A FLORISTIC AND VEGETATION SURVEY OF LUCILE CAVES AREA OF CRITICAL ENVIRONMENTAL CONCERN, COEUR D'ALENE DISTRICT, BLM

by

Robert K. Moseley and Susan Bernatas
Conservation Data Center
Nongame and Endangered Wildlife Program

November 1991

Idaho Department of Fish and Game
600 South Walnut, P.O. Box 25
Boise, Idaho 83707
Jerry M. Conley, Director

Cooperative Challenge Cost-share Project:
Coeur d'Alene District BLM
Idaho Department of Fish and Game

Purchase Order No. D060P10055

ABSTRACT

An inventory of the botanical and ecological features of Lucile Caves Area of Critical Environmental Concern (ACEC) was undertaken during May - July, 1991, by the Idaho Department of Fish and Game's Conservation Data Center[1] as part of a cooperative project with the Coeur d'Alene District, BLM, through the Challenge Cost-share Program. Lucile Caves was established as a Research Natural Area (RNA)/ACEC by the BLM in 1989. The area was known to contain populations of three rare plants: *Epipactis gigantea, Lomatium rollinsii*, and an experimental planting of *Mirabilis macfarlanei*. We confirmed the occurrence of these species in the ACEC and discovered two populations of an additional rare species, *Erigeron engelmannii* var. *davisii*. A list of vascular plant species occurring in the ACEC is provided. We describe each rare species, and include a discussion of their distribution, abundance and conservation status. Plant communities were also inventoried and mapped. We provide a description of each community, as well as a discussion of their distribution and conservation status. We also make several recommendations concerning the RNA designation, monitoring, reference area value, and control of exotic weeds.

[1]Formerly the Idaho Natural Heritage Program

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INTRODUCTION

The Lucile Caves area was designated a Research Natural Area/Area of Critical Environmental Concern (RNA/ACEC) in 1989 by the Coeur d'Alene District, BLM (USDI Bureau of Land Management 1989). The highlight of this 438 acre RNA is a unique cave along with a spring and creek system associated with it. Most of the area of the RNA is upland habitat, however, with a diverse assemblage of plants and plant communities. Ecologists from the Idaho Department of Fish and Game's Conservation Data Center[1] conducted a botanical inventory of the Lucile Caves RNA/ACEC during May, June and July, 1991, through the Challenge Cost-share program with the Coeur d'Alene District, BLM.

PHYSICAL ENVIRONMENT

Climate

The following characterization of the climate of northern Idaho is adapted largely from Ross and Savage (1967).

The climate of northern Idaho is influenced primarily by Pacific maritime air. However, Idaho is 300 to 400 miles inland from the Pacific Ocean, and the Cascade Mountains separate Idaho from the coast. The distance and mountain barrier result in a climate with many continental characteristics.

Because the prevailing westerly winds blow inland from the Pacific Ocean, winters are warmer and milder that might be expected. These mild, moist winds result in winters that are humid and cloudy. Snowfall is heavy in the mountains. Periodically, the westerly flow of air is interrupted by outbreaks of cold, clear, continental air from Canada.

During summer months, the westerly winds weaken, and continental climatic conditions prevail. Rainfall, cloud cover, and relative humidity are at their minimum in summer; daily temperature variation is 40^{o} to 50^{o} F or more.

Climate of Lucile Caves ACEC is not expressed by any climatic record. However, the record for Riggins, Idaho, seven miles south of the RNA and at a similar elevation gives a good indication of climatic trends.

[1]Formerly the Idaho Natural Heritage Program

Climatic Records for Riggins, Idaho
Elevation 1801 feet; 1940-1975
(NOAA records summarized by Johnson 1978)

	Temperature °F	Precipitation inches
Mean Monthly		
January	33.9	1.31
February	41.2	1.08
March	46.6	1.57
April	52.5	1.63
May	61.9	2.13
June	68.7	2.13
July	78.4	0.66
August	77.5	0.81
September	68.5	1.08
October	56.7	1.44
November	42.7	1.45
December	36.6	1.22
Mean Annual	55.4	16.51
Mean April-October	66.3	9.88
Mean November-March	40.2	6.63
Maximum (date)	115.0 (8/1967)	24.00 (1975)
Minimum (date)	-10.0 (1/1957)	10.21 (1958)

Geology

Aside from the layered basalt of the Columbia Plateau flows that occurred during Tertiary time, most of the rocks in west-central Idaho are oceanic or island arc assemblages. Theses islands were part of a large group that formed somewhere in the Pacific about 200 million years ago, during Permian and Triassic time, and joined the North American continent during middle-Cretaceous time, about 100 million years ago. This means that before Cretaceous time, the west coast of North America was situated near Lucile Caves ACEC (Maley 1987; Alt and Hyndman 1989).

These volcanic islands formed in relatively warm oceans and were surrounded by extensive reef systems. When these islands and adjacent basins, collectively known as volcanic arc terrane, collided with North American terrane, they were highly deformed and metamorphosed. The volcanic portion is known as the Seven Devils Group of metavolcanics, while the reefs that occurred in the shallow basins formed limestone deposits known as the Martin Bridge and Lucile formations (Gaston and Bennett 1979).

Five basic geologic substrates occur in Lucile Caves ACEC:

- Lucile Formation - This is a metamorphic unit of late-Triassic age, composed largely of gray calcareous slate and phyllite (a rock having affinities to both slate and mica schists) and has been called Lucile Slate (Hamilton 1963; Gaston and Bennett 1979). Lucile slate forms the underlying bedrock of the lower slopes of the ACEC, and is especially visible in the bluffs above the highway on the northern (downstream) end.

- Martin Bridge Formation - This sedimentary formation is comprised of limestone and dolomite, with some reef debris that has been metamorphosed in the Salmon River area to recrystallized calcite, limestone, and marble (Hamilton 1963; Gaston and Bennett 1979). Within the ACEC, the Martin Bridge limestone occurs as prominent faces above the Lucile slate. These can easily be seen on the air photo (7-2-81; 8164, 1:24,000; LN16-RN1) as a prominent gray band running north to south, paralleling the Salmon River.

- The high slopes above the Martin Bridge Formation are underlain by a metamorphic unit known as the Fiddle Creek Schist. This green and white schist is part of the Riggins Group, possibly of Permian age (Gaston and Bennett 1979).

- River alluvium - Although not mapped on Hamilton (1963) or Gaston and Bennett (1979), Quaternary alluvial material deposited by the Salmon River occurs on the lower slopes of the ACEC. It occurs both on the upper benches, as river gravels, and as deep sands between the old highway and the Salmon River.

- Calc tufa (calcareous tufa) - Calc tufa is a deposit of calcium carbonate, $CaCO_3$, precipitated from solution, in this case, precipitated from the spring creek traversing the ACEC. It especially obvious around the falls and cave entrance. This substrate does not appear on the maps of Hamilton (1963) and Gaston and Bennett (1979).

  Whitten and Brooks (1972) provide a description of the process of calc tufa formation, as follows. The solubility of calcium carbonate in water is a function of the quantity of dissolved carbon dioxide, and thus in turn is a function of temperature and pressure - low temperature and high pressure increasing the amount of carbon dioxide in solution. If the water saturated with carbon dioxide at a particular temperature and pressure is also saturated with calcium carbonate, any increase in the temperature or decrease in pressure will cause calcium carbonate to be precipitated so as to restore equilibrium in the solution. Similarly, loss of water by evaporation will also cause deposition of the calcium carbonate. Both of these processes are operating at Lucile Caves laying down thick cal tufa deposits along the creek through the ACEC.

  Calc tufa is mainly found in limestone regions around springs and resurgences of water which has traversed limestone strata and is often spongy or cellular in character, as at Lucile Caves. Although we did not observe it, this spongy calc tufa may enclose fragments of rocks, plants, or animal remains (Whitten and Brooks 1972).

  In underground caverns another type of calc tufa is formed, known as stalagmite or dripstone. This material coats the floor and walls of limestone caves. Where water containing carbonate in solution drips from the ceiling, long, more or less cylindrical, pendant concretions may build up,

known as stalactites. A corresponding upward projection from the floor is known as stalagmite, which may ultimately link up with the corresponding stalactite (Whitten and Brooks 1972). All these features occur in Lucile Caves.

Although it is somewhat difficult to discern on the small-scale maps of Gaston and Bennett (1979) and Hamilton (1963), it appears that the spring originates on or near a major thrust fault lying on the contact between the Lucile Formation and the Martin Bridge Formation.

Although Ross (1969) states that Lucile Caves is formed in Martin Bridge limestone, it appears to us that it is below the thrust fault on Lucile slate. Large amounts of calc tufa have been deposited along the stream course, from its source to the base of the slope near the old highway. It appears to us that these massive calc tufa deposits formed a room on the steep bluffs. Dripstone deposits have subsequently coated most of the room, with stalactites and stalagmites. "Lucile Caves" actually consists of a single, low-ceilinged room about 40 feet by 100 feet (Ross 1969). A plan view map of Lucile Caves, mapped in 1968 using a tape and compass survey by the Cascade Grotto (an Oregon spelunking club), appears below (from Ross 1969). The entrance is behind a waterfall high on the cliff above the old highway. It can be seen from the road and is shown on the Lucile 7.5' topographic quadrangle.

Plan view map of Lucile Cave

FLORA

The flora of the Lucile Caves ACEC is relatively diverse, consisting of species typical of the canyon grassland formation in west-central Idaho, as well as those occurring in atypical communities occurring along the spring creek and on the limestone and slate outcrops. Members of the Hells Canyon endemic flora (Johnson and Mattson 1978; Bingham 1979) are common in the area, including *Phlox colubrina, Arabis crucisetosa, Tonella floribunda, Lomatium rollinsii, Astragalus inflexus, Astragalus cusickii*, and *Physaria oregana*, among others. Another interesting feature of the flora of Lucile Caves ACEC is the extensive stand of curl-leaf mountain-mahogany (*Cercocarpus ledifolius*) present on the limestone outcrops. Mountain-mahogany is near the northern edge of its range in Idaho at this site (Tisdale 1986a). See Appendix 1 for a list of plant taxa known from the Lucile Caves ACEC.

There are also several rare plant species that are native or were introduced to the ACEC. Below is a brief synopsis of the distribution and abundance of each rare species in the ACEC and in Idaho, as well as the current conservation status of each species in Idaho.

***EPIPACTIS GIGANTEA* DOUGLAS**

CURRENT STATUS
USFS Region 4 Sensitive Species
USFS Region 1 Sensitive Species
Idaho BLM Sensitive Species
USFWS - None
Idaho Native Plant Society - State Priority 2
Heritage Rank - G4 S3

TAXONOMY

Family: Orchidaceae (Orchid)

Common Name: Giant helleborine

Synonymy:
Limodorum giganteum Kuntze, Rev. Gen. 2:672. 1891.
Peramium giganteum Coult., Contr. U.S. Nat. Herb. 2:424. 1894.
Serapias gigantea Eat., Proc. Biol. Soc. Wash. 21:67. 1908.
Helleborine gigantea Druce, Bull. Torrey Club 36:547. 1909.
Amesia gigantea Nels. & Macbr., Bot. Gaz. 56:472. 1913.

Citation: Flora Boreal America 2:202. 1839.

Description: Giant helleborine is a large perennial herb, with leafy stems, 1-3 feet tall from short rhizomes. The leaves are without petioles and up to 8 inches long. The herbage can be rough or mostly smooth to the touch. The numerous flowers are borne singly in a long, narrow, mostly one-sided, leafy-bracted inflorescence at the top of the stems. The brownish flowers have two upper petals that are shorter and broader than the sepals, The lower petal is sac-like (Moseley 1989).

Distinguishing Features and Similar Species: Its relatively large stature, many long leaves, and many brownish-colored flowers hanging on one side of a long raceme, combine to make giant helleborine a distinctive species when it is in flower. In a vegetative state, it can be confused with *Habenaria* species, or more likely with *Simlacina stellata*. Both of these species can occur sympatrically with giant helleborine, although we did not observe them at Lucile Caves ACEC. The prominently clasping leaf bases and taller habit of giant helleborine distinguishes it from *Smilacina*, and its generally more numerous and larger leaves and taller habit from *Habenaria*.

DISTRIBUTION

Range: Giant helleborine occurs from central Mexico northward throughout the western United States and into southern British Columbia. Brunton (1986) notes that its range is entirely within cordilleran areas. In Idaho, giant helleborine has been documented at 43 sites, but is believed to be extirpated from at least two of these sites. All of these populations, except two in the Panhandle region, occur south of the Salmon River, with the majority found in the west-central part of the state (Mancuso 1991).

Giant helleborine is abundant along two portions of the spring creek that flows through Lucile Caves ACEC. The upper subpopulation occurs after the first falls below the spring and in May, 1991, consisted of approximately 100 stems (ramets) occurring in at least five clones (genets). The second subpopulation along the creek occurs below the cave and was considerably more abundant that the upper site. A third subpopulation occurs in the ACEC at a seep adjacent to the trail from the parking area to the cave entrance. In 1991, it consisted of approximately 20 stems in 3(?) clones. The Cottonwood Resource area currently has two monitoring plots in the giant helleborine population at Lucile Caves ACEC.

Habitat and Associated species: In general, giant helleborine occurs in moist areas along streambanks, lake margins, seeps and springs, especially near thermal waters (Hitchcock 1969). Like nearly all low-elevation canyon populations of giant helleborine in Idaho, the one at Lucile Caves ACEC is associated with cold springs. The springs provide a constant temperature and flow of clean water. Such spring habitats are often localized along a larger watercourse, and associated with various types of riparian vegetation. Giant helleborine, however occurs generally in open vegetation or in partially shaded sites, but never as an understory species in tall, dense riparian communities.

At Lucile Caves ACEC, the upper subpopulation of giant helleborine occurs along stretches of the stream that are dominated by the exotic shrub *Rubus discolor* (Himalayan blackberry). The lower site is in an open *Betula occidentalis* (water birch) stand. Other associates include *Mimulus guttatus, Rorippa nasturtium-aquaticum, Carex aurea, Urtica dioica, Distichilis stricta, Philadelphus lewisii, Cornus stolonifera,* and *Viola neurophylla*.

CONSERVATION STATUS

Conservation Status - Idaho: Giant helleborine was first recognized as a conservation concern in Idaho, in the mid-1960's when it was included on a list of protected plants in the state wildflower protection act (Idaho Code, Chapter 18-3911). In his treatment of giant helleborine for the Idaho rare plant project of the Idaho Natural Areas Council, Henderson (1981) recommended a status of State Threatened, due to numerous and varied threats to its habitat. Giant helleborine is currently a Forest Service Region 4

Sensitive Species for several National Forests, including the Payette NF (Spahr et al. 1991; USDA Forest Service 1991a). It is also a Region 1 Sensitive Species, although no populations have been verified from Idaho Forests in the Region (USDA Forest Service 1991b).

The Idaho Native Plant Society considers giant helleborine a Priority 2 species (Idaho Native Plant Society 1991). The Priority 2 category of the Idaho Native Plant Society refers to taxa "that are likely to be classified as Priority 1 within the foreseeable future in Idaho, if factors contributing to its decline or habitat degradation or loss continue".

The Idaho Conservation Data Center currently ranks giant helleborine as G4 S3 [G4 = apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery, S3 = either very rare and local throughout Idaho, or found locally in a restricted range or because of other factors making it vulnerable to extinction (Moseley and Groves 1990)].

Conservation Status - Elsewhere:

BRITISH COLUMBIA - S1 = taxa in British Columbia that are imperiled because of rarity (6 to 20 occurrences) (Argus and Pryer 1990). Brunton (1986) states that most British Columbia occurrences are known from single records and only four have been recently seen. In addition, the largest known occurrence has declined in recent years and is vulnerable to further disturbance.

MONTANA - The Montana Heritage Program ranks giant helleborine as S1 (Lesica and Shelly 1991). This category lists taxa that are critically imperiled in Montana because of extreme rarity, or because of some factor of its biology making it especially vulnerable to extirpation from the state. It is also a Forest Service Region 1 Sensitive Species known from several Montana Forests (USDA Forest Service 1991a).

WASHINGTON - State Sensitive = taxa that are vulnerable or declining, and could become endangered or threatened in the state without active management or removal of threats (Washington Natural Heritage Program 1990).

WYOMING - The Wyoming Natural Diversity Data Base (1991) ranks giant helleborine S1. This category lists taxa that are critically imperiled in Wyoming because of extreme rarity, or because of some factor of its biology making it especially vulnerable to extirpation.

Argus and Pryer (1990) also list Colorado, Oklahoma and South Dakota as states ranking giant helleborine a conservation concern.

Ownership: Idaho populations occur on private, state and federal land (several agencies).

MANAGEMENT RECOMMENDATIONS

The Cottonwood Resource Area BLM currently has two monitoring plots in the giant helleborine population at Lucile Caves ACEC. It is in a better position to assess the short-term populations trends of this rare species in the ACEC. They have also constructed a trail to the cave that bypasses the giant helleborine population along the stream below the cave. Prior to the trial, visitors to the cave used to climb directly up the stream through the underbrush, trampling giant helleborine along the way.

Of particular concern to us is the dense stand of Himalayan blackberry that has invaded portions of the creek in the vicinity of the upper giant helleborine subpopulation. It appears that the Himalayan blackberry has so choked the riparian zone in this area, that it has reduced available habitat for the helleborine. The BLM's permanent monitoring may show whether or not the invasion is currently reducing helleborine habitat. When and if practicable, the BLM should attempt to control or eradicate Himalayan blackberry from the ACEC.

Steve Brunsfeld, Department of Forest Resources at the University of Idaho, has a graduate student who is currently conducting research on the biology and management of giant helleborine. The BLM should stay informed of her progress.

***ERIGERON ENGELMANNII* A. NELS. VAR. *DAVISII* CRONQ.**

CURRENT STATUS
USFS Region 1 Sensitive Species (Nez Perce NF)
USFS Region 6 Sensitive Species (Wallowa-Whitman NF)
USFWS - none
Idaho Native Plant Society - Sensitive
Heritage Rank - G5T2 S2

TAXONOMY

Family: Asteraceae or Compositae (Sunflower)

Common Name: Davis' fleabane

Citation: Cronquist, Leaflets in Western Botany 3:167-168. 1942.

Description: Perennial herb with a taproot and branched caudex, relatively robust, erect, about 4-12 inches high; leaves confined to the lower part of the stem leaving a long scape-like peduncle with a solitary head. The basal leaves are linear-oblanceolate, tapering gradually to a slender petiole; cauline leaves are few and linear; spreading septate hairs occur along the margins at the base of the leaves; The conspicuous head has numerous white rays (Cronquist 1942; 1947).

Distinguishing Features and Similar Species: The erect form, large white heads, and linear basal leaves covered largely with relatively long appressed hairs, except for spreading ones along the lower margins, makes Davis' fleabane quite distinctive in the region. It is most similar to another regional endemic, *E. disparipilus*, which has pubescence on the stems that is widely spreading, as opposed to Davis' fleabane which has appressed hairs on the stem. We did not observe *E. disparipilus* at Lucile Caves ACEC.

DISTRIBUTION

Range: Davis' fleabane is endemic to Idaho and Nez Perce counties, Idaho, where its is locally abundant, and Wallowa County, Oregon, where only one population is known. Surveys by the Conservation Data Center in 1991, in Hells Canyon, revealed that this species is widespread and often abundant along nearly all the ridge systems on the Salmon - Snake divide (Mancuso and Moseley 1991). We also found two small populations in Lucile Caves ACEC (See Appendix 2 for locations of these two populations).

Habitat and Associated Species: Davis' fleabane occurs most commonly on rocky, ridgecrest openings within *Festuca idahoensis* and *Agropyron spicatum* grassland communities. To a lesser extent it can be found on upper slopes either in relatively sparsely vegetated openings or even within the predominate grassland communities. On a few occasions it was observed growing beneath the canopy along the grassland-forest edge. Davis' fleabane occurs on all aspects, from flat to fairly steep slopes, and from approximately 2000 to 6000 feet elevation.

At Lucile Caves ACEC, Davis' fleabane occurs in ridgeline *Agropyron spicatum* communities on the edge of *Cercocarpus ledifolius* stands. Common associates include *Zigadenus venenosus*, *Astragalus inflexus*, and *Phlox colubrina*. These populations are the lowest elevation ones known in Idaho.

CONSERVATION STATUS

Conservation Status- Idaho: Davis' fleabane was recently added to the rare plant list for the state (Idaho Native Plant Society 1991), because available data indicated that it had a restricted distribution and occurred in habitats that were threatened. Based on surveys in 1991, (Mancuso and Moseley 1991) the Idaho Conservation Data Center will recommend that it be removed from the state list at the Idaho Rare Plant Conference in February 1992. It should also be removed from the Forest Service Region 1 list and from the Wallowa-Whitman NF sensitive species list for Idaho.

Conservation Status - Elsewhere:

OREGON - Davis' fleabane is currently on the Oregon List 1, which includes taxa which are threatened or endangered throughout their range (Oregon Natural Heritage Data Base 1991). This classification reflects the pre-1991 knowledge of its distribution in Idaho.

Ownership: Populations of Davis' fleabane in Idaho, occur on private land, as well as public land administered by the Bureau of Land Management (Coeur d'Alene District, Cottonwood Resource Area), Wallowa-Whitman NF (Hells Canyon National Recreation Area) and Nez Perce NF (Salmon River Ranger District).

MANAGEMENT RECOMMENDATIONS

No special management considerations need be given to Davis' fleabane in Lucile Caves ACEC. Both populations are isolated, high on the canyon side, away from most human-related disturbances.

***LOMATIUM ROLLINSII* MATH. & CONST.**

CURRENT STATUS USFWS Category 3c Candidate
Idaho BLM Sensitive Species
USFS Region 6 Sensitive Species (Wallowa-Whitman NF)
Idaho Native Plant Society - Monitor
Heritage Rank - G4 S3

TAXONOMY

Family: Apiaceae or Umbelliferae (Celery)

Common Name: Rollins' biscuitroot

Citation: Mathias and Constance, Bulletin of the Torrey Botanical Club 70:59-60. 1943.

Description: The genus *Lomatium* consists of 70 species, distributed throughout western North America, occurring in arid and semi-arid regions where they flower in late winter and early spring, and complete their reproductive cycle before the onset of summer drought. Rollins' biscuitroot belongs to an infrageneric group known as tuberous lomatiums (Schlessman 1980). This group is most common and diverse in the steppe and sagebrush-steppe region of the Columbia River Plateau in eastern Washington and Oregon and adjacent Idaho, where they form a conspicuous element of the early spring flora.

The following technical description of Rollins' biscuitroot is from Schlessman (1984):

> Plants caulescent, 20-70 cm tall at maturity. Roots with a single ovoid thickening, 1-3 cm long and 0.5-1 cm in diameter, or monoliform, the surface brown. Leaves bipinnately compound and pinnately-ternately dissected; petioles partially to wholly sheathing, green; blades oblong in general outline, 2.5-12 cm long, scaberulous; ultimate leaf segments 15-40, linear, 0.5-1.5 cm long, 0.5-2 mm wide, the apices rounded to acute. Umbels 2-several, scaberulous; rays 4-10, the outer ones 3-7 cm long at maturity; involucels present, the bractlets 2-5, free, filiform, 2-3 mm long, less than 0.5 mm wide, the apices acute. Flowers 15-20 per umbellet; petals, anthers, and stylopodia yellow, the stylopodia smooth; ovaries glabrous. Fruiting pedicels 5-11(-15) mm long at maturity. Mericarps ligulate in cross section, ovate in outline, 5-8 mm long, 3-4.5 mm wide, glabrous; lateral wings of the mericarps slightly less than one-half as wide as the body, 0.7-1 mm wide, the cell wall thin; oil canals 1-2 in the intervals, 4-6 on the commissure.

Distinguishing Features and Similar Species: Rollins' biscuitroot was overlooked for many years (Moseley 1988) probably because of the identification problems associated with the large number of *Lomatium* taxa occurring in the canyons of the region. Ten species can be encountered in the canyons of west-central Idaho. Only four of these ten species fall into the tuberous lomatium group, however. Tuberous lomatiums are characterized by roots with tuberous thickenings, leaves with narrow segments, and fruits with an elliptical outline and narrow, thin lateral wings (Schlessman 1984). Although no other tuberous lomatiums were seen at Lucile Caves, for future reference the following are keys to tuberous lomatiums of the lower Salmon River and Snake River canyons (from Schlessman 1984).

Key Emphasizing Floral and Vegetative Characters

1. Involucels absent; plants glabrous ..... *L. ambiguum*

1. Involucels present; plants glabrous to scaberulous (beset with minute, cuticular barbs no more than 0.3 mm long).

2. Involucellar bractlets narrowly to broadly obovate, 0.8- 3.2 mm wide; stylopodia with cavities in the upper surface, these 0.10 mm wide, visible with 10x hand lens ..... *L. cous*

2. Involucellar bractlets linear to elliptic, 0.1-1.6 mm wide; stylopodia smooth.

3. Plants caulescent, scaberulous; leaves bipinnately compound ... *L. rollinsii*

3. Plants acaulescent or rarely caulescent with one or two cauline leaves, glabrous to scaberulous; leaves ternately, ternately-pinnate, or quinately compound ..... *L. bicolor* var. *leptocarpum*

Key Emphasizing Features of the Mericarp (Fruit)

1. Longest fruiting pedicels 6 mm long or longer.

2. Plants glabrous; involucels absent, mericarps elliptic, 5-12 mm long, 1.3-3.3 mm wide ..... *L. ambiguum*

2. Plants scaberulous (beset with minute cuticular barbs no more than 0.3 mm long); involucels present, mericarps ovate, 5-8 mm long, 3.4.5 mm wide ..... *L. rollinsii*

1. Longest fruiting pedicels up to 5 mm long.

3. Mericarps granular-roughened with more than 5 papillae per square mm .. *L. cous*

3. Mericarps glabrous or granular roughened with less that 5 papillae per square mm.

4. Mericarps linear, 9-17 mm long, 1.5-3 mm wide; rays and often peduncles and leaves scaberulous ..... *L. bicolor* var. *leptocarpum*
4. Mericarps elliptic to ovate, 4-13 mm long, 2.4-6.5 mm wide; rays, peduncles, and leaves glabrous ..... *L. cous*

DISTRIBUTION

Range: Rollins' biscuitroot is found in the deep canyons of the Snake River and lower Salmon River in northeastern Oregon, southeastern Washington and adjacent Idaho. A complete status inventory completed in 1988 by the Idaho Conservation Data Center and the Oregon Natural Heritage Data Base (Moseley 1988) found that specifically, it appears to be distributed from the Lewiston-Clarkston area, at the confluence of the Snake and Clearwater rivers, up the Snake River to about Big Bar in Hells Canyon; in the Salmon River canyon from its confluence with the Snake River to about Lake Creek, 7 miles east of Riggins; and up the Little Salmon River to Pollock. Elevationally, Rollins' biscuitroot occurs from the river level, which varies from about 800 feet near Lewiston to 1800 feet above Riggins, up the canyonsides to about 3800 feet. Within the general range outlined above, Rollins' biscuitroot populations are distributed in a more-or-less continuous manner in suitable habitats. Gaps in the distribution, however, were found. The most conspicuous was along a section of the Snake River canyon below the confluence of the Salmon River, where no populations were found in what appeared to be ideal habitat. New populations were discovered this year in Hells Canyon (Mancuso and Moseley 1991). Over 40 populations are now known from Idaho.

We found Rollins' biscuitroot to be distributed throughout the high quality grassland habitats in the upper portion of Lucile Caves ACEC. It is less common on the benchlands at lower elevations in the ACEC, where heavy grazing has taken place for many years. The Macfarlane's four-o-clock experimental population (see below) was placed within the Rollins' biscuitroot population. This population of Rollins' biscuitroot at Lucile Caves is occurrence number 009 in the Conservation Data Center data base.

Habitat and Associated Species: Rollins' biscuitroot is found in mid- to low elevation canyon grasslands, ranging from very steep to relatively gentle slopes and dominated by one to four bunchgrasses. Populations occur in several grassland and shrubland communities, ranging from late to very early seral stages of succession. Rollins' biscuitroot has been observed in the following communities in the Hells Canyon - Salmon River canyon area (Tisdale 1986, Johnson and Simon 1987):

1. *Aristida longiseta/Poa secunda* habitat type
2. *Festuca idahoensis/Koeleria cristata* habitat type
3. *Festuca idahoensis/Agropyron spicatum* habitat type
4. *Agropyron spicatum/Poa secunda/Balsamorhiza sagittata* habitat type
5. *Sporobolus cryptandrus/Poa secunda* community type
6. *Rhus glabra/Agropyron spicatum* habitat type
7. *Glossopetalon nevadense/Agropyron spicatum* habitat type

CONSERVATION STATUS

Conservation Status- Idaho: Rollins' biscuitroot was first collected by Lincoln Constance and Reed Rollins, "near Deep Creek, Snake River Canyon," Wallowa County, Oregon, on 15 May 1936. It was formally described in 1943 (Mathias and Constance 1943). Because few specimens were collected over the next 40 years, it was considered an extremely rare taxon endemic to the Snake River and lower Salmon River canyons of northeast Oregon, southeast Washington and adjacent Idaho. Also, collection data suggested that it was restricted to the river corridors in these canyons. Due to its rarity, threats to Rollins' biscuitroot were unknown, but overgrazing by domestic livestock was considered a possibility (Brunsfeld

1983; Meinke 1983) and attempts to relocate several populations cited in the original description were unsuccessful (Schlessman 1984).

Field work conducted in late April and early May 1988, in Oregon and Idaho revealed Rollins' biscuitroot to be quite common in suitable habitats, from river level, at 800 feet, up the canyon side, to 3800 feet. Several factors appear to have been responsible for this dramatic increase in known populations: (1) It flowers from early April to early May, before many academic botanists are in the field collecting, (2) Fruits mature quickly and shatter by mid-May at the lower elevations, making identification difficult, (3) Canyons in this region have a high diversity of *Lomatium* taxa, again making identification difficult, and (4) Much of its distribution occurs in remote canyons and/or relatively inaccessible habitats.

Rollins' biscuitroot was on the U.S. Fish and Wildlife Service notice of review list as a candidate for listing (Category C2) under the Endangered Species Act (U.S. Fish and Wildlife Service 1985a), but Moseley (1988) recommended that it be downgraded to Category 3c in recognition its abundance within the deep canyons of the Snake and Salmon rivers. It appeared as a 3c candidate in the 1990 Federal Register list (U.S. Fish and Wildlife Service 1990).

Moseley (1988) also recommended that it be taken off all agency sensitive species lists, which included the Forest Service Region 1, 4, and 6, and Oregon and Idaho BLM lists. Currently, it is still on the Idaho BLM and Region 6 (for Oregon) sensitive species lists.

The Idaho Native Plant Society maintains Rollins' biscuitroot on its Monitor list of rare plants in Idaho (Idaho Native Plant Society 1991). The Monitor list category applies to species that are common within a limited range as well as those which are uncommon, but have no identifiable threats.

The Idaho Conservation Data Center currently ranks Rollins' biscuitroot as G4 S3 [G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery; S3 = Either very rare and local in Idaho or found locally in a restricted range or because of other factors making it vulnerable to extinction (Moseley and Groves 1990)].

Conservation Status - Elsewhere:

OREGON - Rollins' biscuitroot is currently on the Oregon List 4, which includes taxa of concern which are not currently threatened or endangered (Oregon Natural Heritage Data Base 1991).

WASHINGTON - It is considered threatened in Washington (Washington Natural Heritage Program 1990).

Ownership: Populations of Rollins biscuitroot in Idaho, occur on private land, as well as public land administered by the Bureau of Land Management (Coeur d'Alene District, Cottonwood Resource Area) and Wallowa-Whitman NF (Hells Canyon National Recreation Area).

MANAGEMENT RECOMMENDATIONS

Rollins' biscuitroot is one of a relatively large number of taxa endemic to, although quite common in the Hells Canyon region. In fact, it appears to be more common than several other of the Hells Canyon endemics that were never seriously considered for special protection (*e.g.*, *Lomatium serpentinum* and *Ribes cereum* var. *colubrinum*).

There appears to be little special attention required in the management of Rollins' biscuitroot in Lucile Caves ACEC. Although it appears to be more abundant on grassland sites that are not currently grazed by domestic livestock, the lower-elevation, grazed sites appear vigorous, although less dense. This species requires no special monitoring in the ACEC.

MIRABILIS MACFARLANEI CONSTANCE AND ROLLINS

CURRENT STATUS USFWS Listed Endangered
Idaho BLM Sensitive Species
USFS Region 1 Sensitive Species (Nez Perce NF)
USFS Region 4 Sensitive Species (Payette NF)
USFS Region 6 Sensitive Species (Wallowa-Whitman NF)
Idaho Native Plant Society - None
Heritage Rank - G1 S1

TAXONOMY

Family: Nyctaginaceae (Four-o'clock)

Common Name: Macfarlane's four-o'clock

Citation: Constance and Rollins, Proceedings of the Biological Society of Washington 49:148. 1936.

Description: Perennial herb from a stout, deep-seated root; stems freely branched, forming hemispheric clumps 2 to 4 feet in diameter; leaves opposite, lower orbicular or ovate-deltoid, the upper narrowly ovate, succulent, nearly sessile; perianth large, showy, magenta (Meinke 1982).

Distinguishing Features and Similar Species: No other species of *Mirabilis* occur in Hells Canyon, and no member of the regional flora resembles Macfarlane's four-o'clock. This large plant is easily recognized by its large, green, succulent leaves that are oppositely arranged on the stem. The cluster of large, magenta flowers is unlike anything else in our flora.

DISTRIBUTION

Range: Macfarlane's four-o'clock is known from one experimental and 15 native populations in lower Hells Canyon and Salmon River canyon of west-central Idaho and adjacent Oregon. Five of the native populations were discovered in May 1991, in the Hells Canyon National Recreation Area (Mancuso and Moseley 1991).

The one experimental population of Macfarlane's four-o-clock occurs in Lucile Caves ACEC, on the east-facing slope ca. 0.25 mile south of Lucile Cave, within the fenced exclosure (occurrence number 008 in the Conservation Data Center data base). This population of 60 individuals was established in April 1988, through rhizome cuttings, seeds, and seedling transplants (Johnson 1988; USDI Bureau of Land Management 1989). It is monitored annually by BLM biologists from the Cottonwood Resource Area for number of plants, cover, and flower production.

Habitat and Associated Species: Macfarlane's four-o'clock prefers steep, relatively unstable slopes within grassland and shrubland communities. Aside from these generalities, however, the specific plant associations in which it occurs vary widely, from *Bromus tectorum*-dominated grasslands to *Glossopetalon nevadense*/*Agropyron spicatum* shrublands and *Celtis reticulata* woodlands. In other

words, it is not easy to predict the occurrence of Macfarlane's four-o'clock by habitat distribution.

CONSERVATION STATUS

Conservation Status - Idaho: Macfarlane's four-o'clock has long been recognized as one of Idaho's rarest plants (Johnson 1977; Johnson and Mattson 1978; Bingham 1979; Johnson 1981; U.S. Fish and Wildlife Service 1985b). It was listed as Endangered by the U.S. Fish and Wildlife Service in 1979 (Federal Register 44:61910, 26 October 1979). It is an Idaho BLM, Forest Service Region 1 (Nez Perce NF), Region 4 (Payette NF), and Region 6 (Wallowa-Whitman NF) Sensitive Species.

Because Macfarlane's four-o'clock is a Listed species, no Idaho Native Plant Society category applies (Idaho Native Plant Society 1991).

The Idaho Natural Heritage Program currently ranks Macfarlane's four-o'clock as G1 S1 [G1 = Critically imperiled globally because of rarity or because of other factors demonstrably making it very vulnerable to extirpation; S1 = Critically imperiled in Idaho because of rarity or because of other factors demonstrably making it very vulnerable to extirpation (Moseley and Groves 1990)].

Conservation Status - Elsewhere:

OREGON - Macfarlane's four-o'clock is Listed as Endangered by the State of Oregon. It is also on the Oregon Natural Heritage Data Base's List 1, which includes taxa which are endangered or threatened throughout their range or which are presumed extinct. These species need active protection measures to insure their survival (Oregon Natural Heritage Data Base 1991).

Ownership: Populations of Macfarlane's four-o-clock occur on private land, as well as public land administered by the Bureau of Land Management (Coeur d'Alene District, Cottonwood Resource Area) and Wallowa-Whitman NF (Hells Canyon National Recreation Area).

MANAGEMENT RECOMMENDATIONS

The Cottonwood Resource Area should continue to annually monitor the experimental population at Lucile Caves ACEC.

VEGETATION

Lucile Caves ACEC lies within the canyon grasslands element of the Pacific Northwest Bunchgrass Region (Tisdale 1983; 1986b). The canyon grasslands are dominated by bunchgrasses, primarily by bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue, but are distinguished from other grasslands of the region primarily by occurring on steep canyon slopes. Canyon grassland communities occur throughout the canyons of the Columbia Plateau, with the most extensive examples being in the canyon systems of west-central Idaho, northeastern Oregon, and southeastern Washington (The Nature Conservancy *et al*. 1987).

Although much of the vegetation of the ACEC is comprised of canyon grassland communities, there are also three types of woody-dominated vegetation in the area. These include a riparian forest along the creek dominated by broad-leaved, deciduous trees, a coniferous tree-dominated community on a north-facing canyon slope, and shrub-dominated types occurring primarily on rock outcrops. The following plant associations were observed in the ACEC:

Canyon Grasslands

Agropyron spicatum/Opuntia polyacantha habitat type
(bluebunch wheatgrass/prickly pear)
Agropyron spicatum/Poa secunda/Balsamorhiza sagittata habitat type
(bluebunch wheatgrass/Sandberg bluegrass/arrowleaf balsamroot)
Sporobolus cryptandrus/Poa secunda community type
(sand dropseed/Sandberg bluegrass)
Stipa comata/Poa secunda community type
(needle-and-thread/Sandberg bluegrass)

Riparian

Betula occidentalis community type
(water birch)

Shrublands

Cercocarpus ledifolius/Agropyron spicatum habitat type
(curl-leaf mountain-mahogany/bluebunch wheatgrass)
Glossopetalon nevadense/Agropyron spicatum habitat type
(spiny-greenbush/bluebunch wheatgrass)

Coniferous Forest

Pseudotsuga menziesii/Physocarpus malvaceus habitat type
(Douglas-fir/ninebark)

Following is a description of each of the communities found in Lucile Caves ACEC, along with a discussion of their global and regional distribution, conservation status and other pertinent information.

Agropyron spicatum/Opuntia polyacantha habitat type

Reference: Tisdale 1986

Synonymy: *Agropyron spicatum/Poa secunda/Opuntia polyacantha* plant association (Johnson and Simon 1987).

Description: This habitat type is characterized by the dominance of widely spaced plants of *Agropyron spicatum*, with *Poa secunda* occurring on a majority of sites, but usually with low cover. Perennial forbs are not abundant, but Tisdale (1986) found the six species occurred in 50 percent or more of the sites. In the ACEC, *Opuntia polyacantha* and *Scutellaria angustifolia* are important in characterizing this type. Johnson and Simon (1987) found that this habitat type lacked *Balsamorhiza sagittata*. The ground cover of this habitat type is distinctive, with total gravel, rock and bare ground averaging 50 percent. The cryptogam and litter cover is lower than any of the other major canyon grassland habitat types (Tisdale 1986).

In the ACEC, this type occupies steep, south- and west-facing slopes with rocky substrates. It occurs on the steep slopes above the highway and on other rocky slopes in the upper slopes of the area.

Distribution: This habitat type is endemic to the deep canyon systems in west-central Idaho and northeastern Oregon (Tisdale 1986; Johnson and Simon 1987) and probably adjacent Washington.

Conservation Status: Sites occupied by this habitat type tend to be bypassed by domestic livestock and most stands tend to be in late seral condition. This is the case in the ACEC. Because it is endemic to the Hells Canyon - lower Salmon River canyon area, it is ranked G4 S3 by the Idaho Conservation Data Center [G4 = Apparently secure globally, though it may be quite rare in parts of its range; S3 = Found locally within a restricted range in Idaho (Moseley and Groves 1990)]. This habitat type is found in at least three proposed and established natural areas in Hells Canyon (Hilty and Moseley 1991).

Agropyron spicatum/Poa secunda/Balsamorhiza sagittata habitat type

Reference: Tisdale 1986

Synonymy: Johnson and Simon (1987) described several associations in their intensive investigation of grasslands in Hells Canyon which appear to be included in this habitat type described by Tisdale (1986). They include the *Agropyron spicatum-Poa secunda* (basalt), *Agropyron spicatum-Poa secunda/Astragalus cusickii*, *Agropyron spicatum-Poa secunda/Phlox colubrina*, and possibly the *Agropyron spicatum-Poa secunda* (granite) and *Agropyron spicatum-Poa secunda/Erigeron pumilus* plant associations (Johnson and Simon 1987), although the latter may be more similar to the *Agropyron spicatum/Opuntia polyacantha* habitat type described above.

Description: This habitat type is characterized by the dominance of *Agropyron spicatum* with *Poa secunda* being the only other perennial bunchgrass of significance. *Balsamorhiza sagittata* is the most

frequently occurring and conspicuous perennial forb, found in 75 percent of the sites sampled. The ground surface is occupied mainly by cryptogams and litter. Because of the greater cover of both live vegetation and litter, and small amounts of surface gravel, this habitat type gives the general impression of relatively well-vegetated ground. Areas occupied by the *Agropyron spicatum/Opuntia polyacantha* habitat type, in comparison, appear as poorly vegetated and rather barren (Tisdale 1986).

In the ACEC, this type occupies steep, south- and west-facing slopes at upper elevations.

Distribution: This habitat type is endemic to the deep canyon systems in west-central Idaho and northeastern Oregon, and southeastern Washington (Tisdale 1986; Johnson and Simon 1987).

Conservation Status: This habitat type is somewhat more accessible to domestic livestock than the previous type, but many high quality examples can be found throughout the canyons of the Snake and Salmon rivers. Because it is endemic to the Hells Canyon - lower Salmon River canyon area, it is ranked G4 S3 by the Idaho Conservation Data Center [G4 = Apparently secure globally, though it may be quite rare in parts of its range; S3 = Found locally within a restricted range in Idaho (Moseley and Groves 1990)]. This habitat type is found in at least three proposed and established natural areas in Hells Canyon (Hilty and Moseley 1991).

***Sporobolus cryptandrus/Poa secunda* community type**

Reference: Tisdale 1986

Synonymy: *Sporobolus cryptandrus* plant association (Johnson and Simon 1987).

Description: This type occurs on the sandy river terraces and alluvial bars where *Sporobolus cryptandrus* is considered climax and has a strong dominance. *Poa secunda* is a common associate, but it varies greatly in amount and may not be present in all stands. *Aristida longiseta* and *Stipa comata* are also common, while *Agropyron spicatum* is usually absent (Tisdale 1986; Johnson and Simon 1987). Tisdale found that characteristic native species of this habitat type include three perennials, *Astragalus inflexus, Calochortus macrocarpus*, and *Chrysopsis villosa*, and one annual, *Plantago patigonica*, which are uncommon or lacking in other grassland types. We did not observe *Calochortus macrocarpus* in this type at Lucile Caves ACEC.

In the ACEC, this type occupies the gently-sloping, mid-level benches on sandy soil.

Distribution: *Sporobolus cryptandrus* occurring in an association without a dominant or codominant shrub appears to be endemic to the deep canyon systems in west-central Idaho, northeastern Oregon, and southeastern Washington (Tisdale 1986; Johnson and Simon 1987).

Conservation Status: This habitat type is very accessible to domestic livestock and has been degraded over much of its range. The occurrence of at least a small stand of this habitat type within the fenced portion of the ACEC is significant. It also occurs in the proposed Bills Creek RNA on the Hells Canyon NRA and in The Nature Conservancy's Garden Creek Preserve (Hilty and Moseley 1991). Because it is endemic to the Hells Canyon - lower Salmon River canyon area and has been much degraded throughout its range, it is ranked G2 S1 by the Idaho Conservation Data Center [G2 = Imperiled globally because of

rarity or because of some other factor making it especially vulnerable to extinction; S1 = Critically imperiled in Idaho because of rarity or because of some other factor making it especially vulnerable to extinction (Moseley and Groves 1990)].

***Stipa comata* community type**

Reference: Tisdale 1986

Synonymy: None

Description: Tisdale (1986) describes communities dominated by *Stipa comata* as being very limited in extent in his study area. They occupy low-elevation sites with coarse-textured soils, mostly fine sandy loam. It is unclear whether or not stands dominated by *Stipa comata* in Idaho are seral to other communities, notably those dominated by *Agropyron spicatum*. Because its successional status is presently unknown, we have chosen to recognize it as a community type, until successional relationships are better understood.

In the ACEC, this type is very limited in extent, occupying the gently-sloping, mid-level benches on gravelly soil.

Distribution: *Stipa comata* occurring in an association without a dominant or codominant shrub appears to be distributed in several, apparently isolated areas of the Pacific Northwest, including interior British Columbia, Columbia Basin of Washington, the canyons of canyon systems in west-central Idaho, northeastern Oregon, and southeastern Washington (Tisdale 1986) and possibly southwestern Montana (Daubenmire 1970), although the type in the latter area is probably more closely related to communities on the Great Plains. It also occurs in isolated sites in foothills along the northern edge of the Snake River Plain in southern Idaho. These site are probably seral to *Purshia tridentata* habitat types, however.

Conservation Status: This habitat type is very accessible to domestic livestock and has been degraded over much of its range in Idaho. The occurrence of a small stand of this community type within the ACEC is significant, although it is still grazed. It is ranked G2? S1 by the Idaho Conservation Data Center [G2? = Possibly imperiled globally because of rarity or because of some other factor making it especially vulnerable to extinction; S1 = Critically imperiled in Idaho because of rarity or because of some other factor making it especially vulnerable to extinction (Moseley and Groves 1990)].

Riparian

***Betula occidentalis* community type**

Reference: None

Synonymy: None

Description: This community type includes riparian vegetation along spring-fed streams dominated by *Betula occidentalis* at low-elevations in the canyons of southwestern and west-central Idaho. Since these communities have not been sampled quantitatively, this community type may actually consist of several associations. Community types described from higher elevations in Montana (Hansen *et al*. 1988) and Utah and southeastern Idaho (Padgett *et al*. 1989) are quite different in composition and diversity than those found in western Idaho. The presence and high abundance of *Philadelphus lewisii* in the community type described here is one of the features that distinguishes it from the higher elevation types.

In the ACEC, this type occurs along the spring creek that traverses the area. It occupies moderate- to steep-gradient sections of the stream. It consists of an overstory of *Betula occidentalis* and a diverse understory of shrubs, lianas and forbs. Associated shrubs and lianas include *Clematis ligusticifolia, Celtis reticulata, Crataegus douglasii, Rubus bicolor, Cornus stolonifera,* and *Philadelphus lewisii*. Understory forbs include *Mimulus guttatus, Epipactis gigantea, Gallium triflorum,* and *Viola neurophylla*.

Distribution: Although it occurs in many riparian communities, the one described here is a community type dominated by *Betula occidentalis* occurring along low-elevation, spring-fed creeks in the Snake River canyon, downstream from Twin Falls, and the lower reaches of its confluent tributaries, such as the lower Salmon River canyon. The only Salmon River occurrence of this community type is at Lucile Caves ACEC.

Conservation Status: Because the spring-creek habitats of this community type occur in an arid environment, many have been altered by numerous and varied human-caused disturbances. Several of the remaining occurrences are protected or proposed for protection in private and public natural areas (Hilty and Moseley 1991). Because it has been highly altered throughout its range, and few high quality examples remain, the community type is ranked G1 S1 by the Idaho Conservation Data Center [G1 = Critically imperiled globally because of rarity or because of some other factor making it especially vulnerable to extinction; S1 = Since it is not known to occur outside Idaho, the state (S) rank equals the global (G) rank (Moseley and Groves 1990)].

Shrublands

Cercocarpus ledifolius/Agropyron spicatum habitat type

Reference: Hironaka, Fosberg, and Winward 1983; Tisdale 1986

Synonymy: In part the *Cercocarpus ledifolius* plant community type of Johnson and Simon (1987). Their high elevation plots may actually be the *Cercocarpus ledifolius/Festuca idahoensis* association.

Description: The *Cercocarpus ledifolius/Agropyron spicatum* habitat type reaches its northern limit in the Salmon and Snake River canyons of west-central Idaho (Tisdale 1986). The habitat type in the ACEC consists of widely- to densely- spaced plants approximately 10 feet in height. Two low-growing shrubs, *Glossopetalon nevadense* and *Chrysothamnus nauseosus* area common in the understory, although at very

low densities. *Agropyron spicatum* is the understory dominant, although *Poa secunda* also occurs with high frequency. *Opuntia polyacantha* along with several native forbs, such as *Achillea millefolium, Phacelia heterophylla, Chaenactis douglasii*, *Penstemon eriantherus, Phlox colubrina,* and *Zigadenus venenosus*, are characteristic. The understory closely resembles the *Agropyron spicatum/Opuntia polyacantha* habitat type, which often occurs on adjacent slopes (Tisdale 1986).

In the ACEC, this habitat type is found on the limestone bluffs that traverse the middle elevations of the area. It is largely inaccessible to domestic livestock and is of high quality.

Distribution: This habitat type occurs throughout southern Idaho and in the Salmon River canyon and southern Hells Canyon in central Idaho. It is most commonly found on sedimentary substrates, although it is not exclusive to that geology. It also extends into other areas of the Intermountain and northern Rocky Mountain areas.

Conservation Status: This habitat type is widely distributed in Idaho, at least, and many high quality sites exist throughout its range in the state. In west-central Idaho, however, this habitat type is at its northern limit and the stands are widely scattered. Tisdale (1986) sampled only four sites in his study and Johnson and Simon (1987) only sampled six. This habitat type is ranked G5 S4 by the Idaho Conservation Data Center [G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery; S4 = Apparently secure in Idaho (Moseley and Groves 1990)].

***Glossopetalon nevadense/Agropyron spicatum* habitat type**

Reference: Johnson and Simon 1987

Synonymy: None

Description: This habitat type is found exclusively on rock outcrops and canyon rims and occurs as small isolated shrub groupings in a vegetation complex with *Agropyron spicatum* communities, or in the case of Lucile Caves ACEC, in a mosaic with the *Cercocarpus ledifolius/Agropyron spicatum* habitat type. Species characteristic of this habitat type include *Agropyron spicatum* as the codominant species, along with *Erigeron pumilus, Phacelia heterophylla* and occasionally *Opuntia polyacantha*.

This habitat type occurs in very small, localized areas of the ACEC, in a mosaic with the *Cercocarpus ledifolius/Agropyron spicatum* habitat type on the limestone bluffs. Individual *Glossopetalon nevadense* plants occur on outcrops of the Lucile Formation, downstream from the cave, but does not constitute a plant community occurrence. A community recognized as the *Glossopetalon nevadense/Chrysothamnus nauseosus/Eriogonum microthecum* in the Habitat Management Plan prepared by the BLM (USDI Bureau of Land Management 1985) was not observed by us.

Distribution: Although *Glossopetalon nevadense* is widely distributed in southern Idaho, it appears to occur only as recognized community in the Salmon River canyon and Hells Canyon (Johnson and Simon (1987). The range of this habitat type outside of this region is not known.

Conservation Status: Although apparently and regional endemic, this habitat type occurs in relatively inaccessible sites and many high quality examples area known, including in several proposed and established natural areas (Hilty and Moseley 1991). The habitat type is ranked G4 S3 by the Idaho Conservation Data Center [G4 = Apparently secure globally, though it may be quite rare in parts of its range; S3 = Found locally within a restricted range in Idaho (Moseley and Groves 1990)].

Coniferous Forest

Pseudotsuga menziesii/Physocarpus malvaceus habitat type; *Physocarpus malvaceus* phase

Reference: Cooper, Neiman, and Roberts 1991; plus other Forest Service habitat type publications.

Synonymy: None

Description: This habitat type represents the moist extreme of vegetation present in the ACEC. It occurs at the upper end of the area, on a north-facing canyon slope along Crawford Creek. *Pseudotsuga menziesii* is the overstory dominant with a diverse shrub understory, including *Physocarpus malvaceus, Holodiscus discolor, Philadelphus lewisii, Rosa woodsii, Spiraea betulifolia,* and *Symphoricarpos albus.* High coverages of *Calamagrostis rubescens* and *Carex geyeri* are diagnostic of the *Physocarpus malvaceus* phase of this habitat type.

Distribution: This habitat type and phase are widely distributed and common in northern Rocky Mountains and Pacific Northwest.

Conservation Status: This habitat type and phase is common and well protected throughout its range, although human fire suppression is altering its structure and composition. It is ranked G5 S5 by the Idaho Conservation Data Center [G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery; S5 = Demonstrably secure in Idaho (Moseley and Groves 1990)]. It is found in numerous proposed and established natural areas (Hilty and Moseley 1991).

RECOMMENDATIONS

1. The spring, spring-fed creek, waterfall, and cave, all occurring on limestone or calc tufa deposits has long been recognized as being of state and regional significance. This significance was recognized by the Bureau of Land Management when they designated the site an ACEC in 1989 (USDI Bureau of Land Management 1989). At the same time, the BLM designated the Lucile Caves area a RNA, largely at the recommendation of the Idaho Natural Areas Committee.

Based on our inventory of the physical, botanical, and ecological features of the Lucile Caves ACEC, we consider the area to be of statewide significance, at least. In fact, the features associated with the spring and stream probably have much greater significance, and should be protected as fully as possible, and the ACEC designation is a fitting one. On the other hand, we do not believe that the area meets the intent of the definition of a RNA. The Federal Committee on Ecological Reserves (1977) defines RNAs as those areas that are specially designated to preserve, in as undisturbed condition as possible, representative common and rare biotic communities and associated natural processes. For the following reasons, we believe that the RNA designation ought to be reassessed:

A. While the area is sufficiently large to meet the intent of the definition, most of the significant portions are either continuing to be disturbed or have been disturbed until the recent past. For example:

- Most of the benchlands and lower slopes of the area are continuing to be grazed by domestic livestock.
- The 15 acre exclosure, established in June 1987, while providing much-needed protection for most of the spring creek, is too small to be of much value other than as a reference area. It is also separated into two parts, allowing cattle to access and cross the stream.
- The trail to the cave eliminated disturbances in the lower part of the riparian zone, but people still climb up into the cave, significantly trampling slopes at the base of the waterfall and the cave system itself.
- Much of the area between the old and new highways has been irreparably disturbed by past building development.
- Several old mine adits and diggings occur on the lower bluffs of the Lucile Formation.
- A road and grazing has altered the lower slopes in Crawford Creek.

B. In addition to the numerous exotic plant species that have invaded the ACEC, it is also the site of a purposeful introduction. In April 1988, the 15 acre exclosure became the transplant site for an experimental population of *Mirabilis macfarlanei*. While it is more or less within the known range of this federally endangered plant, there is no evidence that *Mirabilis macfarlanei* ever occurred at Lucile Caves ACEC.

2. The 15 acre exclosure is an excellent reference area to examine the recovery of the *Betula occidentalis* community type and the *Sporobolus cryptandrus/Poa secunda* habitat type from grazing. The fence should be maintained, as needed. The Society for Range Management is putting increased emphasis on identifying, cataloging, and maintaining rangeland exclosures (Laycock 1975; Allen 1986). The BLM should inform the Society of this and other enclosures on its lands.

3. The upper reaches of the spring creek through Lucile Caves ACEC is choked in many places with the exotic shrub, *Rubus bicolor* (Himalayan blackberry). It has decreased the quality of the riparian zone there, and possibly decreased the potential habitat for *Epipactis gigantea*. The BLM should look for ways to control or eradicate this threatening weed in the ACEC.

4. The present level of recreation should not significantly impact the sensitive features of the ACEC further than they already have, however, we recommend that the area not be developed into a developed recreation site or be "advertized" in brochures. The features that would draw the most recreational use, the spring, creek, and cave, are simply too fragile and easily impacted by recreationists. An increase in recreation pressure at the cave could further damage some of the features and trample the giant helleborine population below the cave entrance. A sign on the way up the trail suggesting visitors to "tread lightly" may be an appropriate reminder to use care.

5. The Cottonwood Resource Area, BLM, has an extensive monitoring program in the ACEC, including monitoring of the following features:

- the *Epipactis gigantea* population with two plots.
- the experimental population of *Mirabilis macfarlanei*; annually for number, cover and flower production.
- vegetation with 12 permanent photo points, 2 photo trend plots, and 2 nested frequency transects.

This monitoring generates extremely valuable information. Monitoring information for many rare plant populations around the state is entered into the Idaho Conservation Data Center occurrence data base. We would like to be kept informed of the results of this and other rare plant monitoring on the Cottonwood Resource Area.

We feel that the BLM has developed an adequate monitoring program in the ACEC and have no further monitoring recommendations at this time.

REFERENCES

Allen, B.H. 1986. Remember rangeland reference areas. Rangelands 8:180-182.

Alt, D.D., and D.W. Hyndman. 1989. Roadside Geology of Idaho. Mountain Press Publishing Co., Missoula, MT. 393 pp.

Argus, G. W., and K. M. Pryer. 1990. Rare vascular plants in Canada. Our natural heritage. Canadian Museum of Nature, Ottawa, Ontario. 191 p. plus maps.

Bingham, R.T. 1979. An annotated list of rare, native plants known or likely to occur on the Hells Canyon National Recreation Area. Unpublished report on file at the Conservation Data Center, Idaho Fish and Game, Boise, ID. 155 p.

Brunsfeld, S.J. 1983. *Lomatium rollinsii*. Page 27 *In*: Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, compilers, Vascular Plant Species of Concern in Idaho. Bull. Number 34. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID.

Brunton, D. F. 1986. Status of giant helleborine, *Epipactis gigantea* (Orchidaceae), in Canada. Canadian Field-Naturalist. 100(3): 414-417.

Cooper, S.V., K.E. Neiman, and D.W. Roberts. 1991. Forest habitat types of northern Idaho: A second approximation. General Technical Report INT-236. USDA, Forest Service, Intermountain Research Station, Ogden, UT. 143 pp.

Cronquist, A. 1942. A new *Erigeron* from Idaho. Leaflets in Western Botany 3:167-168.

Cronquist, A. 1947. Revision of the North American species of *Erigeron*, north of Mexico. Brittonia 6:121-300.

Daubenmire, R. 1970. Steppe vegetation of Washington. Technical Bulletin 62. Washington Agricultural Experiment Station, Pullman WA. 131 pp.

Federal Committee on Ecological Reserves. 1977. A directory of Research Natural Areas on federal lands of the United States of America. USDA, Forest Service, Washington, D.C. 280 pp.

Gaston, M.P., and E.H. Bennett. Geologic map of the Grangeville quadrangle, Idaho. Geologic Map Series (2^{o} Quadrangle). Idaho Bureau of Mines and Geology, Moscow.

Hamilton, W. 1963. Metamorphism in the Riggins region, western Idaho. U.S. Geologic Survey Professional Paper 436.

Hansen, P., S. Chadde, R. Pfister, J. Joy, D. Svoboda, J. Pierce, and L. Meyers. 1988. Riparian site types, habitat types, and community types or southwestern Montana. Montana Riparian Association, School of Forestry, University of Montana, Missoula, MT. 140 pp.

Henderson, D. M. 1981. *Epipactis gigantea*. Page 72 *In*: Vascular plant species of concern in Idaho, by the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, Bull. No. 34, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

Hilty, J., and B. Moseley. 1991. Idaho Natural Areas Directory. Conservation Data Center, Idaho Department of Fish and Game, Boise.

Hironaka, M., M.A. Fosberg, and A.H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Bulletin Number 35. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow. 44 pp.

Hitchcock, C. L. 1969. *Epipactis*. Page 837 *In*: Hitchcock, C. L., A. Cronquist, M. Ownbey, and J. W. Thompson; Vascular Plants of the Pacific Northwest, Part 1; University of Washington Press, Seattle.

Idaho Native Plant Society. 1991. Results of the seventh annual Idaho Rare Plant Conference. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise. 6 pp.

Johnson, C. 1988. Proposed experimental Macfarlane's four-o-clock (*Mirabilis macfarlanei*) planting. Unpublished plan prepared by the Bureau of Land Management, Cottonwood Resource Area; on file at Conservation Data Center, Idaho Department Fish and Game, Boise. 3 pp.

Johnson, C.G., and S.A. Simon. 1987. Plant associations of the Wallowa-Snake Province, Wallowa-Whitman National Forest. R6-ECOL-TP-255A-86. USDA, Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest, Baker, OR. 400 p, plus appendices.

Johnson, F.D. 1977. *Mirabilis macfarlanei*. Page 52 *In*: Endangered and threatened plants of Idaho, by the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, Bull. No. 21, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

Johnson, F.D. 1978. Idaho climate/vegetation/life zone data. Unpublished data on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise.

Johnson, F.D. 1981. *Mirabilis macfarlanei*. Page 29 *In*: Vascular plant species of concern in Idaho, by the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, Bull. No. 34, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

Johnson, F.D., and D.J. Mattson. 1978. A survey of sensitive plants of the Snake River corridor, Hells Canyon National Recreation Area, United States Forest Service. Unpublished report by the Forest Resources Department, University of Idaho; on file at the Conservation Data Center, Idaho Fish and Game, Boise, ID.

Laycock, W.A. 1975. Rangeland Reference Areas. Range Science Series Number 3. Society for Range Management, Denver CO. 66 pp.

Lesica, P., and Shelly, J.S. 1991. Sensitive, threatened and endangered vascular plants of Montana. Montana Natural Heritage Occasional Publication No. 1. Helena, MT. 88p.

Maley, T. Exploring Idaho Geology. Mineral Land Publications, Boise, ID. 232 pp.

Mancuso, M. 1991. Field investigation of *Epipactis gigantea* (giant helleborine), a Region 4 Sensitive Species, on the Payette National Forest. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise. 12 pp., plus appendices and maps.

Mancuso, M., and R.K. Moseley. 1991. Summary of 1991 surveys for threatened, endangered and sensitive plants in the Hells Canyon National Recreation Area. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise. 13 pp., plus appendices and maps.

Mathias, M., and L. Constance. 1943. New Umbelliferae - II. Bulletin of the Torrey Botanical Club 70:59-60.

Meinke, R.J. 1978. Notes on the rare, threatened and endangered vascular flora of northeastern Oregon. I. Baker County and adjacent areas: 1976-1978. USDI, Bureau of Land Management, Baker, OR. 209 pp.

Meinke, R.J. 1983. Threatened and endangered vascular plants of Oregon: An illustrated guide. U.S. Fish and Wildlife Service, Portland, OR. 352 pp.

Moseley, R.K. 1988. Species Management Guide for *Lomatium rollinsii*. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise. 9 pp., plus appendices and maps.

Moseley, R.K. 1989. Field investigations of 16 rare plant taxa occurring in wetlands on the Bonners Ferry Ranger District, Idaho Panhandle National Forests. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise. 75 p. plus appendices and maps.

Moseley, R., and C. Groves. 1990. Rare, threatened and endangered plants and animals of Idaho. Natural Heritage Section, Nongame and Endangered Wildlife Program, Idaho Department of Fish and Game. Boise. 33 pp.

Oregon Natural Heritage Data Base. 1991. Rare, threatened and endangered plants and animals of Oregon. Oregon Natural Heritage Data Base, Portland, OR. 64 pp.

Padgett, W.G., A.P. Youngblood, and A.H. Winward. 1989. Riparian community classification of Utah and southeastern Idaho. R4-ECOL-89-01. USDA, Forest Service, Intermountain Region, Ogden, UT. 191 pp.

Ross, S.H. 1969. Introduction to Idaho Caves and Caving. Earth Science Series No. 2. Idaho Bureau of Mines and Geology, Moscow. 54 pp.

Ross, S.H., and C.N. Savage. 1967. Idaho Earth Science. Earth Science Series No. 1. Idaho Bureau of Mines and Geology, Moscow. 217 pp.

Schlessman, M.A. 1980. Systematics of tuberous species of *Lomatium* (Umbelliferae). Ph.D. Dissertation, University of Washington.

Schlessman, M.A. 1984. Systematics of tuberous lomatiums (Umbelliferae). Systematic Botany Monographs 4:1-55

Spahr, R., L. Armstrong, D. Atwood, and M. Rath. 1991. Threatened, endangered, and sensitive species of the Intermountain Region. USDA Forest Service, Intermountain Region, Ogden, UT.

The Nature Conservancy, Idaho Natural Heritage Program, and Oregon Natural Heritage Database. 1987. Final Report. Phase I, 1987 National Natural Landmark Project, Pacific Northwest Region, National Park Service. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise. 47 pp.

Tisdale, E.W. Grasslands of western North America: The Pacific Northwest Bunchgrass. Pages 223-245 *In*: Grassland Ecology and Classification Symposium Proceedings, A.C. Nicholson, A. McLean, and T.E. Baker, eds. British Columbia Ministry of Forests, Victoria.

Tisdale, E. W. 1986a. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Bulletin No. 40. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow. 42 p.

Tisdale, E. W. 1986b. Native vegetation of Idaho. Rangelands 8:202-207.

USDA Forest Service. 1991a. Region 4 sensitive plant list. Unpublished list from the USFS Region 4 Office; on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise.

USDA Forest Service. 1991b. Updated Northern Region Sensitive Species list. Unpublished list from the USFS Region 1 Office; on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise.

USDI Bureau of Land Management. 1985. Lucile Caves HMP ID-6WHA-T25, Idaho County, Idaho. Unpublished plan prepared by Cottonwood Resource Area, Coeur d'Alene District, BLM and Region 2, Idaho Department of Fish and Game; on file at Conservation Data Center, Idaho Department of Fish and Game, Boise. 14 pp.

USDI Bureau of Land Management. 1989. Plan amendment for the Emerald Empire and Chief Joseph Management Framework Plans to designate 12 areas as Research Natural Areas (RNA) and/or Areas or Critical Environmental Concern (ACEC). Coeur d'Alene District, Coeur d'Alene, Idaho.

U.S. Fish and Wildlife Service. 1985a. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 50(188): 39526-39585 (27 September 1985)

U.S. Fish and Wildlife Service. 1985b. Macfarlane's four-o'clock recovery plan. U.S. Fish and Wildlife Service, Portland OR. 41 p.

U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 50(17): 6184-6229 (21 February 1990)

Washington Natural Heritage Program. 1990. Endangered, threatened and sensitive vascular plants of Washington. Department of Natural Resources, Olympia, WA. 52 p.

Whitten, D.G.A., and J.R.V. Brooks. 1972. A Dictionary of Geology. Penguin Books Inc., Baltimore, MD. 495 pp.

Wyoming Natural Diversity Data Base. 1991. Plant species of special concern. Unpublished manuscript on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise.

Appendix 1

List of vascular plant species occurring in Lucile Caves ACEC.
VASCULAR PLANTS OF LUCILE CAVES ACEC

Distribution of each species is noted according to the following community groupings (see text for habitat and community types of the ACEC that comprise these groupings).

1 = Canyon Grassland communities
2 = Riparian community
3 = Shrubland communities
4 = Coniferous Forest community

* = Species not native to ACEC

Species	1	2	3	4
TREES				
Celtis reticulata	*x*	*x*		
Betula occidentalis		*x*		
Pinus ponderosa		*x*	*x*	*x*
**Prunus avium*		*x*		
**Prunus domestica?*		*x*		
Pseudotsuga menziesii				*x*
**Pyrus malus*		*x*		
SHRUBS AND LIANAS				
Amelanchier alnifolia		*x*		*x*
Berberis repens		*x*		*x*
Cercocarpus ledifolius			*x*	
Chrysothamnus nauseosus	*x*		*x*	
Chrysothamnus viscidiflorus	*x*			
Clematis ligusticifolia		*x*		
Cornus stolonifera		*x*		
Crataegus douglasii		*x*		
Eriogonum microthecum	*x*		*x*	
Eriogonum strictum			*x*	
Glossopetalon nevadense	*x*		*x*	
Holodiscus discolor				*x*
Opuntia polyacantha	*x*		*x*	
Petrophytum caespitosum			*x*	
Philadelphus lewisii		*x*		*x*
Physocarpus malvaceus				*x*
Rhus glabra		*x*		
Rhus radicans		*x*		
Rosa gymnocarpa				*x*
Rosa woodsii		*x*		*x*
**Rubus bicolor*		*x*		
Spiraea betulifolia				*x*
Symphoricarpos albus		*x*		*x*

Species (continued)	1	2	3	4
FORBS				
Achillea millefolium	x		x	
Amsinkia tessellata	x			
Apocynum androsaemifolium	x	x		
Arabis crucisetosa	x			
**Artemisia dracunculus*		x		
Artemisia ludoviciana	x	x	x	
Astragalus atropubescens	x			
Astragalus cusickii	x			
Astragalus inflexus	x			
Balsamorhiza sagittata	x			
Besseya rubra	x			
Brodiaea douglasii	x			
Descurainia pinnata	x			
Dodecatheon pulchellum	x			
**Camelina microcarpa*	x			
Castilleja hispida	x			
Cerastium arvense	x	x		
Chaenactis douglasii	x			
**Chenopodium album*	x			
Chrysopsis villosa	x			
**Cynoglossum officinale*		x		
Delphinium nuttallianum?	x			
Erysimum asperum	x			
Epipactis gigantea		x		
Erigeron engelmannii var. davisii	x			
Erigeron peregrinus		x		
Erigeron pumilus	x		x	
Eriophyllum lanatum	x		x	
**Erodium cicutarium*	x			
Frasera montana	x			
Fritillaria pudica	x			
Galium triflorum		x		x
Gilia aggregata		x		x
Grindelia squarrosa	x			
Hackelia hispida			x	
Helianthus anuus	x			
Heuchera grossulariifolia			x	
Hieracium albiflorum		x		
**Hypericum perforatum*		x		
**Lepidium perfoliatum*	x			
**Lithospermum arvense*		x		
Lomatium dissectum	x		x	
Lomatium rollinsii	x			
**Marrubium vulgare*	x	x		

Species (continued)	1	2	3	4
**Melilotus alba*		x		
Mimulus guttatus		x		
**Mirabilis macfarlanei*	x			
Nemophila kirtleyi		x	x	
Penstemon eriantherus	x		x	
Penstemon triphyllus	x		x	
Phacelia heterophylla	x		x	
Phacelia linearis	x		x	
Phlox colubrina		x		x
Plantago patigonica	x			
Physaria oregana	x		x	
Prunella vulgaris		x		
Rorippa nasturtium-aquaticum		x		
**Salsola kali*	x			
Scutellaria angustifolia	x		x	
**Silene alba*		x		
**Sisymbrium altissimum*		x		
**Solanum dulcamara*		x		
**Taraxacum officinale*	x			
Thelypodium laciniatum		x		x
Tonella floribunda	x			
**Trifolium repens*	x			
Urtica dioica		x		
**Verbascum thapsus*	x			
Viola neurophylla		x		
Zigadenus venenosus	x			
GRASSES AND GRAMINOIDS				
Agropyron spicatum	x		x	
Aristida longiseta	x			
**Bromus tectorum*	x	x	x	x
Calamagrostis rubescens				x
Carex aurea		x		
Carex geyeri				x
Carex lanuginosa		x		
Carex oederi		x		
**Dactylus glomerata*		x		
Distichilis stricta		x		
Elymus cinereus	x			
Festuca idahoensis	x		x	
Festuca megalura	x			
Glyceria striata		x		
Juncus brachyphyllus		x		
Panicum occidentale		x		
**Phalaris arundinacea*		x		

Species (continued)	1	2	3	4
**Poa bulbosa*	*x*			
**Poa pratense*		*x*		
Poa secunda	*x*		*x*	
Sporobolus cryptandrus		*x*		
Stipa comata				
FERNS AND ALLIES				
Equisetum arvense		*x*		
Woodsia oregana	*x*		*x*	

Appendix 2

Vegetation map of Lucile Caves ACEC.

A floristic and vegetation survey of Lucile Caves Area of Critical Environmental Concern, Coeur D'Alene District, BLM. by Robert K. Moseley 1 edition - first published in 1991. Read Listen. The taxonomy and preliminary conservation status of Eriogonum shockleyi S. Wats. in Idaho. Diversity of vegetation floristic coastal in the area of tlemcen (algeria western). HASSIBA STAMBOULI - MEZIANE & MOHAMED BOUAZZA Department of Ecology and Environment, University of Tlemcen, Tlemcen, Algeria. ABSTRACT. This study is devoted to the analysis of the vegetation of coastal dunes in the region of Tlemcen.Â Diversity of Vegetation Floristic Coastal in the Area of Tlemcen (Algeria Western). 3. The bioclimatic study for two periods (1913-1938) and (1970-2002) Figure 2 showed a vertical indent of each station in direct relation with the Q2 Emberger.Â Table 5: Them Floristic Surveys of Beach of Moskarda; the Border; Beider and Marsat Ben Mâ€™hidi. Station: Beach of Moskarda and the Border. Exposition: North. Areas of Critical Environmental Concern (ACEC) is a conservation ecology program in the Western United States, managed by the Bureau of Land Management (BLM). The ACEC program was conceived in the 1976 Federal Lands Policy and Management Act (FLPMA), which established the first conservation ecology mandate for the BLM. The FLPMA mandate directs the BLM to protect important riparian corridors, threatened and endangered species habitats, cultural and archeological resources, as well as unique scenic Vegetation Survey; widely used in Europe for applied vegetation science, conservation planning EuroVegChecklist; International Code of and land management. During the long history of syntaxonomy, many concepts Phytosociological Nomenclature; Lichen and names of vegetation units have been proposed, but there has been no single communities; Order; Syntaxonomy; classification system integrating these units. Climate change is yet another environmental concern that has surfaced in the last couple of decades. Environmental change has different destructive impacts that include, but are not limited to, the melting of polar ice, change in seasons, new sicknesses, and change in the general climate situation. Read more about the articles related to Climate Change belowÂ The depletion of the critical Ozone layer of the air is credited to contamination brought about by Bromide and Chlorine found in Chlorofloro carbons (CFCs). When these poisonous gasses reach the upper parts of the atmosphere, they cause a gap in the ozone layer, the greatest of which is over the Antarctic.