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HELENA, MONTANA 59620SENSITIVE PLANT SPECIES SURVEY  
GARFIELD AND MCCONE COUNTIES, MONTANA

## Prepared by:

Bonnie L. Heidel, Botanist  
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State Library Building  
1515 E. 6th Avenue  
Helena, MT 59620

## Prepared for:

Bureau of Land Management  
P.O. Box 36800  
Billings, MT 59107-6800Task Order No. 21  
Agreement No. E-950-A1-0006

December 1994

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Heidel, B. L. 1994. Sensitive plant survey in Garfield and McCone counties, MT. Unpublished report to the Bureau of Land Management. Montana Natural Heritage Program, Helena. 58 pp. plus appendices.

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TABLE OF CONTENTS

	<u>Page</u>
I. EXECUTIVE SUMMARY .....	i
II. INTRODUCTION .....	1
III. STUDY AREA .....	1
IV. METHODS .....	5
V. RESULTS .....	7
A. OVERVIEW	
B. VERIFIED PLANTS OF SPECIAL CONCERN WITHIN THE COUNTIES; species status and habitat profiles	
1. Annual bursage ( <u>Ambrosia acanthicarpa</u> )	10
2. Geyer's milkvetch ( <u>Astragalus geyeri</u> )	15
3. Roundleaf water-hyssop ( <u>Bacopa rotundifolia</u> )	19
4. American waterwort ( <u>Elatine americana</u> )	23
5. Tulip gentian ( <u>Eustoma grandiflora</u> )	27
6. Hot spring phacelia ( <u>Phacelia thermalis</u> )	31
7. Moss phlox ( <u>Phlox andicola</u> )	35
8. Persistentsepal yellowcress ( <u>Rorippa calycina</u> )	40
9. Few-flowered goldenrod ( <u>Solidago sparsiflora</u> )	48
10. Graceful arrowgrass ( <u>Triglochin concinnum</u> var. <u>debile</u> )	52
VI. DISCUSSION .....	56
VII. LITERATURE CITED.....	57

TABLES AND FIGURES

TABLES	<u>Page</u>
Table 1. Plant Species of special state concern in Garfield and McCone counties, Montana	7
FIGURES	
Figure 1. Garfield and McCone County study area	2
Figure 2. Plant species of special state concern in Garfield and McCone counties, Montana	8
Figure 3. Annual bursage ( <u>Ambrosia acanthicarpa</u> ) illustration	11
Figure 4. Geyer's milkvetch ( <u>Astragalus geyeri</u> ) illustration	16
Figure 5. Roundleaf water-hyssop ( <u>Bacopa rotundifolia</u> ) illustration	19
Figure 6. American waterwort ( <u>Elatine americana</u> ) illustration	23
Figure 7. Tulip gentian ( <u>Eustoma grandiflora</u> ) photo reprint	28
Figure 8. Hot spring phacelia ( <u>Phacelia thermalis</u> ) illustration	31
Figure 9. Moss phlox ( <u>Phlox andicola</u> ) photo reprint	36
Figure 10. Persistentsepal yellowcress ( <u>Rorippa calycina</u> ) photo reprint from slide (close-up)	41
Figure 11. Persistentsepal yellowcress ( <u>Rorippa calycina</u> ) photo reprint from slide (typical habitat in Wyoming)	43
Figure 12. Few-flowered goldenrod ( <u>Solidago sparsiflora</u> ) illustration	49
Figure 13. Graceful arrowgrass ( <u>Triglochin concinnum</u> var. <u>debile</u> ) illustration	53



## APPENDIX

Appendix 1 - BLM areas surveyed for sensitive plant species

Appendix 2 - Preliminary list of survey target species potentially occurring in Garfield and McCone counties

Appendix 3 - Survey form for state plant species of special concern

Appendix 4 - Element occurrence records and maps of species of concern in Garfield and McCone counties

Appendix 5 - Preliminary list of vascular plants in Garfield and in McCone counties



## EXECUTIVE SUMMARY

Sensitive plant survey work was conducted in Garfield and McCone counties of Montana, on lands administered by the Bureau of Land Management. This report summarizes the findings of the field inventory and concurrent compilation of written information. It represents a sensitive species program baseline and preliminary floristic inventory in an area of the state which has not been well studied. The BLM lands do not represent the entire array of landscape in the two-county area, though they were the focus of this study. Information compiled in the course of this study represents an initial approximation of the two-county sensitive species diversity and flora as a whole.

Ten plant species of special concern are known from Garfield and McCone counties; two were discovered in the course of this project. Neither of the two are recommended for BLM designation as sensitive because it was determined in the fieldwork that they are not rare, nor under existing or foreseeable threats associated with rarity. Status recommendations and the likelihood of finding the other eight species on BLM lands are discussed in the report.



## INTRODUCTION

This botanical study of sensitive species was conducted on lands administered by the Bureau of Land Management (BLM) in McCone and Garfield counties, in eastern Montana. The purpose of this work was to locate and evaluate populations of potential sensitive or watch species as proposed by the BLM in Montana (USDI Bureau of Land Management 1993).

Surveys to determine the location and size of populations of rare species are conducted on public lands to produce a botanical conservation baseline, and to aid in resource management planning at all levels. An additional goal of this study was to begin documenting the general flora across the entire area.

## STUDY AREA

Garfield and McCone counties are located south of the Missouri River in eastern Montana (Figure 1). Their county seats are Jordan and Circle, respectively, and nearest cities are Glendive to the north and Billings to the south. The BLM lands within these two counties are part of the Big Dry Resource Area within the Miles City District. The BLM lands are concentrated along the Missouri River breaks, Mussellshell River breaks, and across scattered badlands.

The bedrock geology of the study area is comprised of Tertiary sedimentary formations that include the Fort Union Formation, the most extensive formation and prevailing across the uplands; the Hell Creek Formation mainly along northern drainageways, the Fox Hill sandstone mainly in narrow bands above the Missouri River and the Mussellshell River, and the Bearpaw shale below the Fox Hill sandstone along the major rivers and across the southwestern end of Garfield County (Ross et al. 1955). The Fort Union Formation is variably composed of clayey shale, siltstone, and sandstone, with localized lenses of impure limestone and lignite beds. The Hell Creek Formation is somber-gray sandstone and gray shaley clay and mudstone. Most of the area is unglaciated; only the northwestern corner of McCone County is sparingly mantled by glacial till.

A published soil survey is available for McCone County (Strom 1984) which provided basis for characterizing the soil series associated with target species sites, as well as copies of black-and-white aerial photography for discerning unusual features in this part of the study area.

There has been little vegetation research in the project area, with possible exception of range reference sites of the USDA Soil Conservation Service to characterize the range sites associated with soil series. Prevailing potential vegetation across the two-county area is the grama-needlegrass-wheatgrass prairie type of Kuchler (1985), which is also the single most widespread vegetation type in

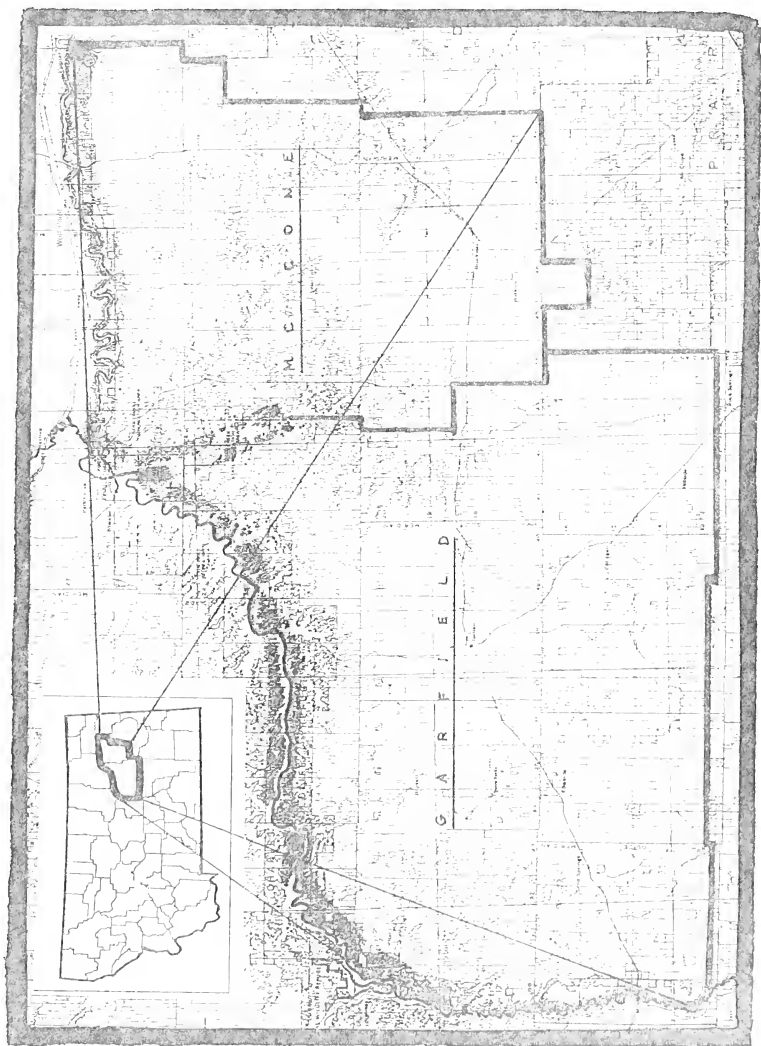


Figure 1. Carfield and McConne County study area

Montana. None of the target species occupy the prevailing prairie vegetation, so the deviation in vegetation composition and distribution patterns observed in the course of fieldwork have bearing on the probability of finding the target species in the study area.

#### Woodlands

Woodlands are present in trace amounts in the study area, but contribute significantly to floristic diversity, providing key habitat for many of the peripheral plant species having Rocky Mountain or eastern deciduous forest affinities. Woodlands are restricted mainly to breaklands in or adjoining the Mussellshell and Missouri River valleys, also extending upstream short distances along major tributaries.

Ponderosa pine woodlands are the most extensive woodland type on BLM lands and the study area in general. They occur on ridges and north-facing slopes centered along watercourses in settings which typically do not carry fire. Soils are mainly derived from sandstone and other coarsely-grained bedrock. An unusual pine savanna community on Bearpaw shale is found at the west end of Garfield County near Highway 200, but it barely enters BLM lands. Pine woodlands grade into Rocky Mountain juniper slopes on steep, sheltered hills in the Badlands or along major watercourses. Limber pine-dominated ridgetops are found near the Missouri River, primarily or entirely outside of BLM lands (e.g., at Hell Creek State Recreation Area). Douglas fir stands were found on steep, sheltered north-facing slopes on Missouri River tributaries (e.g., in Seven Blackfoot Creek on BLM lands), also representing minor range extension for the species in Montana.

Green ash woody draws are widely scattered above the Missouri River and its tributaries, most commonly at coulee heads above the Dry Arm of Fort Peck. Cottonwood stands are limited to the Mussellshell Valley and major tributaries of the Missouri River that are not inundated, as well as the free-flowing segment of the Missouri River at the north end of McCone County.

#### Shrublands

Shrublands and steppe vegetation are present in alkaline upland settings, and as pioneer vegetation in both wet and dry settings. They are most extensive on the Hell Creek Formation and the Bearpaw shale, where there are extensive Badlands outcrops and flats.

The most common upland shrubland community is dominated by silver sage and grasses including western wheatgrass and green needlegrass. More localized communities of big sage and greasewood are found in outwash flats; and longleaf sage, rabbitbrush, silverscale, and saltbush on Badlands outcrops. Thinsoil rocky slopes are dominated by skunkbush sumac, creeping juniper and yucca.

Willow shrub communities are uncommon along river corridors; also found across impoundment backwaters. Salt cedar, which is a shrub and a noxious species, is extensively invading the latter.

### Prairie

Grassland vegetation dominates the study area, and includes many plant associations. The prevailing upland association includes western wheatgrass and needle-and-thread as co-dominants, both of which are cool-season species. In harsher sites, this grades into associations of needle-and-thread, blue grama and thread-leaved sedge. Searches were made for uncommon prairie habitats that may harbor rare species, so visits were made to sand dunes along the Little Muddy River with their prairie sandreed plant association. BLM lands did not overlap with any of the scattered, discrete dune complexes along the watercourse.

The more diverse prairie landscape habitats are often pioneer communities on thinsoil settings within otherwise continuous prairie vegetation. They are strongly influenced by the parent material and microhabitat features (aspect, slope, topographic position). They often grade into pioneer shrubland types, mentioned previously.

### Wetland and riparian

Riparian habitat follows in narrow bands along the largest rivers. Wetland habitat is uncommon apart from wet meadows in floodplains and along outwashes. Surface water in most of these settings is temporary, and the setting may be parched in the latter part of the growing season. Springs and seeps are very rare, particularly the freshwater springs. Beaver pond complexes were found associated with the latter on BLM lands. Many of the wetland and riparian habitats are heavily used by livestock, and have high cover and composition in nonnative species like Kentucky bluegrass, Canada thistle and smooth brome.

In general, there is relatively uniform habitat over the center of the study area, and relative diverse habitat at the periphery; areas which are least accessible.



## METHODS

Systematic survey of sensitive plant species hinges on compiled information about the species targets and the study area setting. This study provided an opportunity to compile the scattered information and build upon it in fieldwork.

At the time this survey was conducted, five species were known from the two-county area that were also proposed by BLM as watch (USDI BLM 1993):

Geyer's milkvetch (*Astragalus geyeri*)  
Round-leaved water-hyssop (*Bacopa rotundifolia*)  
Hot spring phacelia (*Phacelia thermalis*)  
Moss phlox (*Phlox andicola*)  
Persistentsepal yellowcress (*Rorippa calycina*)

This reflected on the paucity of botanical studies in the area as much as its diversity. Eastern Montana has not been botanically well-studied, so the list of target species to consider in the project was developed further. The Biological Conservation Database (BCD) maintained by the Montana Natural Heritage Program was queried for records of Montana plant species of special concern (Heidel and Poole 1993), across the two-county area and from counties that directly adjoining the project area, augmented by species from the eastern third of the state that could have suitable habitat in the study area. This composite list (Appendix 2) served in planning the focus and phenology of fieldwork and helped to ensure that species were not omitted which may be of biodiversity significance. The compiled lists of species sought is referred to as the set of target species or potentially sensitive species throughout this report.

Field surveys were conducted in McCone and Garfield counties during June 4-6, June 18-21, and August 16-19 of 1993. Searches were made to revisit known sites to the extent that it was necessary to develop a search image, and projected to potential habitats for sensitive species on BLM lands. Maps showing primary travel routes are given in Appendix 1.

In the field, all vascular plant taxa identified were recorded. When target species were encountered, survey forms for state species of special concern were completed (Appendix 3), and the populations were mapped on 7.5 minute USGS quad maps. Data collected including information on habitat (associated vegetation, topography, soils), demography (population numbers, flowering extent and area covered), plant biology (phenology, vigor, reproductive success), and potential threats to the populations. Photographs (35 mm slides) were taken of target species and their habitats.

Voucher specimens of the target species were collected when adequate material was available, and deposited at the herbaria at Montana State University (MONT) and University of Montana (MONTU). Following the

field season, determinations in certain groups were verified by specialists, including the Asteraceae (Kenton Chambers at Oregon State University). Extra specimens of grasses were collected with intent of labelling and mounting them under contact paper for use at the Jordan field office of BLM.

Field guides most commonly used to key out plants included Dorn (1984), Great Plains Flora Association (1986), Larson (1993), Hermann (1970) and Hitchcock (1950). Technical nomenclature used in this report generally follows Dorn (1984) and common names generally follow the unpublished state flora compiled by the U.S. Forest Service Regional Office (USDA Forest Service 1994).

The spring months of 1993 were extremely dry, followed by June rains which elevated local stock dam water levels to peak highwater marks (Heidel pers, obs.). The 1993 field season was exceptionally cool and wet. This had the effects of delaying and prolonging flowering of upland plants, and delaying or curtailing flowering of wetland and aquatic plants.

Almost all large areas of BLM lands in the study area were visited at least once (Appendix 1). The fieldwork does not construe definitive sensitive species survey for any individual tract.

## OVERVIEW OF RESULTS

Searches in the literature and in the field have produced ten state species of special concern in or immediately adjoining the two-county area. Only one of these, Graceful arrowgrass (Triglochin concinnum var. debile) is found on lands administered by the BLM. Seven other species may possibly occur on BLM lands and are appropriate to consider for watch status. These results are summarized below and on a map (Figure 2; next page). Status summaries for the individual species make up the rest of the results section.

Table 1. PLANT SPECIES OF SPECIAL STATE CONCERN  
IN GARFIELD AND MCCONE COUNTIES, MONTANA\*

SCIENTIFIC NAME COMMON NAME	CURRENT GRANK, SRANK (current)	ORIGINAL BLM STATUS (Miles City Dis.)	RECOMMENDED BLM STATUS
<u>Ambrosia acanthicarpa</u> Annual bursage	G5SU	-	-
<u>Astragalus geyeri</u> Geyer's milkvetch	<b>G5S2</b>	Watch	Watch
<u>Bacopa rotundifolia</u> Roundleaf water-hyssop	<b>G5S1</b>	-	Watch
<u>Elatine americana</u> American waterwort	<b>G4S1</b>	-	-
<u>Eustoma grandiflora</u> Tulip gentian	<b>G5S1</b>	-	Watch
<u>Phacelia thermalis</u> Hot spring phacelia	<b>G3G4S1</b>	Watch	Watch
<u>Phlox andicola</u> Moss phlox	<b>G4S1</b>	Watch	Watch
<u>Rorippa calycina</u> Persistentsepel yellowcress	<b>G3S1</b>	Watch	Watch
<u>Solidago sparsiflora</u> Few-flowered goldenrod	<b>G7S1</b>	-	Watch
<u>Triglochin concinnum</u> var. <u>debile</u> Graceful arrowgrass	G5T4S4	-	-

\*Only those species whose ranks are boldfaced are still being tracked in Montana as state plant species of special concern.

Note: Two of the species newly-documented in the study area are no longer tracked as state species of special concern, including Annual bursage and Graceful arrowgrass.

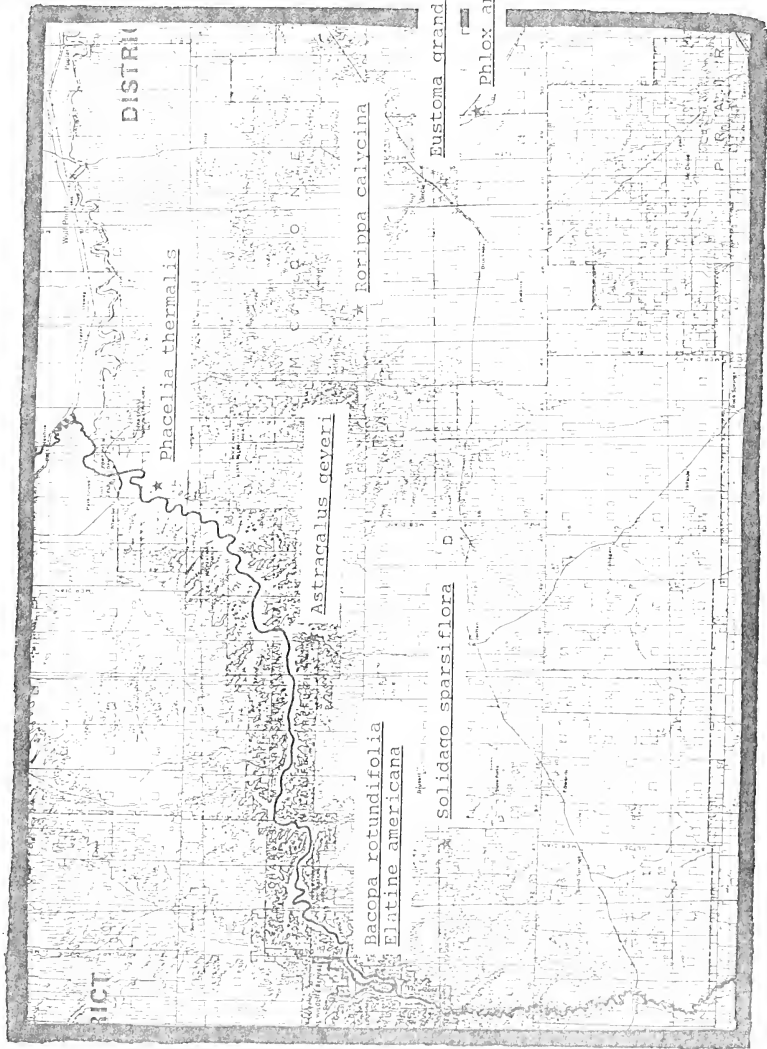


Figure 2. Plant species of special state concern in Garfield and McCone counties, Montana

Complete printouts are provided for each of the species documented from the study area that are still being tracked as plant species of special concern in Montana (Appendix 4), accompanied by maps showing their locations.

In addition, a vegetative goldenrod was observed on BLM land and tentatively identified in the field as Narrow-leaved goldenrod (Solidago graminifolia var. major), a species that Dorn (1984) notes as reported for Montana. It was also mapped as occurring in Rosebud County (Great Plains Flora Association 1977). The voucher specimen and accompanying label information for the Rosebud County record has not been located to date. The field observation was made in McCone County along a unique spring-fed series of beaver ponds with a relatively diverse wetland and woodland flora, located due south of Indian Hill in T.26N R.42E Sec. 28 NE 1/4. Narrow-leaved goldenrod cannot consistently be distinguished from Western goldenrod (Solidago occidentalis) in vegetative condition, so this possible addition to the state flora warrants further investigation and the species has been given a state rank of "SU" (status undetermined). A revisit is needed to collect it at the McCone County site. Any recommendations to the BLM will be held pending verification.

There are 24 more species from surrounding counties potentially occur on BLM lands in Garfield and McCone counties, as determined by data searches and comparison of available habitats in the study area. These results are summarized in Appendix 2.

The known vascular flora of Garfield and McCone counties includes 406 taxa to date (Appendix 5. Preliminary flora of Garfield and McCone counties, Montana), based upon fieldwork, and on county distribution data mapped in Booth (1966) and in Great Plains Flora Association (1977).

## VERIFIED PLANTS OF SPECIAL CONCERN WITHIN THE COUNTIES

ANNUAL BURSAGE  
Ambrosia acanthicarpa

## A. CLASSIFICATION

1. **FAMILY:** Asteraceae; Composite or Sunflower Family. This family has the largest number of species in Montana, and is subdivided into twelve well-defined tribes in most technical keys. Annual bursage is a member of the Heliantheae Tribe, a large tribe distinguished by imperfect flowers, style without a fringe of hairs, pappus never chaffy, and style branches flattened, without stigmatic lines and commonly with elongate, pointed hairy tips.
2. **GENUS:** Ambrosia; Ragweed genus. Some species in this genus have notoreity in that their windborne pollen causes hayfever.
3. **SPECIES:** Annual bursage (Ambrosia acanthicarpa). The scientific species epithet refers to its spiny (Gr. acanthi-) fruits (Gr. -carpa).

## B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. **FEDERAL STATUS**
  - a. **U.S. FISH AND WILDLIFE SERVICE:** none
  - b. **BUREAU OF LAND MANAGEMENT:** none
2. **STATE:** In 1993, Annual bursage was added to the Montana state species of special concern list since it was only known from six collections in the state, and five of the six were before 1940. It was given a state rank of "SU" (status unknown) because it was also suggested by Dorn (1984) that it may possibly be adventive. The appropriateness of tracking it on the state list was re-evaluated in the course of this study. The reason for its apparent rarity as indicated by collection records is because it is restricted to settings with reworked sand deposits, which are uncommon in the state and have not been closely-studied. However, this species increases under heavy grazing pressure and is under no foreseeable threats. It is therefore re-assigned a state rank of "S3S4" (vulnerable or potentially secure in Montana).

Figure 3. Annual bursage  
(*Ambrosia acanthicarpa*) illustration



### C. DESCRIPTION

1. **GENERAL NONTECHNICAL DESCRIPTION:** Annual bursage is a branching annual, 2-15 dm (8-40 in) tall. It is distinguished by several series of elongate, pointed spines on the pistillate heads, and the mature heads are 6-10 mm (1.8-6.2 in) long. Pistillate heads are in axillary clusters below the elongate staminate inflorescence. Leaves are opposite below, alternate above, petiolate or the uppermost becoming sessile, and with a variable blade outline from lanceolate to broadly ovate and 2-8 cm (0.8-2.4 in) long. The margins are lobed to 1-2X pinnatifid; the lobes sometimes deeply dentate. The upper and lower leaf surfaces are often both green, but the upper is sometimes sparsely white-pubescent (adapted from: Great Plains Flora Association 1986).
2. **TECHNICAL DESCRIPTION:** Branching annual, 2-15 dm (8-40 in) tall, variously long-pubescent to hispid, or both. Leaves opposite below, alternate above, petiolate or the uppermost becoming sessile; blade variable but broadly ovate to lanceolate in outline, 2-8 cm (0.8-2.4 in) long lobed to 1-2 x pinnatifid, the lobes sometimes deeply dentate, upper and lower surfaces both green or the upper surface sometimes sparsely white-pubescent. Staminate inflorescence racemiform and often much branched, heads stalked, involucre 3-12 mm (1.2-4.8 in) across and 3-9-lobed; pistillate heads in clusters below the staminate inflorescence, involucre 5-10 mm (.31-.62 in) long and up to 14 mm (.9 in) across, 1-flowered, with several series of flattened, pointed spines or spines occasionally reduced or absent.

3. **LOCAL FIELD CHARACTERS:** Annual bursage is the only annual species in the genus with distinctly spiny fruits. Perennial bursage (Ambrosia tomentosa) has spiny fruits but it is a generally a smaller plant of 1-4 dm (3.1-12.4 in), with leaves that are white pubescent beneath rather than glabrous and green. Annual bursage may be difficult to distinguish vegetatively from first year plants of the Western ragweed (Ambrosia psilostachya) which is perennial; and from young plants of the Giant ragweed (Ambrosia trifida) which commonly grow 1-3 m (3-9 ft) tall.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Annual bursage is known from the Great Plains, west to Washington, California and Arizona. It has been collected in the southwest, northcentral, and southeastern areas of Montana (Dorn 1984), representing half of the regions of the state.
2. **CURRENT SITES:** The only site where Annual bursage has been collected in the past 40 years is from the Little Muddy Creek in the Garfield County study area.
3. **HISTORICAL SITES:** Five of the six collections made of this species were collected before 1940.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** There are a few other similar sandy streambottom segments that have been reworked by the wind into well-developed sand dunes along Little Muddy Creek in Garfield County, but these are not on BLM lands and were not evaluated.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** Suitably open sandy habitat was not found elsewhere in the course of this project. The only potential habitat for it suspected from the area might be segments of sandy shore on the Fort Peck Reservoir.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** Annual bursage colonizes loose sandy settings as a pioneer species in prairie. Associated species that were documented at the Little Muddy Creek site in the study area include: Calamovilfa longifolia, Oryzopsis hymenoides, Sporobolus cryptandrus and Chrysopsis villosa. The vegetation there is very sparse, and annual bursage was often the most common plant in these settings.
2. **TOPOGRAPHY:** This species occupies the toeslopes and gently rolling margins of sand dunes.



3. **SOIL RELATIONSHIPS:** This species is restricted to extremely sandy soils that have little or no soil development (entisols); generally characterized as "open, sandy sites" (Great Plains Flora Association 1986).
4. **CLIMATE FACTORS:** The aridity of the Great Plains continental climate is a central factor in creating or maintaining the early successional open quality of Annual bursage habitat.

#### F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Annual bursage was barely beginning to set fruit on 17 August, 1993. Flowering and fruiting activity was at least two weeks delayed in the cool, wet growing season of 1993. The range of collection dates for this species ranges from early August to early September, taken to reflect the period in which fruits can be found.
2. **POPULATION SIZE AND CONDITION:** A population estimate of over 1000 individuals was made at the Little Muddy Creek site, the only Montana site at which population size has been noted. The plants were in patchy distribution, with hundreds present or none at all. Since this species is an annual, its numbers are expected to vary from year to year.
3. **REPRODUCTIVE BIOLOGY:** Flowers are wind-pollinated. Seeds are most effectively distributed by adhering to the fur of animals.

#### G. POPULATION ECOLOGY

1. **BIOLOGICAL INTERACTIONS**
  - a. **COMPETITION:** This species is found only in early-succession settings, indicating that it is not competitive with the climax plant species.
  - b. **HERBIVORY:** There were no signs of any browse to this species at the Little Muddy Creek site though it occupies habitat that is intensively used by sheep in their loafing on loose sand.
  - c. **OTHER:** The spines of the seed are taken to represent an adaptation to seed dispersal by animals. Such spiny-seeded plants are often a concern in livestock operations as causing injury with ingestion, but Annual bursage is not palatable and is habitat that is so sparsely vegetated that livestock injury is unlikely.

- H. **LAND OWNERSHIP:** The Little Muddy Creek population is on private land that adjoins a BLM tract but is fenced separate from it. Many if not all of the other collections made of this species are from within the floodplains of navigable rivers.
- I. **ASSESSMENT AND MANAGEMENT RECOMMENDATIONS**
1. **THREATS TO CURRENTLY KNOWN POPULATIONS:** None known.
  2. **MANAGEMENT PRACTICES AND RESPONSE:** The evidence of intense sheep use around the Little Muddy Creek population is taken to indicate that this is not impacted but may actually increase under grazing pressure.
- J. **SUMMARY:** There was no recent information on Annual bursage in Montana prior to this study. One population was found in the study area. The lack of threats, persistence or increase under sheep grazing disturbance, and breadth of historic state distribution are collectively taken to provide a basis for recommending it be dropped from any further consideration by the Bureau of Land Management and from tracking as a state species of special concern by the Montana Natural Heritage Program.

GEYER'S MILKVETCH  
Astragalus geyeri

A. CLASSIFICATION

1. FAMILY: Fabaceae; Bean Family.
2. GENUS: Astragalus geyeri is one of ca. 2,000 species in this large genus worldwide. Roughly 550 species occur in North America (Barneby 1964), with 47 species found in Montana (Dorn 1984).
3. SPECIES: Astragalus geyeri is named after

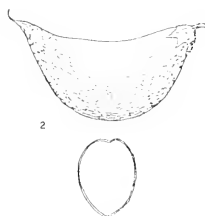
B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS
  - a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: Proposed sensitive (Miles City District); proposed watch (Big Dry District).
2. STATE: The state rank is S2 (imperiled) based on nine occurrences (two historic), small population sizes, and vulnerability to encroachment by exotics.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Geyer's milkvetch is an annual with spreading to erect stems 5-20 cm (2-7.9 in) tall. Its 5-13 leaflets are distinct from the rachis, are linear to oblong, and have pubescence with the hair ends affixed to the leaf. The inflorescence is few-flowered and overtopped by the leaves. The small flowers are 6-8 mm (.25-.3 in) long, with yellow to lavender hues. The pod is sessile, ca. 2 cm (.8 in) long, membranous, very inflated, and with only one chamber.
2. TECHNICAL DESCRIPTION: Grayish-strigose to greenish annual with spreading to erect stems 5-20 cm (2-7.9 in) long; leaflets 5-13, linear to oblong, obtuse to retuse, 5-15 mm (.2-.6 in) long; raceme 2- to 7-flowered, shorter than the leaves; flowers 6-8 mm (.25-.3 in) long, ochroleucous to pale lavender; calyx scarcely half as long as the corolla, the short linear-lanceolate teeth about 1/3 as long as the tube; pods sessile, about 2 cm (.8 in) long, membranous, greatly inflated, slightly compressed, oblique, from

Figure 4. Geyer's milkvetch  
(*Astragalus geyeri*) illustration



slightly arcuate to somewhat lanate, 1-celled, the lower suture not at all intruded (Hitchcock et al. 1984).

3. LOCAL FIELD CHARACTERS: The *Astragalus lotiflorus* closely resembles *A. geyeri* in its subcaulescent growth form, and its affinity to sandy habitat in eastern Montana. However, it is not annual as *A. geyeri*. It does not have the inflated, half-ellipsoid, glabrous pods of *A. geyeri*. It does not have the basifixed hairs on leaves and stems; a character which cannot be discerned without a hand lens (10X).

#### D. GEOGRAPHICAL DISTRIBUTION

1. RANGE: Geyer's milkvetch ranges from southern Washington to California and Nevada, extending east to Montana, Wyoming and Utah. In Montana, most of its sites are in the Pryor Mountains, with the exception of the Garfield County collection and historic collections from Dawson and Custer counties.
2. CURRENT SITES: All five other current records for this species are from the Pryor Mountains in Carbon County.
3. HISTORICAL SITES: It was collected in the vicinity of Glendive (Dawson County) and Miles City (Custer County) at the turn of the century.
4. UNVERIFIED/UNDOCUMENTED REPORTS: None.

5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** It appears that this species is restricted to sandstone outcrops of the Fox Hill sandstones, which are restricted to borders of Fort Peck Reservoir in C.M. Russell National Wildlife Refuge. Sandstone outcrops are also widespread in the Fort Union Formation along the Mussellsell valley and above the Fox Hill sandstone. They are not as easily eroded as Fox Hill sandstone, and numerous searches on Fort Union sandstone produced no new populations.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** In the Pryor Mountains, A. geyeri is associated with Artemisia tridentata, Stipa comata and Bouteloua gracilis. The only other record in Montana that has associated species information is the Garfield County record, revisited in the course of this study. It is in the earliest and most unstable of early successional habitat dominated by Calamovilfa longifolia and Oryzopsis hymenoides; near but separate from Psoralea lanceolata, Astragalus kentropyhta and Lupinus pusillus.
2. **TOPOGRAPHY:** In the Pryor Mountains, A. geyeri is restricted to sandy alluvial plains and terraces. In Garfield County, by contrast, the only known population is on a steep midslope eroding out of sandstone bedrock along an exposed ridge.
3. **SOIL RELATIONSHIPS:** This species occupies loose, sandy soils with little or no organic matter and soil development.
4. **CLIMATE FACTORS:** The droughty nature of the soils is exacerbated by the hot and dry microclimate occupied by this species. It is an annual adapted to Great Basin desert conditions with rainfall early in the growing season, followed by stress.

#### F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Collection dates for this species range from late May through late June. It is likely that this species begins flowering by mid May, and that late June collections represent plants in fruit. It desiccates and many plants break off by the middle of the growing season.
2. **POPULATION SIZE AND CONDITION:** All populations in which size was noted were described as small. Its population numbers might be expected to oscillate from year-to-year because it is an annual species.

3. **REPRODUCTIVE BIOLOGY:** The rounded, inflated seed pods can disperse by rolling downhill on slopes as found at the Garfield County site.

G. **POPULATION ECOLOGY**

1. **BIOLOGICAL INTERACTIONS**

- a. **COMPETITION:** A major segment of the Garfield County population is subject to noxious weed invasion and encroachment by other exotics, including Melilotus officinalis and Salsola kali. In the Pryor Mountains, it may be threatened by encroachment of exotic annuals such as Halogeton glomeratus and Salsola kali.
- b. **HERBIVORY:** None observed.

- H. **LAND OWNERSHIP:** All of the Pryor Mountain populations of this species are documented from BLM lands. The Garfield County collection is from U.S. Fish and Wildlife Service lands on Hell Creek Recreation Area within C.M. Russell Wildlife Refuge. Land ownership at the other two eastern Montana sites is unknown.

I. **ASSESSMENT AND MANAGEMENT RECOMMENDATIONS**

1. **THREATS TO CURRENTLY KNOWN POPULATIONS:** Weed encroachment and management factors affecting weed invasion are identified as potential threats.
2. **MANAGEMENT PRACTICES AND RESPONSE:** Factors affecting weed invasion are to be addressed in review of proposed projects or plans in potential habitat for Astragalus geyeri, i.e., on sandy range sites located closest to Fort Peck Reservoir. The only known population in the study area is on secondary range, although it is on primary range in the Pryor Mountains.

- J. **SUMMARY:** Ceyer's milkvetch (Astragalus geyeri) is a watch species in the Big Dry Resource Area and a sensitive species in the Billings Resource Area. It has little potential habitat on BLM lands in the Big Dry study area. It is an annual species at the northern limits of its range here, and appears to be very susceptible to weed encroachment.

ROUND-LEAVED WATER HYSSOP  
(Bacopa rotundifolia)

A. CLASSIFICATION

1. FAMILY: Scrophulariaceae; Figwort Family
2. GENUS: Bacopa is a genus of ca. 60 species, most of which are in tropical or warm-temperate regions, especially in the New World.
3. SPECIES: The species epithet refers to the rounded leaf shape (L. rotund - round; L. folia - leaf).

B. PRESENT LEGAL OR OTHER FORMAL STATUS

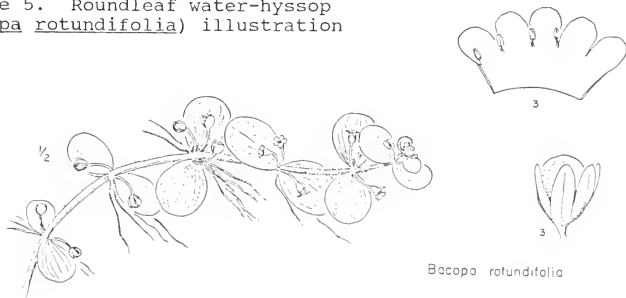
1. FEDERAL STATUS

- a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: Proposed watch (1993)
2. STATE: The state rank is S1 (critically imperiled) based on three records (one historic).

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Round-leaved water-hyssop is a perennial amphibious wetland plant, 1-4 dm (4-16 in), floating in shallow water or sprawling on mud and rooting at the nodes. Its fleshy stems float. Its round leaves are opposite, sessile, 1-3 cm (.4-1.2 in) long, and palmately-nerved. It has fibrous roots, and it roots at the leaf axils under drawdown conditions. The axillary flowers are solitary, on a pedicel 0.5-2 cm (.2-.8 in) long. The 5-

Figure 5. Roundleaf water-hyssop  
(Bacopa rotundifolia) illustration



lobed corolla is white, with a yellow throat, nearly regular, and 5-10 mm (.2-.4 in) long, with the lobes equal or a little less than the corolla tube. It has four anthers and five distinct sepals; the outer sepal broad, rotund-elliptic, the others much narrower (from Hitchcock and Cronquist 1973, Larson 1993).

2. **TECHNICAL DESCRIPTION:** Fibrous-rooted perennial; stems succulent, branched, 1-4 dm (4-16 in); distally-floating and spreading-hairy; leaves opposite, sessile, entire, palmately several-nerved, broadly rotund-obovate to suborbicular, 1-3 cm (.4-1.2 in) long, glabrous; pedicels stout, 0.5-2 cm (.2-.8 in) long; sepals 3-5 mm (.1-.2 in) long, the outer one broad, rotund-elliptic, the others much narrower; corolla white with yellow throat, narrowly-campanulate, 5-10 mm (.2-.4 in) long, the lobes equalling, or a little shorter than the tube (Hitchcock et al. 1984).
3. **LOCAL FIELD CHARACTERS:** The opposite, sessile, round, palmately-veined leaves are distinctive among aquatic plants in eastern Montana.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Round-leaved water-hyssop ranges from Indiana to Idaho, and south to Mississippi and Texas; also in California. All Montana records are from plains of central Montana, including Garfield, Philips and Cascade counties.
2. **CURRENT SITES:** Collections made in Garfield and Phillips counties are recent and presumed extant.
3. **HISTORICAL SITES:** The Cascade County collection was made before the turn of the century near Great Falls (Lower Sand Coulee) in an area that is extensively plowed and developed, where it has been sought and is presumed extirpated.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** Watercourses throughout the Fort Union and Hell Creek Formations were searched for this species without success. It is possible that these settings are too alkaline, in which case only the few wetland pockets and spring-fed watercourses south of Fort Peck Reservoir represent potential habitat. Only a few sites of the latter habitat were found, but not round-leaved water-hyssop.



#### E. HABITAT

1. **ASSOCIATED VEGETATION:** The Phillips County population on BLM lands was associated with Eleocharis palustris and Polygonum aviculare, both wetland species. The vegetation of the Garfield County site was described as "rich".
2. **TOPOGRAPHY:** Bacopa rotundifolia occurs on muddy shores and shallow ponds or marshes.
3. **SOIL RELATIONSHIPS:** It occupies saturated soils of clay or silt particle size that are characterized as muck.
4. **CLIMATE FACTORS:** Throughout most of its range, it is in a continental climate where evaporation and precipitation levels are in dynamic equilibrium and the wetlands recede during the growing season due to evaporation or dropping groundwater levels.

#### F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Flowering is indeterminate, beginning in June and extending as late as August under suitable conditions.
2. **POPULATION SIZE AND CONDITION:** It was noted as common in the two recent sites where it was collected. The wetland habitat areas in which these populations occur are small, so that their numbers are likely to number no larger than hundreds or some order of thousands in magnitude.
3. **REPRODUCTIVE BIOLOGY:** It reproduces both sexually; and asexually by rooting at the axils.

#### G. POPULATION ECOLOGY

1. **BIOLOGICAL INTERACTIONS**
  - a. **COMPETITION:** The fact that the vegetation at one of its Montana records was described as "rich" suggests that it can compete with emergent vegetation.
  - b. **HERBIVORY:** None known.

- H. **LAND OWNERSHIP:** The Garfield county site is on the C. M. Russell National Wildlife Refuge. The Phillips County site is apparently on private land, and the historic Cascade County site was likely to have been on private land.

I. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

1. THREATS TO CURRENTLY KNOWN POPULATIONS: The only two known populations for this species are both on public land:

001 Bureau of Land Management  
002 U.S. Fish and Wildlife Service

2. MANAGEMENT PRACTICES AND RESPONSE: The presence of this species in a stock pond (002) raises the possibility that it is associated with disturbance, but this may be refuted by the characterization of the stock pond vegetation as "rich".

- J. SUMMARY: Round-leaved water-hyssop (Bacopa rotundifolia) is a watch species in the Big Dry, Great Falls, and Phillips Resource Areas. It is an aquatic plant that has limited potential habitat on BLM lands in the study area. It has been suggested that it likely to be more common than records indicate elsewhere in the state (Lesica and Shelly 1991), but this has yet to be corroborated by field information.

AMERICAN WATERWORT  
(Elatine americana)

A. CLASSIFICATION

1. FAMILY: Elatinaceae (Waterwort Family)
2. GENUS: Elatine (L. elatin-) means fir-like; possibly referring to the orientation of leaves along the stem or the semblance to a fir seedling.
3. SPECIES: The species epithet indicates that it is a New World species. It is not recognized as a part of the Montana flora by Dorn (1984), and is said to be "Scarcely distinguishable from E. triandra" and possibly not within the Pacific Northwest region (Hitchcock et al. 1984).

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS
  - a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: none
2. STATE: The original state rank of S1 (critically imperiled) was based on four records. They span large areas of the state, suggesting that it may be overlooked.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: American waterwort is a small submerged aquatic plant with branches 2-4 cm (.8-1.6 in) long, forming mats or ascending. Its capsules are 2-3 celled, it has 3 stamens, petals and sepals. Its seeds are pitted in reticulate rows. The leaves are obovate, often rounded at the tip.

Figure 6. American waterwort (Elatine americana) illustration



*Elatine americana*

2. **TECHNICAL DESCRIPTION:** Plants matted or with some branches ascending and 2-4 cm (.8-1.6 in) long; leaves spatulate to obovate, less than 10 mm. long, the tips rounded and not at all emarginate; sepals and petals 3, seeds somewhat curved, the pits mostly 18-27 in each of about 10 longitudinal rows (Hitchcock et al. 1984).
3. **LOCAL FIELD CHARACTERS:** American waterwort is not recognized in the most recent state flora (Dorn 1984). It is similar to and difficult to distinguish from Three-stamen waterwort (*E. triandra*), which has linear to narrowly oblanceolate leaves which are typically notched, compared to the obovate rounded leaves of American waterwort. Its seeds also have more pits per row (18-27 vs. 10-15).

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** American waterwort is a North American species with its center of distribution on the Atlantic coast. In Montana, it is known from Garfield, and Lewis and Clark counties east of the Divide, and Lake and Ravalli counties west of the Divide.
2. **CURRENT SITES:** All four of the Montana collections records mentioned above are relatively recent, and presumed extant.
3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** BLM lands around the Squaw Creek drainage where it was previously collected were searched for this species, but suitable habitat was not found. The early-season timing of the survey or the extent of the survey may have been inadequate for the task.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** American waterwort occupies the mudflat drawdown zone of ephemeral pools, where it is found in the absence of other vegetation or with scattered emergents. Only the Ravalli County occurrence includes information on associated species: *Potamogeton richardsonii*, *Limsella aquatica* and *Elecharis acicularis*. Note: This species was originally collected in Garfield County on the same day in the same general vicinity as the Round-leaved water-hyssop, but it is not known whether they occupy the same precise location and habitat.

2. **TOPOGRAPHY:** It is at the bottom of the topographic gradient. Two of the four known occurrences seem to be settings which have been dug out, including the stockpond setting of EO 001, and the storage pond setting of EO 004.
3. **SOIL RELATIONSHIPS:** The fine-particle, saturated soils on which it grows are muck.
4. **CLIMATE FACTORS:** Throughout most of its range, it is in a continental climate where evaporation and precipitation levels are in dynamic equilibrium and the wetlands recede during the growing season due to evaporation or dropping groundwater levels.

#### F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Members of the genus flower from early summer until fall, with flowering prolonged depending on water levels. They are difficult to locate until drawdown condition after the submerging water has receded, and require the mature seed for making identification. Specimens of American waterwort have been collected in Montana from 11 July through October.
2. **POPULATION SIZE AND CONDITION:** Unknown.
3. **REPRODUCTIVE BIOLOGY:** Unknown.

#### G. POPULATION ECOLOGY

##### 1. BIOLOGICAL INTERACTIONS

- a. **COMPETITION:** This small short-lived plant might be expected to be a poor competitor with other submerged vegetation, and under eutrophic conditions that foster algal blooms.
- b. **HERBIVORY:** None known.
- c. **OTHER:** This species has wide sporadic distribution, minute seeds, and occupies mudflats; collectively indicating that waterfowl may be an occasional dispersal vector.

- H. **LAND OWNERSHIP:** Three of the four known occurrences are on federal lands, and the Ravalli County occurrence is on private land (next page).

<u>EO No.</u>	<u>County</u>	<u>Land ownership name</u>
001	Garfield	C. M. Russell National Wildlife Refuge
002	Lake	Nine Pine Reservoir National Wildlife Refuge
003	Lewis & Clark	Lewis & Clark National Forest; Bob Marshall Wilderness Area

I. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

1. THREATS TO CURRENTLY KNOWN POPULATIONS: None known.
2. MANAGEMENT PRACTICES AND RESPONSE: None known. The presence of this species in two settings where dredging was likely to have take place may indicate a tolerance to this form of disturbance.

J. SUMMARY: American waterwort (Elatine americana) is a species which is easily overlooked, and may not be affected by most land management activities, so a conservative approach in considering this species for BLM designation is warranted. Further status investigation is underway.

TULIP GENTIAN  
(Eustoma grandiflora)

A. CLASSIFICATION

1. FAMILY: Gentian Family (Gentianaceae)
2. GENUS: Eustoma refers to the open (Gr. eu - good) corolla (Gr. stoma - mouth), as compared to the narrowly cylindrical or closed corolla of other genera in the Gentian Family.
3. SPECIES: The species epithet grandiflorum translates literally as big-flowered (L. grand - big; L. florum - flower). Other common names, beside tulip gentian, are prairie gentian and catchfly gentian.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS
  - a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: none
2. STATE: The state rank is S1 (critically imperiled) based on one record; newly-discovered in McCone County.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Tulip gentian is an annual or short-lived perennial with one or more stems, 25-60 cm. tall. The leaves are opposite, broad, whitish, and 3-veined. The flowers have five large, cleft petals and sepals; 3.5-5 cm (1.4-2 in) long and 1.2-2.3 cm (.5-.9 in) long, respectively. The typical petal color is blue-purple with white at the base, as collected in Montana; but other color forms are known elsewhere in its range.
2. TECHNICAL DESCRIPTION: Erect annual or short-lived perennial, 25-60 cm (10-23.5 in) tall, with one or several stems, internodes 1.4-6 cm (.5-2.4 in) long; tap root elongate. Leaves opposite, elliptic-oblong to lance-ovate, glaucous, 3-veined, 1.5-7.5 cm (.6-3 in) long, 0.3-5 cm (1-2 in) wide. Inflorescence cymose-paniculate, in clusters of 2-6 flowers, pedicels to 6 cm (2.3 in) long. Flowers 5-merous (rarely 6-merous); calyx deeply cleft, lobes keeled, linear-lanceolate, 1.2-2.3 cm (.5 - .9 in) long, 2-3 mm (.4-.8 in) wide; corolla campanulate, deeply cleft, blue-purple, pink or whitish, lobes elliptic to obovate, 3.5-5 cm (1.4-2 in)

Figure 7. Tulip gentian (*Eustoma grandiflorum*) photo reprint

(Reproduced from Rickett)



*Eustoma grandiflorum*

*Roberts*



long, 1.5-2.4 cm (.6-.9 in) wide; stamens 5 or 6, anthers 4-5.5 mm (.2-.22 in) long, filaments 10-15 mm (.4-.6) long; stigmas 2-lobed, style slender, about as long as ovary. Capsule ellipsoid, to 2 cm (.8 in) long.

3. **LOCAL FIELD CHARACTERS:** The broad, glaucous, opposite leaves of Eustoma grandiflorum look superficially similar to those of Penstemon nitidus with which it might be mistaken before flowering. Its flowers are reminiscent of the domestic tulip or the sego lily, but it has five petals which are cleft, and it is otherwise unmistakable with a wide-open large corolla compared to all other species of gentian.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Tulip gentian is a Great Plains species at the northern limits of its distribution in Montana, extending as far south as Mexico, and from Arkansas and Louisiana to Utah. It is known from South Dakota and Wyoming among adjoining states, where it is also considered to be a state species of special concern.
2. **CURRENT SITES:** The only known site for it in the state is in McCone County.
3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** This species was first reported in 1994 after this study was completed, so it was not among the search targets. Surveys were conducted in wet meadow habitat near Circle and it was determined after-the-fact that these settings were probably too alkaline. However, the visit may have been too early in the season for drawing conclusions.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** Throughout its range, this species is restricted to wet meadow plant communities. Information on associated species is wanting in Montana.
2. **TOPOGRAPHY:** It is found at the bottom of the local topographic gradient.
3. **SOIL RELATIONSHIPS:** Information elsewhere in its range indicates that it locally restricted to semi-saturated soils associated with groundwater discharge areas, including areas with "constant moisture in the Nebraska sandhills", settings "near seeping springs", and "moist meadows" (Barr 1983).

4. **CLIMATE FACTORS:** This species is adapted to the continental climate regime.

F. **POPULATION DEMOGRAPHY AND BIOLOGY**

1. **PHENOLOGY:** The McCone County plant specimen was conveyed through the Extension Service to Montana State University on 23 August of 1994, but the collection date is unknown. Its flowering date elsewhere in the Great Plains is reported as extending between July - September (Great Plains Flora Association 1986).
2. **POPULATION SIZE AND CONDITION:** Unknown. Elsewhere in its range, it typically has low numbers, and any estimate of population size depends on whether all flowering stems were counted; or just the discrete clumps that represent individuals.
3. **REPRODUCTIVE BIOLOGY:** Unknown.

G. **POPULATION ECOLOGY**

1. **BIOLOGICAL INTERACTIONS**
  - a. **COMPETITION:** Unknown.
  - b. **HERBIVORY:** Unknown.

H. **LAND OWNERSHIP:** Private.

T. **ASSESSMENT AND MANAGEMENT RECOMMENDATIONS**

1. **THREATS TO CURRENTLY KNOWN POPULATIONS:** Unknown. It is used in florists trade elsewhere in its range (Barr 1983).
2. **MANAGEMENT PRACTICES AND RESPONSE:** This species occupies wet habitat where groundwater discharges, vegetation is productive, and livestock are likely to congregate. Its response to livestock grazing is unknown, though a species with these habitat requirements is likely to be negatively affected by trampling if not grazing.

- J. **SUMMARY:** Tulip gentian (*Eustoma grandiflorum*) represents a new addition to the state flora and is disjunct in McCone County, Montana from its nearest known occurrences in South Dakota and Wyoming. It is potentially affected by land use decisions, and watch status is recommended for BLM consideration in the Big Dry Resource Area.

HOT SPRING PHACELIA  
(Phacelia thermalis)

A. CLASSIFICATION

1. FAMILY: Waterleaf Family (Hydrophyllaceae)
2. GENUS: The genus name Phacelia refers to the clustered flowers (G. phacel - cluster).
3. SPECIES: The species epithet thermalis refers to its habitat affinity to hot springs in at least part of its range (G. therm - heat).

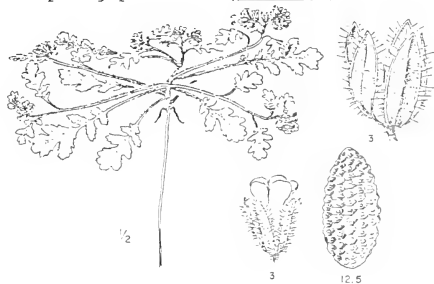
B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS
  - a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: watch
2. STATE: The state rank is S1 (critically imperiled) based on three records.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Hot-spring phacelia is a prostrate to ascending, multi-stemmed annual 1-3 dm (4-12 in) tall, with leaves that are deeply pinnately-lobed and rounded. Leaves and stems are glandular-hairy. The inflorescence is densely-flowered, with lavender or whitish flowers, the petals about the same length as sepals. The sepals enlarge and the inflorescence elongates in fruit. The seeds are prominently pitted in a honeycomb pattern.

Figure 8. Hot spring phacelia (Phacelia thermalis) illustration



*Phacelia thermalis*

2. **TECHNICAL DESCRIPTION:** Glandular-hairy annual, 1-3 dm (4-12 in) tall, branched from the base and commonly without a well-defined central axis, the several stems prostrate to ascending; leaves 1-9 cm (.4-3.5 in) long (short petiole included) and 0.5-2.5 cm (.2-1 cm) wide, pinnatilobate to more often pinnatifid, with mostly narrow rachis and sessile, generally few-toothed segments or leaflets, the upper ones confluent; inflorescences densely flowered even at maturity, up to 10 cm (4 in) long in fruit; corolla about equalling the calyx, 3-4 mm (.12-.16 in) long and 2-3 mm (.08-.12 in) wide, lavender or whitish; calyx segments lance-elliptic, strongly accrescent in fruit, becoming 6-8 mm (.24-.31 in) long, 2-3 mm (.08-.12 in) wide, firm and prominently veiny; style 1.5-2 mm (.06-.08 in) long, cleft to the middle or beyond; ovules 4; seeds 4 or fewer, 2-2.5 mm (.08-.1 in) long, lanceolate, with ventral keel and rounded back, prominently pitted-reticulate.
3. **LOCAL FIELD CHARACTERS:** Hot spring phacelia is the only annual phacelia with pinnately lobed or divided leaves in central or eastern Montana except for Threadleaf phacelia (*Phacelia linearis*). It is easily distinguished from Threadleaf phacelia in being multi-stemmed rather than single-stemmed, with relatively broad leaves rather than linear leaves, and petals ca. equal sepals in length rather than showy petals that exceed the calyx. It bears superficial resemblance to annual species in different genera of the Waterleaf Family, but the phacelia genus has a multi-flowered inflorescence rather than solitary flowers.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Hot spring phacelia occurs from southeast Oregon to northern California and east to southern Idaho, highly disjunct in central Montana (Fergus, Garfield and Phillips counties).
2. **CURRENT SITES:** All Montana records are recent (Fergus, Garfield and Phillips counties). At the Garfield County site (#002) only one plant was found and collected. It is possible but improbable that this single plant made up the full extent of the population. As a relatively short-lived species, population numbers and point-locations within any given site may not be stable over time.
3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None.

5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** Camping visits were made above the Fort Peck shoreline (Bear Creek, Hell Creek, and elsewhere), but it was not found or systematically surveyed in the Refuge.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** It occupies open to partially wooded settings. The only associated species mentioned in collection records is Douglas fir at the Fergus County site (EO #001).
2. **TOPOGRAPHY:** The Fergus County specimen (#001) was collected on level upland immediately above a steep-sloped coulee. The Garfield County specimen (#002) was collected from a steep slope immediately above the beach of York Island. It is not possible from these contrasting settings and incomplete information to determine preferred habitat.
3. **SOIL RELATIONSHIPS:** Information on its soil substrate is not available in Montana. Elsewhere in its range it is associated with "heavy clay soil in desert regions" (Hitchcock et al. 1984).
4. **CLIMATE FACTORS:** Settings for this species are arid microhabitat within semiarid climate regimes.

#### F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Hot spring phacelia flowers between May and June in most of its range (Hitchcock et al. 1984). In Montana, collection dates range between 12 June to 9 July; the latter presumed to be in fruit.
2. **POPULATION SIZE AND CONDITION:** The Garfield County record (EO #002) was based on a specimen in which the only plant found was collected. The Phillips County record (EO #003) was based on a specimen sent to the County Extension agent from a site at which it was described as "scattered".
3. **REPRODUCTIVE BIOLOGY:** Unknown.

#### G. POPULATION ECOLOGY

1. **BIOLOGICAL INTERACTIONS**
2. **COMPETITION:** The C. M. Russell National Wildlife Refuge is extensively invaded by sweetclover (*Melilotus* spp.), which can invade arid microhabitats as occupied by Hot spring

phacelia. Sweetclover is an introduced nitrogen-fixing legume which in large numbers can shift the course of succession and outcompete native plant species.

b. **HERBIVORY:** None known.

H. **LAND OWNERSHIP:** Two of the three known occurrences for this species in Montana are on the C. M. Russell National Wildlife Refuge. The third is on private land.

I. **ASSESSMENT AND MANAGEMENT RECOMMENDATIONS**

1. **THREATS TO CURRENTLY KNOWN POPULATIONS:** There are few populations known and scant information about them for assessing threats, so it is to be presumed vulnerable.

2. **MANAGEMENT PRACTICES AND RESPONSE:** Unknown.

J. **SUMMARY:** Hot spring phacelia (Phacelia thermalis) is a watch species on the Big Dry, Judith and Phillips Resource Areas. If it is restricted to habitats that are close to the reservoir, then it has little potential habitat on BLM lands. Like Geyer's milkvetch, it is an annual species at the northern limits of its range here, and may be susceptible to weed encroachment.

MOSS PHLOX  
(Phlox andicola)

A. CLASSIFICATION

1. FAMILY: Phlox Family (Polemoniaceae)
2. GENUS: Phlox refers to a flame (G. phlox - flame); referring to the brightly-colored flowers.
3. SPECIES: The origin of the species epithet is obscure. An alternate common name for the species is plains phlox.

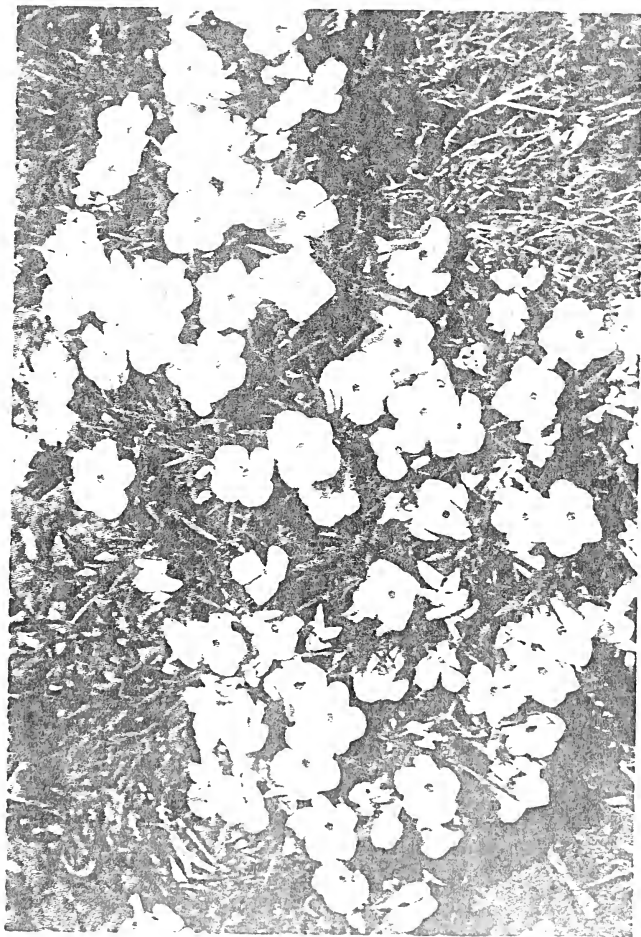
B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS
  - a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: proposed watch (BLM 1993)
2. STATE: The state rank is S1 (critically imperiled) based on three records.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Moss phlox is a loosely-matted phlox with linear narrow leaves averaging 1 mm (.04 in) or less wide and 10-30 mm (.4-1.2 in) long. It usually grows over 6 cm (2.4 in) high with the internodes visible, growing either erect or sprawling. The base of leaves and the stem are usually white hyaline and variably slightly hairy to webbed hairy. The petals are obtusely-lobed and white, and the flower tube is 1/2-2/3 as long as the sepals.
2. TECHNICAL DESCRIPTION: Rhizomatous, caespitose perennial, 4-12 cm (1.6-4.7 in) tall. Fertile shoots solitary or branching near the base, erect to decumbent, with 5-8(10) nodes, the herbaceous stems puberulent to arachnoid-pubescent. Blades linear to subulate, 10-30 mm (.4-1.2 in) long, 1-2 mm (.04-.08 in) wide, nearly glabrous to pubescent or arachnoid-ciliate proximally, the midrib prominently thickened, the tips pungent to subacrose. Inflorescence compact with 1-3(5) flowers; pedicels glabrous to weakly pilose, subsessile to 2(5) mm (.08 in) long. Calyx 6-11 mm (.24-.43 in) long, arachnoid-pubescent along the margins of the lobes and near the summit of the tube, the tube about 1/2 - 2/3 as long as the calyx, the lobes subulate and pungent; corolla white, tubes 6-17 mm (.16-.28 in) long,

(Reproduced from Rickett)



Phlox andicola

*Redfield*



lobes obovate, obtuse, 6-9 mm (.24-.35 in) long, 4-7 mm (.16-.28 in) wide, style 5-9 mm (.2-.31 in) long.

3. **LOCAL FIELD CHARACTERS:** There are five other species of low-growing phlox in central Montana with which moss phlox might be confused. The most common phlox in plains habitat is Hood's phlox (Phlox hoodii), from which it differs in having longer leaves of 10-25 mm vs. 3-10 mm (.4-1 in vs. .12-.4 in) and loosely tufted vs. densely matted growth form. It differs from Alyssum-leaved phlox (Phlox alyssifolia), Kelsey phlox (Phlox kelseyi) and Many-flowered phlox (Phlox multiflora) in having linear, relatively narrow leaves (1 mm. or less at middle) rather than broader leaves. It most closely resembles Tufted phlox (Phlox caespitosa) but it is not densely matted, is usually over 6 cm (2.4 in) high, and occupies plains settings rather than mountains.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Moss phlox is a Great Plains species ranging from eastern Montana and southwestern North Dakota to Colorado and Kansas. In Montana it is known from Carter County and from Dawson County (the collection label for the latter is believed to be in error, reading: McCone County) within 1/2 mile of McCone County.
2. **CURRENT SITES:** All three Montana records of this species are current.
3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** This species was sought in sandy open settings, particularly those uplands similar to the microwave tower collection site on Mount Antelope southeast of Circle.

## E. HABITAT

1. **ASSOCIATED VEGETATION:** Moss phlox is most often found in sandy prairie and pioneer sites within sparsely-vegetated mixed grass prairie. Associated species at the Carter County site include:

<u>Common name</u>	<u>Scientific name</u>
Western wheatgrass	Agropyron smithii
Sandberg's bluegrass	Poa secunda
Needle-and-thread	Stipa comata
Blue grama	Bouteloua gracilis
Sandhills bluestem	Andropogon hallii
Schweinitz' flatsedge	Cyperus schweinitzii
Kentucky bluegrass	Poa pratensis
Yucca	Yucca glauca
White sage	Artemisia ludoviciana
Common sage	Artemisia campestris
Fringed sage	Artemisia frigida
Spiderwort	Tradescantia occidentalis
White prairie clover	Petalostemum candidum
Silverleaf	Psoralea argophylla

2. **TOPOGRAPHY:** It occupies various topographic positions depending on whether the sandy substrates are eroded from bedrock or deposited by wind or water. The Dawson County site is described as occurring on a ridge extending from a prominent butte on the landscape; within a natural blowout.
3. **SOIL RELATIONSHIPS:** Soils are sandy loams or psamment.
4. **CLIMATE FACTORS:** The climate is continental.

## F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Flowering throughout its range is said to take place between May to July (Great Plains Flora Association 1986). The three Montana collections of this species were made between 12 June to 10 July, with flowering possibly beginning in late May. The July specimen was primarily in fruit. The species cannot be identified with certainty except in flower.
2. **POPULATION SIZE AND CONDITION:** The Dawson County population (EO #001) is said to be "locally common" within a discrete blowout area, likely to signify numbers in the hundreds or perhaps thousands. Considering the low, mat-like growth form of the species, it may be very difficult to estimate population numbers to the correct magnitude under high densities. The Carter County populations are noted as made up of at least 8 plants under poor field conditions (EO #002) and of ca. 50 plants (EO #003).

3. REPRODUCTIVE BIOLOGY: Unknown.

G. POPULATION ECOLOGY

1. BIOLOGICAL INTERACTIONS

a. COMPETITION: This low-growing species is crowded out except under sparse vegetation.

b. HERBIVORY: None known.

H. LAND OWNERSHIP: The two Carter County occurrences of this species are on public land: Medicine Rocks State Park (EO #002) and Custer National Forest (EO #003). The Dawson County occurrence seems to be on private land, though the location is not precisely known and there is State School Land in the vicinity. It may or may not be on the same tract leased for the radio tower.

I. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

1. THREATS TO CURRENTLY KNOWN POPULATIONS: There are no known current threats. The habitat supporting Moss phlox is very vulnerable to invasion by leafy spurge (Euphorbia esula), but there are no known on-site encroachments of the weed known from the vicinity at this time.

2. MANAGEMENT PRACTICES AND RESPONSE: Wildfire passed through the Medicine Rocks State Park population (EO #002) the year before it was first found there. Plants observed were vigorous, and it was thought that the affect of the particular fire event was neutral if not positive.

J. SUMMARY: Moss phlox (Phlox andicola) is a watch species on the Big Dry and Powder Riveer Resource Areas of the BLM. Despite the extensive sandstone outcrops along the northern end of the study area, it could not be found there and may be restricted to the younger formations on a few upland buttes as found just outside of McCone County near Mount Antelope.

PERSISTENTSEPAL YELLOWCRESS  
(Rorippa calycina)

A. CLASSIFICATION

1. FAMILY: Mustard Family (Brassicaceae)
2. GENUS: Rorippa possibly refers to the wetland affinity and the curved shape of the fruit (G. ror - dew; G. ipa - worm).
3. SPECIES: The species epithet refers to the calyx (sepals) as they persist after flowering.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

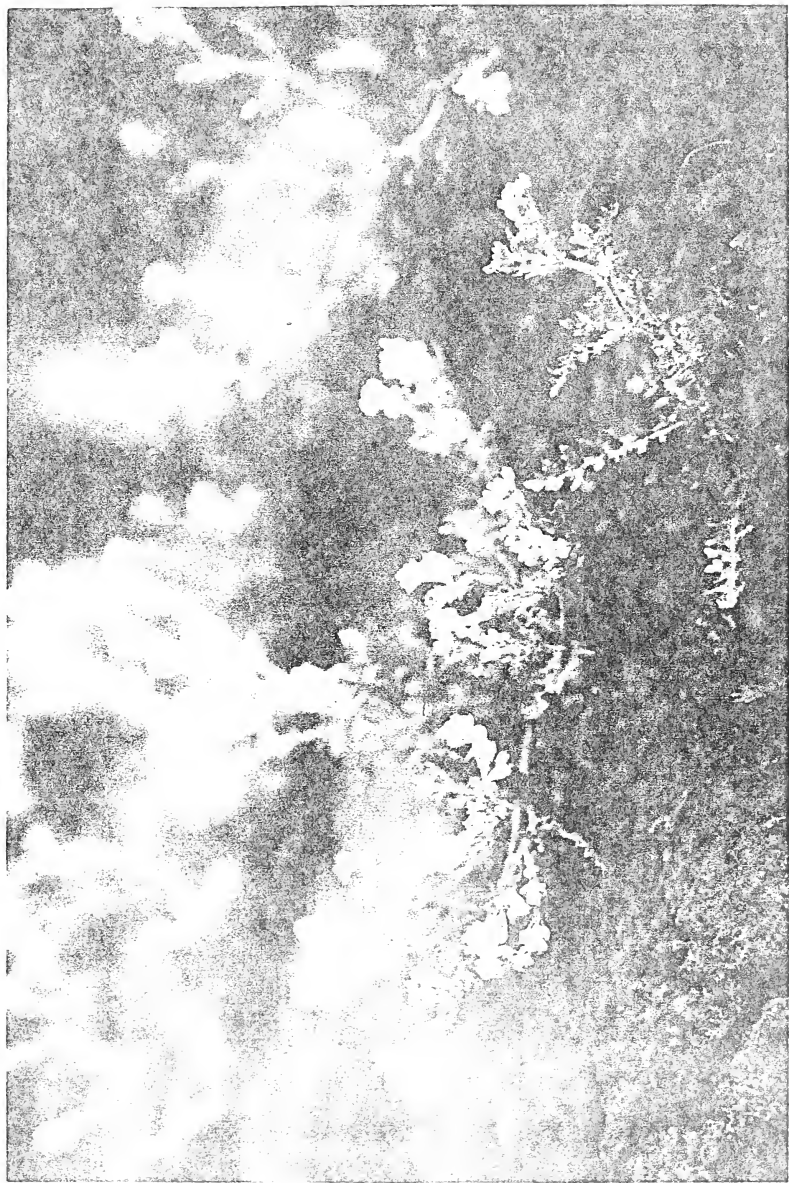
1. FEDERAL STATUS

- a. U.S. FISH AND WILDLIFE SERVICE: C2, a candidate for listing as threatened or endangered (FR NOR 30 Sept. 1993). The only report on this species was prepared in Wyoming in 1981 and recommended that it be kept as a candidate for further study (Lichvar 1981). It has subsequently been recommended dropped from consideration (3C) based on additional field surveys documenting new populations in Wyoming, high relative numbers and relative lack of threats (Fertig pers. commun.).
- b. BUREAU OF LAND MANAGEMENT: proposed watch (BLM 1993)
2. STATE: The state rank is S1 (critically imperiled) based on five records (three historic) in Montana. The two recent records are possibly extirpated.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Persistentsepal yellowcress is a perennial upright or declining herb, 1-4 dm (4-16 in) tall. The stems and leaves are moderately to densely hairy, especially on the leaf midrib, with long, slender hairs. Leaves are sessile, partly clasping at the base, oblong to oblanceolate, and shallowly to deeply lobed. The inflorescence is a raceme growing in both leaf axils and at stem tips. Flowers are bright yellow, with petals 2-3.7 mm (.08-.15 in) long, to 1 mm (.04 in) longer than sepals. Sepals are yellowish-green and persist with fruit. Siliques are globose to subglobose, 2.3-3.4 mm (.09-.13 in) long, 1.2-2.3 mm (.05-.09 in) wide, ca. 1.2-2X longer than wide, and densely hairy with hairs that are broadened at the base and pointed at the tip. Pedicels curve downward, sometimes giving the inflorescence a one-sided appearance.

Figure 10. Persistentsepal yellowcress photo reprint



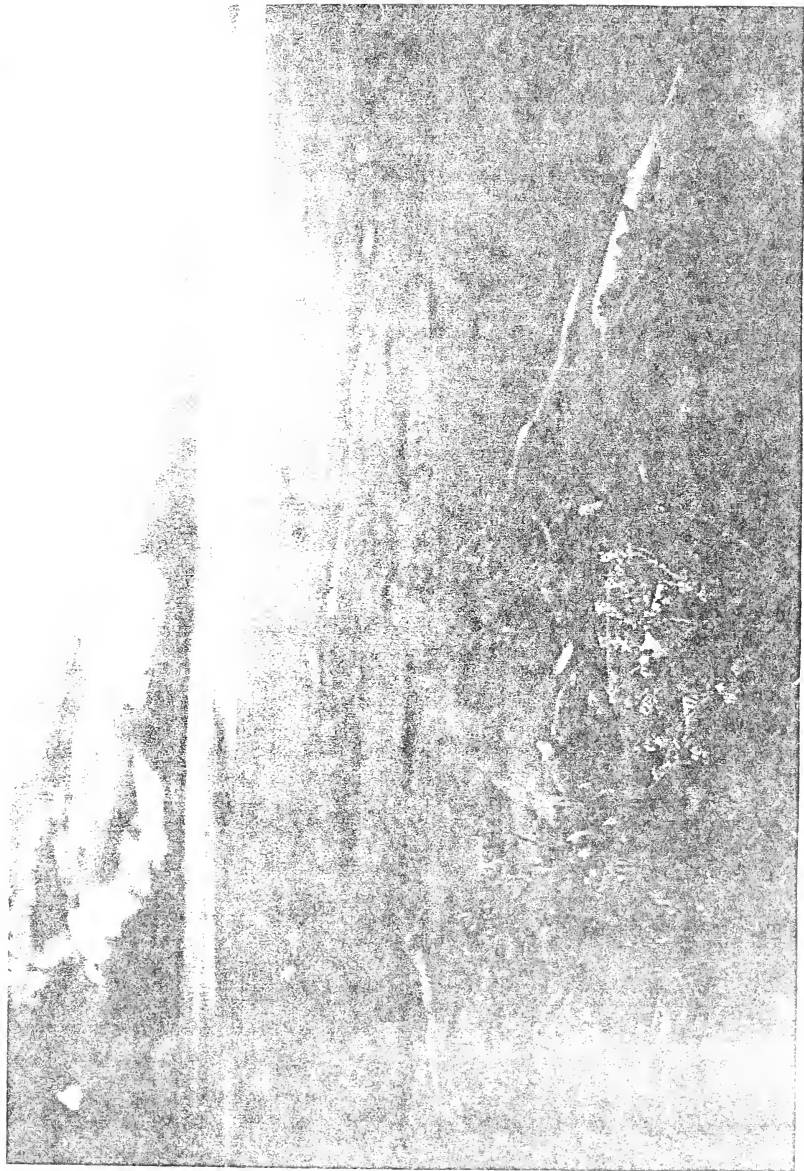
2. **TECHNICAL DESCRIPTION:** Decumbent to prostrate, much-branched perennial from rhizomes, 1-4 dm (4-16 in) tall, moderately to densely hirsute with slender, elongate trichomes. Leaves sessile, blades oblong to oblanceolate in outline, 2.5-5 cm (1-2 in) long, 0.5-1 cm (.2-.4 in) wide, hirsute on both surfaces especially at the midrib, acute to obtuse, shallowly to deeply sinuate, auriculate and partly clasping at the base. Racemes are terminal and axillary, all about the same age or the lowest ones with the oldest siliques. Sepals are yellowish-green, 2.1-3.1 mm (.08-.12 in) long, persistent with fruit. Petals are bright yellow 2-3.7 mm (.08-.15 in) long, to 1 mm (.04 in) longer than the sepals. Siliques are globose to subglobose, 2.3-3.4 mm (.09-.13 in) long, 1.2-2.3 mm (.05-.09 in) wide, ca. 1.3-2X longer than wide, densely strigose on the valves; pedicels strongly recurved, sometimes giving the raceme a 1-sided appearance, 3.5-6.5 mm (.14-.26 in) long (Larson 1993).
3. **LOCAL FIELD CHARACTERS:** The yellowcress genus (Rorippa) is distinguished in having simple hairs, small flowers (petals less than 0.6 mm, i.e. 0.2 in), and lobed leaves. It most closely resembles winter cress (Barbarea orthoceras), but persistent sepal yellowcress is a rhizomatous perennial while winter cress is biennial.

There are four other species of yellowcress in central and eastern Montana. Three of the four are short-lived compared to persistentsepal yellowcress; being annual, biennial or short-lived perennial and lacking rhizomes. The only perennial is Rorippa sinuata, which has elongate, glabrous siliques compared to those of persistentsepal yellowcress which are 1-2.5 times as long as wide and hairy with hairs that are broadened at based and pointed at tip (from Dorn 1984).

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Persistentsepal yellowcress is a regional endemic known from Wyoming, northwestern Nebraska, North Dakota and Montana (Cascade, Choteau, Custer, McCone, and possible Yellowstone counties). In addition, there is a remote outlying population in the Northwest Territories which is likely to have been carried by waterfowl (Rollins 1993). Note: In addition, four specimens at Montana State University (MONT) originally identified as Rorippa calycina have been reviewed and presumed annotated to other species in the genus. Some of these had been included in the summary of species status by Watson (1976), reviewed by and discussed in Lichvar (1981).

Figure 11. Persistentsepal yellowcress habitat photo reprint



2. **CURRENT SITES:** Two collections of this species were made in Montana in recent years. Only one plant was observed when it was found in Choteau County and that plant was collected.

The McCone County collection site of "few" plants could not be relocated and may be extirpated. This same area had been searched intensively in 1981, the year after it was originally collected by Proddgers, and not found. The investigator considered it to be possibly extirpated (Lichvar 1981).

The search is somewhat complicated in that there is question on which of two reservoirs it occurred. Both were extensively searched. It was also complicated by 1993 weather patterns. The landowner noted that severe drought conditions prevailed through spring of 1993, and that extraordinary June rainfall brought stock pond water levels above the normal peak. It is possible that this shoreline species does not consistently flower under such conditions. Considering that the original population consisted of only a few plants, it is likely that it was only an accidental waif at the site originally. Note: The site is used as brood habitat by mallards, and waterfowl have been implicated in dispersing the species beyond its known range into the Northwest Territories (Rollins 1993).

3. **HISTORICAL SITES:** The three historical collections of this species are on the Missouri and Yellowstone Rivers. This species occupies early successional habitat so the historical populations are expected to have shifted if they still persist. The location information for all three historical collections is vague.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** Some of the Wyoming sites are within two miles of the Montana state line on the Big Horn River, but there it has never been found on that river in Montana (Figure 11). Note: This species was not included in the only sensitive plant species survey conducted in the Big Horn Canyon Recreation area in Montana (Knight et al. 1987).
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** Access restrictions through private lands prevented survey of the small parcel of BLM land on the free-flowing segment of the Missouri River in northern McCone County. The camping visits to Fort Peck Reservoir did not turn up this species, and limited survey of BLM stock ponds in the study area did not turn it up. Most of its potential habitat along rivers and reservoirs was not on BLM land, and therefore beyond the scope of this project. Potential habitat for this species may still persist on the free-flowing Missouri River, along its largest reservoirs (Fort Peck Reservoir; possibly Canyon



Ferry Reservoir), along the free-flowing Yellowstone River, and along Big Horn River, and other Yellowstone River tributaries.

## E. HABITAT

1. **ASSOCIATED VEGETATION:** The species associated with Rorippa calycina in Wyoming are mainly pioneer riparian species, and include noxious weeds among them (from Lichvar 1981; exotic species are asterisked). Note: Among the species on the following list of associated species from Wyoming, the asterisked species are exotic.

<u>Common name</u>	<u>Scientific name</u>
Thickspike wheatgrass	Agropyron dasystachyum
Ragweed	Ambrosia psilostachya*
Goosefoot	Chenopodium alba
Bull thistle	Cirsium vulgare*
Gumweed	Grindelia squarrosa
Foxtail barley	Hordeum jubatum
Baltic rush	Juncus balticus
Hoary aster	Machaeranthera canescens
Cusick's bluegrass	Poa sandbergii
Puzzling cinquefoil	Potentilla paradoxa
Russian thistle	Salsola iberica*
Poson suckleya	Suckleya suckleyana
Salt cedar	Tamarix chilensis*
Verbena	Verbena bracteata

The emergent shoreline vegetation at the Garfield County site was submerged under 1993 highwater conditions, and included:

2. **TOPOGRAPHY:** The species is found at the base of slopes within riparian or palustrine habitat that is temporarily flooded; a narrow zone marking old shorelines of rivers, ponds and lakes.
3. **SOIL RELATIONSHIPS:** The largest Wyoming populations are found in loose, non-alkaline, sandy littoral edges. It may also be found in alkaline settings, and on clay substrate (Lichvar 1981). The Garfield County site had alkaline clay substrate around an eutrophic reservoir.
4. **CLIMATE FACTORS:** Persistentsepal yellowcress is adapted to a continental climate with seasonal water level fluctuations.

## F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Collection dates in Montana range from May 10 to August 1. The indeterminate inflorescence can have prolonged flowering well beyond the May-June period of peak flowering. It is easiest to spot when in flower but cannot be identified with certainty unless fruits are present.
2. **POPULATION SIZE AND CONDITION:** The two recent collections in Montana represent small populations or population waifs. The two sets of label information noted the number of plants observed as "one" and "few"; these populations are possibly extirpated.
3. **REPRODUCTIVE BIOLOGY:** Rorippa calycina has two reproductive adaptations as a colonizing species: it is self-compatible, and has strong vegetative reproduction (Mulligan and Porsild 1966; cited in Lichvar 1981).

The restriction of this species to old shoreline zones suggest that its seeds are disseminated by water. The "migrant" population in the Northwest Territories is thought to have been dispersed by waterfowl (Rollins 1993).

## G. POPULATION ECOLOGY

1. **BIOLOGICAL INTERACTIONS**
  - a. **COMPETITION:** As a colonizing species, it is likely to be a poor competitor.
  - b. **HERBIVORY:** It is reported as a decreaser under livestock grazing (Lichvar 1981).

- H. **LAND OWNERSHIP:** The McCone County population (EO #001) is on private land, though BLM administers subsurface mineral rights. The recent collection in Choteau County along the Missouri River (EO #005) was probably within the highwater mark and would therefore be administered by the Montana Department of State Lands.

## I. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

1. **THREATS TO CURRENTLY KNOWN POPULATIONS:** In Wyoming, it has been noted as susceptible to grazing, vulnerable to trampling where it occurs in heavily-used recreation areas, and potentially impacted by increases in reservoir size (Lichvar 1981). Some of its Wyoming sites are also invaded by noxious weeds. Nevertheless, it appears that the

construction of reservoirs has provided an unusual increase in potential habitat for this species, at least in Wyoming (Rollins 1993). There is no basis for addressing potential threats in Montana. It was noted that the Garfield County site of this species is heavily grazed by sheep and has a long history of grazing by sheep.

2. **MANAGEMENT PRACTICES AND RESPONSE:** Management of reservoir water levels are of major management significance for this species in Wyoming.

- J. **SUMMARY:** The Persistentsepal yellowcress (Rorippa calycinia) has been proposed by Wyoming botanists for deletion from consideration as a candidate for federal listing under the Endangered Species Act in light of the large, dispersed number of known Wyoming populations and their contemporary preponderance for reservoirs (Fertig pers. commun.). It is an extremely rare species in Montana from all available information and is appropriately given watch status by the BLM in the Big Dry, Billings, Judith, Powder River and Great Falls Resource Areas. The three historic records are unrelatable; and the two recent records are possibly extirpated.

FEW-FLOWERED GOLDENROD  
(Solidago sparsiflora)

A. CLASSIFICATION

1. FAMILY: Aster, or Sunflower Family (Asteraceae)
2. GENUS: Solidago is an ancient Latin name for the genus.
3. SPECIES: The species epithet translates literally to few-flowered (L. spars. - thin; L. flora - flower). It is treated as synonymous with velvety goldenrod (Solidago velutina) in Cronquist et al. (1994); which is used for the species' illustration. Another common name for S. sparsiflora is three-nerved goldenrod.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. FEDERAL STATUS
  - a. U.S. FISH AND WILDLIFE SERVICE: none
  - b. BUREAU OF LAND MANAGEMENT: none
2. STATE: The state rank is S1 (critically imperiled) based on two records.

C. DESCRIPTION

1. GENERAL NONTECHNICAL DESCRIPTION: Few-flowered goldenrod is a perennial herb, 3-6(8) dm. tall, with an elongate nodding inflorescence and well-developed stem leaves. The leaves are prominently 3-nerved, with short pubescence that gives the leaves a grayish cast. The flower heads are remotely-spaced along the inflorescence, which is typically drooping at the tip, and with side branches that are curved and drooping as well. The flower heads have 8 or fewer ray flowers, and the involucre bracts are broadest at the base.
2. TECHNICAL DESCRIPTION: Perennial 3-8 dm (11.8-31.5 in) tall; herbage grayish-canescenscent. Stems somewhat decumbent or arching upward from a coarse, branching caudex. Leaves firm, oblanceolate to lance-linear, entire to +/- crenate-dentate, especially distally; well-developed midcauline leaves prominently to obscurely 3-nerved, 4-10 cm (1.6-4 in) long and 0.5-2 cm (.2-.8 in) wide; uppermost leaves reduced to mere bracts. Inflorescence a variable, often elongate panicle with the tip nodding, the lateral branches recurved-second and often scarcely exceeding the subtending leafy

Figure 12. Few-flowered goldenrod  
(Solidago sparsiflora) illustration



*Solidago velutina*

bracts; involucre 4-6 mm (.16-.24 in) tall; involucre bracts acute to acuminate; ray florets 8 or less; disk florets of about the same number. Achenes hispidulous (Great Plains Flora Association 1986).

3. **LOCAL FIELD CHARACTERS:** Six other species of goldenrod are in plains of eastern and central Montana and have the same general growth form of well-developed, slender creeping rhizomes that form clonal clusters, and well-developed stem leaves compared to basal leaves which are lacking or small. Few-flowered goldenrod has leaves over 1 cm (.4 in) wide, unlike the two linear-leaved species which are known or reported from the area. Few-flowered goldenrod has stems which are pubescent at least between the inflorescence and the middle of the stem, unlike Solidago gigantea and S. missouriensis which have glabrous stems (rarely pubescent and with a basal cluster of leaves). Few-flowered goldenrod is distinguished from the other two species by technical flower characters. It differs from Solidago mollis in having involucre bracts mostly broadest at base and acute at tip, vs. broadest near middle and obtuse at tip. It differs from S. canadensis in having ray flowers 3-6 mm (.12-.24 in) long and usually 8 or fewer per head, vs. ray flowers 1-4 mm (.04-.06 in) long and usually about 13 per head.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Few-flowered goldenrod is a Great Plains species ranging from Montana to Arizona, and east to Texas, Oklahoma and the Black Hills of South Dakota. In Montana it is only known from Stillwater and Garfield counties.
2. **CURRENT SITES:** The two Montana collections are relatively recent.
3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** None. It may be appropriate to review at least specimens of S. canadensis and S. mollis in Montana herbaria, with which it is more readily confused.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** Suitable habitat with woodland edge was surveyed although it is very restricted along the northern end of Garfield County and northwestern McCone County. The S. . . . were blooming in northwestern McCone County during the last period of fieldwork, but revisits were not made to northern Garfield County (e.g., Seven Blackfoot Creek, Squaw Creek, Lodge Pole Creek) during this time so it is possible it may have been missed.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** Across its range, it is found in a variety of semi-open settings including open woods, woodland margins, and rocky slopes (Great Plains Flora Association 1986).
2. **TOPOGRAPHY:** It is found in unglaciated broken and rolling plains in settings that are well-drained, apparently in a variety of topographic positions (from Great Plains Flora Association 1986). The Garfield County specimen was collected near the edge of a cultivated field which appears from the topographic map to be at the head of a woody draw.
3. **SOIL RELATIONSHIPS:** Across its range, soils are typically sandy (Great Plains Flora Association 1986), but the droughty character of the soils may be partly ameliorated by the moisture-collecting aspects of its microhabitat, including tree cover and rocky slopes.
4. **CLIMATE FACTORS:** The dry, continental climate in which this species grows is moderated at least in part by tree cover and/or moisture-accumulating fractures in sandstone bedrock. Similar species of this genus have very deep taproots.

F. POPULATION DEMOGRAPHY AND BIOLOGY

1. PHENOLOGY: Like other members of the genus, it flowers in August until frost.
2. POPULATION SIZE AND CONDITION: At the Garfield County collection site for this species, it is reported as "frequent". Since it can have multiple stems from the caudex, the observed number of flowering stems does not necessarily represent the number of genetically distinct individuals.
3. REPRODUCTIVE BIOLOGY: Species in this genus are wind-pollinated and have seeds that disperse by wind. Few-flowered goldenrod (Solidago sparsiflora) is one of many goldenrods that reproduce vegetatively by rhizomes, forming clonal clumps.

G. POPULATION ECOLOGY

1. BIOLOGICAL INTERACTIONS
  - a. COMPETITION: Unknown.
  - b. HERBIVORY: Galls which reduce the vigor but do not kill the plants are ubiquitous in the genus; some are species-specific.

H. LAND OWNERSHIP: Unknown.

I. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

1. THREATS TO CURRENTLY KNOWN POPULATIONS: Unknown.
2. MANAGEMENT PRACTICES AND RESPONSE: Unknown.

J. SUMMARY: Few-flowered goldenrod (Solidago sparsiflora) is recommended for watch designation by BLM in the Big Dry and Billings Resource Areas. Of all the current state plant species of special concern, it is the most likely to have potential habitat on BLM-administered lands in the study area. However, the 1993 fieldwork in the study area was curtailed before this species came into flower.

GRACEFUL ARROWGRASS  
(Triglochin concinnum var. debile)

A. CLASSIFICATION

1. **FAMILY:** Arrow Grass Family (Juncaginaceae)
2. **GENUS:** Triglochin refers to the three-pointed fruit of other members in the genus (G. treis - three; G. glochis - point).
3. **SPECIES:** The origin of the species epithet is obscure. The variety name means weak (L. debil - weak), the reference undetermined.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. **FEDERAL STATUS**
  - a. **U.S. FISH AND WILDLIFE SERVICE:** none
  - b. **BUREAU OF LAND MANAGEMENT:** none
2. **STATE:** At the time this project was initiated, Graceful arrowgrass had a state rank of "S1", indicating it to be critically imperiled with typically fewer than six known occurrences in the state. As a result of the 1993 fieldwork, its state rank was reassigned as "S2", indicating it to be imperiled with typically between 6 - 20 known occurrences. As a result of two 1994 field studies, its state rank was reassigned as "S4", indicating it to be potentially secure, and known or expected to have over 100 occurrences in the state or otherwise unsusceptible to disturbance. It was dropped from tracking as a state species of special concern in 1994.

C. DESCRIPTION

1. **GENERAL NONTECHNICAL DESCRIPTION:** Graceful arrowgrass is a perennial, grasslike herb with a racemose inflorescence on a scape, growing in small tufts from a creeping rootstock. The leaves are all basal, subcylindrical, sheathed at the base, and with a distinctly two-lobed ligule. The scape overtops the leaves and grows 1.5-4 (6) dm. tall, the flowers extending almost half the length of the scape. The fruits have six carpels and stigmas, and have a cylindrical shape (from Hitchcock et al. 1984).



2. **TECHNICAL DESCRIPTION:**  
 Plants 1.5-4 (6) dm. tall, often less than 3 dm. tall, tufted from a creeping rootstock. Leaves erect to curved-spreading, nearly terete,  $\frac{1}{3}$  to  $\frac{3}{4}$  the length of the plant, 0.5-1(1.5) mm wide; ligules deeply 2-lobed, the lobes rounded or acute, often overlapping, 1-2 mm long. Racemes are loosely to rather densely flowered, (5)10-25 cm long; pedicels 1-5 mm long. Flowers are ca. 3 mm across; tepals 1-2 mm long; carpels 6, stigmas 6. Fruits cylindric, 3-5 mm. long, 1.5-2 mm thick, splitting into 6 oblong segments, the fruit axis terete (Larson 1993).

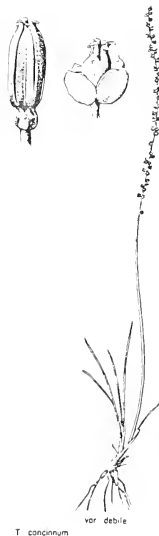


Figure 13. Graceful arrowgrass (*Triglochin concinnum* var. *debile*) illustration

3. **LOCAL FIELD CHARACTERS:** Two other species of arrowgrass are in central and eastern Montana. Graceful arrowgrass differs from (*Triglochin palustris*) in having 6 carpels and stigmas, rather than three, and having a short cylindrical fruit rather than one which is linear and club-shaped on top. Both look alike vegetatively and in flower, so mature fruits are needed in making the distinction. Graceful arrowgrass differs from (*Triglochin maritima*) in having deeply 2-lobed ligules rather than entire ligules, leaf blades nearly cylindrical in outline and less than 1 mm wide rather than somewhat flattened and 1.5-3 mm. wide, and plants usually less than 3 dm tall rather than usually over 3 dm. Note: All three species are likely to be found in similar habitat, and may sometimes occur together at the same site.

#### D. GEOGRAPHICAL DISTRIBUTION

1. **RANGE:** Graceful arrowgrass ranges from British Columbia to Mexico; also in South America. It extends eastward to North Dakota and Arizona. In Montana, it has been collected from Garfield, Jefferson, Madison, McCone, Phillips and Teton counties.

2. **CURRENT SITES:** All collections from the six Montana counties mentioned above are recent; collected from eleven locations.
3. **HISTORICAL SITES:** None.
4. **UNVERIFIED/UNDOCUMENTED REPORTS:** This species is locally abundant around certain Badlands outwash channels of Harding County, SD and is expected in adjoining southeastern Montana in similar habitat.
5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** The species was sought upstream and downstream from newly-discovered populations to delimit boundaries and characterize extent. There are many streams and stream stretches that appear similar to the locations where it was found but which do not have the species.

#### E. HABITAT

1. **ASSOCIATED VEGETATION:** The wet meadow and temporarily inundated vegetation associated with graceful arrowgrass typically includes saltgrass (*Distichlis stricta*), Baltic rush (*Juncus balticus*), foxtail barley (*Hordeum jubatum*); and may also include (*Glaux maritima*), (*Potentilla anserina*) and (*Puccinellia nuttalliana*); as well as both other species of arrowgrass in the state (*Triglochin maritima*, *T. palustre*). At some sites, including the McCone County site on State School land, it is locally dominant.
2. **TOPOGRAPHY:** It occupies riparian habitat in the study area, as well as wetland habitats elsewhere in Montana, at the base of slopes.
3. **SOIL RELATIONSHIPS:** It is found in highly alkaline settings along ponds, springs, streams and outwashes. These soils are saturated at least early in the growing season and have a high clay content. They have a variety of sedimentary parent materials.
4. **CLIMATE FACTORS:** It occupies habitat having arid or semiarid climates where salts accumulate at the surface.

#### F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** The three study area populations documented were found at different times in the 1993 growing season; a season which generally was 2+ weeks late. Graceful arrowgrass was in peak flowering on ... The species is usually collected after it flowers in June. Its fruits persist in recognizable form until frost.

2. **POPULATION SIZE AND CONDITION:** Population sizes in the study area ranged from tens ( ) to ten thousands ( ); two of the three being very large.
3. **REPRODUCTIVE BIOLOGY:** Unknown.

G. **POPULATION ECOLOGY**

1. **BIOLOGICAL INTERACTIONS**

- a. **COMPETITION:** Graceful arrowgrass
- b. **HERBIVORY:** The two largest populations are in areas grazed by livestock. No signs of browse were observed.

- H. **LAND OWNERSHIP:** The ten known sites are evenly split between public and private lands. Two of the three study area populations are on BLM lands and the third is on State School Lands. One of the largest populations is on the Pine Butte Preserve owned by The Nature Conservancy.

I. **ASSESSMENT AND MANAGEMENT RECOMMENDATIONS**

1. **THREATS TO CURRENTLY KNOWN POPULATIONS:** The population documented near Circle was in an abandoned oxbow of the .. One end of the oxbow meander had been dredged apparently to develop waterfowl habitat. The species is absent from this segment.
2. **MANAGEMENT PRACTICES AND RESPONSE:** There is no evidence to suggest that the species decreases under grazing or its indirect affects.

- J. **SUMMARY:** Graceful arrowgrass is no longer being tracked as a Montana species of special concern, based on its wide distribution, range of habitats, and low vulnerability. While it is not common in the study area, it is recurrent, and locally abundant in places.

## DISCUSSION

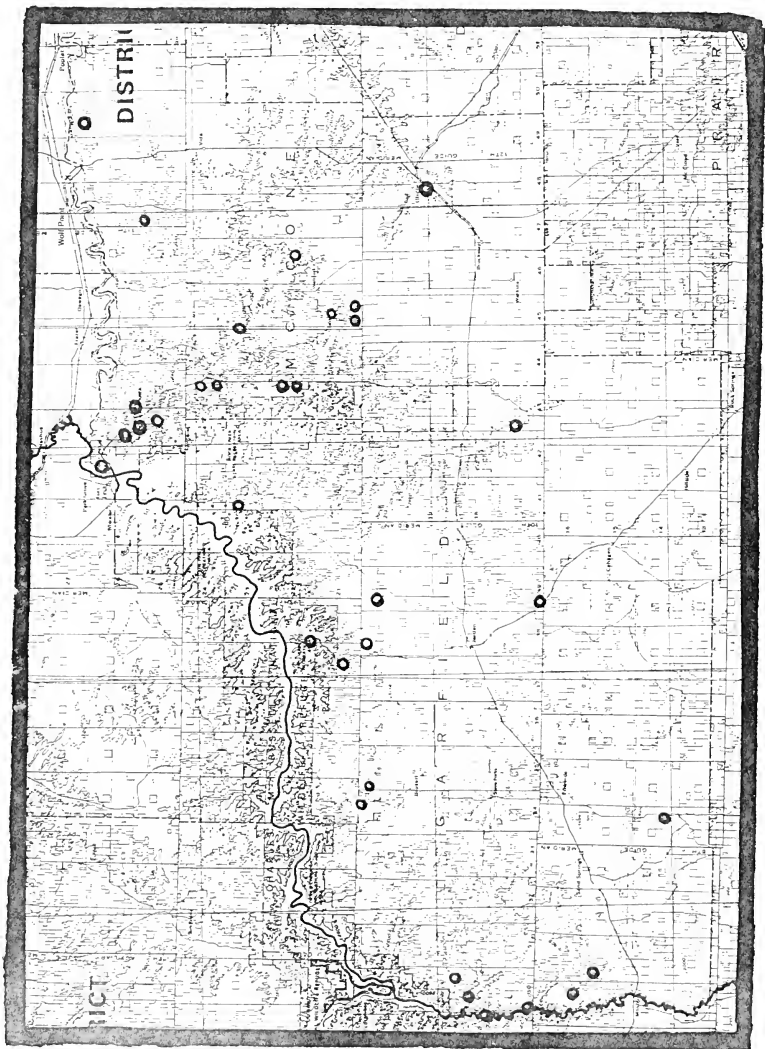
Seven rare plant species are recommended for consideration as watch species by BLM in the study area. They include species of the Great Basin at their northern limits, Great Plains species at their northwestern limits as well as regional endemics, and widely-scattered aquatic species.

<u>Scientific name</u>	<u>Common name</u>	<u>Affinity</u>
<u>Astragalus geyeri</u>	Geyer's milkvetch	Great Basin
<u>Bacopa rotundifolia</u>	Roundleaf water-hyssop	Great Plains?
<u>Elatine americana</u>	American waterwort	Eastern decid.?
<u>Eustoma grandiflorum</u>	Tulip gentian	Great Plains
<u>Phacelia thermalis</u>	Hot spring phacelia	Great Basin
<u>Phlox andicola</u>	Moss phlox	Great Plains
<u>Solidago sparsiflora</u>	Few-flowered goldenrod	Great Plains

While they may be in the two-county area, most are unlikely to have potential habitat on BLM-administered lands. Potential habitat for few-flowered goldenrod (Solidago sparsiflora) seems the the most likely to overlap with BLM lands along rocky ridges and open woodlands as found above the Mussellshell and Missouri Rivers. Survey for this species was preliminary at best because fieldwork was curtailed before this species began flowering during the exceptionally late 1993 field season.

This is a significant start but very incomplete in documenting the plant species and habitat diversity of the study area.

- Mountain Desert, Carbon County, Montana. Unpublished report to USDI Bureau of Land Management, Billings, MT. Montana Natural Heritage Program, Helena.
- Lesica, P. and J. S. Shelly. 1991. Sensitive, threatened and endangered vascular plants of Montana. Montana Natural Heritage Program, Occasional Publ. No. 1. Helena, MT. 88 pp.
- Lichvar, R. W. 1981. Field survey for Rorippa calycina (Engelm.) Rydb. Unpublished report to the Bureau of Land Management. Wyoming Natural Heritage Program, Laramie. 5 pp. plus appendices.
- Rollins, R. C. 1993. The Cruciferae of Continental North America. Stanford University Press, Stanford, CA. 976 pp.
- Rickett, H. W. 1966-1973. Vol. 6. Central Mountains and Plains - Part 2. In: Wild flowers of the United States. McGraw-Hill Book Co. A publication of the New York Botanical Garden.
- Ross, R. L., B. A. Andrews and I. J. Witkind. 1955. Geologic map of Montana. U.S. Geological Survey, Washington, D.C.
- Strom, D. E. 1984. Soil survey of McCone County, Montana. USDA Soil Conservation Service, Bozeman, MT. 361 pp. plus maps and aerial photos.
- USDA Forest Service. 1994. USFS Region 1 Flora List by state. Unpublished.
- USDI Bureau of Land Management. 1993. Draft list of sensitive and watch species in Montana. Billings.
- USDI Fish and Wildlife Service, Federal Register. 1993. Endangered and threatened wildlife and plants: Review of plant taxa for listing as endangered or threatened species. 58 (188): 52244-52290 of 30 September 1993.
- Watson, T. J. 1976. An evaluation of putatively threatened or endangered species from the Montana flora. Unpublished manuscript prepared for the U.S. Forest Service.



Appendix 1. BLM areas surveyed for sensitive plant species

Appendix 2 - Preliminary list of survey target species potentially occurring in Garfield and McCone counties

Scientific/Common Names	Closest Documented County	State/Global Ranks	BLM Status	Comments
<i>Ammania coccinea</i> Scarlet ammania	Garfield	G5S1	proposed watch	Limited suitable wetland habitat in study area
<i>Aster ptarmicoides</i> Prairie aster	Richland	G5S1	proposed watch	Limited mesic grassland habitat in study area
<i>Astragalus geyeri</i> Geyer milkvetch	Garfield	G5S2	proposed watch	Limited sandstone substrate outside of CMR
<i>Bacopa rotundifolia</i> Roundleaf water-hyssop	Garfield	G5S1	-	Limited suitable wetland habitat in study area
<i>Bidens vulgata</i> Tall bur-marigold	Richland	G5S1	proposed watch	Limited suitable wetland habitat in study area
<i>Carex crawei</i> Craw's sedge	Prairie	G5S1	proposed watch	Limited suitable wetland habitat in study area
<i>Carex eburnea</i> Ivory sedge	Dawson, Richland	G5SU	-	Limited suitable juniper slope in study area
<i>Carex gravida</i> Pregnant sedge	Rosebud	G5S1	-	Limited suitable wetland habitat in study area
<i>Cuscuta pentagona</i> Field dodder	Prairie	G5SU	-	Edge of woodlands
<i>Dalea enneandra</i> Nine-anther dalea	Richland	G5S1	-	Limited gravelly substrate in study area
<i>Elatine americana</i> American waterwort				
<i>Eleocharis xyridiformis</i> Creeping spike-rush	Petroleum	G4S1	-	Limited suitable wetland habitat in study area

<i>Elodea longivaginata</i>	Phillips	G4G5S1	-	Limited suitable wetland habitat in study area
<i>Linaria canadensis</i> Blue toadflax	Dawson	G4G5S1	proposed watch	Prairie
<i>Lobelia spicata</i> Pale-spike lobelia	Richland	G5SH	-	Limited suitable mesic grassland habitat in study area
<i>Mentzelia nuda</i> Bractless mentzelia	Dawson	G5S1	proposed watch	Prairie
<i>Mimulus glabratus</i> var. <i>fremontii</i>	Rosebud	G4?TUSU	-	Limited suitable wetland habitat in study area
<i>Mirabilis hirsuta</i> Hairy four o'clock	Sheridan	G5S1	proposed watch	Prairie
<i>Penstemon angustifolius</i> Narrowleaf penstemon	Dawson	G5S1	proposed watch	Prairie
<i>Phacelia thermalis</i> Hot spring phacelia	Garfield	G3G4S1	proposed watch	Barren areas
<i>Plagiobothrys leptocladius</i> Slender-branched popcorn-flower	Phillips	G4S1	-	Limited suitable wetland habitat in study area
<i>Psilocarphus brevisissimus</i> Dwarf woolly-heads	Phillips	G5S1	-	Limited suitable wetland habitat in study area
<i>Psoralea hypogaea</i> Little indian breadroot	Rosebud	G3C4S1	-	Prairie
<i>Rorippa calycina</i> Persistentsepal yellowcress	McCone	G3S1	proposed watch	Shoreline
<i>Scirpus heterochaetus</i> Slender bullrush	Sheridan	G5S1	-	Limited suitable wetland habitat in study area



<i>Solidago sparsiflora</i> Few-flowered goldenrod	Garfield	G7S1	-	Limited suitable woody draw habitat in study area
<i>Sphenopholis obtusata</i> Slender Wedgegrass	Rosebud	G5S1	-	Limited suitable wetland habitat in study area
<i>Sporobolus asper</i> Longleaf dropseed	Custer	G5SH	-	Prairie
<i>Suckleya suckleyana</i> Poison suckleya	Roosevelt Valley	G5SU	-	Prairie
<i>Triglochin concinnum</i> var. <i>debile</i> Graceful arrowgrass	Phillips	G5T4S2	-	Alkaline watercourses
<i>Viburnum lentago</i> Nannyberry	Roosevelt	G5S1	-	Limited suitable woody draw habitat in study area



**PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM****MONTANA NATURAL HERITAGE PROGRAM**

1515 E. 6TH AVE., HELENA, MT 59620

DATE OF SURVEY: \_\_\_\_/\_\_\_\_/\_\_\_\_

OBSERVER(S): \_\_\_\_\_

WORK LOCATION/POSITION TITLE (Forest/District, District/Resource Area of observer(s)): \_\_\_\_\_

**TAXONOMY:**

FAMILY: \_\_\_\_\_ SCIENTIFIC NAME: \_\_\_\_\_

**LOCATION:** (Attach a copy of pertinent 7.5' or 15' topographic map section with locations of populations/subpopulations outlined, one map for each sensitive species described)

COUNTY: \_\_\_\_\_ USGS QUADRANGLE: \_\_\_\_\_

TOWNSHIP: \_\_\_\_\_ RANGE: \_\_\_\_\_ SECTION: \_\_\_\_\_ 1/4 SEC.: \_\_\_\_\_

ADDITIONAL T/R/S, SECTIONS or 1/4 SECS.: \_\_\_\_\_

ELEVATION (at population center (and range of population if known)): \_\_\_\_\_

NATIONAL FOREST/BLM DISTRICT: \_\_\_\_\_ F.S. DISTRICT/ BLM RESOURCE AREA: \_\_\_\_\_

LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM): \_\_\_\_\_

FOREST STAND OR ALLOTMENT NUMBER: \_\_\_\_\_

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.): \_\_\_\_\_

**HABITAT:**

VEGETATION STRUCTURE WITHIN POPULATION AREA:

TOTAL TREE COVER (%) \_\_\_\_\_ TOTAL SHRUB COVER (%) \_\_\_\_\_

TOTAL FORB COVER (%) \_\_\_\_\_ TOTAL GRAMINOID COVER (%) \_\_\_\_\_

TOTAL MOSS/LICHEN COVER (%) \_\_\_\_\_ TOTAL BARE GROUND COVER (%) \_\_\_\_\_

ASSOCIATED PLANT COMMUNITY:(list dominant species currently present, include age structure if known): \_\_\_\_\_

HABITAT TYPE: \_\_\_\_\_

ADDITIONAL ASSOCIATED PLANT SPECIES: \_\_\_\_\_

ASPECT (S, SE, NNW, etc.): \_\_\_\_\_ % SLOPE: \_\_\_\_\_ SLOPE SHAPE (concave, convex, straight, etc.): \_\_\_\_\_

LIGHT EXPOSURE (open, shaded, partial shade, etc.): \_\_\_\_\_

TOPOGRAPHIC POSITION (crest, upperslope, midslope, lowerslope, bottom, etc.): \_\_\_\_\_

MOISTURE: (dry, moist, saturated, inundated, seasonal seepage, etc.): \_\_\_\_\_

PARENT MATERIAL: \_\_\_\_\_

GEOGRAPHIC LAND FORM (e.g. glaciated mountain slopes and ridges, alpine glacial valley, rolling uplands, breaklands, alluvial-colluvial-lacustrine (floodplains, terraces etc.), rockslides)

SOIL TEXTURE: \_\_\_\_\_

EVIDENCE OF DISTURBANCE: \_\_\_\_\_

**POPULATION SIZE:**

ESTIMATED NUMBER OF INDIVIDUALS (or exact count, if feasible; if plants are spreading vegetatively, indicate number of aerial stems): \_\_\_\_\_

NUMBER OF SUBPOPULATIONS (if applicable): \_\_\_\_\_

SIZE OF AREA COVERED BY POPULATION (acres): \_\_\_\_\_

**BIOLOGY:**

PHENOLOGY (percentage flowering, fruiting, vegetative): \_\_\_\_\_

ANY SYMBIOTIC OR PARASITIC RELATIONSHIPS?: \_\_\_\_\_

EVIDENCE OF DISEASE, PREDATION OR INJURY?: \_\_\_\_\_

REPRODUCTIVE SUCCESS (evidence of seed dispersal and establishment): \_\_\_\_\_

**DOCUMENTATION:**

PHOTOGRAPH TAKEN? (if so, indicate photographer and repository): \_\_\_\_\_

SPECIMEN TAKEN? (if so, list collector, collection number, and repository): \_\_\_\_\_

IDENTIFICATION (list name of person making determination, and/or name of flora or book used): \_\_\_\_\_

ECCODATA PLOT NUMBER (attach photocopied data sheets): \_\_\_\_\_

**COMMENTS:**

Appendix 4 - Element occurrence records and maps of species of concern  
in Garfield and McCone counties

December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

Scientific Name: ASTRAGALUS GEYERI

Common Name: GEYER MILKVETCH

Global rank: G5 Forest Service status:

State rank: S2 Federal Status:

Element occurrence code: PDFAB0F3M0.001

Element occurrence type:

Survey site name: HELL CREEK

EO rank: BC

EO rank comments: POPULATION SIZE DROPS LOW AND HABITAT IS SUBJECT  
TO WEED ENCROACHMENT.

County: GARFIELD

USGS quadrangle: MALONEY HILL

Township: Range: Section: TRS comments:

022N 038E 31 N2SW4

Precision: S

Survey date: 1993-06-20 Elevation: 2400 -

First observation: 1978-06-10 Slope/aspect: 20-35% / S-E

Last observation: 1993-06-20 Size (acres): 0

Location:

NORTHWEST OF MAIN CAMPGROUND AND STORAGE ENCLOSURE, HELL CREEK STATE  
PARK. (PORT PECK LAKE.)

Element occurrence data:

1993: 3 COLONIES OF 50-80 PLANTS TOTAL FOUND, SCATTERED IN LOW NUMBERS  
ACROSS 0.25 MILE OF OUTCROPS. 1992: 6 PLANTS ON RIDGE TO WEST; 50-100  
PLANTS WIDELY SCATTERED ON RIDGE TO EAST. IN FRUIT. 1978: LARGE  
COLONIES.

General site description:

CONSPICUOUS SANDSTONE OUTCROP RIDGE TOPS, AMONG SEVERAL RIDGES. LOOSE,  
STEEP SAND SLOPES BELOW SANDSTONE OUTCROPS, WITH MUCH SANDSTONE  
RUBBLE. SPECIES OCCURS ON THE MOST UNSTABLE, SPARSELY-VEGETATED  
HABITAT AVAILABLE. TWO SEPARATE RIDGES, ON LOOSE SAND BELOW LARGE  
OUTCROP FACES. IN HABITAT DOMINATED BY CALAMOVILFA LONGIFOLIA ON BARE  
SAND LOCATED USUALLY LOWER ON SLOPE THAN LUPINUS PUSILLUS, PSORALEIS  
LANCEOLATA AND SOMETIMES ASTRAGALUS KENTROPHYTA. THE WEST RIDGE IS  
INVADED BY WEEDY SPP: MELILOTUS OFFICINALIS, HELIANTHUS PETIOLARIS,  
SALSOLA KALI. WITH ORYZOPSIS HYMENOIDES.

Land owner/manager:

CHARLES M. RUSSELL NATIONAL WILDLIFE REFUGE

Comments:

THE AREA REFERRED TO AS CAMPING MEADOW BY LACKSCHEWITZ AND AS TRAILER  
PARK ON TOPO MAP IS NO LONGER USED FOR CAMPING. SANDSTONE OUTCROPS IN  
VICINITY OF ALL PAST AND PRESENT CAMPING AREAS WHERE CHECKED. SPECIES  
APPEARS TO BE A POOR COMPETITOR WITH OTHER NITROGEN-FIXING PLANTS IN

December 12, 1994

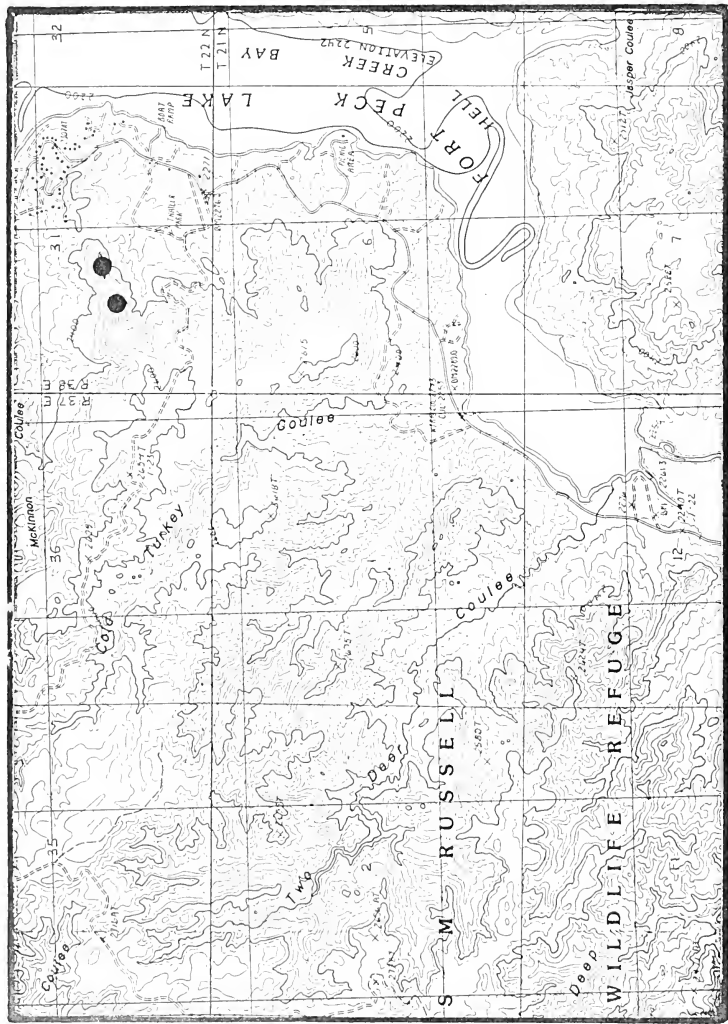
MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

2

EARLY SUCCESSIONAL HABITAT ON SITE, INCLUDING PSORALEA LANCEOLATA,  
LUPINUS PUSILLUS, AND OTHERS.

Information source: HEIDEL, B. L. 1994. SENSITIVE PLANT SURVEY IN  
GARFIELD AND MCCONE COUNTIES, MONTANA. UNPUBLISHED  
REPORT TO THE MILES CITY DISTRICT, BUREAU OF LAND  
MANAGEMENT. MONTANA NATURAL HERITAGE PROGRAM,  
HELENA. [IN PROGRESS]

Specimens: LACKSCHEWITZ, K. (8099). 1978. SPECIMEN #82137. MONTU.  
HEIDEL, B. (1089). 1993. MONT.



ASTRAGALUS GEYERI.001  
 Maloney Hill Quad (7.5)



December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

8

Scientific Name: RORIPPA CALYCINA  
Common Name: PERSISTENTSEPAL YELLOWCRESS

Global rank: G3 Forest Service status: WATCH  
State rank: S1 Federal Status: C2

Element occurrence code: PDBRA27040.001  
Element occurrence type:

Survey site name: CIRCLE  
EO rank:  
EO rank comments:

County: MCCONE

USGS quadrangle: WELDON

Township: Range: Section: TRS comments:  
021N 045E 33 OR 34

Precision: M  
Survey date: 1993-06-21 Elevation: 2530 -  
First observation: 1980 Slope/aspect:  
Last observation: 1980-07 Size (acres): 0

Location:  
ON A RESERVOIR ASSOCIATED WITH MCGUIRE CREEK, CA. 15 MILES NORTHWEST  
OF CIRCLE.

Element occurrence data:  
NOT RELOCATABLE IN 1993, WHETHER DUE TO HIGH WATER CONDITIONS OR LOCAL  
EXTIRPATION.

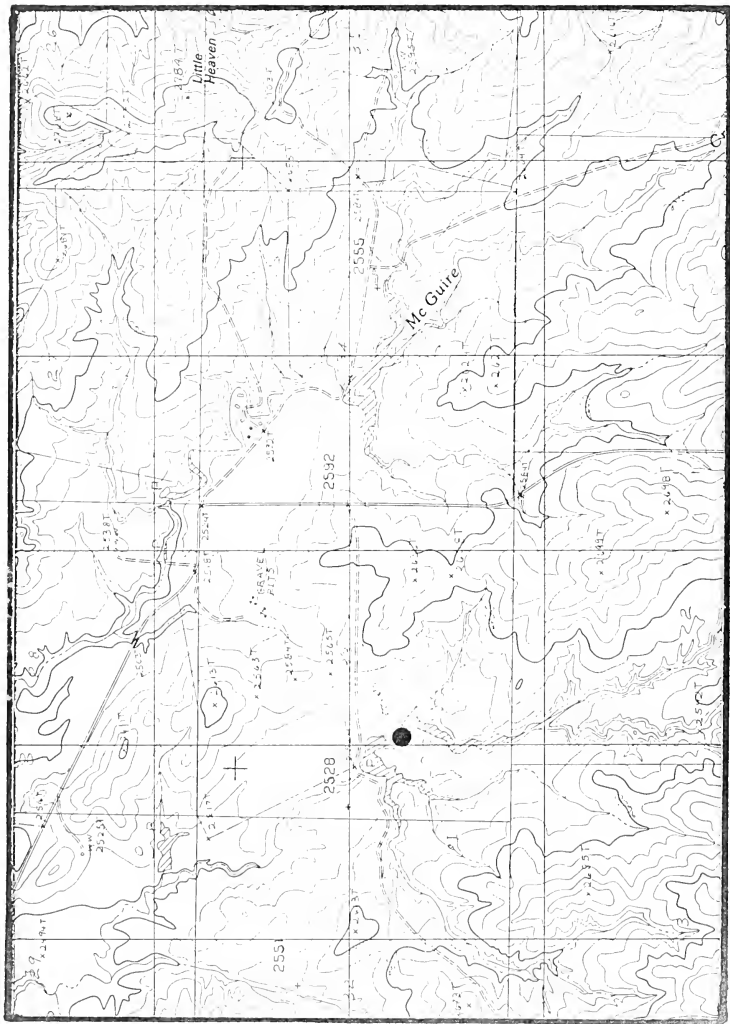
General site description:  
SHORELINE OF IMPOUNDMENT ON MCGUIRE CREEK OR TRIBUTARY. HIGHLY  
EUTROPHIC WATERS AND MAJOR ALTERATION OF SURROUNDING VEGETATION UNDER  
SHEEP GRAZING.

Land owner/manager:  
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:  
ACCIDENTAL OCCURRENCE, AND POSSIBLY NO LONGER EXTANT. TROUT DAM HAS  
STEEP BARE ALKALINE MARGINS, WHILE HOME DAM IS SURROUNDED BY GENTLE  
SLOPES WITH MEADOW MARGINS. WATER LEVELS IN BOTH DAMS WERE BELOW  
AVERAGE UNTIL JUNE WHEN THEY ROSE ABOVE AVERAGE FOR 1993.

Information source: HEIDEL, B. L. 1994. SENSITIVE PLANT SURVEY IN  
GARFIELD AND MCCONE COUNTIES, MONTANA. UNPUBLISHED  
REPORT TO THE MILES CITY DISTRICT, BUREAU OF LAND  
MANAGEMENT. MONTANA NATURAL HERITAGE PROGRAM,  
HELENA. [IN PROGRESS]

Specimens: PRODGERS, R. (S.N.). 1980. SPECIMEN #83830. MONTU.



RORIPPA CALYCINA.001  
Weldon Quad (7.5)

December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

5

Scientific Name: EUSTOMA GRANDIFLORUM

Common Name: SHOWY PRAIRIE-GENTIAN

Global rank: G5 Forest Service status:

State rank: SU Federal Status:

Element occurrence code: PDGEN04030.001

Element occurrence type:

Survey site name: WEST OF CIRCLE

EO rank:

EO rank comments:

County: MCCONE

USGS quadrangle: UNMAPPABLE

Township: Range: Section: TRS comments:

Precision: U

Survey date:

Elevation: -

First observation: 1994-08

Slope/aspect:

Last observation: 1994-08

Size (acres): 1

Location:

CA. 14 MILES WEST OF CIRCLE; NEAR A CREEK.

Element occurrence data:

CA. 14 INCHES TALL, COVERING AN AREA OF 0.25 ACRE. SPECIMENS WERE  
COLLECTED IN FULL FLOWER.

General site description:

WET MEADOW.

Land owner/manager:

Comments:

Information source: BOE, N. E. 1994. [WRITTEN REQUEST TO JOHN H.  
RUMELY, MONTANA STATE UNIVERSITY, REGARDING  
SPECIMEN IDENTIFICATION].

Specimens: HEIDE, G. (S.N.). 1994. MONT.

December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

Scientific Name: SOLIDAGO SPARSIFLORA

Common Name: FEW-FLOWERED GOLDENROD

Global rank: G? Forest Service status:

State rank: S1 Federal Status:

Element occurrence code: PDAST8P1V0.002

Element occurrence type:

Survey site name: HEAD OF SQUAW CREEK

EO rank:

EO rank comments:

County: GARFIELD

USGS quadrangle: STEVE FORKS SW

Township: Range: Section: TRS comments:

019N 033E 35

Precision: G

Survey date:

Elevation: 3220 -

First observation: 1942-08-18

Slope/aspect:

Last observation: 1942-08-18

Size (acres):

Location:

HEAD OF SQUAW CREEK.

Element occurrence data:

FREQUENT.

General site description:

DRY PLACES, ALONG EDGE OF GRAINFIELD.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

BLM: MILES CITY DISTRICT, BIG DRY RESOURCE AREA

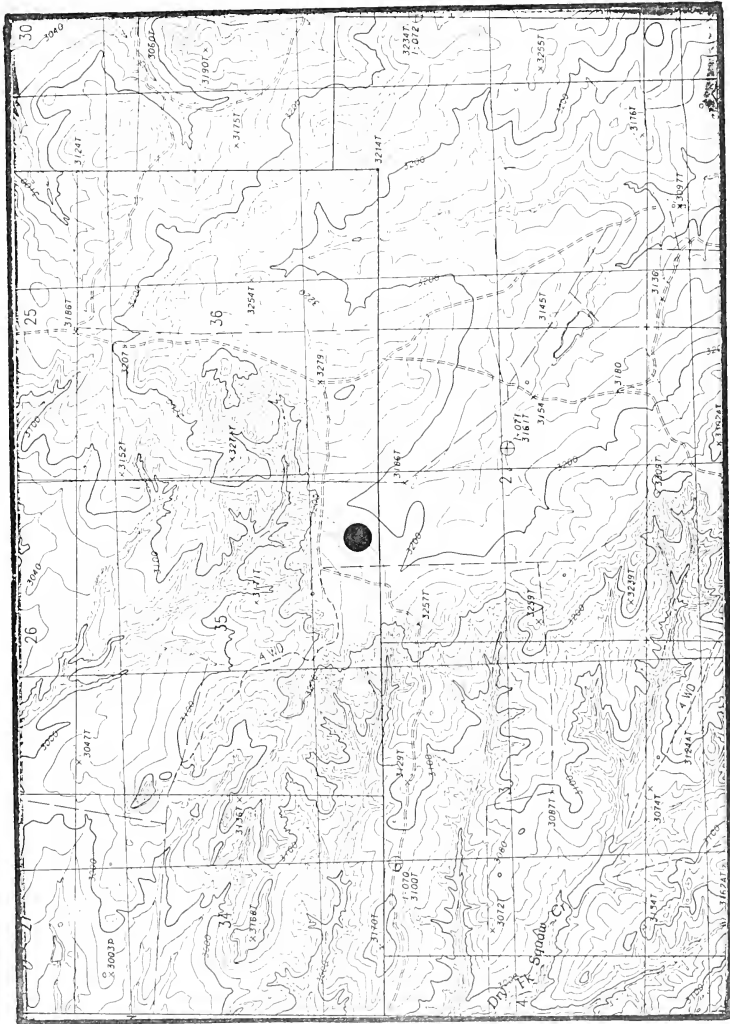
STATE LAND - UNDESIGNATED

Comments:

ORIGINALLY IDENTIFIED AS SOLIDAGO TRINERVATA.

Information source: BOTANIST, MONTANA NATURAL HERITAGE PROGRAM, 1515  
EAST SIXTH AVENUE, HELENA, MT 59620-1800.

Specimens: HOLMGREN AND SHUNK (2167). 1942. SPECIMEN #088598.  
MONTU. ! J. PIERCE 1982.



SOLIDAGO SPARSIFLORA.002  
Steve Forks SW Quad (7.5)

December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

7

Scientific Name: PHLOX ANDICOLA  
Common Name: MOSS PHLOX

Global rank: G4 Forest Service status:  
State rank: S1 Federal Status:

Element occurrence code: PDPLMOD080.001  
Element occurrence type:

Survey site name: HELL CREEK RADIO TOWER  
EO rank:  
EO rank comments:

County: DAWSON

USGS quadrangle: MOUNT ANTELOPE

Township: Range: Section: TRS comments:  
018N 050E 31

Precision: M  
Survey date: Elevation: 3400 -  
First observation: 1987 Slope/aspect:  
Last observation: 1987-06-12 Size (acres): 0

Location:  
RIDGE BELOW (CA. 100 METERS) MICROWAVE TOWER (CA. 9 MILES SOUTHEAST OF  
CIRCLE).

Element occurrence data:  
LOCALLY COMMON.

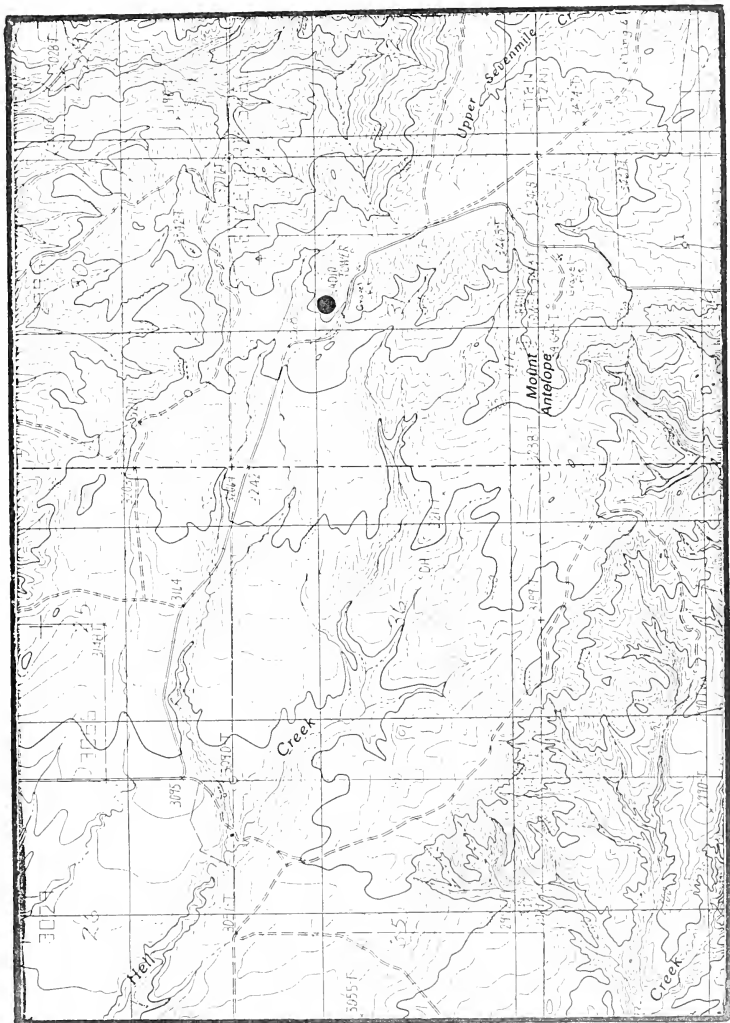
General site description:  
IN A BLOWOUT AREA IN SANDY SOIL.

Land owner/manager:  
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:  
NONE.

Information source: LESICA, PETER. DIVISION OF BIOLOGICAL SCIENCES,  
UNIVERSITY OF MONTANA, MISSOULA, MT 59812.

Specimens: LESICA, P. (4300). 1987. SPECIMEN #107160. MONTU.



PHLOX ANDICOLA.001  
Mount Antelope Quad (7.5)

December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

6

Scientific Name: PHACELIA THERMALIS

Common Name: HOT SPRING PHACELIA

Global rank: G3G4 Forest Service status:

State rank: S1 Federal Status:

Element occurrence code: PDHYD0C4L0.002

Element occurrence type:

Survey site name: YORK ISLAND

EO rank:

EO rank comments:

County: GARFIELD

USGS quadrangle: YORK ISLAND

Township: Range: Section: TRS comments:

025N 041E 08 SW4

Precision: M

Survey date: - -

Elevation: 2260 -

First observation: 1978

Slope/aspect:

Last observation: 1978-06-28

Size (acres): 0

Location:

ON STEEP SLOPE ABOVE THE BEACH OF YORK ISLAND, CHARLES M. RUSSELL NWR.

Element occurrence data:

"JUST THIS ONE PLANT".

General site description:

ON STEEP SLOPE OF ISLAND.

Land owner/manager:

CHARLES M. RUSSELL NATIONAL WILDLIFE REFUGE

FORT PECK RESERVOIR

YORK ISLAND RESEARCH NATURAL AREA

Comments:

NONE.

Information source: BOTANIST, MONTANA NATURAL HERITAGE PROGRAM, 1515

EAST SIXTH AVENUE, HELENA, MT 59620-1800.

Specimens: LACKSCHEWITZ, K. H. (8248). 1978. SPECIMEN #81943. UM.





December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

Scientific Name: BACOPA ROTUNDIFOLIA  
Common Name: ROUNDLEAF WATER-HYSSOP

Global rank: G5 Forest Service status:  
State rank: S1 Federal Status:

Element occurrence code: PDSCR06080.002  
Element occurrence type:

Survey site name: FORT PECK RESERVOIR  
EO rank:  
EO rank comments:

County: GARFIELD

USGS quadrangle: GERMAINE COULEE EAST

Township: Range: Section: TRS comments:  
020N 030E 24 NE4

Precision: M  
Survey date: Elevation: 2260 -  
First observation: 1978 Slope/aspect:  
Last observation: 1978-08-20 Size (acres): 0

Location:  
(FORT PECK RESERVOIR - V.L. BEND. CA. 40 MILES NORTHEAST OF JORDEN)  
CHARLES M. RUSSELL NATIONAL WILDLIFE REFUGE.

Element occurrence data:  
COMMON, IN FLOWER (20 AUGUST 1978).

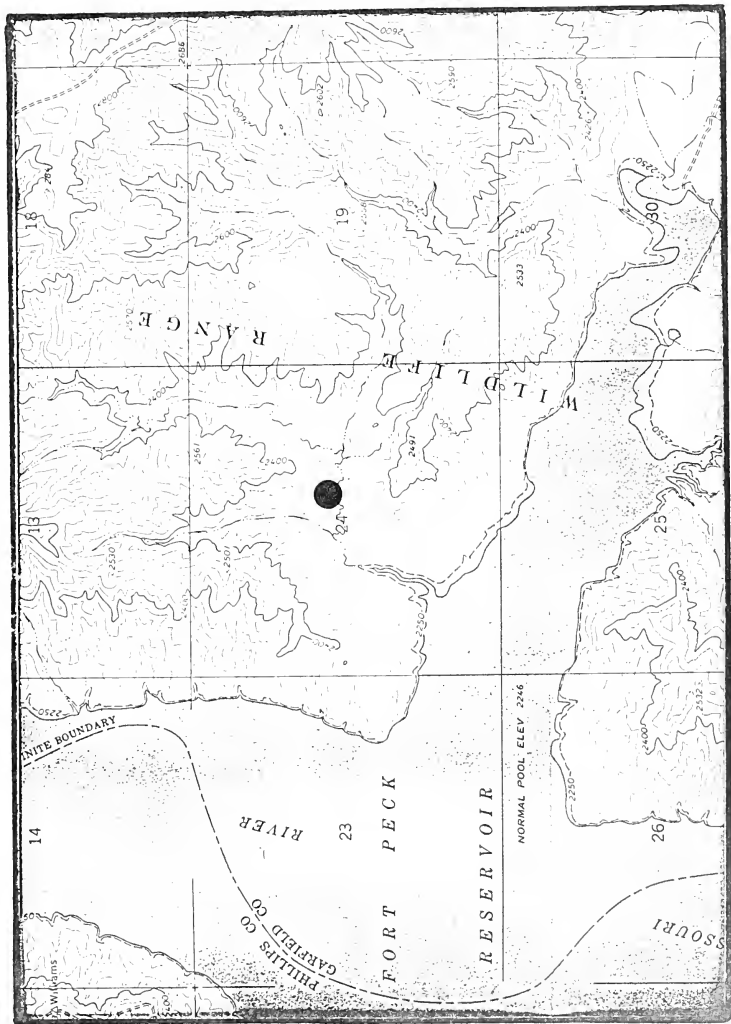
General site description:  
ON THE SHALLOW, MUDDY BANKS OF A STOCK POND WITH RICH AQUATIC  
VEGETATION.

Land owner/manager:  
CHARLES M. RUSSELL NATIONAL WILDLIFE REFUGE

Comments:  
LABEL READS PHILLIPS COUNTY BUT SECTION 24 IS IN GARFIELD COUNTY.

Information source: BOTANIST, MONTANA NATURAL HERITAGE PROGRAM, 1515  
EAST SIXTH AVENUE, HELENA, MT 59620-1800.

Specimens: LACKSCHEWITZ, K.H. (S.N.) 1978. MONTU.



BACOPA ROTUNDIFOLIA, 002  
 Germaine Coulee East Quad (7.5)

December 12, 1994

MONTANA NATURAL HERITAGE PROGRAM  
Element Occurrence Record

4

Scientific Name: ELATINE AMERICANA  
Common Name: AMERICAN WATER-WORT

Global rank: G4 Forest Service status:  
State rank: S1 Federal Status:

Element occurrence code: PDELT02020.001  
Element occurrence type:

Survey site name: FORT PECK RESERVOIR  
EO rank:  
EO rank comments:

County: GARFIELD

USGS quadrangle: GERMAINE COULEE EAST

Township: Range: Section: TRS comments:  
020N 030E 24

Precision: M  
Survey date: Elevation: 2280 -  
First observation: 1978-08-20 Slope/aspect:  
Last observation: 1978-08-20 Size (acres):

Location:  
CA. 0.7 MILE EAST OF FORT PECK RESERVOIR, NEAR SQUAW CREEK DRAINAGE.

Element occurrence data:  
FEW PLANTS.

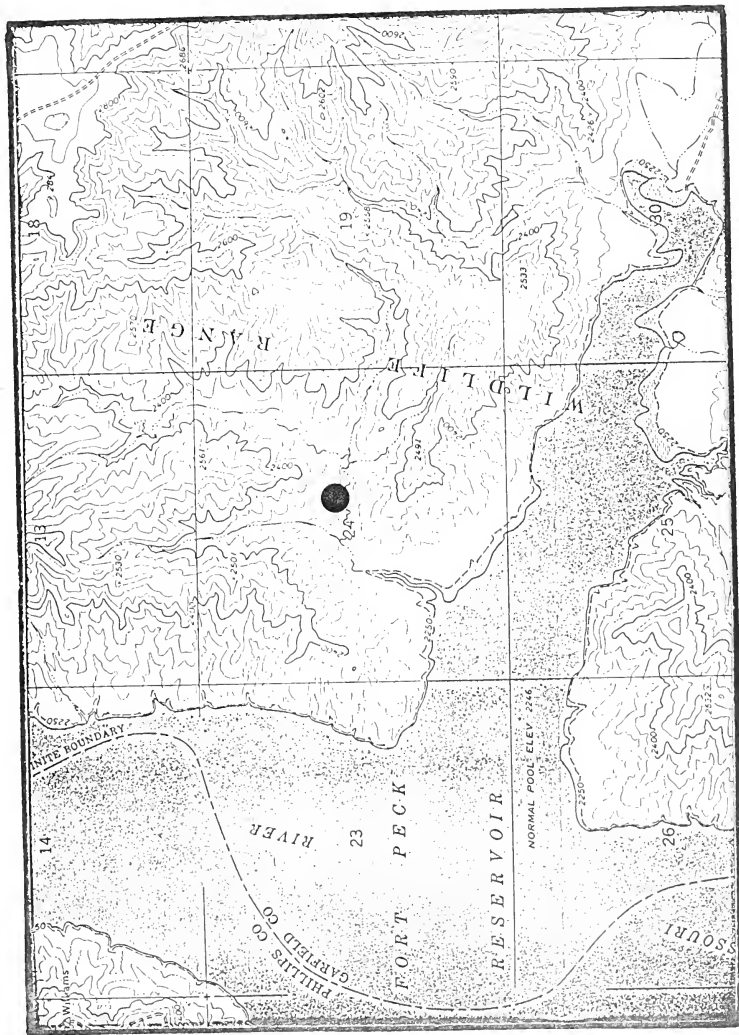
General site description:  
MUD FLATS AROUND A STOCKPOND.

Land owner/manager:  
CHARLES M. RUSSELL NATIONAL WILDLIFE REFUGE

Comments:  
SPECIMEN LABEL SAYS "PHILLIPS" COUNTY; POPULATION MAPPED BASED ON THE  
LEGAL DESCRIPTION, WHICH IS IN GARFIELD COUNTY.

Information source: LACKSCHEWITZ, KLAUS. DIVISION OF BIOLOGICAL  
SCIENCES, UNIVERSITY OF MONTANA, MISSOULA, MT  
59812. 406/243-5222.

Specimens: LACKSCHEWITZ, K. H. (8618). 1978. COLLECTION #288756.  
WTU.



ELATINE AMERICANA.001  
 Germaine Coulee East Quad (7.5)



Appendix 5 - Preliminary list of vascular plants in Garfield and in McCone counties\*

<u>FAMILY</u> <u>Genus, Species</u>	<u>Common name</u>	<u>Garfield</u>	<u>McCone</u>
<b>ACERACEAE</b>			
Acer negundo	Box elder	x	x
<b>ALISMATACEAE</b>			
<b>Alisma gramineum</b>	water plaintain	x	
Alisma triviale	water plaintain		x
<b>AMARANTHACEAE</b>			
Amaranthus alba	Tumbleweed	x	
Amaranthus blitoides	Pigweed	x	x
Amaranthus retroflexus	Pigweed	x	x
<b>ANACARDIACEAE</b>			
Rhus trilobata	Skunkbush	x	x
Toxicodendron rydbergii	Poison ivy	x	x
<b>APIACEAE</b>			
Cymopterus acaulis	cymopterus	x	x
Cymopterus terebinthinus	cymopterus	x	
Lomatium foeniculaceum	Desert parsley	x	
Musineon divaricatum	Wild parsley	x	x
<b>APOCYNACEAE</b>			
Apocynum androsaemifolium	Spreading dogbane	x	
Apocynum cannabinum	Indian hemp dogbane		x
<b>ASCLEPIADACEAE</b>			
Asclepias speciosa	Showy milkweed	x	x
Asclepias verticillata	Whorled milkweed	x	x
Asclepias viridiflora	Green milkweed	x	x
<b>ASTERACEAE</b>			
Achillea millefolium	Yarrow	x	x
Agoseris glauca	False dandelion	x	x
<b>Ambrosia acanthicarpa</b>	Annual bursage	x	
Ambrosia psilostachya	Western ragweed	x	
Antennaria neglecta	Field pussytoes		x
Antennaria parvifolia	Pussytoes	x	x
Arnica fulgens	Arnica	x	
Artemisia biennis	Wormwood	x	x
Artemisia campestris	Western sage	x	x
Artemisia cana	Silver sage	x	x
Artemisia dracunculus	Sillyk wormwood	x	x
Artemisia frigida	Fringed sage	x	x

\*Asterisked species are exotic

Bold-faced species were collected in the course of this study

Artemisia longifolia	Long-leaved sage		x
Artemisia ludoviciana	White sage	x	x
Artemisia tridentata	Big sage	x	x
Aster falcatus	Aster	x	x
Aster laevis	Aster	x	
<b>Bidens cernua</b>	Beggarsticks	x	
Carduus nutans	Musk thistle	x	x
Centaurea maculosa	Spotted knapweed	x	
Centaurea repens	Russian knapweed	x	
Chaenactis douglasii	Chaenactis	x	
Chrysopsis villosa	Golden aster	x	x
Chrysothamnus nauseosus	Rabbitbrush	x	x
Cirsium arvense*	Canada thistle	x	x
Cirsium canovirens	thistle		x
Cirsium flodmanii	Flodman's thistle	x	
Cirsium hookerianum	Hooker's thistle	x	x
Cirsium undulatum	thistle	x	
Conyza canadensis	Horseweed	x	x
Conyza ramosissima	Spreading horseweed	x	
<b>Coreopsis tinctoria</b>	Tickseed		x
Crepis atrabarba	hawkweed	x	
Dyssodia papposa	Fetid marigold	x	x
Echinacea angustifolia	Purple coneflower	x	x
Erigeron divergens	Branching fleabane	x	
Erigeron glabellus	Smooth fleabane		x
Erigeron ochroleucus	fleabane	x	
<b>Erigeron pumilus</b>	fleabane	x	x
<b>Filago arvensis*</b>	Filary	x	
Gaillardia aristata	Blanketflower	x	x
Grindelia squarrosa	Gumweed	x	x
Gutierrezia sarothrae	Broom snakeweed	x	x
Haplopappus armerioides	Goldenweed		x
Helianthus annuus	Wild sunflower	x	x
<b>Helianthus maximiliani</b>	Maximilian's sunflower	x	x
Helianthus petiolaris	Plains sunflower	x	x
Hymenoxys acaulis	Stemless hymenoxys	x	x
Hymenoxys richardsonii	Colorado rubberplant		x
Hymenopappus filifolius	hymenopappus	x	x
Hymenopappus acaulis	hymenopappus	x	x
Hymenopappus richardsonii	hymenopappus	x	
Iva axillaris	Poverty weed	x	
Iva xanthifolia	Marsh elder	x	x
Kuhnia eupatorioides	False boneset	x	
Lactuca oblongifolia	Blue lettuce		x
Lactuca serriola	Prickly lettuce	x	
Liatriis punctata	Gayfeather	x	x
Lygodesmia juncea	Skeletonweed	x	x
Machaeranthera canescens	Hoary aster	x	
Machaeranthera grindelioides	Goldenweed	x	x
<b>Machaeranthera   tanacetifolia</b>	spiny aster		
Microseris cuspidata	microseris	x	x
Microseris nutans	microseris	x	



Picradeniopsis oppositifolia	Picradeniopsis	x	x
Ratibida columnifera	Long-headed coneflower	x	x
Senecio canus	Gray ragwort	x	x
Senecio intergerrimus	ragwort		x
Solidago canadensis	Canada goldenrod	x	
Solidago missouriensis	Early goldenrod	x	x
<b>Solidago mollis</b>	Smooth goldenrod	x	
Solidago nemoralis	Gray goldenrod	x	x
<b>Solidago ridiga</b>	goldenrod	x	x
Solidago sparsiflora	Few-flowered goldenrod	x	
Sonchus arvensis	sow thistle	x	
Sonchus uliginosus	sow thistle		x
Stephanomeria runcinata	Desert wirelettuce	x	x
Taraxacum laevigatum*	dandelion	x	
Taraxacum officinale*	dandelion	x	x
Tetradymia canescens	Horsebrush	x	
Thelesperma marginatum	Greenthread	x	x
Townsendia hookeri	Townsendia		x
Tragopogon dubius	Goatsbeard		x
Xanthium strumarium	Cocklebur	x	x

#### BORAGINACEAE

Cryptantha celosioides	Butte candle	x	x
Cryptantha torreyana	Miner's candle		x
Lappula echinata	Blue stickseed		x
Lappula redowski	Redowski's stickseed	x	x
Lithospermum arvense	Yellow puccoon	x	
Lithospermum incisum	Narrow-leaved puccoon	x	x
Lithospermum ruderale	Field stoneseed	x	

#### BRASSICACEAE

Arabis hirsta	Rock cress		x
Arabis holboellii	Holboell's rockcress	x	x
Camelina microcarpa*	false flax		x
Camelina sativa*	false flax		x
Capsella bursa-pastoris*	Shepherd's purse	x	x
Chorispora tenella*	Blue mustard		x
Conringia orientalis*	Hare's ear mustard	x	x
Descurainia pinnata*	Tansy mustard	x	x
Descurainia sophia*	Flixweed	x	x
Draba reptans	White whitlowwort		x
Erysimum asperum	Western wallflower		x
Erysimum inconspicuum	Smallflower wallflower		x
Hesperis matronalis*	Dame's rocket		x
Lepidium densiflorum	Peppergrass		x
Lepidium perfoliatum	Heart-leaved peppergrass	x	
Lepidium ramosissimum	peppergrass		x
Lesquerella alpina	bladderpod	x	x
Lesquerella ludoviciana	bladderpod	x	x
<b>Malacomia africana*</b>	malcolmia	x	
Physaria didymocarpa	Twinpod	x	x
Rorippa calycina	Persistentsepal yellowcress		x

<i>Sisymbrium altissimum*</i>	Yellow rocket	x	x
<i>Thlaspi arvense*</i>	Field penny cress	x	x
CACTACEAE			
<i>Coryphantha missouriensis</i>	Missouri ballcactus		x
<i>Coryphantha vivipara</i>	Common ballcactus	x	
<i>Opuntia fragilis</i>	Small prickly pear		x
<i>Opuntia polyacantha</i>	Prickly pear	x	x
CALLITRICHACEAE			
<i>Callitriche hermaphroditica</i>	water starwort		x
CAMPANULACEAE			
<i>Campanula rotundifolia</i>	Harebell	x	x
CAPPARACEAE			
<i>Cleome serrulata</i>	Bee plant	x	x
<i>Polanisia trachsperma</i>	Clammyweed	x	x
CAPRIFOLIACEAE			
<i>Symphoricarpos albus</i>	Snowberry	x	x
<i>Symphoricarpos occidentalis</i>	Buckbrush	x	x
CARYOPHYLLACEAE			
<i>Alyssum dessortum*</i>	Alyssum	x	x
<i>Cerastium arvense</i>	Prairie chickweed	x	x
<i>Paronychia sessiliflora</i>	Whitlowwort	x	x
<i>Silene cseri</i>	Smooth catchfly	x	
<i>Stellaria media</i>	chickweed	x	x
CHENOPODIACEAE			
<i>Atriplex argentea</i>	Silverscale	x	x
<i>Atriplex confertifolia</i>	Spiny saltbush	x	x
<i>Atriplex dioica</i>	Rillscale	x	x
<i>Atriplex nuttallii</i>	Saltbush	x	x
<i>Ceratoides lanata</i>	Winterfat	x	
<i>Chenopodium album</i>	goosefoot	x	x
<i>Chenopodium hybridum*</i>	goosefoot		x
<i>Chenopodium leptophyllum</i>	Narrowleaved goosefoot	x	x
<i>Chenopodium rubrum</i>	goosefoot	x	
<i>Corispermum hyssopifolium</i>	bugseed	x	
<i>Kochia scoparia</i>	Burning bush	x	x
<i>Monolepis nuttalliana</i>	Poverty weed	x	x
<i>Salsola kali*</i>	Russian thistle	x	x
<i>Sarcobatus vermiculatus</i>	Greasewood	x	x
<i>Suaeda depressa</i>	sea blite	x	
<i>Suaeda moquinii</i>	seablite	x	
CONVOLVULACEAE			
<i>Convolvulus arvensis*</i>	Field bindweed	x	
CORNACEAE			
<i>Cornus stolonifera</i>	Red-osier dogwood	x	x

CUPRESSACEAE			
Juniperus communis	Common juniper	x	x
Juniperus horizontalis	Creeping juniper	x	x
Juniperus scopulorum	Rocky Mountain juniper	x	x
CYPERACEAE			
Carex brevior	sedge	x	
Carex eleocharis	sedge		
Carex filifolia	Thread-leaved sedge	x	x
Carex foetida	sedge		x
Carex heliophila	sedge	x	
Carex hystericina	sedge		x
Carex lanuginosa	sedge		x
Carex praegracilis	Clustered field sedge		x
Carex utriculata	Bladder sedge		x
Scirpus acutus	Hardstem bullrush		x
Scirpus americanus	Threesquare	x	x
Scirpus validus	Softstem bullrush		x
ELAEAGNACEAE			
Elaeagnus angustifolia*	Russian olive	x	
Shepherdia argentea	Silverlead		x
Shepherdia canadensis		x	x
ELATINACEAE			
Elatine americana	American waterwort	x	
EQUISETACEAE			
Equisetum arvense	Field horsetail		x
Fuiseum hyemale	Souring rush	x	
Equisetum laevigatum	Horsetail		x
ERICACEAE			
Arctostaphylos uva-ursi	Bearberry		x
EUPHORBIACEAE			
Euphorbia esula*	Spurge		x
Euphorbia glyptosperma	Ridge-seeded spurge	x	
Euphorbia robusta	Shrubby spurge	x	x
Euphorbia serpyllifolia	spurge		x
Euphorbia spathulata	spurge	x	x
FABACEAE			
Astragalus agrestis	Field milkvetch	x	x
Astragalus bisulcatus	Two-grooved milkvetch	x	x
Astragalus crassicaupus	Ground plum	x	x
Astragalus drummondii	Drummond's milkvetch	x	
Astragalus flexuosus	Pliant milkvetch	x	
Astragalus geyeri	Geyer's milkvetch	x	
Astragalus gilviflorus	Plains orophaca	x	x
Astragalus gracilis	milkvetch	x	
Astragalus kentrophyta	milkvetch	x	
Astragalus lotiflorus	Lotus milkvetch	x	x
Astragalus missouriensis	Missouri milkvetch	x	x

Astragalus pectinatus	Tine-leaved milkvetch	x	x
Astragalus purshii	Pursh' milkvetch	x	x
<b>Astragalus spathulatus</b>	Draba milkvetch	x	x
Astragalus tenellus	Pulse milkvetch	x	x
Astragalus vexilliflexus	Nickleaf milkvetch	x	x
Dalea candida	White prairie clover	x	x
Dalea purpurea	Purple prairie clover	x	x
Glycyrrhiza lepidota	Wild licorice	x	x
Lupinus argenteus	lupine	x	
Lupinus arbustus	lupine	x	
Lupinus lepidus	lupine	x	
<b>Lupinus pusillus</b>	Small lupine	x	x
Medicago sativa*	Alfalfa	x	
Melilotus albus*	White sweetclover		x
Melilotus officinalis*	Yellow sweetclover	x	x
Oxytropis besseyi	Bessey's crazyweed	x	x
<b>Oxytropis lambertii</b>	Purple locoweed	x	x
<b>Oxytropis sericea</b>	White locoweed	x	
Psoralea argophylla	Silverleaf	x	x
Psoralea esculenta	Indian breadroot	x	x
Psoralea lancolata	Lomon scurfpea	x	x
Thermopsis rhombifolia	Golden pea	x	x
Trifolium repens*	clover	x	x
Vicia americana	American vetch	x	x

#### GENTIANACEAE

Eustoma grandiflorum	Tulip gentian		x
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#### GROSSULARIACEAE

Ribes cereum	Western red currant	x	
Ribes odoratum	Golden currant	x	x
<b>Ribes setosum</b>	gooseberry	x	

#### HALORAGACEAE

Myriophyllum spicatum	Water milfoil		x
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#### HYDROPHYLLACEAE

Ellisia nyctelea	Ellisia	x	
Phacelia linearis	Linear-leaved phacelia		x
Phacelia thermalis	Hot spring phacelia	x	

#### JUNCACEAE

Juncus balticus	Baltic rush	x	x
Juncus bufonis	Frog rush		x
<b>Juncus longistylis</b>	rush	x	
Juncus tenuis	rush	x	

#### JUNCAGINACEAE

Triglochin concinnum var. concinnum	Graceful arrowgrass	x	x
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#### LABIATAE

Hedeoma drummondii	Drummond's false pennyroyal	x	x
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Lycopus americanus	American bugleweed		x
Lycopus asper	Rough bugleweed		x
Mentha arvensis	Wild mint	x	
Monarda fistulosa	Wild bergamot	x	x

#### LILIACEAE

Allium textile	White prairie onion	x	x
Asparagus officinalis	Wild asparagus		x
Calochortus nuttallii	Mariposa lily	x	x
Disporum trachycarpum	Fairybells	x	
Fritillaria atropurpurea	Leopard lily	x	x
Smilacina stellata	False Solomen's seal	x	x
Smilax herbacea	Carrion flower		x
Yucca glauca	Yucca	x	x
Zigadenus venosus	Death camas	x	x

#### LINACEAE

Linum perenne	Blue flax	x	x
Linum rigidum	Yellow flax	x	x

#### LOASACEAE

Mentzelia decapetala	Evening star	x	
Mentzelia dispersa	Stickleaf	x	
Mentzelia laevicaulis	blazing star		x

#### MALVACEAE

Malva rotundifolia	Common mallow		x
Sphaeralcea coccinea	Scarlet globemallow	x	x

#### NYCTAGINACEAE

Mirabilis linearis	Narrowleaf four o'clock	x	x
Mirabilis nyctaginea	four o'clock	x	

#### OLEACEAE

Fraxinus pensylvanica	Green ash	x	x
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#### ONAGRACEAE

Calylophus serrulatus	Tooth-leaved primrose	x	x
Epilobium angustifolium	Fireweed	x	x
Gaura coccinea	gaura	x	x
Gaura parviflora	gaura	x	x
Gayophyton decipiens	Gayophyton		x
Oenothera albicaulis	White-stemmed evening primrose	x	
Oenothera cespitosa	primrose	x	x
Oenothera flava	primrose	x	
Oenothera nuttallii	primrose	x	x

#### OROBANCHACEAE

Orobanche fasciculata	broomrape	x	x
Orobanche ludoviciana	broomrape		x

## PINACEAE

<i>Pinus flexilis</i>	Limber pine	x	
<i>Pinus ponderosa</i>	Ponderosa pine	x	x
<i>Psuedotsuga menziesii</i>	Douglas fir	x	

## PLANTAGINACEAE

<i>Plantago eriopoda</i>	Alkali plantain		x
<i>Plantago major</i>	Common plantain	x	x
<i>Plantago patagonica</i>	Buckhorn	x	x

## POACEAE

<i>Agropyron caninum</i>	Slender wheatgrass	x	
<i>Agropyron cristatum*</i>	Crested wheatgrass	x	x
<i>Agropyron dasystachyum</i>	Thickspike wheatgrass	x	x
<i>Agropyron smithii</i>	Western wheatgrass	x	x
<i>Agropyron spicatum</i>	Bluebunch wheatgrass	x	x
<i>Andropogon scoparius</i>	Little bluestem	x	
<i>Aristida purpurea</i>	Three-awn	x	x
<i>Bouteloua curtipendula</i>	Side-oats grama		x
<i>Bouteloua gracilis</i>	Blue grama	x	x
<i>Bromus inermis*</i>	Smooth brome	x	x
<i>Bromus japonicus*</i>	Japanese brome	x	
<i>Bromus squarrosus*</i>			x
<i>Bromus tectorum</i>	Cheatgrass	x	x
<i>Bromus vulgaris</i>	Common brome		x
<i>Buchloe dactyloides</i>	Buffalograss		x
<i>Calamovilfa longifolia</i>	Prairie sandreed	x	x
<i>Calamagrostis inexpansa</i>	reedgrass	x	
<i>Catabrosa aquatica</i>	Brookgrass		x
<i>Danthonia uniflora</i>	oatgrass	x	
<i>Distichlis stricta</i>	Saltgrass	x	x
<i>Echinochloa crusgallii</i>	Barnyard grass	x	
<i>Elymus canadensis</i>	Canada wild rye	x	x
<i>Festuca octoflora*</i>	Sixweeks fescue		x
<i>Festuca ovina</i>	Sheep fescue		x
<i>Glyceria grandis</i>	Manaagrass		x
<i>Glyceria striata</i>	Fowl mannagrass		x
<i>Helictotrichon hookeri</i>	Spike oat		x
<i>Hordeum brachyantherum</i>	Meadow foxtail	x	
<i>Hordeum pusillum</i>	Little barley	x	x
<i>Hordeum jubatum</i>	Foxtail barley	x	x
<i>Koeleria pramidata</i>	Junegrass	x	x
<i>Muhlenbergia cuspidata</i>	Plains muhly	x	x
<i>Muhlenbergia richardsonis</i>	Muhly grass	x	
<i>Munroa squarrosa</i>	False buffalograss		x
<i>Oryzopsis asperifolia</i>	ricegrass	x	
<i>Oryzopsis hymenoides</i>	Indian ricegrass		x
<i>Oryzopsis micrantha</i>	Little ricegrass	x	x
<i>Panicum capillare*</i>	panic grass		x
<i>Panicum virgatum</i>	Switchgrass	x	
<i>Phragmites australis</i>	Common reed		x
<i>Poa compressa*</i>	Canada bluegrass		x
<i>Poa glaucifolia</i>	Glaucous bluegrass	x	
<i>Poa palustris*</i>	Fowl bluegrass		x

Poa pratensis*	Kentucky bluegrass	X	X	
Poa secunda	Western bluegrass	X	X	
<b>Polypogon monspeliensis</b>	Rabbitfoot grass			X
Puccinellia nuttalliana	Alkali grass		X	
Schedonnardus paniculatus	Tumblegrass	X	X	
Schizachne purpurascens	False melic	X	X	
<b>Setaria viridis*</b>	Green foxtail		X	
Sitanion hystrix	Bottlebrush squirreltail	X	X	
Spartina gracilis	Alkali cordgrass	X	X	
Sporobous airoides	Alkali sacaton	X	X	
Sporobolus cryptandrus	Sand dropsseed	X	X	
Stipa comata	Needle-and-thread	X	X	
Stipa viridula	Green needlegrass	X	X	
POLEMONIACEAE				
Collomia linearis	Collomia	X		
Ipomopsis congesta	ipomopsis	X		
Phlox alyssifolia	Alyssum-leaved phlox	X	X	
Phlox hoodii	Hood's phlox	X	X	
POLYGALACEAE				
Polygala alba	White milkwort	X	X	
<b>Polygala verticillata</b>	Whorled milkwort		X	
POLYGONACEAE				
<b>Eriogonum cernuum</b>	Nodding buckwheat	X	X	
Eriogonum flavum	Sulfer flower	X	X	
Eriogonum pauciflorum	Few-flowered buckwheat	X	X	
<b>Polygonum amphibium</b>	smartweed			X
Polygonum arenastrum	Common knotweed	X		
Polygonum aviculare	knotweed	X	X	
Polygonum convolvulus	Wild buckwheat	X	X	
Polygonum lapathifolium	knotweed		X	
Polygonum persicarioides	knotweed		X	
Pumex crispus	Curly dock	X	X	
Rumex salicifolius	Willow-leaved dock	X		
Rumex venosus	dock	X		
POLYPODIACEAE				
Cystopteris fragilis	Fragile fern	X	X	
Woodsia oregana	Woodsia	X	X	
PORTALUCACEAE				
Portaluca oleracea	Purslane	X		
POTAMOGETONACEAE				
Potamogeton pectinatus	Sago pondweed	X		
Potentilla richardsonii	pondweed			
Potamogeton zosteriformis	pondweed			X
PRIMULACEAE				
Androsace occidentalis	Fairy candelabra	X	X	
Glaux maritima	Sea milkwort			X

RANUNCULACEAE

Anemone cylindrica	anemone	x	
Anemone multifida	anemone	x	x
Anemone patens	Pasqueflower		x
Clematis ligusticifolia	Western clematis	x	x
Delphinium bicolor	Small larkspur	x	x
Limosella aquatica	Mudwort	x	
Myosurus minimus	Mousetail		x
Ranunculus cymbalaria	Shore buttercup	x	x
Ranunculus glaberrimus	buttercup		x
Ranunculus macounii	buttercup		x
Ranunculus rhomboides	Prairie buttercup		x
Ranunculus scleratus	Cursed crowfoot		x

ROSACEAE

Amelanchier alnifolia	Juneberry	x	x
Fragaria virginiana	Wild strawberry	x	x
Geum triflorum	Torchflower	x	x
Potentilla anserina	Silverweed	x	x
Potentilla arguta	Tall cinquefoil	x	x
Potentilla concinna	Cinquefoil	x	x
Potentilla fruticosa	Shrubby cinquefoil	x	
Potentilla norvegica	cinquefoil		x
Prunus virginiana	Chokecherry	x	x
Rosa arkansana	Prairie rose	x	x
Rosa woodsii	Wood's rose	x	x
Rubus idaeus	Raspberry	x	

RUBIACEAE

Galium aparine	Cleavers	x	x
Galium boreale	Northern bedstraw	x	x

SALICACEAE

Populus deltoides	Cottonwood	x	x
Populus tremuoides	Aspen		x
Salix amygdaloides	Peach-leaved willow	x	x
Salix bebbiana	Beaked willow	x	x
Salix exigua	Sandbar willow	x	
Salix lutea	Shining willow	x	

SANTALACEAE

Commandra umbellata	Bastard toadflax	x	x
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SCROPHULARIACEAE

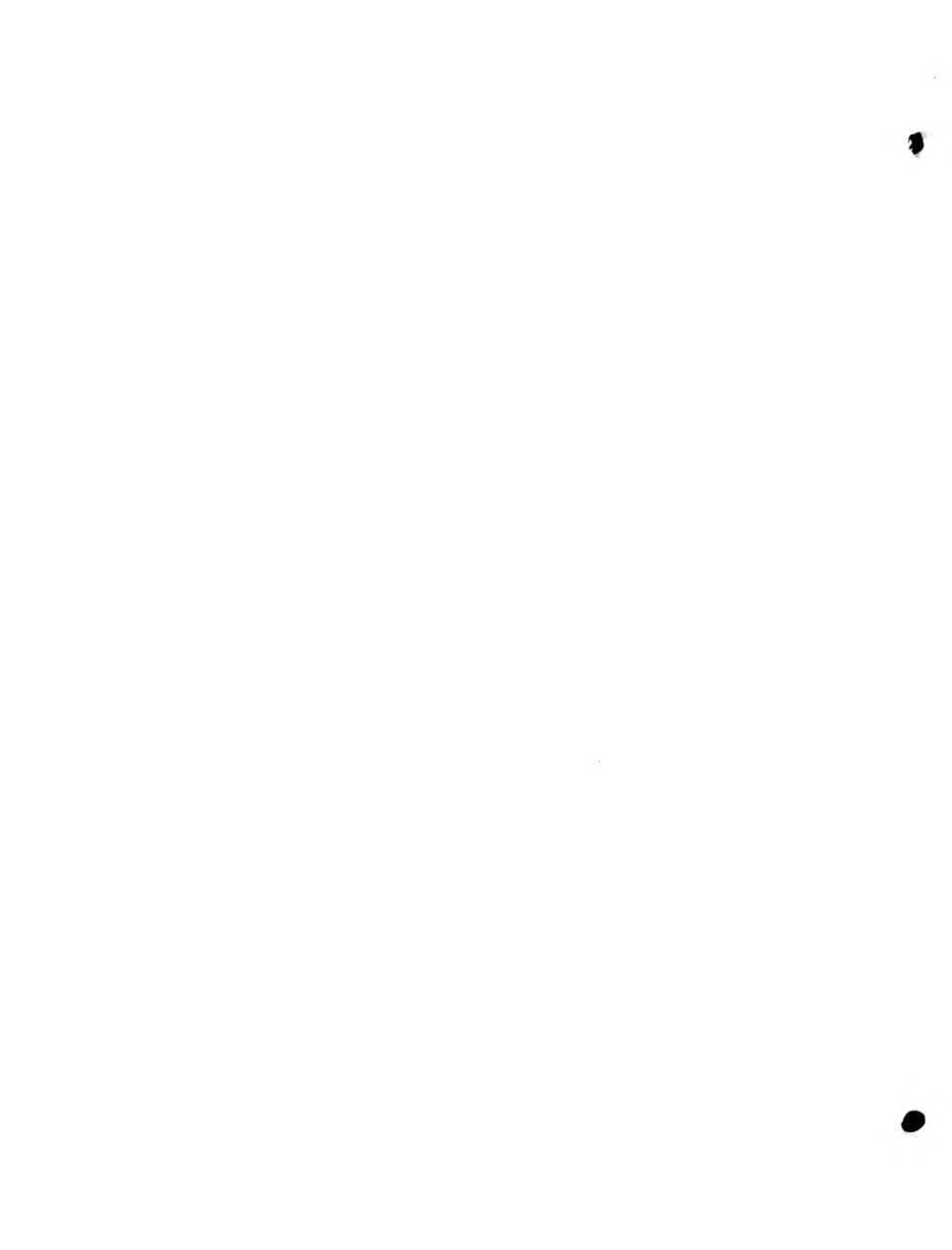
Bacopa rotundifolia	Roundleaf water-hyssop	x	
Besseyia wyomingensis	Kittentails	x	x
Castilleja sessiliflora	Downy paintbrush	x	x
Orthocarpus luteus	Owlclover	x	
Penstemon albidus	White beardtongue	x	x
Penstemon eriantherus	Crested beardtongue	x	
Penstemon gracilis	beardtongue		x
Penstemon nitidus	Blue beardtongue		x
Penstemon procerus	beardtongue	x	
Veronica peregrina	Speedwell	x	



SELAGINELLACEAE				
Selaginella	densa	Small clubmoss	x	x
SOLANACEAE				
Hyoscyamus	niger*	Henbane	x	
Physalis	longifolia	ground cherry		x
Physalis	virginiana	ground cherry		x
	var. hispida			
Solanum	nigrum	nightshade		x
Solanum	rostratum	nightshade	x	x
Solanum	triflorum	Cut-leaved nightshade	x	x
TAMARICACEAE				
Tamarisk	chilensis*	Salt cedar	x	x
TYPHACEAE				
Typha	latifolia	Cattail	x	x
ULMACEAE				
Ulmus	americana	American elm	x	x
URTICACEAE				
Parietaria	pensylvanica	Pellitory	x	x
Urtica	dioica	Nettle	x	x
VERBENACEAE				
Verbena	bracteata	Bracted vervain	x	
VIOLACEAE				
Viola	nuttallii	Nuttall's violet	x	x
Viola	nephrophylla	violet		x
ZANNICHELLIACEAE				
Zannichellia	palustris	Horned pondweed	x	x

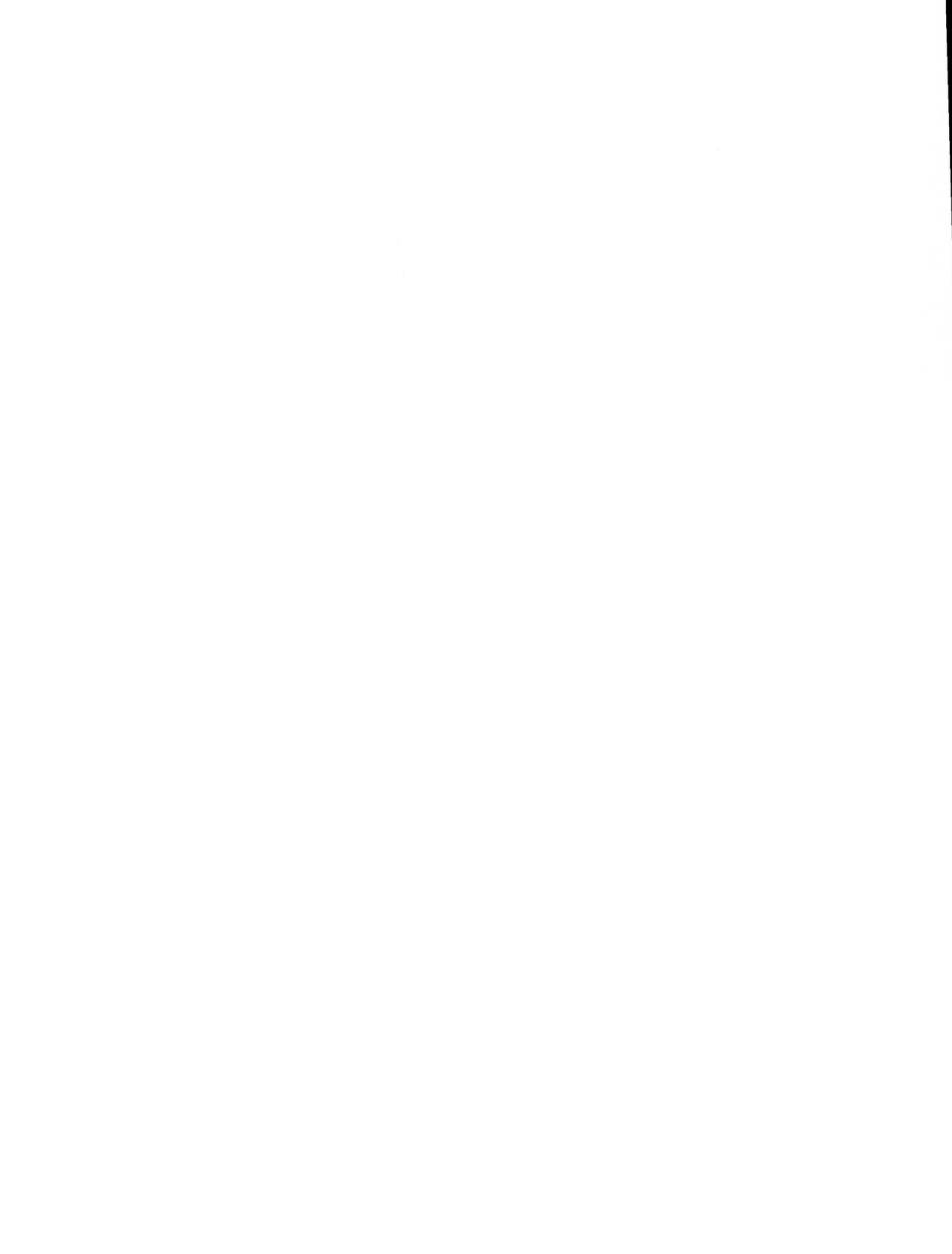
SELAGINELLACEAE				
Selaginella densa	Small clubmoss	x		x
SOLANACEAE				
Hyoscyamus niger*	Henbane	x		
Physalis longifolia	ground cherry			x
Physalis virginiana	ground cherry			x
var. hispida				
Solanum nigrum	nightshade			x
Solanum rostratum	nightshade	x		x
Solanum triflorum	Cut-leaved nightshade	x		x
TAMARICACEAE				
Tamarisk chilensis*	Salt cedar	x		x
TYPHACEAE				
Typha latifolia	Cattail	x		x
ULMACEAE				
Ulmus americana	American elm	x		x
URTICACEAE				
Parietaria pensylvanica	Pellitory	x		x
Urtica dioica	Nettle	x		x
VERBENACEAE				
Verbena bracteata	Bracted vervain	x		
VIOLACEAE				
Viola nuttallii	Nuttall's violet	x		x
Viola nephrophylla	violet			x
ZANNICHELLIACEAE				
Zannichellia palustris	Horned pondweed	x		x











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