understanding of the SNA. Local citizens are encouraged to report any signs of problems or nonconforming uses. A local volunteer should be assigned responsibility for periodic field inspections, answering questions as they arise locally, and preparing an annual status report. Enforcement is the responsibility of the local conservation officer and the SNA staff. The Area Wildlife Manager in Rochester is the local DNR contact for this SNA.

# C. U.S. Highway 63 Right-of-Way Management.

Highway 63 parallels the SNA and forms its western boundary. At the time of sale, the western 25 feet of the railroad right-of-way was retained by the Department of Transportation (D.O.T.) for highway improvements. The highway right-of-way is presently mowed and spot sprayed for Canada thistle. The westernmost edge of the prairie is included in these maintenance activities. D.O.T. has expressed their willingness to modify mowing and spraying activities to protect the prairie.

Action # 2 Post the highway right-of-way paralleling the SNA as a no-mow, no-spray area.

Considerations: Boundaries - Exact boundaries will be determined jointly by DOT and SNA staff.

Action # 3 Initiate a cooperative management agreement with DOT regarding the highway right-of-way.

Considerations:

Burning - The agreement would allow burning the highway right-of-way.

Problem plants - Control of problem plants on the highway right-of-way would be consistent with strategies outlined under 'Vegetation Management' in this plan.

# D. Cleanup

A considerable number of railroad ties still remain on the SNA. These should be removed before burning the prairie.

Action # 4 Remove ties along the right-of-way.

# II. STRUCTURES AND FACILITIES

# A. Fencing

The right-of-way is partially protected on the east side by fencing originally erected and maintained by the railroad. This fence is in need of replacement or repair along most of its length. Shoring up this existing fence may be adequate for the near future. The fence will need replacement eventually. The west side of the right-of-way is continuous with the Hwy 63 right-of-way.

Action #5 Shore up the existing fence on the east side of the right-of-way.

# Considerations:

New Construction - 3-strand barbed wire will be adequate. The lowest strand should be strung relatively high (e.g. 2 ft.) to minimize any possible heat damage from prescribed fires.

# B. Access

Highway 63 has wide paved shoulders that provide ample space for parking. No further dvelopment will be needed.

### C. Farm Crossings

Farm implement crossings are sites of continuing disturbance. Noxious weeds and nuisance plants occur in these areas, confounding management efforts to suppress these species on the rest of the right-of-way. There is only one field crossing in the middle of the SNA. Crossings are necessary for farming operations; however, to fulfill SNA management objectives, the size of crossings must be kept at a minimum.

Action #6 Execute a lease with adjacent landowner for farm crossings.

#### Considerations:

Need - Crossings will only be allowed where reasonable need is demonstrated, and where there is no other practical access.

Containment - Farm crossings will be defined by posts no more than 25' apart on either side of the crossing, both on the east and west boundaries of the SNA.

# D. Signs

The purpose of signing is to 1) identify the area, and 2) provide basic visitor information. Four types of signs will be used. Boundary signs have already been posted along the entire length of the SNA. In addition, a rules and regulations sign, entrance sign, and interpretive sign will be necessary.

Action #7	Post rules and regulation signs.
Action #8	Post an entrance sign.
Action #9	Erect an interpretive sign.

Considerations:

Location - All three signs should be grouped together in the same location, preferably a short distance south of the farm crossing.

Style - The entrance sign will be wood routed, visible to both directions of travel.

# III. VEGETATION MANAGEMENT

# A. Fire Protection and Management

Prescribed burning will be a major management activity. The SNA has been divided into two management units, one north and one south of the field crossing. Initially, cool early spring fires are recommended to remove thatch. To suppress woody vegetation on the north unit, other prescriptions (i.e. fall or summer burn) may be necessary.

Action #10 Burn the prairie.

# Considerations:

Timing - Early spring. In the long-term, some randomness in timing is desirable.

Frequency - Once every 3-4 years. A more random burn schedule is desirable as a long-term objective.

Smoke Management - Winds at the time of burning must have a westerly component to avoid the rish of smoke blowing across state Hwy 63. Burn crews must be prepared to post flagmen to control traffic if the winds shift. These flagmen must have radios to communicate with each other in order to safely direct traffic.

Action #11 Contact the Stewartville Fire Department.

# Considerations:

Desirable control methods - Discuss with the Fire Department the purpose of Racine Prairie SNA and desirable methods of containing a wildfire. Provide them with a fire management map.

# B. Problem Plant Management

The following plant species are potential management concerns on this SNA.

Noxious Weeds:

<u>Cirsium</u> <u>arvense</u>, Canada thistle - a few scattered patches, mostly along the highway right-of-way Biennials:

Melitotus alba, White sweetclover - common to locally abundant on the railbed

Melitotus officionales, Yellow sweetclover - same as above

Pastinaca sativa, Wild parsnip - scattered to locally common on shoulder, and a few low wet areas.

# Perennial Sod-forming Grasses:

Bromus inermis, Smooth brome - dominant on the railbed shoulders and highway right-of-way and locally common along fence lines

# <u>Poa</u> sp., Bluegrass - ubiquitous in both disturbed and undisturbed areas.

Agropyron repens, Quack grass - Occasional on the railbed and other sites of recent disturbance.

# <u>Phalaris</u> <u>arundinaceae</u>, Reed canary grass - occasionally dominates wet areas

The objectives of problem plant management are 1) to arrest the expansion of these non-native species, 2) to identify the real threats of non-native to native species, 3) to stimulate the establishment and growth of native species in disturbed areas, and 4) identify factors limiting the establishment and dominance of native species in disturbed areas.

Management of these problem plants has been considered in the management prescriptions for the management units. Three of these problem species, however, may require additional management. These are smooth brome, and both sweetclovers. Some research attention should also be directed towards reed canary grass and wild parsnip.

#### SMOOTH BROME

#### Present Status

Smooth brome dominates the highway right-of-way and raised railbed shoulders, often in monotypic patces. It is suspected of being able to move onto the prairie without the aid of any disturbances and displace native species.

# Threat

Brome occurs adjacent to good and high quality prairie areas. If capable of displacing native species, areas with brome could threaten the integrity of that adjacent prairie.

# Control Capability

Mowing: The objective would be to cut flowering culms before fruiting. Even under the best conditions this is not expected to be an efficient control method. Brome has an excellent capacity for vegetative regeneration.

Burning: A late spring burn would have the greatest effect in suppressing brome. In monotypic stands it is not certain whether this would result in a shift to other species.

Herbicides: Careful, selective application of a herbicide could effectively control a monotypic stand. Herbicide use might be coupled with burning to stimulate the establishment of other species. Herbicide use is not acceptable in an area with both natives and brome mixed.

Action #12 Keep quantitative and qualitative records of smooth brome.

# Considerations:

Permanent plots - Establish permanent plots and mark boundaries of brome stands. Note change over time.

Qualitative observations - Record the relative status of brome in relation to native species prior to each vegetation management treatment (% coverage, interspersion, etc)

# SWEET CLOVER\*

#### Present Status

Was reported to be well established on railbed, as a result of disturbance caused by tie and rail removal in 1980. In 1982, however, both first and second year plants were scarce.

\*Additional information on sweet clover management provided in Appendix

#### Threat

Sweet clover can compete wth native plants for light, nutrients, water, and space. At the seedling or early vegetative stages sweet clover is not a good competitor. Second year plants grow rapidly in spring and can compete with other plants. Hard seeds lie dormant for many years in the soil, perpetuating the population. It is not certain to what degree sweet clover stresses established native species or affects recolonization of disturbed areas by native plants. Sweet clover does fix nitrogen and may improve the fertility of the soil (i.e., the railbed).

# Control Capability

Mowing: Effect is dependent on location.

- a) Railbed The ground is level. Cutting height with proper equipment will cut below the lowest branch axils. Some resprouting from root crowns occurs. No conflict with native species.
  - b) Shoulder Difficult or impossible to now. Steep slopes are the major limitation on the north unit.

Burning: Effect is dependent on location.

- a) Railbed variable fuels
- b) Shoulders Fuels generally adequate, ground is rough, especially in bermed areas.

Herbicides: Sweet clover does not grow in monotypic stands, hence spraying is not acceptable. Wick application may be effective since 2nd year sweet clover overtops the other vegetation.

Action #13 Record observations on sweetclover abundance, distribution and phenology annually and prior to each vegetation management treatment.

#### REED CANARY GRASS

# Present Status

Reed canary grass dominates several low wet areas and occurs as scattered clumps in several others.

# Threat

Reed canary grass forms a dense monotypic sod. It is uncertain whether this grass is displacing native lowland prairie or simply represents an area of past disturbance.

# Control Capability

Mowing: Not feasible because of wetness.

Burning: Not expected to alter existing conditions but may retard further expansion.

Herbicides: Unknown.

Action #14	Establish a few study areas to monitor displacement of native lowland prairie by reed canary.
Action #15	Prior to each management, treatment record phenologic condition and describe abundance and distribution of reed canary within the unit.

# C. Rare Plant Management

The conservation of threatened, endangered, and special concern species is a primary management objective for SNAs. Monitoring studies that contribute towards a complete understanding of the biology of rare species are the basis for conservation management. Successful management of a rare plant popultion implies the ability to manipulate the size and structure of that population. If monitoring is to contribute significantly to this ability, it must yield predictive understanding of population structure and functioning.

As a minimum, periodic censusing of those species with the highest conservation priority is necessary. The objective would be to document numbers of individuals in a population over time. This might provide guidance for future management decisions and practices.

Major deficiencies in a censusing approach are a) one is monitoring the end result without knowing precisely how it was arrived at, and b) generally only one phenological stage is considered. Both of these difficulties may be overcome by intensive monitoring that studies autecological information on life history, phenology, population flux, survivorship and the causes of mortality. This level of information is highly desirable but the likelihood of obtaining it is remote.

Action #16	Census a few select areas for: <u>Baptisia leucophea</u> and <u>Eryngium yuccifolium</u> .
Action #17	Prior to any management activity on a unit, record phenologic condition and estimate abundance and distribution or rare plants within the unit.

# IV. ADDITIONAL INVENTORY NEEDS

No systematic inventory of Racine Prairie's faunal groups has been conducted. The narrowness of the habitat, and relatively large proportion of edge accentuates influences of surrounding land use on the SNA's animal community. Population dynamics are influenced primarily by circumstances occurring outside the SNA.

Action #18 Systematically survey the fauna of Racine Prairie SNA.

# Considerations:

Priorities - Small mammals and insects should receive the highest priority for survey work.

# V. EFFECTS OF MANAGEMENT ON SIGNIFICANT RESOURCES

Rattlesnake Master (Eryngium yuccifolium)

1. Burning (Action #11): This species is a summer blooming, perennial forb. Burning, and in particular spring burns are expected to benefit the plants.

# Wild Indigo (Baptisia leucophea)

1. Burning (Action #11): Wild indigo is at its greatest growth rate and flowering in May and June. Late spring burning may be directly damaging to this plant, however, burning in general is expected to invigorate growth and flowering.

Highway Right-of-Way Management (Actions 2 and 3): Management of the highway right-of-way consistent with the SNA will benefit the prairie.

Fencing: (Action 5): Shoring up the fence on the east side of the SNA will assure protection of the prairie from encorachment.

Problem Plant Management (Actions 12, 13, 14 and 15): Because the rare species generally do not occur in disturbed areas they will not be directly impacted by management activities for problem plants. Controlling the spread of these undesirable plants onto the existing prairie will be beneficial.

# MANAGEMENT COSTS AND IMPLEMENTATION

Actions recommended in this plan have been separated into two categories: administrative operational. The costs of administrative actions are difficult to itemize because they are included in an SNA staff member's salary. Collectively, increases in administrative responsibility recommended in this and other plans will exceed existing staff capacity. Adequate staffing must be provided to implement these plans as recommended.

Operational actions are on-site activities. These often have both capital and labor costs. Capital costs have been listed. Estimates of labor needs are provided where possible.

Administrative and operational actions are often funded out of different sources. This makes it difficult to present an implementation schedule that equates both types of actions. To accommodate this, separate implementation schedules are outlined for each category.

It is important, however, to have a mechanism that allows comparison between all actions in this plan, and between actions from different plans. The system outlined below distinguishes between a) actions needed to improve or maintain the integrity of a site's most important features, b) legal or moral obligations of ownership or land management by SNA, and c) all other actions important for reasons other than above.

Stewardship Group I Actions: These are actions that prevent or reduce the vulnerability of the element to destruction or serious degredation. That is, in the absence of these actions the preservation of the element is threatened on this site. Research, ecological survey and monitoring may be included here if, without such information, it is not known what actions are necessary to maintain the element.

Stewardship Group Ia Actions: These actions are the same as Group I except that they are actions needed by all or the majority of elements on the site, i.e., they address those needs/threats that were preceded by an asterisk (\*).

Stewardship Group II Actions: Actions necessary because they constitute an obligation of land management/ownership by the SNA Program. In some cases, actions may qualify under both Group I and II. For instance, a plant listed on a state noxious weed law may grow on a preserve. Control of the plant may be necessary as an obligation of ownership. If no action is taken, the county agricultural inspector might go in and broadcast spray to control the weed, and this could seriously impact elements on the preserve. In this case, the action to control the weed to avoid the broadcast spraying should be listed under Group I actions. If the weed grew in a road ditch and whatever action taken to control it was unrelated to element protection, weed control would be included under Group II actions. Other examples of actions usually included here are maintenance of road shoulders and litter removal.

Stewardship Group III Actions: Actions taken for all other reasons. Once again, care should be taken to 'float' actions up to the highest group justified. In many cases, activities such as guided field trips will fall under Group III. If it can be truly said that in the absence of such education activities vandalism or other acts would ensue which would negatively impact element preservation, these stewardship actions could be listed under Group I. Such arguments should be well supported with background information. In general, actions taken to improve aesthetics, promote or enhance public use, develop trails, derive income and develop facilities will fall under Group III.

The following chart illustrates the scheduling of actions described in the text, and the immediate and on-going capital costs of implementation. The scope of this plan covers a ten year period. The plan should be reviewed every five years to evaluate progress, reassess priorities and refine management techniques. Actions listed under the category "Begin Immediately" need immediate attention. "Phase I" is the first five year period. "Phase II" is the second five year period. Implementation of many actions is dependent on availability of materials, equipment and labor. An action may be initiated sconer than scheduled if circumstances so dictate and earlier scheduled actions will not suffer as a result.

ADMINISTRATIVE ACTIONS

Action			Strd- ship Group	Begin Immed- iately	Phase I	Phase II	Connents
Action	#2	Post highway right-of-way No-Mow No-Spray sign	Ia	X			· · ·
Action	#3	Initiate cooperative management agreement with DOT for the highway right-of-way.	Ia	X			
Action	#11	Contact Stewartville Fire Department	Ia	X			
Action	#6	Lease farm crossing	II		X		
Action	#1	Identify volunteer steward	III		X		
OPERAT	IONAL A	CTIONS		· · · · · · · · · · · · · · · · · · ·			
Action	#4	Remove railroad ties	Ia	х			1 work crew/day
Action	#5	Repair fence	Ia		500	2500	Phase I - shore up fence Phase II - rep- lacement
Action	#10	Burn the prairie	Ia	Х			Contingent on Action #4
Action	#12	Keep a) quantitative and b) quali- tative records on smooth brome grass	Ia	nc			Ongoing
Action	#13	Record sweetclover abundance, distri- bution and phenology annually and prior to management	- Ia	nc			Ongoing
Action	#14	Establish study project on reed canary grass	Ia		nc		Ongoing
Action	#15	Record observations on reed canary grass	Ia	nc			

Action		Stra- ship Group	Begin Immed- iately	Phase I	Phase II	Comments
Action #16	Census <u>Eryngium</u> yuccifolium and Baptisia leucophea	I	nc			Ongoing
Action #17	Record observations on rare plants prior to each management agreement	Ia	nc			Ongoing
Action #7	Post rules and regulations sign		\$5	· .		
Action #8	Post entrance sign	-		\$50		
Action #9	Post interpretive sign			\$100		
Action #18	Survey fauna	III		Cost?		

# Appendix

# Sweet Clover Management

Control Factors

Α. Critical Growth Periods

1st year plants - Late summer. Top growth efforts of the plant decrease and root growth accelerated. Root reverses important for winter survival and second yar growth.

2nd year plants - Early summer, just before flowering.

Β. Persistance

> Sweet clover produces a large proportion of hard (dormant) seeds that are long lived in the soil. Germination can be stimulated by burning and physical disturbance.

с. Competitive Ability

> Sweet clover is a poor competitor at the seedling and early vegetative stages. Second year plants grow rapidly in the spring and competes effectively with newly arising plants. Sweet clover will not persist in a perennial sward, however long-lived seeds in the soil can perpetuate a population.

#### D. Germination and Perenniation

Seedlins can appear any month of the year although there are pronounced peaks of emergence in March-April and September-October. Annual and biennial forms exist. Annual individuals overwinter as seeds and biennial individuals overwinter alternately as seeds and as thick tap roots with a crown and winter buds.

# Sweet Clove: anagement

	•					
Life History Phase	Control Method	Timing	Repetit: Yrl Yr2		n Yr3	Comments
st year plant Vegetative)	Burn	Late summer	>	?	?	Repetition depends on complementary management practices. Crops are still apt to be in adjacent fields
	Mow		-	-	-	<ul> <li>Does not provide effective control</li> <li>Dequipment does not cut low enough to ground.</li> <li>Some reduction of vigor is possible.</li> </ul>
	Herbicide 2,4-D (Glyphos- phate)	Summer	<b>V</b>	?	?	•Repetition depends on degree of control. lst yr. plants more susceptible than 2nd yr. plants.
	Handpulling	Summer	-	~	~	•Difficult to grasp
id year plant Flower Searing)	Burn	Early summer	?	~	~	Repetition will depend on perenniation (annual is biennial) and population age structure (even age, uneven aged).
	Mow	Early summer	?	2-3 times		<ul> <li>Same comments as under burning.</li> <li>Should wait until lower branches begin to die back from self shading.</li> </ul>
	Herbicide Glyphos- phate (2,4-D)	Early summer	?		-	<ul> <li>Same as burn</li> <li>Wick application of glyphosphate (Round-up) when sweetclover is taller than surrounding vegetation.</li> <li>\$2,4-D less effective on 2nd yr. plants than 1st yr. plants.</li> </ul>
	Handpulling	Early summer	?	~	-	•Same as burn
3ed	Burn - stimulates seed germination	Fall, early spring	~	-		Preparation for any of the control methods described above releases maximum amount of sweet clover so that control methods will be directed at the 'whole' sweet clover population.
				l	- <u>1</u>	

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