



**BIOLOGICAL SURVEY OF  
NAVAL OIL SHALE RESERVE NO. 1 (NOSR-1)  
1996 FINAL REPORT**

Renée J. Rondeau, Michael B. Wunder  
Annette Meredith, Christopher A. Pague, and Susan Spackman

Colorado Natural Heritage Program  
College of Natural Resources  
254 General Services Building  
Colorado State University  
Fort Collins, Colorado 80523

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# TABLE OF CONTENTS

List of Tables .....	iv
List of Figures .....	iv
EXECUTIVE SUMMARY .....	1
INTRODUCTION .....	4
Colorado Natural Heritage Program's Element and Occurrence Ranks .....	6
Study Area .....	9
History .....	11
Geology .....	12
Soils .....	15
Overview of Major Vegetation Types .....	15
INVENTORY METHODS .....	21
Information Collection Phase .....	21
Potentially Occurring Elements .....	21
Identifying Targeted Inventory Areas .....	23
Field Surveys .....	23
Delineating Preliminary Conservation Planning Boundary .....	24
RESULTS .....	29
Overview .....	29
Plants .....	34
Birds .....	34
Fish .....	34
Mammals .....	35
Insects .....	35
RECOMMENDED CONSERVATION SITES .....	36
Anvil Points Rim .....	42
East Fork Parachute Creek .....	47
Northwater Creek .....	53
Trapper Creek .....	58
Northeast Book Cliffs .....	63
Ben Good Creek .....	66
PLANTS .....	68
Parachute penstemon ( <i>Penstemon debilis</i> ) .....	71
Wild hollyhock ( <i>Iliamna grandiflora</i> ) .....	73
Arapien stickleaf ( <i>Mentzelia argillosa</i> ) .....	75

## TABLE OF CONTENTS (continued)

Hanging garden sullivantia ( <i>Sullivantia hapemanii</i> var. <i>purpusii</i> ).....	77
Utah fescue ( <i>Festuca dasyclada</i> ).....	79
Sun-loving meadowrue ( <i>Thalictrum heliophilum</i> ).....	81
Fragrant horsemint ( <i>Monardella odoratissima</i> ).....	83
Dragon milkvetch ( <i>Astragalus lutosus</i> ).....	85
Osterhout's penstemon ( <i>Penstemon osterhoutii</i> ).....	87
<b>ANIMALS</b> .....	89
<b>Fish</b>	
Colorado River cutthroat trout ( <i>Oncorhynchus clarki pleuriticus</i> ).....	92
<b>Birds</b>	
Veery ( <i>Catharus fuscenscens</i> ).....	94
Columbian sharp-tailed grouse ( <i>Tympanuchus phasianellus columbianus</i> ).....	96
American peregrine falcon ( <i>Falco peregrinus anatum</i> ).....	98
Cooper's hawk ( <i>Accipiter cooperii</i> ).....	100
Boreal owl ( <i>Aegolius funereus</i> ).....	102
Purple martin ( <i>Progne subis</i> ).....	104
Three-toed woodpecker ( <i>Picoides tridactylus</i> ).....	106
Golden eagle ( <i>Aquila chrysaetos</i> ).....	108
Long-eared owl ( <i>Asio otus</i> ).....	110
Northern harrier ( <i>Circus cyaneus</i> ).....	112
Olive-sided flycatcher ( <i>Contopus borealis</i> ).....	114
Sharp-shinned hawk ( <i>Accipiter striatus</i> ).....	116
<b>Mammals</b>	
Preble's shrew ( <i>Sorex c.f. preblei</i> ).....	118
<b>Butterflies</b>	
Baird's swallowtail ( <i>Papilio bairdii</i> ).....	120
Green-winged hairstreak ( <i>Callophrys affinis affinis</i> ).....	122
<b>SIGNIFICANT NATURAL COMMUNITIES</b> .....	124
<b>Riparian Forests</b>	
Boxelder riparian forest ( <i>Acer negundo</i> - <i>Populus angustifolia</i> / <i>Cornus sericea</i> ).....	127
Narrowleaf cottonwood/Dogwood ( <i>Populus angustifolia</i> / <i>Cornus sericea</i> ).....	129
Montane riparian forest ( <i>Picea pungens</i> / <i>Cornus sericea</i> ).....	131
Subalpine fir-Engelmann spruce/Drummond's willow ( <i>Abies lasiocarpa</i> - <i>Picea</i> ..... <i>engelmannii</i> / <i>Salix drummondiana</i> ).....	133
<b>Riparian Shrublands</b>	
Drummond's willow/mesic forb ( <i>Salix drummondiana</i> /mesic forb).....	135
Rocky Mountain willow/mesic forb ( <i>Salix monticola</i> /mesic forb).....	137
<b>Riparian Graminoid</b>	
Montane wet meadow ( <i>Carex utriculata</i> ).....	139

## TABLE OF CONTENTS (continued)

Tufted hairgrass wetland ( <i>Deschampsia caespitosa</i> - <i>Carex</i> spp.) .....	141
<b>Upland Forests</b>	
Aspen wetland forest ( <i>Populus tremuloides</i> / <i>Pteridium aquilinum</i> ).....	143
Aspen/Rocky Mountain maple ( <i>Populus tremuloides</i> / <i>Acer glabrum</i> ).....	145
<b>Upland Shrublands</b>	
Western slope sagebrush shrubland ( <i>Artemisia tridentata vaseyana</i> / <i>Festuca thurberi</i> ) .....	147
Sagebrush bottomland shrubland ( <i>Artemisia tridentata vaseyana</i> / <i>Leymus cinereus</i> ) .....	149
<b>Upland Grasslands</b>	
Montane grassland ( <i>Festuca thurberi</i> - <i>Lathyrus leucanthus</i> ).....	151
Western slope grassland ( <i>Oryzopsis hymenoides</i> shale barren).....	153
Great Basin grassland ( <i>Pseudoroegneria spicata</i> ssp. <i>inermis</i> ).....	155
Great Basin montane grassland ( <i>Pseudoroegneria spicata</i> ssp. <i>inermis</i> / <i>Poa secunda</i> ) .....	157
ACKNOWLEDGMENTS .....	159
LITERATURE CITED .....	160
APPENDIX A. Biological Clearance Survey Forms/Section Reports	
APPENDIX B. Example of Colorado Natural Heritage Element Occurrence Record Form	
APPENDIX C. Colorado County Map	

## LIST OF TABLES

Table 1. Colorado Natural Heritage Program Imperilment and Occurrence Ranks .....	7
Table 2. Shale Oil Deposits in the Green River Formation. ....	13
Table 3. Potential Elements of NOSR-1 with natural heritage and federal status .....	24
Table 4. Federal and State Agency Special Designation .....	28
Table 5. Rare, threatened, and endangered elements of NOSR-1 with natural heritage ranks and federal status.....	30
Table 6. Natural heritage program tracked elements and their associated community types .....	32
Table 7. Oil shale endemic plants restricted to either the Uinta or Piceance Basins of Utah and Colorado .....	68
Table 8. Rare or biologically significant plant species of NOSR-1 with natural heritage ranks and federal status .....	69
Table 9. Rare or biologically significant animal species of NOSR-1 with natural heritage ranks and federal status .....	90
Table 10. Rare or biologically significant plant communities of NOSR-1 with natural heritage ranks and federal status.....	125

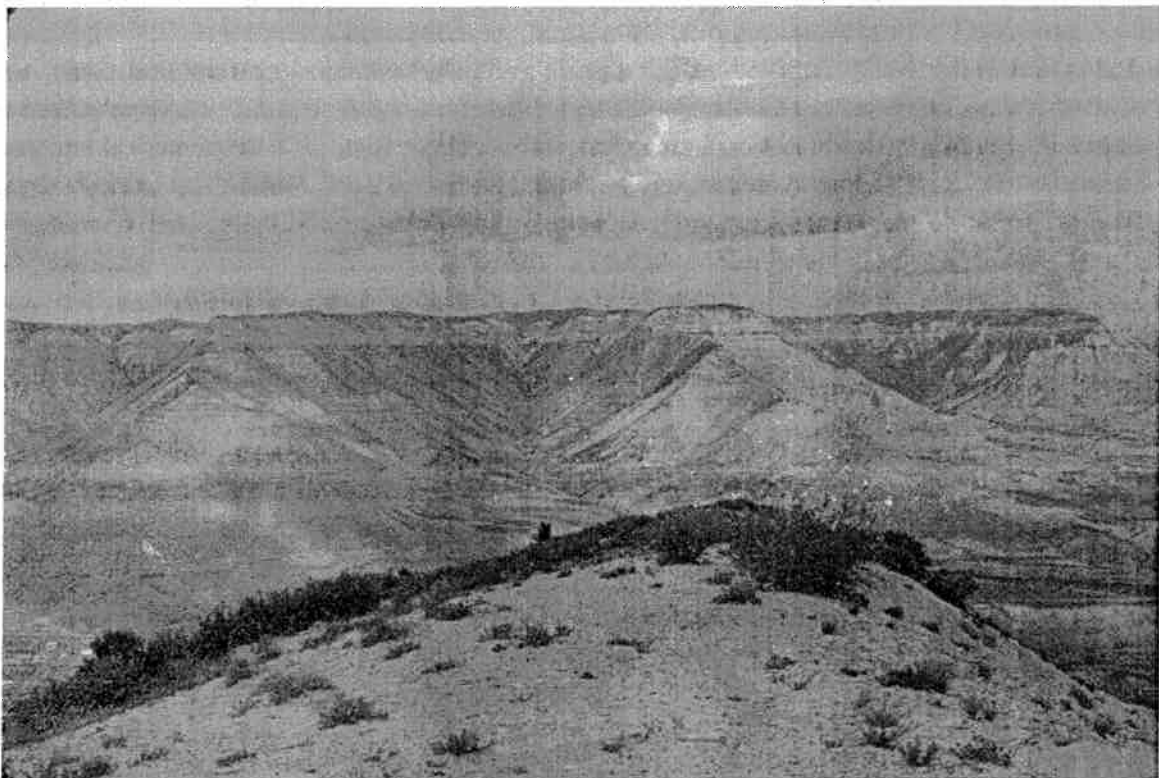
## LIST OF FIGURES

Figure 1. NOSR-1 boundaries and vicinity map, Garfield County, Colorado.....	10
Figure 2. Distribution of the Green River Formation in the western United States and location of oil rich regions.....	13
Figure 3. Percent cover of vegetation types on NOSR-1 and associated elements per type.	33
Figure 4. Map of conservation sites within NOSR-1.....	38
Figure 5. Plant occurrences on NOSR-1, Garfield County, Colorado.....	70
Figure 6. Vertebrate and invertebrate occurrences on NOSR-1, Garfield County, Colorado .....	91
Figure 7. Significant natural communities on NOSR-1, Garfield County, Colorado.....	126

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*Our minds try to project the future, and we only know we have been firmly launched by the past. We pray that judgments of the present be proper ones so that they who gave us our heritage may rest in peace.* (From the Rifle Reading Club "Rifle Shots: Story of Rifle, Colorado" 1973).



Roan Plateau and NOSR-1 as viewed from Mt. Callahan

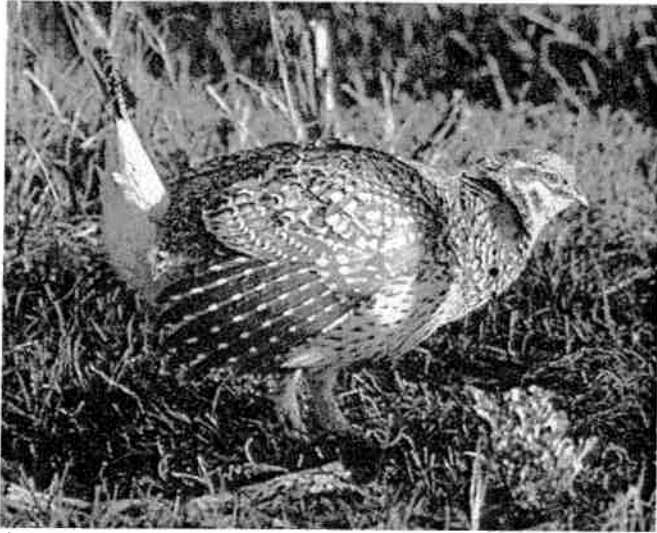
R. J. Rondeau

## **EXECUTIVE SUMMARY**

Approximately 50 million years ago a large tropical lake covered most of present day Garfield and Rio Blanco counties in Colorado. Over a period of many million years, 3,000 feet of organic and sedimentary material from the surrounding slopes were deposited on the bottom of the lake. Through changes in the earth's crust, these deposits were thrust up and the present day plateaus were created. Erosion by rivers cut into the plateaus, leaving much of the Green River Formation oil shale exposed as dramatic cliff faces. The Department of Energy, Naval Oil Shale Reserve #1 (NOSR-1) covers approximately 41,000 acres of land on the southeast boundary of this Eocene lake. This area is commonly referred to as the Piceance Basin; however it is not truly a watershed basin, but an historic geologic basin. The

potential for oil and gas development within the Green River Formation has resulted in many biological inventories of NOSR-1 and the Piceance Basin.

The purpose of this study, which was conducted during 1995-96, was to conduct a prioritized biological inventory of NOSR-1 including rare, threatened, and endangered plants and animals as well as important natural communities and springs.



**Columbian sharp-tailed grouse.**

K. Giesen

We found a diverse array of significant biological resources (42 significant elements of biodiversity). While NOSR-1 has an abundance of common Colorado Plateau plants and animals, we also found it to be rich with imperiled plants, animals, and plant communities. Twenty-five plant and animal species and 17 natural communities of concern were found on NOSR-1. Of the 9 species of plants, 5 have a world-wide distribution restricted to the portion of the Green River Formation shale that is located only in the Piceance Basin. The entire range for most of these plants is limited

to, at most, a few counties in western Colorado and eastern Utah. Additionally, one of these species, Parachute penstemon, is extremely restricted in range known from only three other locations in the world.

Of the 14 rare and imperiled vertebrate species found on the property, the American peregrine falcon is federally listed as endangered, and three additional species are known to be globally imperiled. Specifically, the Colorado River cutthroat trout populations located in East Fork Parachute, Northwater, and Trapper Creeks have been identified as important for the survival of this species. The Colorado River cutthroat trout is known from over 300 locations in Utah, Wyoming, and Colorado; there are 272 occurrences in Colorado alone. However, the species is believed to be genetically compromised at most of the locations; there are only 20 sites that are thought to be of high integrity (C. Pague pers. comm.). The discovery of Columbian sharp-tailed grouse has helped to close a gap between two formerly disparate populations, which is significant because all data point to sharply declining populations of the species in Colorado.

In comparison to other parts of Colorado, we found NOSR-1, a relatively small geographic area, to be extremely species rich. For example, in Colorado there is an average of 4 significant elements of biodiversity per 38,080 acres (1 U.S.G.S. topographic map). There were 42 significant elements of biodiversity documented on the 41,000 acres within NOSR-1. We are aware of only three other Colorado areas which compare to the richness of NOSR-1's rare flora and fauna. All three of these areas (Colorado and Dinosaur National Monuments and Mesa Verde National Park) are federally protected lands. It is especially important to note that although NOSR-1 is the only area of the four that does not have protective status such as that afforded to National Parks or Monuments; NOSR-1 is clearly of comparable biological significance.



To ensure the survival of these important species we suggest six distinct areas as the most critical habitat to manage in order to protect nearly 100% of the rare plants, animals, and natural communities found on NOSR-1. In this report we describe these areas as well as all the elements of concern located within NOSR-1. Biological clearance survey forms and section maps in Appendix A provide survey details.

## INTRODUCTION



**View of an outcrop of the shale-bearing Green River Formation along the Book Cliffs**

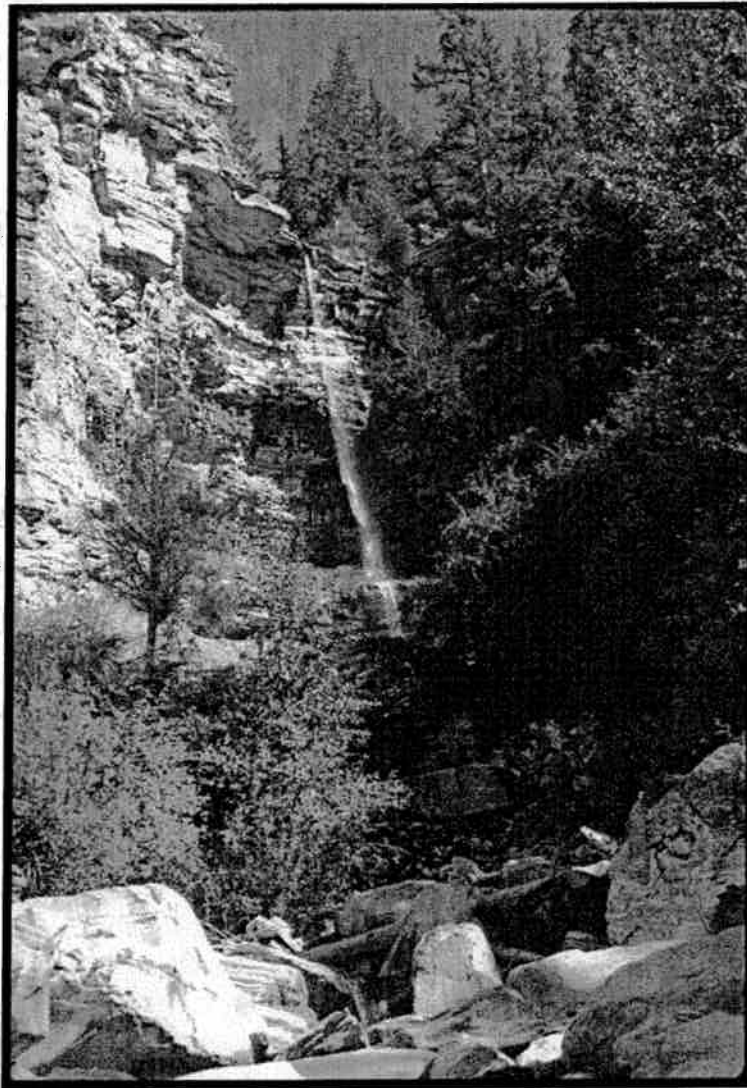
R. J. Rondeau

Ever since 1882, when Michael Callahan's fireplace and chimney burst into flames during his house warming party, oil shale has been known as the rock that burns (Kraushaar and Ristinen 1988; Gulliford 1983). By 1915, geologists had examined and reported that the oil shale deposits of Garfield County, Colorado were a potential source of oil (Harman and Murray 1985). In order to ensure that the U.S. naval fleet would always have a source of petroleum, approximately 55,000 acres of land in Garfield County were withdrawn from public domain on December 6, 1916 (Schrack 1973; L. Coleman pers. comm.). By 1935 a cooperative agreement was signed between the Department of the Navy and the Department of the Interior turning over administration of NOSR-1 and 3 to the Bureau of Land Management (BLM). Then in 1966 another cooperative agreement between the Department of the Navy and Department of Interior restricted BLM administrative duties to surface resources on NOSR-1 and 3. In 1977, the Department of Energy Organization Act transferred the authority of the Naval Oil Shale Reserves' from the Department of the Navy to the Department of Energy. Presently, jurisdiction of mineral resources of NOSR-1 and 3 belongs to the Department of Energy, while the BLM administers surface resources pursuant to the 1966 Department of Navy Cooperative Agreement. Since the early 1900's, the traditional primary uses of the surface have been grazing, big game hunting, fishing, and other recreation (Schrack 1973; L. Coleman pers. comm.). The Department of Energy is conducting an on-going oil shale and natural gas drilling program on its Naval Oil Shale Reserves. As part of the drilling program, a survey of rare, threatened, and endangered plants

and animals, and significant natural vegetation is required. During 1994-95 Greystone (1995) conducted a biological survey of **NOSR-3**.

We conducted the biological survey of **NOSR-1** during 1995-96. Prior to field searches, we contacted relevant government agencies and reviewed publications and our Biological Conservation Data System to identify species and communities of special interest that might occur on NOSR-1. We identified seventy-five prospective species and communities for intensive field inventory. We visited approximately 60% of the 65 sections during the 1995 field season and all sections during the 1996 field season (Figure 1). Seventeen significant plant communities and 24 species of special concern (9 plants, 12 birds, 1 fish, 2 butterflies, and 1 mammal) were located.

This document is the summary report of the Colorado Natural Heritage Program's biological inventory conducted on NOSR-1. Included herein is a brief description of the Natural Heritage Program's methodology and ranking system, a review of the history, geology, soils, and vegetation of the study area, field methods, results (including a description of each element of concern), proposed conservation sites with descriptions, boundaries, management recommendations, and section by section reports.



## Colorado Natural Heritage Program's Element and Occurrence Ranks

The Colorado Natural Heritage Program (CNHP) is part of an international network of conservation data centers that compile comprehensive information on rare, threatened, and endangered species and natural communities in the U.S., Canada, and many Latin American countries. A multi-disciplinary team of scientists and information managers gather information and incorporate it into continually updated databases. By concentrating on site-specific data for significant elements of natural diversity, CNHP accurately details the status and distribution of each species or community. Each of these significant natural features (species and community types) is an **element of natural diversity**, or simply an **element**.

Each element is assigned a rank that indicates its relative imperilment on a five-point scale (1 = critically rare/imperiled; 5 = abundant/secure; Table 2). Each species and natural community is ranked for its global and local distribution and rarity, reflecting a need for conservation priority. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive or imperiled sites.

The primary criterion for determining **element ranks** are: 1) the number of known distinct localities or occurrences and; 2) the total number of individuals at each location. Other considerations include the condition of the occurrences, the number of protected occurrences, population trends, fragility, and threats. However, the emphasis remains on the number of occurrences, such that ranks can be an index of known biological rarity or imperilment. These ranks are assigned both in terms of the element's rarity or imperilment over its entire range (Global or G-rank) and within the sites of Colorado state (State or S-rank) (Table 1). Together these two ranks give an instant picture of the imperilment of the element. Although most species protected under state or federal endangered species laws are critically imperiled, not all imperiled species are listed as endangered or threatened. **Natural Heritage ranks should not be interpreted as legal designations.**



**Table 1.** Colorado Natural Heritage Program Imperilment and Occurrence Ranks.

Global rarity ranks (G) refer to a species' rarity throughout its range; state rarity ranks (S) refer to a species' rarity throughout the state. Global and State ranks are denoted, respectively, with a "G" or an "S" followed by a character. Note that GA and GN are not used, and GX means extinct. **These ranks should not be interpreted as legal designations.**

**Rarity Ranks (applies to elements only)**

**G/S1** Critically imperiled; usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

**G/S2** Imperiled; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.

**G/S3** Vulnerable; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

**G/S4** Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.

**G/S5** Very common; demonstrably secure under present conditions.

**G/SU** Status uncertain, often because of low search effort or cryptic nature of the element.

**T** Trinomial specifies the rank of a sub species.

**S#B** Refers to the breeding season imperilment of elements that are not permanent residents.

**S#N** Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of ZN is used.

**SZ** Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.

**SH** Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

**SR** Reported to occur in the state, but unverified.

**G3G4/S3S4** Watchlisted: Specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. Watchlisted species are noted in the lists by an asterisk (\*) next to the species name.

Notes: When a question mark follows a numerical rank (e.g., S2?), it indicates uncertainty about the accuracy of this rank. When two numbers appear in a state or global rank (e.g., S2S3), the actual rank of the elements falls between the two numbers. When a 'Q' follows a rank, it indicates uncertainty about the taxonomic status of the element.

**Element Occurrence ranks (applies to the site where an element occurs)**

**A** The occurrence is relatively large, pristine, defensible, and viable.

**B** The occurrence is small but in good condition, or large but removed from its natural condition and/or not viable and defensible.

**C** The occurrence is small, in poor condition, but restorable.

**D** The occurrence is of questionable viability and could be restored only with great effort.

The spot on the landscape that supports a particular population of a species or a specific stand of a given community type is an **element occurrence**. So that protection efforts can be aimed not only at the most imperiled elements, but at the best examples of these elements, we rank each occurrence.

The **occurrence rank** is on a four point scale, and is a synthesis of four attributes: quality, condition, viability, and defensibility. The definition of the attributes are:

**quality** - overall size, vigor, health of occurrence, degree of connectedness to surrounding natural ecosystems, etc.;

**condition** - naturalness of the habitat, abundance of non-native species present, degree of human-induced disturbance, degree of soil compaction, degree in which species composition is altered by anthropogenic changes, (e.g. grazing), etc.;

**viability** - refers to questions such as, are natural pollinators in place, is the hydrologic regime altered, will site be improved or maintained by current management practices?

**defensibility** - ease or difficulty of protecting the occurrence from external threats, site specific problems, and adjacent land use compatibility.

**Occurrence ranks** can be summarized as follows: 'A' = pristine or undisturbed, 'B' = undisturbed to slightly altered, 'C' = disturbed to highly altered, 'D' = recognizable, but probably unrecoverable. For example, an 'A' ranked occurrence of a riparian plant association (Narrowleaf cottonwood/Red-osier dogwood, a G3/S2 community), has no, or very few, non-native plant species present, the channel and banks are stable and show no signs of trampling or sloughing, the soils are not compacted, and the ecological processes, primarily flooding, necessary to maintain this system are in place. The association is surrounded by other riparian associations of similar quality, creating a connected, high quality mosaic. The surrounding hill slopes and areas up and down stream are in natural condition and have not been drastically altered (e.g., no dams or diversions upstream and no logging or mining up stream). A 'B' ranked occurrence of this same riparian plant association may have all of the above 'A' criteria but is very small in size, or has a higher abundance of non-native plant species present, or may be in an area where surrounding land use fragments the occurrence. A 'C' ranked occurrence is of poor condition, generally with abundant non-native plant species present and/or the area is highly fragmented, or degraded, and/or the area is very small. Again, surrounding land use and condition plays a role in the overall riparian plant association occurrence rank.



**Anvil Points and the Book Cliffs on the SE edge of the Roan Plateau**

M. B. Wunder

**Study Area.** The NOSR-1 site consists of approximately 41,000 acres, primarily on top of the Roan Plateau, situated some 3,000 feet above and 1 to 4 miles north of the Colorado River between the towns of Rifle and Parachute in Garfield County, Colorado (Figure 1). The plateau generally consists of rolling to steep mountainsides and canyons at a montane elevation, ranging from 6,640 feet above sea level along the western boundary in East Fork Parachute Creek to 9,256 feet on the eastern boundary on the rim of the Roan Cliffs. Scenic 500 foot Green River Formation shale cliffs denote the eastern edge of the Book Cliffs and the Piceance Basin, and are home to Peregrine falcons and Golden eagles. At the top of these large cliffs, a narrow but distinct band of Great Basin desert grasslands creates important habitat for rare and imperiled plants, butterflies, Columbian sharp-tailed grouse, and small mammals that support raptors.

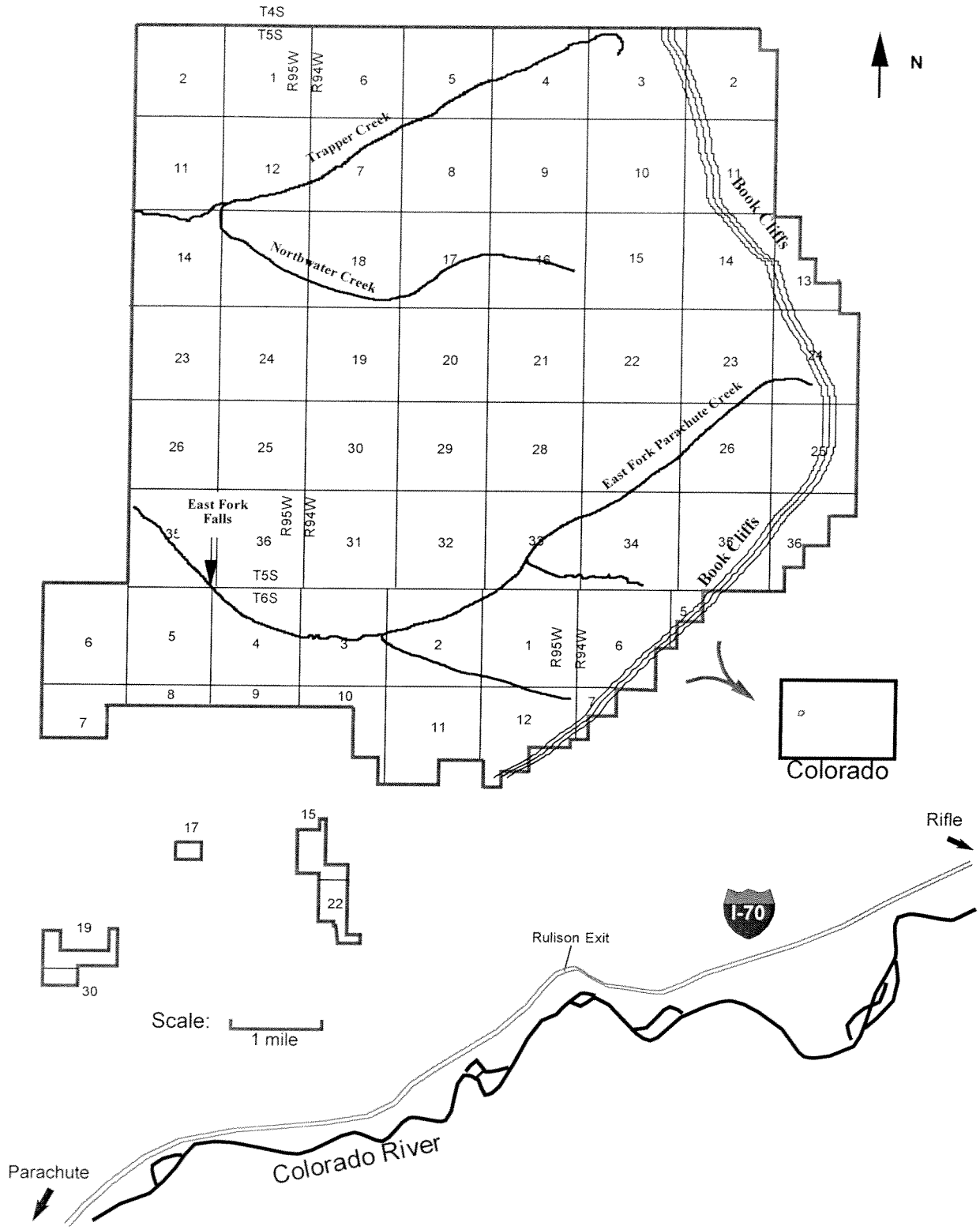


Figure 1. NOSR-1 boundaries and vicinity map, Garfield County, Colorado





As the Roan Plateau gently slopes downward to the west, several creeks dissect the Plateau, creating deep valleys or canyons, all home to the Colorado River cutthroat trout and the globally rare Hanging garden sullivania. Small waterfalls are numerous, but East Fork Parachute Creek Falls plunges a dramatic 200 feet over white shale cliffs into a box canyon of exceptional scenic quality.

Aspen forests and sagebrush rolling hills dominate the NOSR-1 landscape. Habitats occupying less area, but of equal biological significance, are the Shale barrens, Pinyon-Juniper woodlands, Douglas fir and Spruce-fir forests, mixed Mountain shrublands, Mountain grasslands, Riparian forests, Wetlands, and Hanging garden.

The rugged topography causes large variations in the local climate, or microclimatic zones. NOSR-1 is generally classified as arid steppe, with most precipitation occurring during the winter months (Schrack 1973).



**History.** The Roan Plateau has been important to humans since prehistoric days with Utes, and probably pre-Ute Indians, using the Plateau as summer hunting and grazing grounds (Gulliford 1983). When Escalante and Dominguez, the first European explorers of the area, passed through in 1776, they used the help of Indian guides to follow Roan Creek up and over the Book Cliffs. These early Spanish explorers were searching for a passage overland to connect Spanish missions of the southwest with those of the California coasts as they traveled up from Mexico and into present day Colorado (Velez de Escalante 1792). They found very little to warrant their return, and it was nearly another 100 years before Europeans returned to the area.

In 1876, Colorado gained statehood and Ferdinand Vandever Hayden was commissioned to study the West (Hayden 1878; Gulliford 1983). Hayden and his survey crew set up camp in Meeker, soon-to-be home of the famous Meeker Massacre. These men were the first explorers and scientists to observe and describe the flora, fauna, and geology of the Piceance Basin (Hayden 1878; Gulliford 1983). In October 1876 they followed the crest of the Book Cliffs to Roan Creek, and then dropped down into the Valley of the Grand. Dr. Peale, of the Hayden expedition, described the Book Cliffs and the Roan Plateau as:

*“Cretaceous beds rising one above another, successive shelves of marls, roan colored; hence the name that has long been given this elevated plateau abundantly supplied with grass, more valuable for Indians than for settlement. An Indian trail runs along the entire height of the crest.”* As cited in Reading Club of Rifle (1973).



Settlement came to the area five years after the Hayden survey and by 1882 the town of Rifle was founded (Gulliford 1983; Reading Club of Rifle 1973). With settlement came the first commercial livestock grazing on the Roan Plateau (Ute Indians probably grazed mustangs on top, as the first settlers noted these horses). J. Hurlburt brought 2,000 ewes from

California in 1882 and settled in the Parachute Creek drainage. Cattle soon followed and by 1885, the old JQS Trail (Johnson, Quinlen, and Squire) was built to the top of the Book Cliffs (Reading Club of Rifle 1973). With construction of the JQS cattle trail, access was gained to pastures on the Roan Plateau for herds of cattle. As more settlers kept pouring in and claiming land, the rangeland acreage continually decreased. It was not long before the pinch was felt; the once open range became crowded, and area suitable for grazing was beginning to become scarce (Reading Club of Rifle 1973).

This, in time, led to a confrontation between sheep herders and cattlemen. This violence, known locally as the Sheep and Cattle War or Book Cliffs War (1890's), was a gruesome slaughter of sheep. Cattlemen hired forty men to kill Hurlburt's sheep at \$100 a head. The cattlemen accomplished their purpose, at least with Hurlburt, as Hurlburt sold the remaining sheep, and never owned another sheep again. This war brought about one of the first grazing reform acts. The Rees-Oldland Grazing Act permanently divided and defined grazing areas on the Roan Plateau for sheep and cattle (Reading Club of Rifle 1973). Livestock grazing is still one of the primary uses of NOSR-1. As one travels the backroads of the Roan Plateau, evidence of early ranching can still be seen. Several old cabins with cowboy artifacts still stand near springs.



Although grazing has been an important use of this land, oil and gas development has also influenced many decisions. Prior to large mining operations, the pioneers distilled oil shale to make axle grease for covered wagons (Savage 1974). The first large oil boom for the Piceance Basin took place in 1903 (Reading

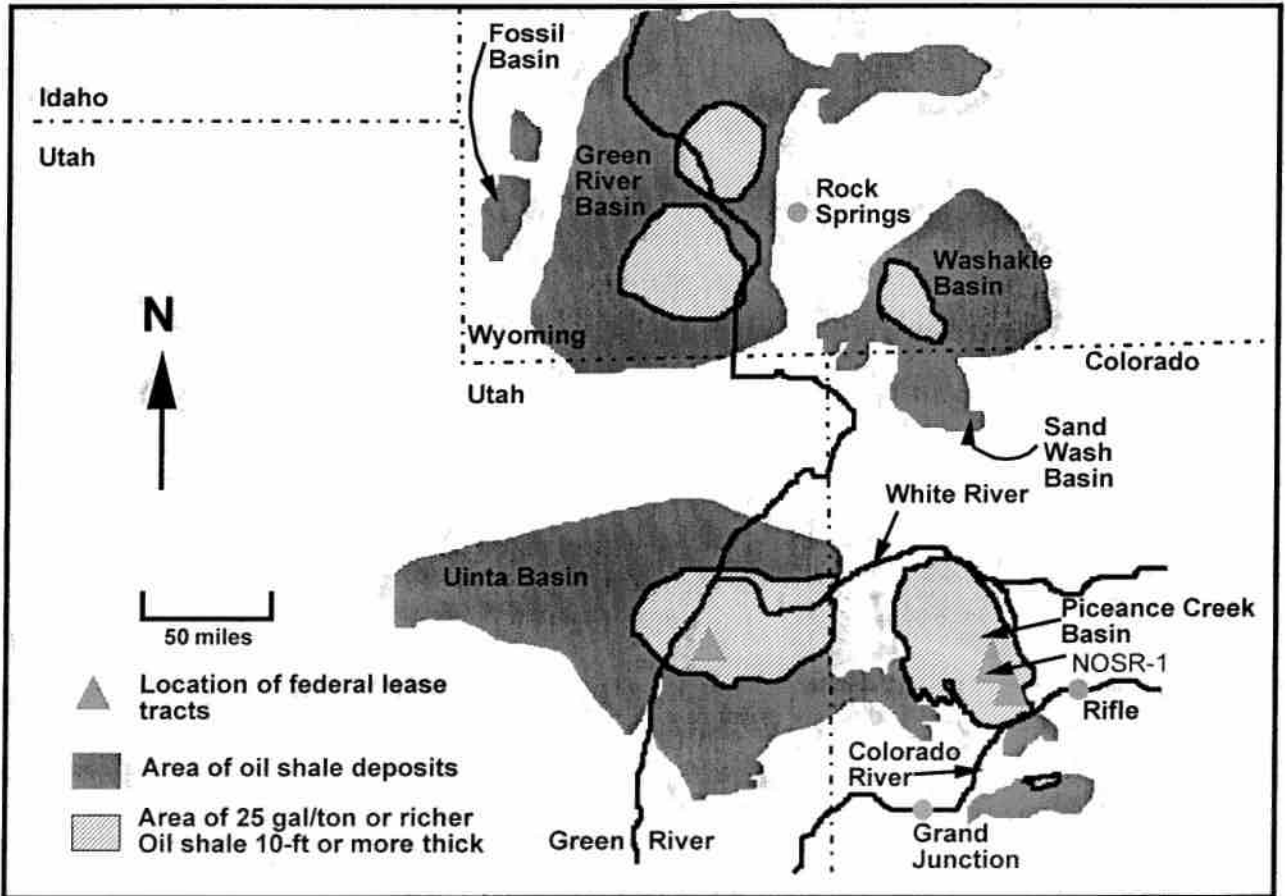


Club of Rifle 1973), and by 1917 the first oil shale retort in Colorado was built on Dry Fork, northwest of Debeque (Savage 1974). By 1929 Bureau of Mines had established the Anvil Points Experiment Station, and by 1947 Anvil Points village, a village of prefabricated houses, warehouses, offices, and laboratories was established. The large room and pillar mine and the mine tailings of the NOSR-3 Rulison mine, built into the Book Cliffs, can still be seen. During the 1970's the energy crisis created another boom and the industrial giants moved into the Piceance Basin (Gulliford 1983). By 1982 the boom had again busted and many of the large oil corporations stopped production (Gulliford 1983).

The most current extractive industry boom for the area is in natural gas development. The Mesa Verde Formation directly below the Wasatch and Green River Formations is rich with natural gas (D. Sokal pers. comm.). Gas wells are being drilled at a fairly rapid rate. Since 1984, Barrett Resources Corporation has completed 275 wells from Beaver Creek to Parachute (D. Sokal, pers. comm.). The D.O.E. has completed 267 wells on NOSR-3 and is part owner with Barrett of another 21 wells (D. Sokal pers. comm.). D.O.E. has indicated a potential 40 gas wells per section for the NOSR-1 lands. The economic feasibility of further development is probably directly correlated with the price of natural gas.



**Geology.** Some 50 million years ago, Lake Uinta, a large tropical lake, covered most of present day Garfield and Rio Blanco counties in Colorado and adjacent Utah (Roehler 1974; Kraushaar and Ristinen 1988). Over a period of many million years, 3,000 feet of organic and sedimentary material from the surrounding slopes were deposited on the bottom of the lake (Kraushaar and Ristinen 1988). An algal bloom responsible for enriching the shale beds with oil occurred during what appears to have been an extremely warm and humid period of the middle Eocene (Roehler 1974). The organic material was compressed into marlstone, which is the origin of shale oil (Kraushaar and Ristinen 1988). Through changes in the earth's crust, these deposits were thrust up to present day plateaus. Erosion by rivers cut them into the plateaus, leaving much of the Green River Formation oil shale exposed as dramatic cliff faces (Kraushaar and Ristinen 1988). This Eocene lake (Lake Uinta) is presently referred to as the Uinta and Piceance "Basins" (Roehler 1974; Figure 2). NOSR-1 is along the southeastern boundary of the Piceance Basin.



**Figure 2.** Distribution of the Green River Formation in the western United States and location of oil rich regions. Source: Hester 1974; Kraushaar and Ristinen 1988.

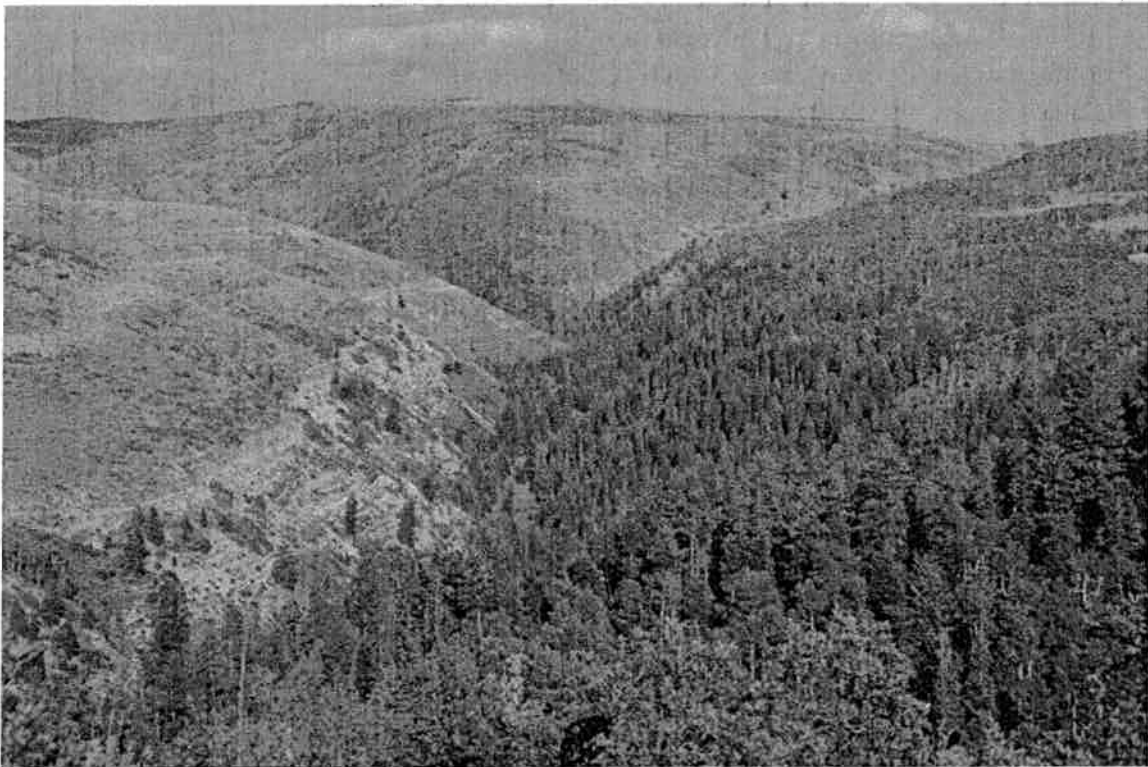
Two formations, the Uinta and Green River are present on the Roan Plateau (O'Sullivan et al. 1981; O'Sullivan 1986; O'Sullivan and Hail 1987). Both of these formations consist of semi-consolidated shales that contain significant amounts of oil shale (Harman and Murray 1985). The fluvial and deltaic environment of the younger Uinta Formation lies on top of the older lake environment of the Green River Formation (O'Sullivan 1986). The Uinta Formation is the dominant surface formation for much of NOSR-1, found primarily in the rolling hills. But directly under this formation and most easily seen in the canyons and along the cliffs is the Green River Formation. The Mahogany Zone of the Parachute Creek Member is the most economically important substrate within the Green River Formation, as it contains the richest concentration of sequestered oil (Laurence et al. 1974). Approximately 80 percent of the oil shale resources of the Eocene Green River Formation are in the Piceance Basin; this amounts to an estimated 1,200 billion barrels of oil-equivalent (Table 2; National Petroleum Council 1973; Kraushaar and Ristinen 1988), includes the thickest and richest deposits, and is one of the largest deposits of petroleum known anywhere in the world (Murray and Haun 1974). Of this total resource, approximately 600 billion barrels of oil are contained in oil shale that averages 25 or more gallons of oil per ton (Murray and Haun 1974). Figure 2 shows the oil shale region; NOSR-1 and 3 are in the region with the highest oil shale yield in the Green River Formation (Murray and Haun 1974; Kraushaar and Ristinen 1988).



**Table 2.** Shale oil deposits in the Green River Formation. From Kraushaar and Ristinen (1988).

	Billions of barrels of oil in place			
	Colorado	Utah	Wyoming	Total
Intervals 10-ft. or more thick averaging 25 gallons or more of oil per ton	480	90	30	600
Intervals 10-ft. or more thick averaging 10-25 gallons of oil per ton	800	230	400	1430
Total: intervals 10-ft or more thick averaging over 10 gallons of oil per ton	1280	320	430	2030

**Soils.** Shale dominated parent materials within NOSR-1 are easily weathered producing many types of loamy soils (Harman and Murray 1985). The Soil Conservation Service (Harman and Murray 1985) mapped nine distinct loam-soil complexes and two rock outcrop types for the NOSR-1 study site: 1) Cushman-Lazear stony loam; 2) Irigul Channery loam; 3) Irigul-Starman Channery loam; 4) Northwater loam; 5) Parachute loam; 6) Parachute-Rhone loam; 7) Rhone loam; 8) Silas loam; 9) Villa Grove-Zoltay loam; 10) Torriothents-Rock outcrop; and 11) Torriothents-Camborthids Rock outcrop.



**East Fork Parachute and First Anvil Creeks. Conifers on north-facing slopes, with aspen at higher elevations; sparsely vegetated slopes and sagebrush shrublands on south-facing slopes.** R. J. Rondeau

**Overview of Major Vegetation Types.** The Piceance Basin is part of the northeastern boundary of the ecoregion defined by Bailey (1994) as the Colorado Plateau province and is adjacent to the Southern Rocky Mountain province. Bailey (1994) considers the Roan Plateau as part of the Tavaputs Plateau Section of the Temperate Desert Regime Mountains.

NOSR-1 occupies a large and botanically diverse tract of land. The landscape is a mosaic of mesic and xeric montane vegetation dominated by aspen stands and shrublands, although grasslands, coniferous forests, riparian areas and wetlands are all represented on NOSR-1.

Keammerer and Peterson (1981) mapped nine major vegetation types on NOSR-1 (Aspen woodlands, Spruce-fir-Douglas fir forests, Pinyon-Juniper woodlands, Mixed

mountain shrublands, Mountain sagebrush, Mountain grasslands, Moist meadows, Indian ricegrass shale barrens, and Sparsely vegetated slopes) and we describe two other vegetation types: riparian (includes moist meadows) and hanging garden seeps. The following is a brief summary of the NOSR-1 vegetation types.



**Aspen woodlands** are widespread and one of the most common vegetation types on NOSR-1. They generally occur on north and northeast-facing slopes and cover approximately 25% of NOSR-1 (Keammerer and Peterson 1981). The dominant species is Aspen (*Populus tremuloides*). The shrub layer in the aspen woodlands is well developed and consists of a variety of species, although Snowberry (*Symphoricarpos rotundifolius*) is the most common. Over 40 species of forbs and perennial grasses comprise the herbaceous layer (Keammerer and Peterson 1981).

According to Mueggler (1985), many of the NOSR-1 Aspen stands may be considered climax. These stands appear stable and will not readily succeed into conifer stands. A few stands, normally adjacent to stream bottoms, appear to be seral, as mixed-age conifers co-mingle with the aspen.

Within the Aspen woodland type of NOSR-1, the most commonly found plant association is Aspen/ Snowberry (*Populus tremuloides*/*Symphoricarpos rotundifolius*). Also represented within NOSR-1, but less common are: Aspen/Rocky Mountain maple (*Populus tremuloides*/*Acer glabrum*) and Aspen/Bracken fern (*Populus tremuloides*/*Pteridium aquilinum*). (See Results section for a full description of these plant associations). Aspen woodlands throughout NOSR-1 have had over a century of domestic livestock grazing, prescribed burns, and fire suppression. It is not clear what effects these factors may have had on aspen woodlands.

**Spruce-fir and Douglas fir forests** cover approximately 8% of NOSR-1 (Keammerer and Peterson 1981). They are primarily limited to the steep north-facing slopes of drainages atop the plateau and below the cliffs along the east and northeast sections. These forests include a variety of conifers: Douglas fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea engelmannii*), Blue spruce (*Picea pungens*), and Sub-alpine fir (*Abies lasiocarpa*); any one of these may dominate a stand. The shrub layer in these forests include Snowberry (*Symphoricarpos rotundifolius*), Serviceberry (*Amelanchier alnifolia*), Thimbleberry (*Rubus parviflorum*), Honeysuckle (*Lonicera* sp.), Ninebark (*Physocarpus monogynus*), and Rocky Mountain maple (*Acer glabrum*). The major herbaceous species include Elk sedge (*Carex geyeri*), Northern bedstraw (*Galium septentrionale*) and Fendler meadowrue (*Thalictrum fendleri*) (Keammerer and Peterson 1981).



The forests along the steep north-facing slopes have numerous springs and seeps creating mesic microhabitats that are distinctly different from the

surrounding landscape. These mesic sites are often dominated by Sedges (*Carex* spp.) and Rushes (*Juncus* spp.) or Bluebells (*Mertensia ciliata*), Bittercress (*Cardamine cordifolia*), and Arrowleaf groundsel (*Senecio triangularis*).

**Pinyon-juniper woodlands** are poorly represented (1% cover of NOSR-1) and are limited to the northeast and southwest corners of NOSR-1, below the cliffs (Keammerer and Peterson 1981).



**Mixed mountain shrublands** are one of the most variable and widespread vegetation types in the Piceance Basin (Keammerer and Peterson 1981). These community types cover approximately 12% of NOSR-1 lands. Common shrubs include Gambel's oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), and Chokecherry (*Prunus virginiana*). The understory may have Elk sedge (*Carex geyeri*) or be sparsely vegetated. These shrublands are scattered throughout NOSR-1, with the largest patches in the eastern and

southwestern sections below the cliffs and the extreme western quarter on the plateau. They occur on steep slopes of variable aspect, but are usually found on slopes with north-east or west-facing aspects (Keammerer and Peterson 1981).

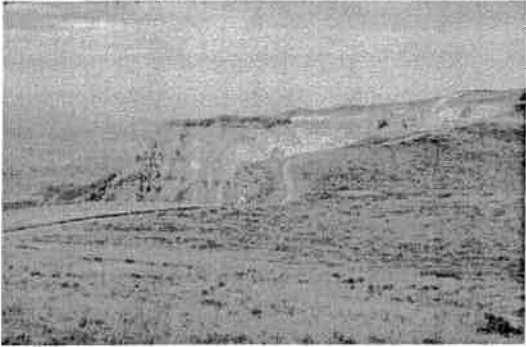
**Mountain sagebrush shrublands** cover approximately 52% of NOSR-1 lands (Keammerer and Peterson 1981). These community types include three distinct variations: Serviceberry/Sagebrush; Sagebrush/Snowberry; and Sagebrush/grassland.

Serviceberry/Sagebrush (*Amelanchier utahensis*/*Artemisia tridentata* ssp. *vaseyana*) is a mixed shrubland type scattered throughout the plateau region (Keammerer and Peterson 1981). Serviceberry, Mountain sagebrush, and Snowberry are the dominant species. This is a tall shrubland type in which large clumps of Serviceberry grow in a matrix of Sagebrush. The herbaceous layer includes the following species: Columbia needlegrass (*Stipa columbiana*), Letterman needlegrass (*Stipa lettermanii*), and Nuttall's violet (*Viola nuttallii*) (Keammerer and Peterson 1981). This type is very similar and usually interdigitates with the next.

Sagebrush/snowberry (*Artemisia tridentata* ssp. *vaseyana*/*Symphoricarpos rotundifolius*) shrubland is one of the most common plant communities on NOSR-1. It requires more moisture than the pure stands of sagebrush but less than the Utah serviceberry/Mountain sagebrush types (Keammerer and Peterson 1981) and is often adjacent to the more mesic Aspen stands. The herbaceous layer in this type is very similar to that found in the Utah serviceberry/Mountain sagebrush type.



Sagebrush/grassland (*Artemisia tridentata* ssp. *vaseyana*/grassland) is dominant in a narrow band just east of the rim on the eastern boundary of NOSR-1, and also occurs commonly along the slopes of the northern boundary, specifically in the Trapper Creek area.



The dominant, and often the only shrub, is Mountain sagebrush. The understory is a mixture of grasses and forbs, although the Beardless blue bunch wheatgrass (*Pseudoroegneria spicata* var. *inermis*) may dominate in some areas. This shrubland is probably very important to many game species such as Deer, Elk, and Sage grouse. A recent study by Wambolt (1996) found Mountain sagebrush to be the most palatable and important sagebrush for wintering herds of Deer and Elk.



**Mountain grasslands** have a limited distribution (1% cover) along the eastern rim of the Plateau and are scattered along ridges and hilltops throughout NOSR-1 (Keammerer and Peterson 1981). Several distinct grassland plant communities are represented. The hill and ridge top sites usually have tall bunch and rhizomatous grasses, e.g., Thurber fescue (*Festuca thurberi*), Letterman needlegrass (*Stipa lettermanii*) and Columbian brome (*Bromus columbiana*). The rim grasslands are characterized by the prominent Great Basin desert grasses: Beardless blue bunch wheatgrass (*Pseudoroegneria spicata* var. *inermis*) and Sandberg bluegrass (*Poa secunda*).

A grassland near Twin and Gardner Peaks is sandwiched between the Mountain shrubland communities below the cliff and the Mountain sagebrush/Snowberry communities on top of the plateau. It is an important hunting ground for the many birds of prey, e.g., Peregrine falcon, Northern harrier, Red tailed hawk, and others. Other grassland birds nesting here are the Horned lark and Meadow lark.

**Indian ricegrass shale barrens** occupy small narrow linear strips (1% cover) along the south-facing shale talus slopes of Trapper, Northwater, and Ben Good Creeks. This community type is characterized by a mixture of shrubs and herbaceous plants although the overall vegetation is relatively sparse (Keammerer and Peterson 1981). The major shrubs are Snowberry and Mountain sagebrush.

In addition, some rare plant species may be common in this community type. The oil-shale endemic Utah fescue (*Festuca dasyclada*) and the narrowly restricted Osterhout's penstemon (*Penstemon osterhoutii*) are found in this plant community (see photo on page 15).



**Sparsely vegetated slopes/shale barrens** are among the most limited community types (1% cover) and occur only on the steep south-facing shale barren slopes above the rim along the drainages. This type is sparsely vegetated and is composed primarily of oil shale endemic plants such as: Parachute penstemon (*Penstemon debilis*), Arapien stickleaf (*Mentzelia argillosa*), Utah fescue (*Festuca dasyclada*), Dragon milkvetch (*Astragalus lutosus*), and Fragrant mint (*Monardella odoratissima*). Most of NOSR-1 and Piceance Basin's rarest plants occur in this vegetation type.



**Riparian areas/wetlands** include moist meadow/graminoid wetlands, riparian shrublands, and riparian woodlands. These community types cover approximately 2% of NOSR-1 (Keammerer and Peterson 1981). Moist meadow/graminoid wetlands occupy small scattered patches primarily associated with the headwaters of the drainages. Mesic grasses and sedges, primarily Tufted hairgrass (*Deschampsia cespitosa*), Barley foxtail (*Hordeum brachytherum*), Beaked sedge (*Carex utriculata*), and Water sedge (*Carex aquatilis*) characterize this vegetation type. In general, the meadows are quite distinct and tend to be very productive and free of shrubs (Keammerer and Peterson 1981). This is an important habitat for wetland species and probably helps to maintain a healthy aquatic ecosystem further downstream.



Riparian shrublands occupy the bottomlands of the major drainages of NOSR-1 on



top of the Plateau. The primary shrub is Rocky Mountain willow (*Salix monticola*), although Drummond's willow (*Salix drummondiana*) occasionally forms dense stands. The NOSR-1 riparian shrublands reflect a century of livestock grazing, primarily exhibited in the high abundance of non-native understory grasses and forbs, e.g., Houndstongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), Kentucky bluegrass

(*Poa pratensis*), and Clover (*Trifolium repens*). Steeper and difficult to access sections of East Fork Parachute Creek exhibit the best condition observed of this shrubland type. These better quality sites exhibit a higher abundance of native species, e.g., Tufted hairgrass

(*Deschampsia cespitosa*), and Sedges (*Carex* spp.). Although non-native weedy species are still present, they are less common. This habitat is extremely important to the health of the Colorado River cutthroat trout populations of East Fork Parachute and Northwater Creeks. Trapper Creek probably harbored a mosaic of moist meadows and riparian shrublands prior to heavy beaver and livestock activity. The lack of this mosaic in Trapper Creek has had a negative impact on the the Colorado River cutthroat trout population.



Riparian woodlands are limited to the bottomlands of East Fork Parachute Creek just above and below East Fork Falls, and the canyon section of Northwater Creek. Above the falls, Blue spruce (*Picea pungens*) and Engelmann spruce (*P. engelmannii*) dominate the overstory with a mosaic of mesic shrubs, including Red-osier dogwood (*Cornus sericea*), Rocky Mountain willow (*Salix monticola*), and Drummond's willow (*S. drummondiana*). Below the falls, Boxelder (*Acer negundo*) and Narrow-leaf cottonwood (*Populus angustifolia*) are the dominant trees with Red-osier dogwood as the common shrubs.

**Hanging Garden seeps** occupy approximately 1% of NOSR-1 and are limited to the walls of waterfalls or cliffs with seeps. They occur primarily on the north-facing slopes along the headwaters of East Fork Parachute, Northwater, and East Middle Fork Parachute Creeks. The Green River Formation Shale, especially the Mahogany Zone, is extremely resistant to erosion and therefore forms the numerous cliffs found in NOSR-1. The combination of water and Green River Formation Shale cliffs creates the hanging garden habitat. The Hanging garden sullivania (*Sullivantia hapemanii*) is narrowly restricted to calcareous seeps, but commonly found in abundance at these hanging gardens. Due to its inaccessibility, this habitat is fairly secure as long as the natural hydrology remains intact.



## INVENTORY METHODS

The methods for assessing and prioritizing conservation needs over a large area are necessarily diverse. This study follows a general method that the Colorado Natural Heritage Program has used and continues to develop specifically for this purpose. The Natural Heritage Inventory was conducted in several steps summarized below.

### Information Collection Phase

CNHP databases were updated with information regarding the known locations of species and significant natural communities within NOSR-1. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado, Western State, Rocky Mountain Herbarium, and local private collections. The Colorado Division of Wildlife provided extensive data on the fishes of NOSR-1, as well as information regarding the status of the American peregrine falcon. Both general and specific literature sources were incorporated into CNHP databases as either locational information or as biological data pertaining to a species in general. Such information covers basic species and community biology including range, habitat, phenology (timing), food sources, and substrates. This information was entered into the Biological Conservation Database (BCD).

### Identify Rare or Imperiled Species and Significant Natural Communities with Potential to Occur on NOSR-1

The information collected in the previous step was used to refine the potential element list and to refine our search areas. In general, species and natural communities that have been recorded from NOSR-1, or from Garfield and adjacent counties, are included in this list (Table 3). Species or natural communities which prefer habitats that are not included in this study area were removed from the list. This primarily included those that prefer lower elevations, such as those found along the Colorado River.

### Potentially Occurring Elements

The list of elements includes those elements currently tracked by CNHP that were thought to potentially occur on NOSR-1, and were therefore targeted in CNHP field inventories can be found in Table 3. The Department of Energy supplied us with the following list of potential rare, threatened, and endangered species:

#### Plants:

- Arapien stickleaf (*Mentzelia argillosa*)
- DeBeque phacelia (*Phacelia submutica*)
- DeBeque milkvetch (*Astragalus debequaeus*)
- Parachute penstemon (*Penstemon debilis*)

Uinta Basin hookless cactus (*Sclerocactus glaucus*)  
Widleaf biscuitroot or desert parsley (*Lomatium latilobum*)

Fish:

Bonytail chub (*Gila elegans*)  
Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*)  
Colorado squawfish (*Ptychocheilus lucius*)  
Humpback chub (*Gila cypha*)  
Razorback sucker (*Xyrauchen texanus*)  
Roundtail chub (*Gila robusta*)

Birds:

Bald eagle (*Haliaeetus leucocephalus*)  
Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*)  
Loggerhead shrike (*Lanius ludovicianus*)  
Northern goshawk (*Accipiter gentilis*)  
American peregrine falcon (*Falco peregrinus*)  
Southwestern willow flycatcher (*Empidonax trailii extimus*)

Mammals:

Black-footed ferret (*Mustela nigripes*)

Several of the above species require habitat which is not found on NOSR-1. These include: Bonytail chub, Colorado squawfish, Humpback chub, Razorback sucker, and Roundtail chub.

The Black-footed ferret was once found atop the Roan Plateau, but has since been extirpated, along with the Grey wolf, Grizzly bear, and Bighorn sheep (Cringan 1973). The Black-footed ferret relies primarily on three species of prairie dogs for their prey, including the White-tailed prairie dog (Biggins and Godbey 1995). The White-tailed prairie dog once occurred on NOSR-1, although we know of no extant populations of either the prairie dog or Black-footed ferret on site.

Over 75 rare or imperiled species and significant natural communities were targeted in these surveys (Table 3). The amount of search effort given to the inventory for each of these elements is prioritized according to the element's rank or significant federal status, i.e., threatened or endangered. Although many of the elements listed in Table 3 have no legal status, we feel that they are a significant part of our natural resources and should be monitored when possible.

The Natural Heritage ranks given in Table 3 give quick insight into the imperilment of the species or natural community from both the global and state perspective. For example, the Utah fescue (*Festuca dasyclada* G3S3) is geographically restricted to talus slopes derived from Uinta Formation sandstone and Green River Formation shale. Its distribution includes three eastern counties in Utah (Welsh et al. 1987), and Rio Blanco, Garfield, and Mesa counties of western Colorado (Harner and Associates 1984). From within this range, we know of only 61 sites with approximately 7,000 plants (CNHP 1997). Although this plant has no legal status, we feel that this narrowly-distributed oil shale endemic is a significant

natural constituent of our resources. It is also important to note that we know of no protected sites for the Utah fescue.

### **Identifying Targeted Inventory Areas (TIA's)**

Survey sites were chosen based on the likelihood of their harboring rare or imperiled species or significant natural communities. Known locations were targeted so that the occurrences could be verified and updated. Additional potential areas were chosen using a variety of information sources. Many locations were not precisely known due to ambiguities in the original data, e.g., "headwaters of Parachute Creek." In such cases, survey sites for that element were chosen in likely areas in the general vicinity. Areas with potentially high natural values were chosen using infrared aerial photographs, geology maps, vegetation surveys, personal recommendations from knowledgeable local scientists, and numerous roadside surveys by our field scientists. Aerial photography is perhaps the most useful tool in this step of the process. High altitude infrared photographs at 1:24,000 scale (NHAP 85) were used for this project and are ideally suited for assessing vegetation types and, to some extent, natural conditions on the ground.

The above information was used to delineate over 50 survey areas that were believed to have relatively high probability of harboring natural heritage resources. These areas vary in size from less than 10 to several thousand acres and include all major habitat types in the study area.

In compliance with the D.O.E. contract we also surveyed for springs. Every NOSR-1 section was surveyed and our route demarcated. A section by section report is included in Appendix A.

### **Field Surveys**

Survey sites (TIAs) were visited at the appropriate time as dictated by the phenology of the targeted elements. It is essential that surveys take place during a time when the targeted elements are detectable. For instance, breeding birds cannot be surveyed outside of the breeding season and plants are often not identifiable without flowers or fruit, which are only present during certain times of the season.

The methods used in the surveys necessarily vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that would attempt to cover the area as thoroughly as possible in the given time. Some types of organisms require special techniques in order to capture and document their presence. These are summarized below:

Amphibians:	visual or with aquatic nets
Reptiles:	visual or with hook
Mammals:	small mammals only, Sherman live traps or gopher traps
Birds:	visual or by song/call, evidence of breeding sought
Fish:	aquatic nets
Insects:	aerial net
Plants:	visual

Natural communities: visual, collect qualitative or quantitative composition data

When necessary and permitted, voucher specimens were collected and deposited in local university museums and herbaria.

When a rare species or significant natural community was discovered, its precise location and known extent was recorded on 1:24,000 scale topographic maps. Other data recorded at each occurrence included numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the quality (size, vigor, etc.) of the population or community, the condition or naturalness of the habitat, the long-term viability of the population or community, and the defensibility (ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See Natural Heritage Methodology in the introduction for a more complete definition of element occurrence ranking.

### Delineating Preliminary Conservation Planning Boundary

A preliminary conservation planning boundary was delineated to estimate the minimum area needed to assure persistence of the element. Primarily, in order to ensure the preservation of an element, the ecological processes that support that occurrence must be protected. The preliminary conservation planning boundary is meant to include features on the surrounding landscape that provide these functions. Data collected in the field are essential to delineating such a boundary, but other sources of information such as aerial photography are also used. These boundaries are considered **preliminary** and additional information about the site or the element may call for alterations of the boundaries.

**Table 3.** Potential elements of NOSR-1 with natural heritage ranks, state, and federal status (see Table 4 for explanation of federal and state agency designation).

Scientific Name	Common name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
<b>Plants</b>						
<i>Astragalus debequaeus</i>	DeBeque milkvetch	G2	S2	(C2)		
<i>Astragalus lutosus</i>	Dragon milkvetch*	G4	S3S4	(3C)		BLM
<i>Astragalus wetherillii</i>	Wetherill milkvetch	G3	S3	(3C)		BLM
<i>Cryptantha mensana</i>	Carbon cryptanth	G3	S1	(3C)		
<i>Eriogonum ephedroides</i>	Ephedra buckwheat	G3	S1	(3C)		BLM
<i>Festuca dasyclada</i>	Utah fescue	G3	S3	(3C)		
<i>Gentianella tortuosa</i>	Utah gentian	G3	S1			BLM
<i>Gilia stenothyrsa</i>	Narrow-stem gilia	G3	S1			BLM
<i>Iliamna grandiflora</i>	Wild hollyhock	G3?	SU			
<i>Lesquerella congesta</i>	Dudley Bluffs	G1	S1	LT		

Scientific Name	Common name	Global Rank	State Rank	Fed. Status	State Status	Fed. Sens.
	bladderpod					
<i>Lesquerella parviflora</i>	Piceance bladderpod	G3	S3	(3C)		
<i>Mentzelia argillosa</i>	Arapien stickleaf	G2?	S2	(C2)		
<i>Parthenium ligulatum</i>	Ligulate feverfew	G3	S2	(3C)		BLM
<i>Penstemon debilis</i>	Parachute penstemon	G1	S1	C		
<i>Penstemon grahamii</i>	Graham beardtongue	G2	S2	C		
<i>Penstemon osterhoutii</i>	Osterhout's penstemon	G2G3	S2S3			
<i>Penstemon scariosus</i> var. <i>albifluvis</i>	White River penstemon	G4T2	S1	C		
<i>Phacelia incana</i>	Hoary phacelia	G3G4	S1			
<i>Phacelia scopulina</i> var. <i>submutica</i>	DeBeque Phacelia	G4T2	S2	C		FS
<i>Physaria obcordata</i>	Piceance twinpod	G2	S2	LT		
<i>Sclerocactus glaucus</i>	Uinta Basin hookless cactus	G3	S3	LT		
<i>Sullivantia hapemanii</i> var. <i>purpusii</i>	Hanging garden sullivantia	G3T3	S3			FS BLM
<i>Thalictrum heliophilum</i>	Sun-loving meadow rue	G3	S3	(3C)		
<b>Natural Communities</b>						
<i>Acer negundo</i> - <i>Populus angustifolia</i> / <i>Cornus sericea</i>	Narrowleaf cottonwood riparian forests	G3	S3			
<i>Amelanchier utahensis</i> / <i>Pseudoroegneria spicata</i>	Mixed mountain shrublands	G2G3	S2S3			
<i>Artemisia tridentata</i> <i>tridentata</i> / <i>Leymus cinereus</i>	Sagebrush bottomland Shrublands-West	G2G3	S1S2			
<i>Juniperus scopulorum</i> / <i>Cercocarpus montanus</i>	Foothills Pinyon-Juniper woodlands/scarp woodlands	G2	S2			
<i>Oryzopsis hymenoides</i> Shale Barren	Western slope grasslands	G2	S2			

<i>Populus angustifolia/Cornus sericea</i>	Cottonwood riparian forests	G3	S2?			
<i>Populus tremuloides/Acer glabrum</i>	Montane riparian forests	G1G2	S1S2			
<i>Pseudotsuga menziesii/Pachistima myrsinites</i>	Lower montane forests	G2G3	S2S3			
<b>Insects</b>						
<i>Callophrys affinis</i>	Green-winged hairstreak*	G4T?	S3S4			
<i>Euphilotes rita emmeli</i>	Desert buckwheat blue	G4T2	S1			
<i>Hesperopsis libya</i>	Mohave sooty-wing	G5	S2			
<i>Lycaena editha</i>	Edith's copper	G5	S2S3			
<i>Ochlodes yuma</i>	Yuma skipper	G5	S2S3?			
<i>Papilio bairdii</i>	Baird's swallowtail*	G4	S3S4			
<i>Pyrgus ruralis</i>	Two-banded skipper	G4	S3			
<i>Satrium fuliginosum</i>	Sooty gossamer wing	G4	S3			
<i>Speyeria cybele cybele</i>	Great spangled fritillary	G5T5	S1			
<i>Speyeria egleis</i>	Egleis fritillary	G5	S2			
<i>Speyeria hydaspe</i>	Hydaspe fritillary	G5	S2			
<i>Speyeria nokomis nokomis</i>	Great Basin silverspot butterfly	G4T2	S1	(C2)		
<b>Fish</b>						
<i>Oncorhynchus clarki pleuriticus</i>	Colorado River cutthroat trout	G5T2 T3	S2	(C2)	SC	FS
<b>Birds</b>						
<i>Haliaeetus leucocephalus</i>	Bald eagle	G4	S1B,S3N	LT	T	
<i>Cypseloides niger</i>	Black swift	G4	S2B			FS
<i>Bombycilla cedrorum</i>	Cedar waxwing	G5	S3B,S5N			
<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	G4T2	S2	(C2)		FS
<i>Coccothraustes vespertinus</i>	Evening grosbeak	G5	S2S3B,S5N			



<i>Dumetella Carolinensis</i>	Gray catbird*	G5	S3S4B,SZN			
<i>Vireo vicinior</i>	Gray vireo	G5	S2B			
<i>Piranga flava</i>	Hepatic tanager	G5	S1B			
<i>Lanius ludovicianus</i>	Loggerhead shrike	G4	S3B, SZN	C2		FS
<i>Asio otus</i>	Long-eared owl*	G5	S3S4B,SZN			
<i>Accipiter gentilis</i>	Northern goshawk*	G5	S3S4B,S4N	(C2)		FS
<i>Falco peregrinus</i>	Peregrine falcon	G3	S2B,SZN	LE	T	
<i>Falco mexicanus</i>	Prairie falcon*	G5	S3S4B,S4N			
<i>Progne subis</i>	Purple martin	G5	S3B			FS
<i>Amphispiza belli</i>	Sage sparrow	G5	S3B,SZN			
<i>Icterus parisorum</i>	Scott's oriole	G5	S2B			
<i>Accipiter striatus</i>	Sharp-shinned hawk*	G5	S3S4B,S4N			
<i>Empidonax trailii extimus</i>	Southwestern willow flycatcher	G5T2	SR	LE		FS
<i>Cathartes aura</i>	Turkey vulture	G5	S3B,SZN			
<i>Catharus fuscenscens</i>	Veery*	G3	S3S4B,ZN			
<b>Reptiles</b>						
<i>Coluber constrictor mormon</i>	Western yellowbelly racer	G5T5	S2S3			
<i>Gambelia wislizenii</i>	Longnose leopard lizard	G5	S2			
<b>Amphibians</b>						
<i>Bufo boreas</i> (Rocky Mt. population)	Boreal toad	G5T2 Q	S1	C	E	FS
<i>Rana pipiens</i>	Northern leopard frog*	G5	S3		SC	FS
<i>Scaphiopus intermontanus</i>	Great Basin spadefoot	G5	S2		SC	
<b>Mammals</b>						
<i>Bassariscus astutus</i>	Ringtail cat*	G5	S4			
<i>Eudormia maculatum</i>	Spotted bat	G4	S2	(C2)		FS
<i>Myotis californicus</i>	California myotis*	G5	S3S4			
<i>Myotis evotis</i>	Long eared myotis*	G5	S4			
<i>Myotis volans</i>	Long legged myotis*	G5	S5			
<i>Myotis yumanensis</i>	Yuma myotis	G5	S3	(C2)		
<i>Notiosorex crawfordi</i>	Desert shrew	G5	S3?			
<i>Plecotus townsendii pallescens</i>	Townsend's big-eared bat	G4T4	S3	(C2)		
<i>Sorex merriami</i>	Merriam's shrew	G5	S3			FS

\* Watchlisted

**Table 4.** Federal and State Agency Special Designations**Federal Status:**

U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993)

- |      |   |
|------|---|
| LE   | Endangered; taxa formally listed as endangered.   |
| LT   | Threatened; taxa formally listed as threatened.   |
| P    | Proposed E or T; taxa formally proposed for listing as endangered or threatened.  |
| C    | Candidate: taxa for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.   |
| (C1) | FORMERLY: Notice of Review, Category 1: taxa for which substantial biological information exists on file to support proposing to list as endangered or threatened.  |
| (C2) | FORMERLY: Notice of Review, Category 2: taxa for which current information indicates that proposing to list as endangered or threatened is possible, but appropriate or substantial biological information is not on file to support an immediate rulemaking. |
| (3C) | FORMERLY: Notice of Review, Category 3C: taxa that have proven to be more abundant or widespread than was previously believed, and/or those that are not subject to any identifiable threat.  |

**Federal Sensitive**

U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as "S")

- |     |  |
|-----|--|
| FS: | Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: |
| a.  | Significant current or predicted downward trends in population numbers or density.   |
| b.  | Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.                 |

Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as "S")

- |      |  |
|------|--|
| BLM: | Sensitive: those species found on public lands, designated by a State Director, that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C1 and C2 candidate species. |
|------|--|

**State Status:**

Colorado Division of Wildlife

- |    |                 |
|----|-----------------|
| E  | Endangered      |
| T  | Threatened      |
| SC | Special Concern |



## RESULTS

### Overview

Thirty-eight sections were surveyed during the 1995 surveys and all 66 sections were surveyed during the 1996 field season (see Appendix A for section by section reports). We found a variety of significant elements including plants, natural communities, insects, fish, birds, and mammals on NOSR-1. Of the 66 sections surveyed in 1996, we found significant elements in 45 sections (68%).

We found a total of 42 rare or imperiled elements on NOSR-1 property during surveys in 1995 and 1996 (Table 5). See the Colorado Natural Heritage Program section in the introduction of this report for a complete definition of global and state imperilment ranks. Among these 42 elements are nine species of plants, two insect species, one fish species, one mammal species, 12 species of bird, and 17 natural communities. When we compared number of elements known from areas of similar size in Colorado, we found that only three other regions in the state supported comparable numbers. Oddly, these three include one national park (Mesa Verde National Park), and two national monuments (Dinosaur and Colorado National Monuments). Admittedly, these preserves were established primarily for their archaeological or geological values, not for their biological values. However, the fact remains that the biological values of these preserves are high, perhaps due to habitat alteration in adjacent areas, or to inventory resources not available for other areas of similar size. More importantly, these three other areas all enjoy the protective status afforded National Parks and Monuments. NOSR-1 currently enjoys no protective status, yet is clearly of similar biological significance.

Ten major community types occur on NOSR-1 ranging from sparsely vegetated shale barrens to densely forested Aspen and conifer woodlands (see the vegetation section in the Study Area section of this report for a detailed description of these communities). Table 6 lists each element and its associated community. Some elements, for example most of the plants, occur in just one community, while others, such as the Long-eared owl, occur in many different communities. Each major community type hosts at least one rare or imperiled element but the distribution of elements per habitat type is uneven (Figure 3). For example, Aspen woodlands comprise approximately one quarter of the NOSR-1 landscape, yet only one tenth of NOSR-1 elements are within this type. Sagebrush communities cover nearly 50% of NOSR-1 and have approximately 20% of NOSR-1's rare elements. Whereas riparian areas, shale barrens, and grasslands cover only approximately 5% of the NOSR-1 landscape and contain numerous rare or imperiled elements (Figure 3). However, all NOSR-1 habitat types host conservation elements. There are two points which can be emphasized from Figure 3: 1) every habitat type supports at least one rare element, and 2) the spatially restricted habitat types support the highest number of rare elements.

**Table 5.** Rare, threatened, and endangered elements of NOSR-1 with Natural Heritage Program ranks (see Table 1, page 7, for explanations) and federal status. An asterisk before the common name indicates a watchlisted species.

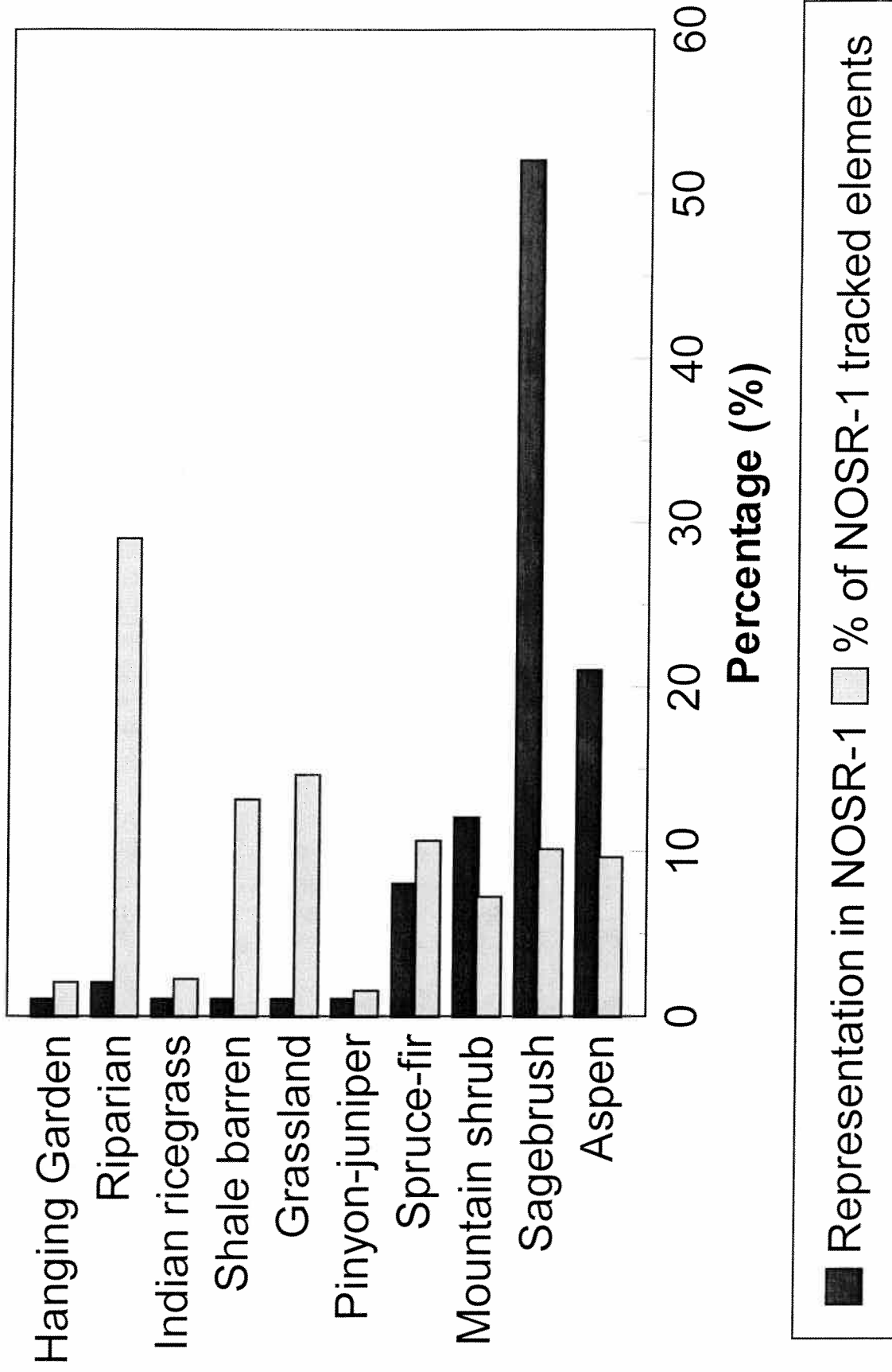
Common Name	Scientific Name	Heritage	Fed
<b>Plants</b>			
*Dragon milkvetch	<i>Astragalus lutosus</i>	G4/S3S4	(3C)
Utah fescue	<i>Festuca dasyclada</i>	G3/S3	(3C)
Wild hollyhock	<i>Iliamna grandiflora</i>	G3?Q/SU	
Arapien stickleaf	<i>Mentzelia argillosa</i>	G2?/S2	(C2)
Fragrant horsemint	<i>Monardella odoratissima</i>	G4G5/S2	
Parachute penstemon	<i>Penstemon debilis</i>	G1/S1	C
*Osterhout's penstemon	<i>Penstemon osterhoutii</i>	G3G4/S3S4	
Hanging garden sullivania	<i>Sullivania hapemanii purpusii</i>	G3T3/S3	FS
Sun-loving meadowrue	<i>Thalictrum heliophilum</i>	G3/S3	(3C)
<b>Natural Communities</b>			
Boxelder riparian forest	<i>Acer negundo-Populus angustifolia/Cornus sericea</i>	G2/S2	
Western slope sagebrush shrubland	<i>Artemisia tridentata vaseyana/Festuca thurberi</i>	GU/S1S2	
Sagebrush bottomland shrubland	<i>Artemisia tridentata vaseyana/Leymus cinereus</i>	G4/S2	
Montane wet meadow	<i>Carex utriculata</i> wetland	G5/S3	
Tufted hairgrass wetland	<i>Deschampsia caespitosa-Carex spp.</i>	G4/SU	
Montane grassland	<i>Festuca thurberi-Lathyrus leucanthus</i>	G4/S4	
Western slope grassland	<i>Oryzopsis hymenoides shale barren</i>	G2/S2	
Montane riparian forest	<i>Picea pungens/Cornus sericea</i>	G2/S2	
Spruce-fir/ Drummond's willow	<i>Abies lasiocarpa-Picea engelmannii/Salix drummondiana</i>	G3/S3	
Cottonwood riparian forest	<i>Populus angustifolia/Cornus sericea</i>	G3/S3	
Montane aspen forest	<i>Populus tremuloides/Acer glabrum</i>	G1G2/S1S2	
*Aspen wetland forest	<i>Populus tremuloides/Pteridium aquilinum</i>	G4/S3S4	
Great Basin grassland	<i>Pseudoroegneria spicata inermis</i>	G2?/S2?	
Great Basin montane grassland	<i>Pseudoroegneria spicata inermis-Poa secunda</i>	G4/S1	
Lower montane forest	<i>Pseudotsuga menziesii/Carex geyeri</i>	G5Q/S3	
Drummond's willow/mesic forb	<i>Salix drummondiana/mesic forb</i>	G3/S3	
Rocky Mountain willow/mesic forb	<i>Salix monticola/mesic forb</i>	G3/SU	
<b>Invertebrates</b>			
*Green-winged hairstreak	<i>Callophrys affinis</i>	G4T?/S3S4	
*Baird's swallowtail	<i>Papilio bairdii</i>	G4/S3S4	
<b>Vertebrates</b>			
Colorado River cutthroat trout	<i>Oncorhynchus clarki pleuriticus</i>	G5T2T3/S2	(C2)
Boreal owl	<i>Aegolius funereus</i>	G5/S2	FS
Columbian sharp-tailed grouse	<i>Tympanuchus phasianellus columbianus</i>	G5T3/S2	(C2)
*Cooper's hawk	<i>Accipiter cooperii</i>	G4/S3S4B,S4N	
*Golden eagle	<i>Aquila chrysaetos</i>	G5/S3S4B,S4N	
*Long-eared owl	<i>Asio otus</i>	G5/S3S4B,SZN	
*Northern harrier	<i>Circus cyaneus</i>	G5/S3S4B,S4N	
*Olive-sided flycatcher	<i>Contopus borealis</i>	G5/S3S4B,S4N	(C2)
American peregrine falcon	<i>Falco peregrinus anatum</i>	G4T4/S2B,SZN	LE
Purple martin	<i>Progne subis</i>	G5/S3B	FS
*Sharp-shinned hawk	<i>Accipiter striatus</i>	G5/S3S4B,S4N	

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Common Name	Scientific Name	Heritage	Fed
*Three-toed woodpecker	<i>Picoides tridactylus</i>	G5/S3S4	FS
*Veery	<i>Catharus fuscenscens</i>	G3/S3S4B,SZN	
Preble's shrew	<i>Sorex c.f. preblei</i>	G5/S1?	

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**Figure 3.** Percent cover of vegetation types (communities) on NOSR-1 (Keammerer and Peterson 1981) and associated elements per type. Elements occurring in more than one community were weighted by a proportional fraction, e.g., an element which occurs in 3 communities was valued at .33 for each community type.



## Plants

Surveys in 1995 and 1996 yielded new locations for nine species of rare or imperiled plants tracked by the Colorado Natural Heritage Program. Of these, five are oil shale endemics: Dragon milkvetch (*Astragalus lutosus*), Utah fescue (*Festuca dasyclada*), Arapien stickleaf (*Mentzelia argillosa*), Parachute penstemon (*Penstemon debilis*), and Sun-loving meadowrue (*Thalictrum heliophilum*). These five species are restricted to the Piceance and Uinta Basins of Colorado and Utah. Further, the Parachute penstemon is found in only one other location in the world. Worldwide, Parachute penstemon is found on a total of approximately 45 acres of land (Spackman et al. 1997). Nearly 50 % of NOSR-1 legal sections (30/66) contain at least one location of a rare plant species.

Refer to the following section on plants of NOSR-1 for information on each of the 9 species of plants and refer to Figure 5 and Appendix A for exact locations. Use these point locations with caution however, since plants may vary their exact location from year to year.

## Birds

Our surveys in 1995 and 1996 discovered new locations for 10 species of rare or imperiled birds, and updated locations for two additional species. Of the 12 species of CNHP tracked birds, one, the American peregrine falcon (*Falco peregrinus anatum*), is federally listed as endangered. The Boreal owl (*Aegolius funereus*), the Olive-sided flycatcher (*Contopus borealis*), the Purple martin (*Progne subis*), and the Three-toed woodpecker (*Picoides tridactylus*) are all listed as sensitive species by the U.S. Forest Service. The discovery of the Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) on NOSR-1 has helped to close some of the gaps in its known distribution in Colorado. We were unable to survey the area during the typical breeding season for the Columbian sharp-tailed grouse (March-April), so we have not yet obtained data to suggest that NOSR-1 supports a lek site for this species. The Colorado Division of Wildlife has made plans to survey the area in the spring of 1997 to determine if any lek sites are present (K. Giesen and R. Hoffman pers. comm.).

Refer to the section on animals of NOSR-1 for information on each of the 12 species of birds, and refer to Figure 6 and Appendix A for exact locations. Use these point locations with caution however, since birds are very mobile organisms. The likelihood of relocating a particular bird in a precise location is slight at best. That is, since these birds are mobile, any efforts to conserve these species should work to conserve the extent of the habitat used by the species, rather than simply a point-location.

## Fish

The Colorado River cutthroat trout has been known from creeks on NOSR-1 since at least 1973. Our surveys in 1995 and 1996 have updated the occurrences of this subspecies in East Fork Parachute, Trapper, and Northwater Creeks. Northwater and Trapper Creeks

support populations of only cutthroat trout, while East Fork Parachute Creek is used by both cutthroat and Brook trout. We conducted seine-net surveys to obtain ratios of Brook to cutthroat trout in East Fork Parachute Creek. We found a skewed ratio of Brook to Colorado River cutthroat trout. The Colorado Division of Wildlife conducted electroshock surveys in 1983 and found a ratio of 30:1 Brook to Colorado River cutthroat trout.

The Colorado River cutthroat trout has been adversely impacted throughout its historical range by the introduction of non-native fishes and by habitat alteration. The populations on NOSR-1 are important strongholds for the species in Colorado. In particular, East Fork Parachute, Trapper, and Northwater Creeks could provide potential conservation sites for the Colorado River cutthroat trout, since the 200 foot waterfall on East Fork Parachute Creek, and that on East Middle Fork Parachute Creek could serve as natural barriers to upstream migration of introduced non-native fishes. Refer to the section on Animals of NOSR-1 for more information about the Colorado River cutthroat trout, and to Appendix A for exact locations of occurrences.

### **Mammals**

The Preble's shrew was the only unusual and unexpected mammal found on NOSR-1. It was found in only one legal section (Appendix A). That occurrence was in the oakbrush on the slopes of the box-canyon below the falls on East Fork Parachute Creek. It is known from only two other locations in Colorado, and prior to its discovery on NOSR-1, has not been found in Colorado since 1966. Refer to the section on the Animals of NOSR-1 for more information about the Preble's shrew.

### **Insects**

We found new locations for two rare, threatened, or endangered species of butterfly on NOSR-1, including locations for Baird's swallowtail and the Green-winged hairstreak. Both of these species were known from Garfield County prior to our surveys, and the type locality (location from where the species was first described) for the Baird's swallowtail is near Glenwood Springs, Colorado, approximately 35 miles east of NOSR-1. Refer to Figure 7 and Appendix A for exact locations of butterfly occurrences, and to the section on the Animals of NOSR-1 for information on the natural history of each species.

## RECOMMENDED CONSERVATION SITES

The Natural Heritage Programs develop site boundaries and profiles, or proposed conservation sites. In order to protect nearly 100% of NOSR-1 elements we have developed six proposed conservation sites.

We found that most of NOSR-1 species and communities were concentrated either along the southeast rim of the Book Cliffs or in the major drainages of the property (Trapper, Northwater, and East Fork Parachute Creeks). We designated the rim area and these three creeks as conservation sites and refer to them as Anvil Points Rim, Trapper Creek, Northwater Creek, and East Fork Parachute Creek, respectively (Figure 4). Two of these sites were given a Natural Heritage Biodiversity rank of B2 (Very Significant), and two were ranked as B3 (Significant). We delimited two additional sites on NOSR-1 property due to the occurrence of rare plants, birds, and communities; these are referred to as the Northeast Book Cliffs and the Ben Good Creek sites (Figure 4). Each of these two sites were ranked B3 (Significant) for biodiversity. See the following section for a complete definition of biodiversity ranks.

### NOSR-1 Sites with Natural Heritage Significance

The Colorado Natural Heritage Program (CNHP) identified 6 conservation sites on NOSR-1. These sites are described in this section. The importance of conservation sites is determined using Natural Heritage methodology. This methodology is implemented on three different levels. Taken together, these three levels allow a comprehensive, scientific approach to prioritizing conservation efforts.

On the first level, **elements** of natural diversity (rare or imperiled plants, animals, and significant natural communities) are ranked<sup>1</sup> according to their rarity and/or degree of imperilment. The relative rarity of the various elements is based upon the scientific information known about the element and the number of populations currently known. As new information is acquired, element ranks can be modified.

The second level of the Heritage Methodology is the ranking of populations or **occurrences** of a particular element. It is frequently impossible to protect all populations of a particular plant, animal, or natural community. Therefore, CNHP evaluates the relative quality of all known occurrences of an element so that conservation efforts can be focused on the largest, most viable populations.

On the third level CNHP delineates potential **conservation sites** that contain element occurrences. These sites are then ranked according to their significance, enabling planners to determine which sites deserve the most attention. The rank is called the biodiversity significance rank (B-rank). The highest ranking sites (B1 sites) contain the rarest elements and/or the highest quality occurrences. The lowest ranking sites (B5 sites) typically contain an element that is rare in Colorado but common elsewhere, or a low quality occurrence of an element. "Macro" sites and "Mega" sites are sites that include several standard sites that are

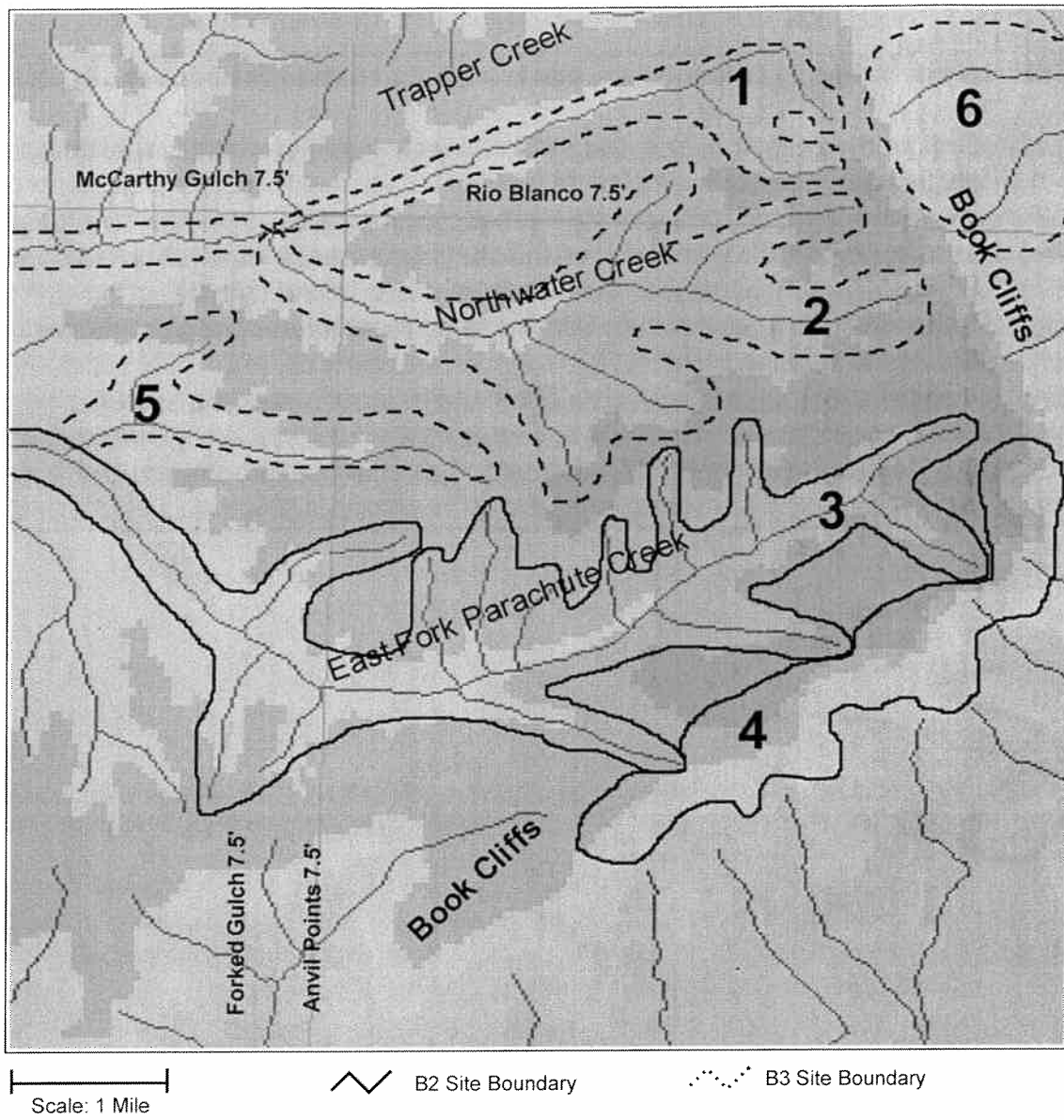
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<sup>1</sup> See the section on Natural Heritage Methodology for a detailed explanation of the Heritage Program ranking system.

connected by landscape position or ecological processes. Locations of all NOSR-1 sites are shown in Figure 4. NOSR-1 is considered part of the CNHP's Parachute Creek Megasite.

**Biodiversity ranks (applies to the site where an element(s) occurs).**

- B1** Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.
- B2** Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.
- B3** High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.
- B4** Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.
- B5** General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.



**Figure 4.** Map of conservation sites within NOSR-1, by site name and biodiversity rank (see text for rank explanation)

- 1. Trapper Creek (B3)
- 2. Northwater Creek (B3)
- 3. East Fork Parachute Creek (B2)
- 4. Anvil Points Rim (B2)
- 5. Ben Good Creek (B3)
- 6. Northeast Book Cliffs (B3)



The elements contained in some of the conservation sites described below are globally rare (e.g., Utah fescue--*Festuca dasyclada*) and their conservation is of global importance. In other words, **the protection of these species and natural communities on NOSR-1 will have major consequences across their ranges.** Other sites are significant for their contribution to Colorado's natural heritage. Some sites are relative "hotspots," containing many elements within a relatively large and intact habitat complex. The East Fork Parachute Creek site, for example, supports the globally rare Utah fescue, several other rare plants, a rare fish, and several significant plant communities.

**CNHP in no way suggests that other areas of NOSR-1 not included in conservation sites are not important for conserving the areas' natural values.** The sites presented here represent the highest land protection priorities for NOSR-1 based on known element occurrences. Ideally, these sites could serve as core natural areas that are surrounded by adequate buffer zones and connected to other core sites with well designed corridors. It will be necessary to adequately plan and protect lands beyond those recommended here if these highly significant sites are to retain their full natural value. Furthermore, other sites may be worthy of conservation actions based on other values such as game species, aesthetics, or recreation.

The six sites of NOSR-1 are presented below in order of natural heritage significance (B-rank). The first two sites, Anvil Points Rim and East Fork Parachute Creek, are B-2. These are the most important conservation sites on NOSR-1. Loss of these sites could imperil an entire species or plant community. Where possible, conservation resources should be directed to them before all others. The next four sites, Northwater, Trapper Creek, Northeast Book Cliffs, and Ben Good Creek are B-3 sites. These sites are generally only slightly less important than the B2 sites. They are also a high conservation priority. The following table summarizes NOSR-1 proposed conservation sites.

Name	B-Rank	*P-Rank	*M-Rank	Summary of significant elements
Anvil Points Rim	B2	P2	M3	Shale barren community supports oil shale endemic plants; grasslands support butterfly and potential grouse lek site; cliffs support nesting falcons and eagles
East Fork Parachute Creek	B2	P2	M2	Creek supports native trout population; hanging gardens support Sullivantia; shale barren slopes support oil shale endemic plants; forested areas support nesting raptors
Northwater Creek	B3	P2	M3	Creek supports a dense Colorado River cutthroat trout population, excellent occurrence of Hanging garden sullivantia and riparian plant communities
Trapper Creek	B3	P2	M2	A degraded but recoverable stream which supports a small population of trout; slopes support oil shale endemic grass
Northeast Book Cliffs	B3	P2	M5	Old growth Douglas fir community supports the a population of Three-toed woodpecker; also an important refugia for large game animals
Ben Good Creek	B3	P2	M4	Sparsely vegetated shale slopes support oil shale endemic grass

\* See site profile explanation below for definition of P (protection) and M (management) ranks.

## Site Profile Explanation

The following explains the fields contained in the site profiles.

**SITE NAME:** Centered at the top of the site profile, the site is generally named by CNHP after a prominent landscape feature.

**SIZE:** The approximate acreage included within the preliminary conservation planning boundary for the site.

**BIODIVERSITY RANK (B-rank):** The overall significance of the site in terms of rarity of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. As explained above, these ranks range from B1 (Outstanding Significance) to B5 (General Interest). In general the B-ranks should be used to prioritize protection efforts. The element which drives the biodiversity rank is noted but multiple elements often occur in a single site.

**PROTECTION URGENCY RANK (P-rank):** An estimate of the time frame in which conservation protection must occur. This rank generally refers to the need for a major change of protective status (e.g., ownership or designation as a natural area). The ranks range from P1 (immediate urgency; actions taken within the next year could result in loss of the element(s)) to P5 (no known urgency). For a better understanding of protection urgency, refer to the section on protection considerations toward the end of the site profile. See the protection considerations section for additional comments.

**MANAGEMENT URGENCY RANK (M-rank):** The time frame in which a change in management of the element or site must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g., increased fire frequency, decreased herbivory, weed control, etc.). The ranks range from M1 (immediate urgency, within one year) to M5 (no known urgency). For a better understanding of management urgency, refer to the section on management considerations toward the end of the site profile. See the management considerations section for additional comments.

**LOCATION:** General location, followed by the USGS 7.5' quadrangles and the township, range, and section that include the Conservation Site.

**GENERAL DESCRIPTION:** A brief narrative picture of the topography, vegetation, and current use of the conservation site. Scientific names are given for plants the first time the plant is mentioned and only common names used thereafter.

**NATURAL HERITAGE RESOURCE SIGNIFICANCE:** A synopsis of the rare species and significant natural communities that occur on the conservation site. See the section on Natural Heritage Methodology for a description of element and element occurrence ranks.

**CURRENT STATUS:** A summary of the ownership, degree of protection currently afforded the conservation site, and threats to the site or natural heritage resources as determined to date.

**BOUNDARY JUSTIFICATION:** The preliminary conservation planning boundaries delineated in this report are intended to protect the occurrences of the elements of concern and the ecological processes affecting these elements. The justification provides a brief summary of the ecological processes we feel are the most important.

**PROTECTION CONSIDERATIONS:** A summary of major land ownership issues that may affect the site and the elements on the site.

**MANAGEMENT CONSIDERATIONS:** A summary of site management issues that may affect the long-term viability of the site.

### **Relating this Report to Managing Biodiversity at the Landscape Level**

The management of biological diversity must consider not only species specific management criteria but also human use in the area. The conservation sites identified in this type of study may be considered as core areas for the protection of the full range of biological diversity. Some of these areas may be appropriate for special area designations, others as sites within a landscape that should be managed to maintain the site's integrity.

A basic premise in the landscape management approach starts with the delineation of core protected areas that can be represented by special designations. Where possible, these should be linked together and appropriately buffered. Buffer areas should include the ecological processes supporting the diversity of the core area. Such is the basis of the development of preliminary conservation planning boundaries.



## Anvil Points Rim Recommended Conservation Site



View of Anvil Points

M.B. Wunder

**Size:** 2100 acres (850 ha)

**Biodiversity Rank:** B2

The Anvil Points Rim site is an unusual grassland habitat which supports 14 elements of concern. Among these are excellent examples of the federally endangered American peregrine falcon, the state-rare Columbian sharp-tailed grouse, and two watchlisted butterfly species. In addition to the above are several oil shale endemic plants. Most notable is the Parachute penstemon, known from only 2 sites (approximately 45 total acres) in the world.

**Protection Urgency Rank:** P2

This site is owned by the United States Department of Energy, but they are currently reexamining the value of keeping the Naval Oil Shale Reserves. There appears to be a very high probability that ownership of the Reserves will change to either private or Department of Interior ownership, potentially Bureau of Land Management. No special protection measures are currently afforded the site. Land exchange of one type or another may occur within the next two years, and therefore, protection urgency is high (especially if sold to a non-conservation oriented entity).

**Management Urgency Rank:** M3

In order to address the known and potential threats of this area we recommend development of a resource management plan within the next several years. At this point the primary threat appears to be off road vehicular use from ranchers and recreationists (including hunters, hang gliders and occasional sightseers). Due to the flat nature of the grassland, the area is extremely vulnerable to new roads. These roads not only fragment this relatively small site, but also allow noxious weeds and introduced species to move in, further endangering this unique system. This type of fragmentation has been termed "divisive fragmentation" by Harris and Gilberto (1992) and will have a negative effect on parts of the native flora and fauna. The management plan should also address livestock grazing, although the present low use of the area is adequate and complimentary to this ecosystem. In order to ensure low livestock use, we recommend that **no** water enhancement or improvement projects take place in the Anvil Points Rim proposed conservation site.

**Location:** Garfield County: Five miles northwest of Rifle. **USGS Quadrangle:** Anvil Points. **Legal Description:** T5S R94W sections 25, 35, and 36; T6S R94W sections 5, 6, and 7; T6S R95W section 12. **Elevation:** 8600' - 9300' (2580 - 2790 m).

**General Description:** The Anvil Points Rim site is characterized by rolling grasslands positioned between two very different and distinct landscapes. To the east are the Book Cliffs which form 200-400 foot sheer cliffs, home to nesting American peregrine falcons and Golden eagles. To the west, a more gentle landscape of rolling hills is dominated by Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Snowberry (*Symphoricarpos rotundifolius*), and Aspen forests (*Populus tremuloides*). Along parts of this site and just above the Book Cliffs are shale barren slopes, a narrow interface between the grasslands and the cliffs. These slopes provide habitat for the Parachute penstemon (*Penstemon debilis*), Arapien stickleaf (*Mentzelia argillosa*), Dragon milkvetch (*Astragalus lutosus*), and Utah fescue (*Festuca dasyclada*) ---all narrowly restricted oil-shale endemic plants.

**Historical Land Use:** Potentially more than 5000 years of use by prehistoric Indians occurred on this land prior to European settlers (Gulliford 1994; Tickner et al. 1996). In 1996 archeologist Tickner and others (1996) surveyed NOSR-1 and found much evidence supporting prominent summer use of the area by Utes and prehistoric Indians, primarily in the headwaters of the major streams and near the numerous springs. Tickner et al. (1996) estimated approximately 1.56 sites per square mile for the NOSR-1 property. At least one area on the plateau shows bison bones that are believed to be the remnants of an Indian kill. European settlement came to the area shortly after the 1876 Hayden survey. These first settlers noted that the Ute Indians maintained a wild herd of mustangs on the Plateau. By the 1890's the JQS cattle trail was built up the Book Cliffs, opening the area to livestock grazing. Nearly a century of livestock grazing has been present on the plateau. Management of the area for livestock grazing started out as a free for all, but a rapid decline in the range may have been a major factor in the Book Cliffs Grazing War in the 1890's. This brought about the Rees-Oldland grazing reform act. Ever since, grazing management has taken place.

In 1971 the BLM devised a plan to increase recreational use of the area (Schrack 1973). Several campgrounds and picnic areas were built, including the Anvil Points overlook

site. None of these campgrounds or picnic grounds are visible today, although BLM has continued to encourage recreation, and a mountain bike trail map was produced in 1994. The area remains a popular area for hunting. See the introduction and history sections in the Study Area section of this report for more historical details.

**Natural Heritage Resource Significance:** The Anvil Points Rim site supports 14 elements tracked by the Heritage Program (see table below). The Parachute penstemon (G1S1) has been found in only one other location in the world--approximately twelve miles southwest of Anvil Points Rim on Mt. Callahan (Spackman et al. 1997). Although this site supports only a small population of this species it is very important to protect this site, especially since it is disjunct from the other populations. On the same shale barren slope where the Parachute penstemon grows, three other oil shale endemic plants are also found: Arapien stickleaf (G3S2), Utah fescue (G3S3) and the Dragon milkvetch (G4S3S4).

This site is also very important to several rare or imperiled animals, including the federally endangered American peregrine falcon, which has nested at this site for a number of years. Golden eagles nest along the cliff walls of Anvil Points Rim.

The montane grasslands (*Pseudoroegneria spicata* ssp. *inermis*) of this site have been found in only a few places. Baker (1983) believes high quality occurrences of this plant association are very hard to find, primarily due to heavy grazing pressures. The Anvil Points site has a good example (B-ranked) of this type.

This mosaic of grassland and adjacent open sagebrush habitat provides important hunting grounds for the Long-eared owl and the Northern harrier as well as the eagle and falcon. The grassy knoll of Gardner Peak within this site provides lekking grounds for the Baird's swallowtail and the Green-winged hairstreak, and may also prove to be an important lek site for the state-rare Columbian sharp-tailed grouse. See individual abstracts at the end of the Results section for a description and distribution of all the NOSR-1 tracked elements.

Element	Common Name	O Rank*	CNHP Rank	Fed
<b>Plants</b>				
<i>Penstemon debilis</i>	Parachute penstemon	C	G1/S1	C
<i>Mentzelia argillosa</i>	Arapien stickleaf	B	G3/S2	
<i>Festuca dasyclada</i>	Utah fescue		G3/S3	
<i>Astragalus lutosus</i>	Dragon milkvetch	B	G4/S3S4	
<i>Monardella odoratissima</i>	Fragrant horsemint	A	G5/S2	
<b>Communities</b>				
<i>Populus tremuloides/Acer glabrum</i>	Montane aspen forest	B	G2/S1S2	
<i>Pseudoroegneria spicata inermis</i>	Great Basin grassland I	B	G2?/S2?	
<i>Pseudoroegneria spicata inermis</i> - <i>Poa secunda</i>	Great Basin grassland II	B	G4/S1	
<i>Artemisia tridentata</i> <i>vaseyana/Leymus cinereus</i>	Sagebrush bottomland shrubland	B	G4/S1S2	
<b>Birds</b>				

<i>Falco peregrinus anatum</i>	American peregrine falcon	A	G4T4/S2B,SZN	LE
<i>Tympanuchus phasianellus columbianus</i>	Columbian sharp-tailed grouse	A	G5T3/S2	(C2)
<i>Circus cyaneus</i>	Northern harrier	C	G5/S3S4B,S4N	
<i>Aquila chrysaetos</i>	Golden eagle	A	G5/S3S4B,S4N	
<i>Asio otus</i>	Long-eared owl	C	G5/S3S4B,SZN	
<b>Insects</b>				
<i>Collophrys affinis</i>	Green-winged hairstreak	A	G4T7/S3S4	
<i>Papilio bairdii</i>	Baird's swallowtail	A	G4/S3S4	

\*O Rank is "Occurrence Rank"

**Current Status:** The property this site occurs on is owned by the U.S. Department of Energy (D.O.E.). There is no formal designated protective status for this proposed conservation site. D.O.E is currently examining status options. They are most likely going to transfer the property to another federal agency or sell to private interests. The relinquishing of the property is expected by 1998.

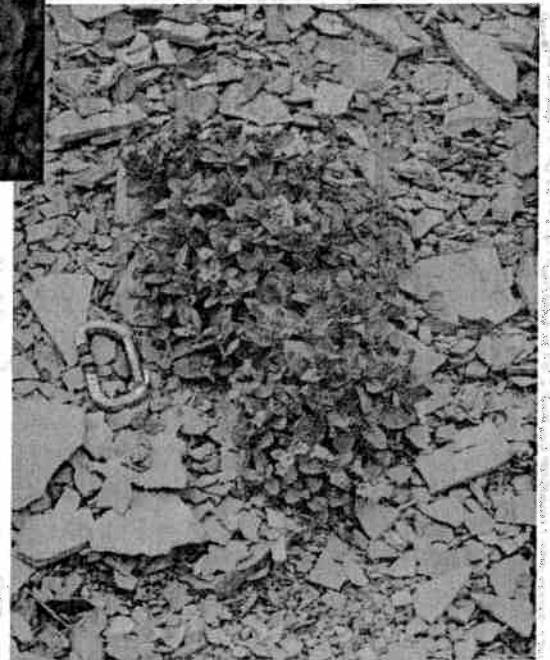
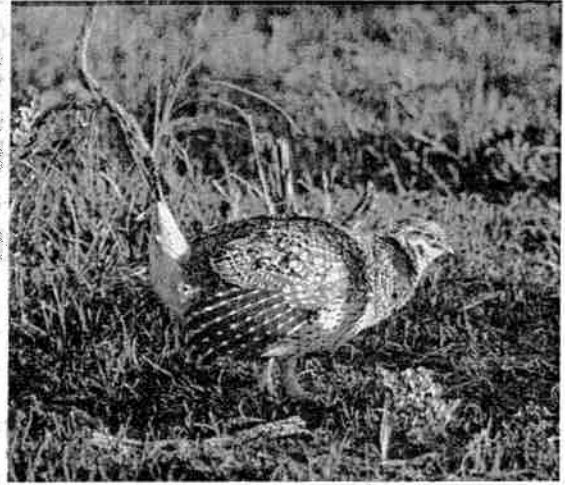
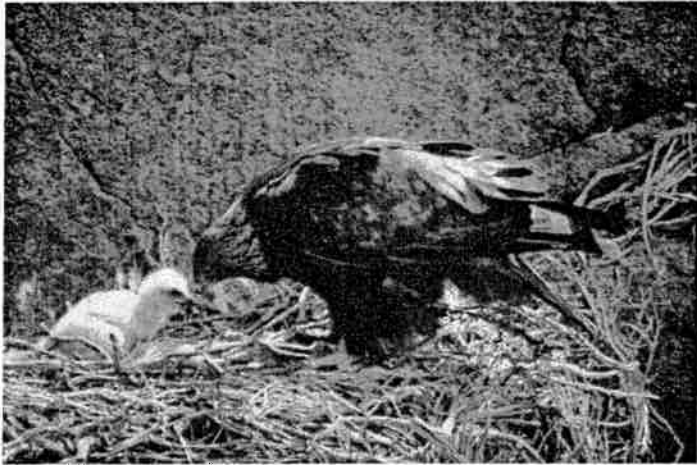
**Boundary Justification:** The preliminary conservation boundary (Figure 4) follows natural features, encompassing all of the rim grassland communities, the cliff and adjacent slope. The boundary is intended to protect the occurrences of the elements of concern and the ecological processes affecting these elements. The most significant natural processes are believed to be precipitation, wind, and herbivory. Buffers to the site are narrow and generally occur naturally as steep slopes along the eastern edge and the shrublands on the western boundary. This boundary protects the nesting area of the falcons and eagles but does not include all of their hunting territory. Additional information may alter the proposed conservation boundaries.

**Protection Considerations:** We recommend, regardless of ownership, that the biological significance of this conservation site be recognized with a special area designation (e.g., an Area of Critical Environmental Concern (ACEC), Research Park, or Research Natural Area.)

**Management Considerations:** We recommend developing a land use management plan for the entire NOSR-1 property. This plan should incorporate maintenance and or improvement of the integrity of the most biologically important sites, including this one. It would appear the threats to this site include off road vehicular traffic, livestock grazing, recreation, weeds, and potential oil and gas development. A management plan should be developed to address all of these threats.

At present time, the obvious threat is habitat fragmentation from roads. Due to the gentleness of the terrain, and no off road vehicular regulations, this habitat is prone to an abundance of roads. The unconstrained use of vehicles through this terrain will eventually take its toll on the environment by fragmenting the habitat into many small pieces, as well as allowing an avenue for introduced weedy species which will compete with the native grasses. We recommend developing one primary road along the rim and eliminating any off road traffic and closing many of the non-essential existing tracks and roadways.

Livestock grazing is an economically important and viable use of NOSR-1. Due to a lack of natural water supplies along the rim, livestock pressure is low. We recommend that it maintain this status and that any grazing management plans recognize the significance of this site and not try to "improve" water resources.



## East Fork Parachute Creek Recommended Conservation Site



East Fork Parachute Creek looking downstream from Falls

R. J. Rondeau

**Size:** 6700 acres  
(2710 ha)

**Biodiversity Rank:**

B2

East Fork Parachute Creek proposed conservation site hosts a very high concentration of tracked Natural Heritage elements. Included in the 21 elements are nine significant natural communities (8 of these are riparian), one rare fish, five species of birds, four rare plants, one rare butterfly, and one rare mammal. This site harbors the best known population of the Hanging garden sullivaniana, with over 25 high quality sub populations within the site.

**Protection Urgency Rank:** P2

This site is owned by the United States Department of Energy, but they are currently reexamining the value of keeping the Naval Oil Shale Reserves. There appears to be a very high potential that ownership of the Reserves will change to either private or Department of Interior ownership, potentially Bureau of Land Management. Currently, no special protection measures are afforded the site. Land exchange of one type or another may occur within the next year, and

therefore, protection urgency is high (especially if sold to a non-conservation oriented private entity).

**Management Urgency Rank:** M2

A report from the Colorado Division of Wildlife (Sealing et al. 1996) covering the status of the Colorado River cutthroat trout in East Fork Parachute Creek speculates that the concurring population of introduced Brook trout is expected to preclude the cutthroat population within the next few years. Active management for reducing the Brook trout population in East Fork Parachute Creek is warranted.

**Location:** Garfield County: five miles northwest of Rifle, ten miles southeast of Rio Blanco (Figure 4). **USGS Quadrangle:** Anvil Points, Forked Gulch **Legal Description:** T5S R94W sections 23, 26, 27, 33, and 34; T5S R95W section 35; T6S R95W sections 1, 2, 3, 4, and 5. **Elevation:** 6700' - 9000' (2010 - 2700 m).

**General Description:** East Fork Parachute Creek is a small but biologically significant tributary to the Colorado River. The headwaters for this creek begin at approximately 9000 feet in elevation with gently rolling hills of Aspen forests, Sagebrush and Snowberry shrublands, and grasslands. East Fork Parachute Creek originates near the eastern rim of the Roan Plateau and bisects the NOSR-1 property forming a deep canyon before plunging 200 feet into a narrow scenic box canyon (Figure 4).

Numerous creeks drain into East Fork Parachute Creek: JQS, Golden Castle, First and Second Anvil Creeks, First, Second, and Third Water Gulches, Camp, Grassy and Bull Gulches, Sheep Hollow Trail, etc. All of these side tributaries begin with small springs and seeps which flow more or less year round. Each tributary except for Golden Castle and First and Second Anvil have a dramatic cliff/waterfall near its confluence with East Fork providing picturesque hanging garden habitat. The spectacular hanging garden sites of Golden Castle and Anvil Creeks are on their respective tributaries.

The riparian plant communities of East Fork Parachute Creek are the most diverse of any on NOSR-1. Willow dominated communities, primarily Rocky Mountain willow (*Salix monticola*) and Drummond's willow (*S. drummondiana*), create several miles of habitat for common birds such as Yellow warbler, Cordilleran flycatcher, Song sparrow, House wren, and Lincoln sparrow. Approximately a mile above the 200 foot waterfall, the canyon narrows and the riparian vegetation is forested with Spruce-fir and Narrowleaf cottonwoods. Below the falls the riparian vegetation changes drastically to a more low-elevation type of Box elder (*Acer negundo*), Narrowleaf cottonwood (*Populus angustifolia*), and Red osier dogwood (*Cornus sericea*) community.

Due to the westerly orientation of the creek, the north and south-facing slopes are dramatically different. The south-facing slopes are sparsely vegetated on the steep sections right above the creek and more densely vegetated on the more gentle slopes above, dominated by Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Snowberry (*Symphoricarpos rotundifolius*). The north-facing slopes are characterized by spruce-fir

forests on the steep mesic slopes adjacent to the stream and aspen forests above them on the more gentle terrain.

The creek itself is primarily a pool/drop shale bedrock stream. Although the volume of this stream is relatively small, especially towards the end of the summer, it has an amazingly dense population of trout, primarily Brook trout.

**Historical Land Use:** All of NOSR-1 was within the summer camps and hunting grounds for the Ute and prehistoric Indians, dating back to more than 5000 B. C. (Tickner et al. 1996). They probably hunted bison, deer, elk, and other game and fished East Fork Parachute Creek. Grinding stones, arrowhead points, and bison bones have all been found within this site.

Indians were followed by ranchers. In the late 1800's ranchers from Rifle and Parachute began to use this area for summer grazing grounds (Rifle Reading Club 1973). They built many cabins near the numerous springs, which may still be seen today. The Bull Gulch cabin was built in the early 1900's and was first restored by BLM in 1940 (M. Kinser pers. comm.). Livestock grazing is still the primary use of this land, although hunting is extremely popular in this area. See the Anvil Points Rim conservation site and the introduction for a more complete history of NOSR-1 and the area.

**Natural Heritage Resource Significance:** East Fork Parachute Creek conservation site includes a concentration of 21 different significant species and natural communities. Most notable among these are excellent examples of three plants, two communities, one bird, and one mammal.





Rocky Mountain willow carr along East Fork Parachute Creek

R. J. Rondeau

Element	Common Name	O Rank*	CNHP Rank	Fed
<b>Plants</b>				
<i>Mentzelia argillosa</i>	Arapien stickleaf	A	G3/S2	
<i>Festuca dasyclada</i>	Utah fescue	A	G3/S3	
<i>Sullivantia hapemanii</i> var <i>purpusii</i>	Hanging garden sullivantia	A	G3T3/S3	FS
<i>Penstemon osterhoutii</i>	Osterhout's penstemon	A	G3G4/S3S4	
<b>Communities</b>				
<i>Acer negundo</i> - <i>Populus angustifolia</i> / <i>Cornus sericea</i>	Boxelder riparian forest	A	G2/S2	
<i>Populus angustifolia</i> / <i>Cornus sericea</i>	Cottonwood riparian forest	B	G3/S2?	
<i>Salix drummondiana</i> /mesic forb	Drummond's willow/mesic forb	C	G3/S3	
<i>Salix monticola</i> /mesic forb	Yellow willow/mesic forb	B	G3/SU	
<i>Picea pungens</i> / <i>Cornus sericea</i>	Montane riparian forest	B	G4/S2	
<i>Populus tremuloides</i> - <i>Pteridium aquilinum</i>	Aspen wetland forest	C	G4/S3S4	
<i>Cardamine cordifolia</i> - <i>Caltha leptosepala</i>	Alpine wetland	A	GU/S?	
<i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> / <i>Salix drummondiana</i>	Spruce-fir/Drummond's willow	B	GU/SU	
<b>Fish</b>				
<i>Oncorhynchus clarki pleuriticus</i>	Colorado River cutthroat trout	C	G4T2T3/S2	FS
<b>Birds</b>				
<i>Catharus fuscenscens</i>	Veery	B	G3/S3S4B,SZN	
<i>Aegolius funereus</i>	Boreal owl	B	G5/S2	FS
<i>Progne subis</i>	Purple martin	A	G5/S3B	FS
<i>Contopus borealis</i>	Olive-sided flycatcher	A	G5/S3S4B,S4N	(C2)
<i>Accipiter striatus</i>	Sharp-shinned hawk	A	G5/S3S4B,S4N	
<b>Mammals</b>				
<i>Sorex c.f. preblei</i>	Preble's shrew	A	G5/S1?	
<b>Insects</b>				
<i>Papilio bairdii</i>	Baird's swallowtail	C	G4/S3S4	

\*O Rank is "Occurrence Rank"

**Current Status:** The property this site occurs on is owned by the U.S. Department of Energy (D.O.E.). There is no formal designated protective status for this proposed conservation site. D.O.E. is currently examining status options. They may transfer the property to another federal agency or sell to private interests. The relinquishing of the property is expected by 1998.

**Boundary Justification:** The preliminary conservation boundaries encompass East Fork Parachute Creek and all of its tributaries from the headwaters to approximately 1 mile beyond the NOSR-1 boundary (Figure 4). The boundary is intended to protect the occurrences of the elements of concern and the ecological processes affecting these elements. The most significant natural processes are believed to be maintaining a natural hydrologic regime, especially flooding. Buffers to the site are narrow and generally include the headwaters of the side tributaries, which we believe to be important for protecting the fish population.

**Protection Considerations:** We recommend, regardless of ownership, that the biological significance of this conservation site be recognized with a special area designation (e.g., an Area of Environmental Concern (ACEC) if it were to become BLM land.)

**Management Considerations:** We recommend this site be included in an entire NOSR-1 resource management plan. This plan should provide for maintenance and or improvement of the integrity of the most biologically important sites, including this one. The primary threat to this site is degradation of the native trout population from competition with the non-native Brook trout. Sealing et al. (1996) believe the native trout population may be gone from the site in few years. The last trout study, in 1983, of East Fork Parachute Creek (Sealing et al. 1996) gave the population a B + genetic purity rating. Other threats to consider are noxious weed invasion which are especially encouraged from livestock grazing, recreation (including hunting and fishing), and potential oil and gas development. A management plan should be developed to address all of these threats.

Due to the natural barrier to migrating fish (200 foot waterfall) on East Fork Parachute Creek and the already existing trout population, this site is an excellent location to restore the Colorado River cutthroat trout. There are several ways to control the exotic fish population. All possibilities such as poisoning and electroshocking should be researched and a plan to restore a healthy native trout population should be seriously considered.

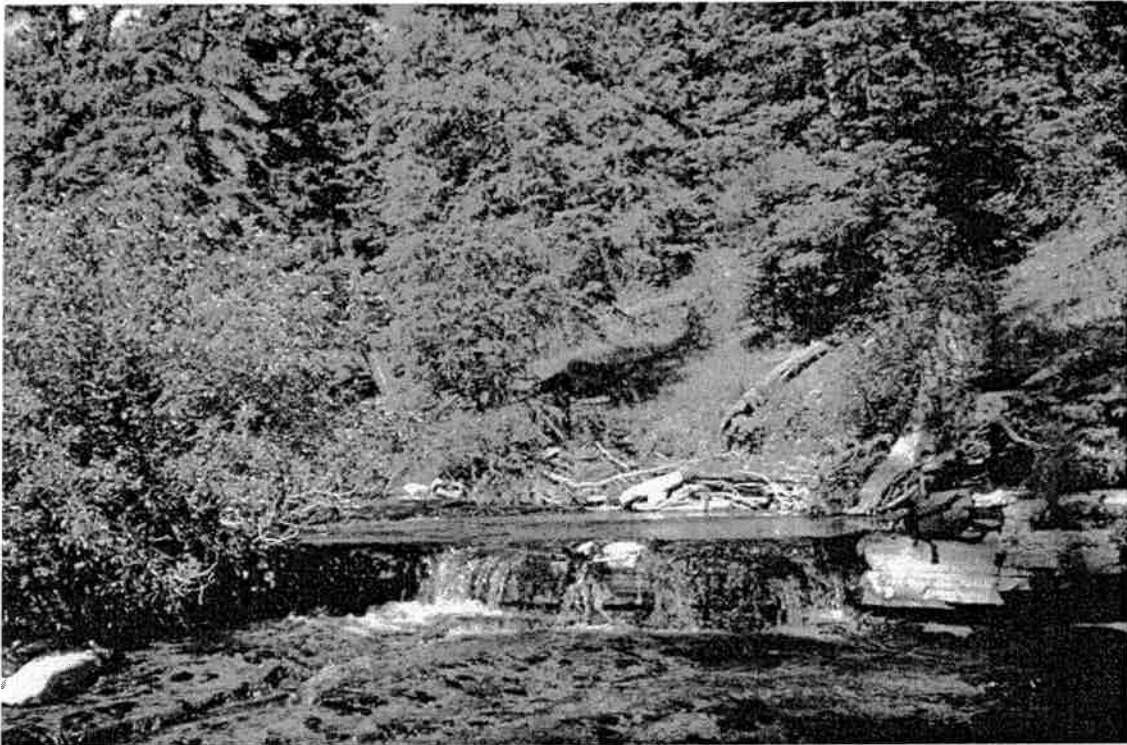
Livestock grazing is an economically important and viable use of NOSR-1. The riparian areas are magnets to livestock and therefore present a difficult management challenge. We recommend that a management plan include a reasonable method to improve the health of the riparian vegetation and hence the riparian ecosystem. The primary grazing concerns are uncontrolled weed invasions and more than 40% utilization of the pastures, causing increased erosion and downcutting of the stream banks.



East Fork Parachute Creek, above Falls

R. J. Rondeau

## Northwater Creek Recommended Conservation Site



East Middle Fork Creek near confluence with Northwater Creek

R. J. Rondeau

**Size:** 3800 acres (1540 ha)

**Biodiversity Rank:** B3

Northwater Creek Site supports 13 elements tracked by the Colorado Natural Heritage Program. Among those elements are excellent examples of the rare endemic Colorado River cutthroat trout, the state-rare Boreal owl, and the range restricted Hanging garden sullivania.

**Protection Urgency Rank:** P2

This site is owned by the United States Department of Energy, but they are currently reexamining the value of keeping the Naval Oil Shale Reserves. There appears to be a very high potential that ownership of the Reserves will change to either private or Department of Interior ownership, potentially Bureau of Land Management. Currently, no special protection measures are afforded the site. Land exchange of one type or another is likely within the next year, and therefore, protection urgency is high (especially if sold to a non-conservation oriented private entity).

**Management Urgency Rank:** M3

The primary use of the site is for livestock grazing. Over 100 years of cattle and sheep grazing has had an impact on Northwater Creek, especially on the headwater region.

The primary noticeable adverse effect of livestock grazing to this area has been the degradation of the riparian vegetation and the stream banks and bottoms. Nearly all of Northwater Creeks riparian plant communities have a high number of non-native species or increasers, and in some areas the abundance of willows has been drastically reduced. In addition to altering the plant composition of the riparian vegetation, grazing has increased soil erosion. The increase is due primarily to over utilization of the stream side vegetation, resulting in compaction and an abundance of bare ground. The result of the above is accelerated stream bank downcutting, eventually resulting in terraces without water and a new floodplain without vegetation. The site would benefit from a management plan which would include monitoring and improving the riparian vegetation.

**Location:** Garfield County: Nine miles northwest of Rifle, and five miles southeast of Rio Blanco. **USGS Quadrangle:** Anvil Points, Forked Gulch **Legal Description:** T5S R94W sections 15, 16, 17, and 18; T5S R95W section 13. **Elevation:** 7680' - 9000' (2304 - 2700 m).

**General Description:** Northwater Creek is one of three prominent drainages on the southeastern portion of the Roan Plateau (Figure 4). It is a major tributary to East Middle Fork Parachute Creek, a tributary of the Colorado River. It begins as a small stream on the eastern edge of the Roan Plateau (Figure 4) and joins Trapper Creek approximately 7 miles later. The first several miles are in an open valley with Aspen forests and Mountain sagebrush/Snowberry shrublands. In the more open gentle gradient areas of upper Northwater Creek, graminoid wetlands, e.g., Tufted hair grass (*Deschampsia cespitosa*) and sedges (*Carex* spp.) are common.

The headwaters are too small to support trout but are nonetheless important to the health of the trout population downstream. Approximately 3 miles from the headwaters the stream gains more volume and begins to cut through the Green River Formation. The stream develops a pool/drop character which creates excellent habitat for the native Colorado River cutthroat trout. The last 2 miles of Northwater is in a narrow canyon with difficult access. This section harbors a dense population of Colorado River cutthroat trout. Part of this canyon is walled with beautiful cliffs on both sides with numerous seeps providing excellent habitat for the Hanging garden sullivania.

The surrounding landscape is very similar to East Fork Parachute Creek and has slopes of contrasting vegetation. The south-facing slopes are sparsely vegetated on the steep sections right above the creek and more densely vegetated on the more gentle slopes above, dominated by Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Snowberry (*Symphoricarpos rotundifolius*). The north-facing slopes are characterized by spruce-fir forests on the steep mesic slopes adjacent to the stream and aspen forests above them on the more gentle terrain.

**Historical Land Use:** This site was a hunting ground for the Ute and prehistoric Indians, dating back to as early as 5000 B. C. (Tickner et al. 1996). They probably hunted bison, deer, elk, and other game and fished the creek directly. Grinding stones, arrowhead points, and bison bones have all been found scattered throughout the NOSR-1 property.

Following the Indians came the ranchers. In the late 1800's ranchers from Rifle and Parachute began to use this area for summer grazing grounds (Rifle Reading Club 1973). They built many cabins near the numerous springs, which may still be seen today. For example the Northwater cabin near Yellowjacket creek was built in 1944 (M. Kinser pers. comm.). Livestock grazing is still the primary use of this land, although hunting is extremely popular in this area. See the Anvil Points Rim conservation site and the introduction for a more complete history of NOSR-1 and the area.

Young et al. (1996) stated that Rainbow and non-native cutthroat trouts were stocked in Northwater and Trapper Creeks, although they do not mention the year this took place. The Rainbow trout did not survive, although the genetic purity of the native trout population was severely affected before they disappeared. The Northwater Creek population was ranked as a C purity by CDOW in 1983 (Sealing et al 1996).



Old wagon at Northwater cabin

R. J. Rondeau

**Natural Heritage Resource Significance:** Northwater Creek site supports a high concentration of rare or imperiled elements, including an endemic subspecies of cutthroat trout that is rare throughout its range. Also included are a number of significant natural communities, three rare plants, three rare birds, and one watchlisted species of butterfly.

Element	Common Name	O Rank*	CNHP Rank	Fed
<b>Plants</b>				
<i>Festuca dasyclada</i>	Utah fescue	B	G3/S3	(3C)
<i>Sullivantia hapemanii</i> var <i>purpusii</i>	Hanging garden sullivantia	A	G3T3/S3	FS
<i>Penstemon osterhoutii</i>	Osterhout's penstemon	A	G3G4/S3S4	
<b>Communities</b>				
<i>Carex utriculata</i> wetland	Montane wet meadow	C	G5/S3	
<i>Juncus balticus</i>	Western slope wet meadow	C	G4G5/S?	
<i>Salix monticola/mesic forb</i>	Yellow willow/mesic forb	D	G5/S3	
<i>Deschampsia cespitosa-Carex spp.</i>	Tufted hairgrass wetland	C	G5/S3S4	
<i>Artemisia tridentata</i> <i>vaseyana/Festuca thurberi</i>	Western slope sagebrush shrublands	B	GU/S1S2	
<b>Fish</b>				
<i>Oncorhynchus clarki pleuriticus</i>	Colorado River cutthroat trout	A	G4T2T3/S2	FS
<b>Birds</b>				
<i>Accipiter cooperii</i>	Cooper's hawk	A	G4/S3S4B,S4N	
<i>Aegolius funereus</i>	Boreal owl	A	G5/S2B	FS
<i>Accipiter striatus</i>	Sharp-shinned hawk	C	G5/S3S4B,S4N	
<b>Insects</b>				
<i>Callophrys affinis</i>	Green-winged hairstreak		G4T?/S3S4	

\*O Rank is "Occurrence Rank"

**Current Status:** The property this site occurs on is owned by the U.S. Department of Energy (DOE). There is no formal designated protective status for this proposed conservation site. DOE is currently examining status options. They are most likely going to transfer the property to another federal agency or sell to private interests. The relinquishing of the property is expected by 1998.

**Boundary Justification:** The preliminary conservation boundaries for this site include Northwater Creek and its tributaries (Figure 4). The boundary is intended to protect the occurrences of the elements of concern and the ecological processes affecting these elements. The most significant natural process to the stream is believed to be flooding and maintaining a natural hydrologic regime. The most significant natural process for the slopes are believed to be rainfall, herbivory, and fire. Buffers to the site are narrow and generally include the headwaters of the side tributaries.

**Protection Considerations:** We recommend, regardless of ownership, that the biological significance of this conservation site be recognized with a special area designation (i.e., an Area of Environmental Concern (ACEC) if it were to become BLM land.)

**Management Considerations:** We recommend developing a land use management plan for the entire NOSR-1 property. This plan should provide for the maintenance and or improvement of the integrity of the most biologically important sites, including this one. The primary threats to the site include stream degradation and noxious weed invasion, primarily from livestock grazing and potential oil and gas development. A management plan should address all of these threats.

Due to the natural barrier to migrating fish (200 foot waterfall) on East Middle Fork Parachute Creek and the already existing trout population, this site is an excellent location to maintain the Colorado River cutthroat trout. The current Colorado River cutthroat trout population has some genetic mixing with Rainbow and non-native cutthroat trout, which are no longer present. Research may be warranted for exploring the possibilities of enhancing this population with pure cutthroats.

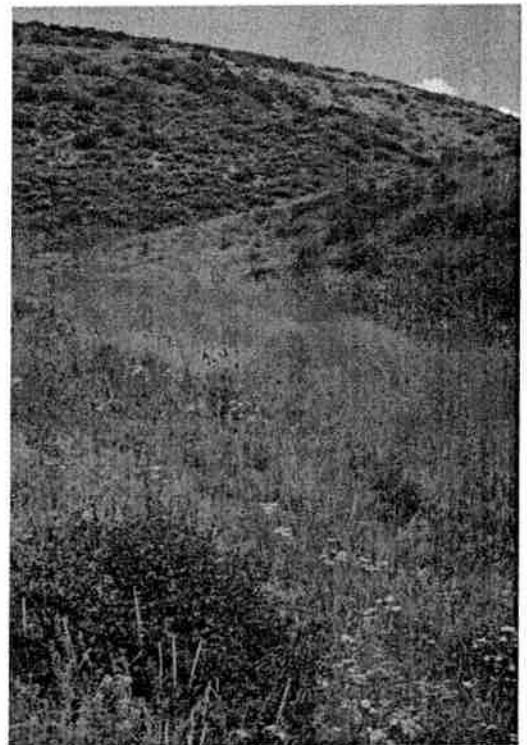
Livestock grazing is an economically important and viable use of NOSR-1. The riparian areas are magnets to livestock and therefore present a difficult management challenge. We recommend that a management plan include a reasonable method to improve the health of the riparian vegetation and hence the riparian ecosystem. The primary grazing concerns are uncontrolled weed invasions and more than 40% utilization of the pastures, causing increased erosion and downcutting of the streams.

All of NOSR-1 offers an excellent opportunity to employ a natural fire regime. We recommend that a "let it burn policy" be seriously considered.



Hanging garden sullivantia

R. J. Rondeau



Tufted hairgrass wetland

R. J. Rondeau



## Trapper Creek Recommended Conservation Site



Tufted hairgrass and sedge wetland within Trapper Creek enclosure

R. J. Rondeau

**Size:** 2280 acres (923 ha)

**Biodiversity Rank:** B3

Trapper Creek recommended conservation site supports occurrences of nine significant elements, including one oil shale endemic plant, a small sub-population of Colorado River cutthroat trout, several wetland plant communities and excellent occurrences of several birds.

**Protection Urgency Rank:** P2

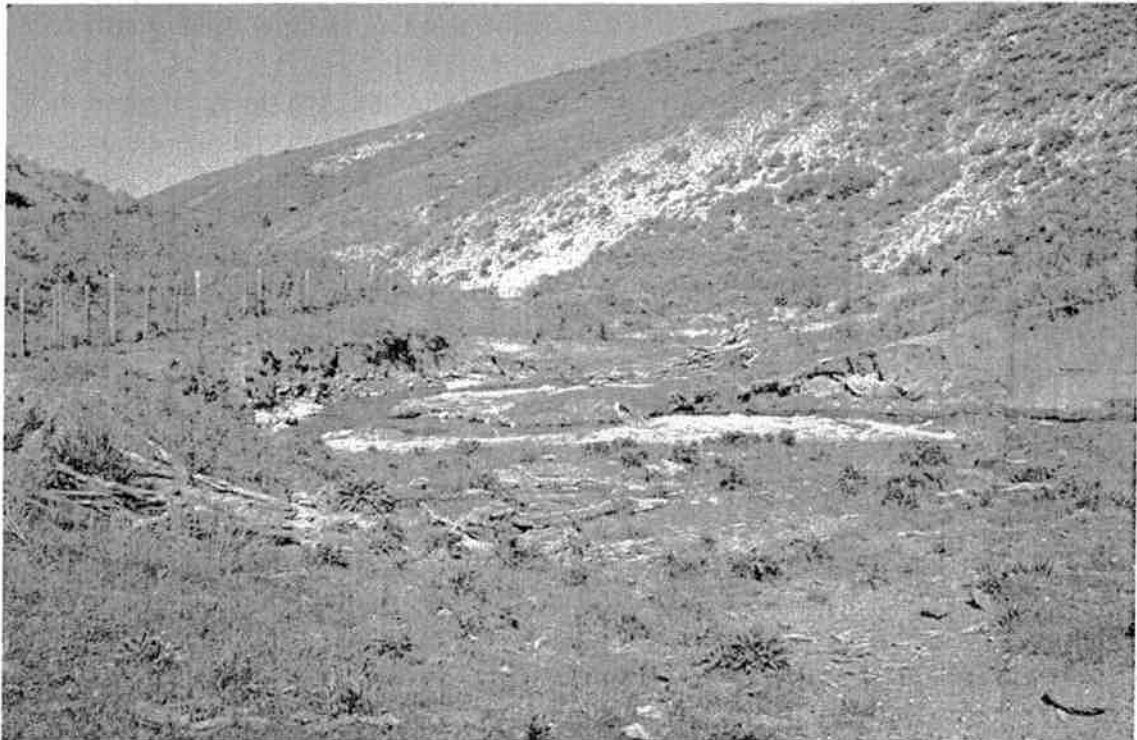
This site is owned by the United States Department of Energy, but they are currently reexamining the value of keeping the Naval Oil Shale Reserves. There appears to be a very high potential that ownership of the Reserves will change to either private or Department of Interior ownership, potentially Bureau of Land Management. Currently, no special protection measures are afforded the site. Land exchange of one type or another is likely within the next year, and therefore, protection urgency is high (especially if sold to a non-conservation oriented private entity).

**Management Urgency Rank:** M2

The stream banks and bottoms, riparian vegetation, and the water quality of Trapper Creek are severely degraded in many places, primarily due to livestock grazing and historically dense populations of beavers. In order to protect the riparian and wetland communities and the Colorado River cutthroat trout, a change in grazing practices or management is warranted. The stream bottom needs a significant rest from grazing, and any grazing management plans for the area should omit domestic livestock from most of the drainage bottom until the range has ample coverage of native vegetation. Oil and gas development exists as a potential additional use of the area, and any plans to do so should be mitigated to minimize use of the Trapper Creek drainage.

**Location:** Garfield County: Ten miles northwest of Rifle, and four miles southeast of Rio Blanco (Figure 4). **Legal Description:** T5S R94W sections 3,4,5,7, and 8; T5S R95W section 12. **Elevation:** 7,680' - 8,400' (2340 - 2560 m).

**General Description:** Trapper Creek originates from the east edge of the Roan Plateau on DOE Naval Oil Shale Reserve property near Rifle, Co. (Figure 4). It flows east to west and joins Northwater Creek to form East Middle Fork Parachute Creek, a tributary of the Colorado River. The drainage is characterized by forested north-facing slopes, e.g., Spruce (*Picea* spp.), Subalpine fir (*Abies lasiocarpa*), and Narrowleaf cottonwood (*Populus tremuloides*) and shrublands, e.g., Mountain sagebrush (*Artemisia tridentata* var. *vaseyana*) on the south-facing slopes. The vegetation along the riparian corridor includes a number of wet meadow communities, e.g., Rush (*Juncus balticus*), Beaked sedge (*Carex utriculata*), and Tufted hairgrass (*Deschampsia cespitosa*), though many of the reaches have been severely altered from a long history of overuse by livestock and beaver. In places, Trapper Creek is home to a rare subspecies of cutthroat trout, but the willow communities are patchy and long stretches of the creek experience water temperatures too high to support these fish.



Downstream of Trapper Creek livestock enclosure

R. J. Rondeau

**Historical Land Use:** It is believed that Trapper Creek once supported summer migrations of Ute and prehistoric Indians, dating from approximately 5000 B.C. to the late 1800's (Tickner et al. 1996). Since the advance of European people to the area, Trapper Creek has been an important range for domestic livestock including sheep and cattle. The area has had nearly a century of intense livestock grazing (Rifle Reading Club 1973).

In earlier years Rainbow and cutthroat trout were stocked along side the native Colorado River cutthroat trout. Although the Rainbows are not present today, their genes have altered the purity of the native trout.

In addition to altering the genetics of the trout, the habitat has also been adversely affected. A century of livestock grazing has degraded the riparian vegetation, stream banks, stream bottoms, and water quality. In order to help protect a declining trout population due to the above degradation, the Glenwood Springs office of BLM constructed a livestock enclosure in 1988 (J. Thompson pers. comm.). Although the enclosure has periodically failed, a remarkable recovery of the stream bottoms, banks, riparian vegetation, and water quality is evident. The enclosure is now the primary habitat for the small population of Colorado River cutthroat trout in Trapper Creek.

**Natural Heritage Resource Significance:** A concentration of significant natural heritage resources was located at this site. The site supports one subspecies of fish considered rare

throughout its range, a number of natural communities and birds considered rare in Colorado, as well as a butterfly that is watchlisted in Colorado.

Element	Common Name	O Rank*	CNHP Rank	Fed
<b>Plants</b>				
<i>Festuca dasyclada</i>	Utah fescue	A	G3/S3	
<b>Communities</b>				
<i>Juncus balticus</i>	Western slope wet meadow	C	G4G5/S?	
<i>Carex utriculata wetland</i>	Montane wet meadow	C	G5/S3	
<i>Deschampsia cespitosa-Carex spp.</i>	Tufted hairgrass wetland	C	GU/SU	
<b>Fish</b>				
<i>Oncorhynchus clarki pleuriticus</i>	Colorado River cutthroat trout	C	G4T2T3/S2	
<b>Birds</b>				
<i>Progne subis</i>	Purple martin	A	G5/S3B	
<i>Picoides tridactylus</i>	Three-toed woodpecker	A	G5/S3S4	
<i>Accipiter striatus</i>	Sharp-shinned hawk	C	G5/S3S4B,S4N	
<b>Insects</b>				
<i>Callophrys affinis</i>	Green-winged hairstreak	B	G4T?/S3S4	

\*O Rank is "Occurrence Rank"

**Current Status:** The property this site occurs on is owned by the U.S. Department of Energy (DOE). There is no formal designated protective status for this proposed conservation site. DOE is currently examining status options. They are most likely going to transfer the property to another federal agency or sell to private interests. The relinquishing of the property is expected by 1998.

**Boundary Justification:** The preliminary conservation boundaries (Figure 4) include Trapper Creek and approximately 200 feet of the adjacent slopes. The boundary is intended to protect the occurrences of the elements of concern and the ecological processes affecting these elements. The most significant natural process is believed to be flooding and maintaining a natural hydrologic regime. Buffers to the site are narrow and include a small part of the adjacent slopes.

**Protection Considerations:** We recommend, regardless of ownership, that the significance of this conservation site be recognized.

**Management Considerations:** We recommend developing a land use management plan for the entire NOSR-1 property. This plan should incorporate maintenance and/or improvement of the integrity of the most biologically important sites, including this one. The primary threats to the site include stream degradation and noxious weed invasion, primarily from livestock grazing and potential oil and gas development. A management plan should be developed to address all of these threats.

Due to the natural barrier to migrating fish (200 foot waterfall) on East Middle Fork Parachute Creek and the already existing trout population, this site is an excellent location to maintain the Colorado River cutthroat trout. The current Colorado River cutthroat population

has some genetic mixing with Rainbow and non-native cutthroat trout, which are no longer present. Research may be warranted for exploring the possibilities of enhancing this population with pure cutthroats.

Livestock grazing is an economically important and viable use of NOSR-1. The riparian areas are magnets to livestock and therefore create a difficult management challenge. We recommend that a management plan include a reasonable method to improve the health of the riparian vegetation and hence the riparian ecosystem. The primary grazing concerns are uncontrolled weed invasions and more than 40% utilization of the pastures, causing increased erosion, down cutting of the streams, and increased water temperature.

In order to protect the riparian and wetland communities and the Colorado River cutthroat trout, a change in grazing practices or management is warranted. The valley bottom needs a significant rest from grazing, and any grazing management plans for the area should omit domestic livestock from the drainage bottoms (other than for water access) until the range has ample coverage of native vegetation. Oil and gas development exists as a potential additional use of the area, and any plans to do so should be mitigated to minimize use of the Trapper Creek drainage.

## Northeast Book Cliffs Recommended Conservation Site



Mature Douglas fir forest below Book Cliffs

R. J. Rondeau

**Size:** 190 acres (77 ha)

**Biodiversity Rank:** B3

Northeast Book Cliffs proposed conservation site supports a small old-growth Douglas fir community, that in turn supports a small population (three breeding pairs) of Three-toed woodpeckers.

**Protection Urgency Rank:** P2

This site is owned by the United States Department of Energy, but they are currently reexamining the value of keeping the Naval Oil Shale Reserves. There appears to be a very high potential that ownership of the Reserves will change to either private or Department of Interior ownership, potentially Bureau of Land Management. Currently, no special protection measures are afforded the site. Land exchange of one type or another is likely within the next year, and therefore, protection urgency is high (especially if sold to a non-conservation oriented private entity).

**Management Urgency Rank:** M5

Current management practices at this site are passive, and no major changes are required for the preservation of the elements located at the site.

**Location:** Garfield County: Eight miles northwest of Rifle, two miles southeast of Rio Blanco (Figure 4). **USGS Quadrangle:** Rio Blanco. **Legal Description:** T5S R94W sections 2 and 3. **Elevation:** 7000' - 8800' (2100 - 2640 m).

**General Description:** This site is on a steep east-facing slope just below the Book Cliffs in the northeast section of NOSR-1 (Figure 4). It is best described as an excellent and unfragmented example of an old-growth Douglas fir community surrounded by mountain shrublands, predominantly Scrub oak (*Quercus gambelii*). Historic wildfires in parts have helped to create a healthy mosaic of dense and open areas important to the diverse wildlife of this area. Some small areas in the conifer forest have also been inflicted by beetle infestation, where Three-toed woodpeckers now thrive.

**Historical Land Use:** It is unclear if this site has ever had much use by humans. Due to its steepness it is inaccessible and no trails or roads exist. This site was perhaps once used as an access to the top of the Roan Plateau, as we noticed a few locations where a tree has been cut by a saw. The remaining stumps are strung in a line as though they were felled to create a trail.

**Natural Heritage Resource Significance:** The Northeast Book Cliffs Conservation Site supports a small concentration of significant natural heritage resources, including an excellent example of an old growth Douglas fir community and a significant species of bird. In addition, we found this to be an important refugia for deer, elk, and bear during the hunting season.

Element	Common Name	O Rank*	CNHP Rank	Fed
<i>Pseudotsuga menziesii</i> / <i>Carex geyeri</i>	Lower montane forests	A	G5Q/S3	
<i>Picoides tridactylus</i>	Three-toed woodpecker	A	G5/S3S4	FS

\*O Rank is "Occurrence Rank"



**Current Status:** The property this site occurs on is owned by the U.S. Department of Energy (DOE). There is no formal designated protective status for this proposed conservation site. DOE is currently examining status options. They are most likely going to transfer the property to another federal agency or sell to private interests. The relinquishing of the property is expected by 1998.

**Boundary Justification:** The boundaries of the site mostly follow the natural boundary of the Douglas fir community, encompassing part of the Book Cliffs and several minor drainages. They also incorporate the Three-toed woodpecker occurrence and its habitat.

Three-toed woodpecker by M. Tremaine for Cornell Lab

**Protection Considerations:** We recommend that regardless of ownership, this site be recognized as an area worthy of protection in order to preserve an intact community and all of the wildlife associated with this old-growth Douglas fir site.

**Management Considerations:** Due to the site's inaccessibility, little human effects were noted; that is, no trails, roads, or livestock grazing. We did not find any serious problems with exotic plant species. We believe that maintaining the site in a natural state is necessary. Fires undoubtedly play an important role in maintaining this system. Any natural fires should be allowed to burn.



Mature Douglas fir community below Book Cliffs

M. B. Wunder



## Ben Good Creek Recommended Conservation Site

**Size:** 1200 acres (485 ha)

**Biodiversity Rank:** B3

The majority of significance at this site stems from the occurrence of Utah fescue (*Festuca dasyclada*), an oil shale endemic.

**Protection Urgency Rank:** P2

This site is owned by the United States Department of Energy, but they are currently reexamining the value of keeping the Naval Oil Shale Reserves. One report that DOE received in 1996 suggests selling the land. Another possibility would be to transfer the land to another federal agency like the Bureau of Land Management. Currently, no special protection measures are afforded the site. Land exchange of one type or another is likely within the next year, and therefore, protection urgency is high (should the site end up in private hands).

**Management Urgency Rank:** M4

The current land use of this site is primarily livestock grazing. Due to the naturally occurring sparsely vegetated south-facing slopes, this is not ideal livestock habitat. Therefore the current grazing doesn't appear to have any negative impact on this site. Future management may be necessary if additional research on Utah fescue provides other information. No major changes are required for the preservation of the elements located at the site.

**Location:** Garfield County: Ten miles northwest of Rifle, six miles southeast of Rio Blanco (Fig 4). **USGS Quadrangle:** Anvil Points, Forked Gulch. **Legal Description:** T5S R95W sections 22, 23, 25, and 26. **Elevation:** 7200' - 8200' (2160 - 2460 m).

**General Description:** Ben Good Creek is one of many small perennial streams draining into East Fork Parachute Creek off of the Roan Plateau. It runs primarily east to west with steep north-facing slopes densely vegetated with Douglas fir (*Pseudotsuga menziesii*) and Aspen (*Populus tremuloides*) and understory of Snowberry (*Symphoricarpos rotundifolius*). The south-facing slopes are sparsely to moderately vegetated with Gambel's oak (*Quercus gambelii*), Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Utah serviceberry (*Amelanchier utahensis*). A band of shale barrens runs nearly 2 miles on the south-facing slope adjacent to the creek. The shale barren slopes are the primary habitat for the oil shale endemic Utah fescue (*Festuca dasyclada*).

**Historical Land Use:** See the previous site profiles for NOSR-1 history.

**Natural Heritage Resource Significance:**

Element	Common Name	O Rank*	CNHP Rank	Fed
<i>Festuca dasyclada</i>	Utah fescue	B	G3/S3	

\*O Rank is "Occurrence Rank"

**Current Status:** The property this site occurs on is owned by the U.S. Department of Energy (DOE). There is no formal designated protective status for this proposed conservation site. DOE is currently examining status options. They are most likely going to transfer the property to another federal agency or sell to private interests. The relinquishing of the property is expected by 1998.

**Boundary Justification:** The boundaries include all known occurrences of Utah fescue in the drainage, and a small buffer to protect the ecological processes (e.g., landslides).

**Protection Considerations:** This site is primarily important for protecting a Utah fescue occurrence. Noteworthy that three of the other NOSR-1 sites also include Utah fescue.

**Management Considerations:** Current management practices appear adequate at this time, although future research on Utah fescue may require some changes.



## Plants

The Piceance and Uinta Basins in Colorado and Utah (Figure 2 page 14) are important refugia for 15 species of plants (Table 7). These 15 species are globally restricted to edaphic conditions found only in these two basins, primarily the Green River Formation shale outcrops. The Piceance Basin has one of the highest endemism rates in Colorado, probably second only to the Mancos Shale area.

Within the Piceance Basin there are no areas specially designated to provide long-term protection for any of these plants. The Colorado Natural Areas Program has established the following Designated Natural Areas for rare plants and intact plant communities, but no management plans have been initiated: Deer Gulch, Dudley Bluffs, Lower Greasewood Creek, Mount Callahan, Raven Ridge, south Cathedral Bluffs, and Yanks Gulch/Upper Greasewood Creek (J. Coles pers. comm.).

**Table 7.** Oil shale endemic plant species that are restricted to either the Uinta or Piceance Basins of Utah and Colorado.

Species	Distribution
<i>Astragalus lutosus</i>	Piceance Basin and adjacent Utah
<i>Cryptantha breviflora</i>	Piceance and Uinta Basins
<i>Cryptantha grahamii</i>	Uinta Basin
<i>Cryptantha rollonsii</i>	Uinta and Piceance Basins
<i>Eriogonum ephedroides</i>	Piceance and Uinta Basins
<i>Festuca dasyclada</i>	Piceance Basin
<i>Gentianella tortuosa</i>	Piceance and Uinta Basins
<i>Lesquerella congesta</i>	Piceance Basin
<i>Lesquerella parviflora</i>	Piceance Basin
<i>Mentzelia argillosa</i>	Piceance Basin and disjunct population in Utah
<i>Penstemon debilis</i>	Piceance Basin
<i>Penstemon grahamii</i>	Uinta Basin
<i>Penstemon scariosus</i> var. <i>albifluvis</i>	Piceance and Uinta Basins
<i>Physaria obovata</i>	Piceance Basin
<i>Thalictrum heliophilum</i>	Piceance Basin

**NOSR-1 Plants.** Our surveys discovered new locations for nine plant species which the Colorado Natural Heritage Program tracks (Table 8). Of these, five are oil shale endemics: Dragon milkvetch (*Astragalus lutosus*), Utah fescue (*Festuca dasyclada*), Arapien stickleaf (*Mentzelia argillosa*), Parachute penstemon (*Penstemon debilis*), and Sun-loving meadowrue (*Thalictrum heliophilum*). Figure 5 shows the approximate locations for all occurrences of these plant species on NOSR-1. Nearly 50 % of NOSR-1 legal sections (30/66) contain at least one location of a rare plant species (Figure 5).

**Table 8.** Rare or biologically significant plant species of NOSR-1 with natural heritage ranks (global and state) and federal status (see introduction for explanation of heritage ranks). Bolded ranks and federal status indicate a high level of imperilment.

Common name	Scientific Name	Global Rank	State Rank	Fed. Status
<b>Plants</b>				
*Dragon milkvetch	<i>Astragalus lutosus</i>	G4	S3S4	(3C)
Utah fescue	<i>Festuca dasyclada</i>	G3	S3	(3C)
Wild hollyhock	<i>Lilium grandiflora</i>	G3?Q	SU	
Arapien stickleaf	<i>Mentzelia argillosa</i>	<b>G2?</b>	<b>S2</b>	<b>(C2)</b>
Fragrant mint	<i>Monardella odoratissima</i>	<b>G?</b>	<b>S1?</b>	
Parachute penstemon	<i>Penstemon debilis</i>	<b>G1</b>	<b>S1</b>	<b>C</b>
*Osterhout's penstemon	<i>Penstemon osterhoutii</i>	G3G4	S3S4	
Hanging garden sullivantia	<i>Sullivantia hapemanii purpusii</i>	G3T3	S3	
Sun-loving meadowrue	<i>Thalictrum heliophilum</i>	G3	S3	(3C)

The following section is a brief description of the nine rare plants found on NOSR-1. Each description includes both a global and Colorado distribution map as well as a photo of the species and its habitat (See Appendix C for a state map with the county names). The order is by rarity rank.

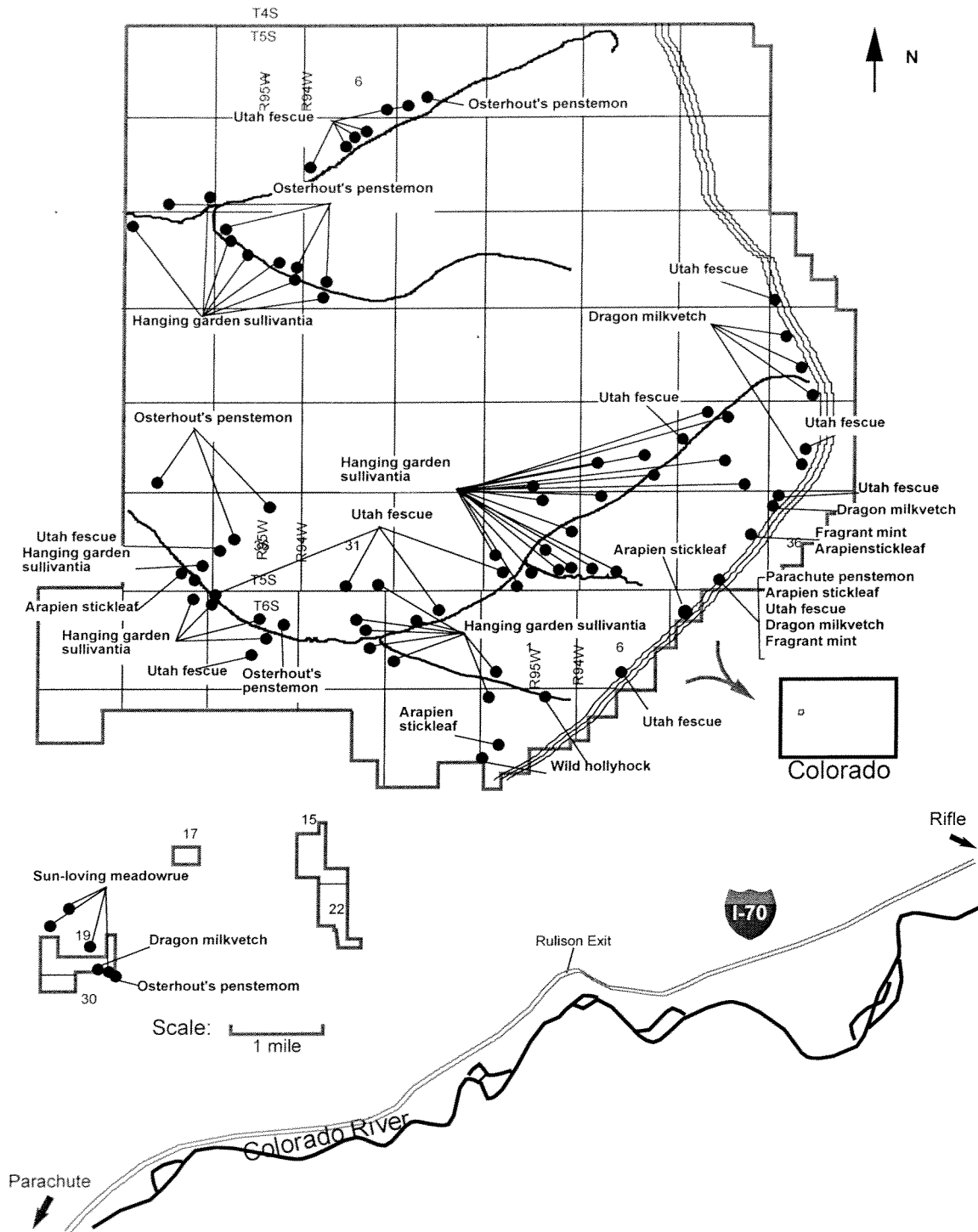


Figure 7. Plant Occurrences on NOSR-1, Garfield County, CO.

**Parachute penstemon (*Penstemon debilis*) (G1/S1)**

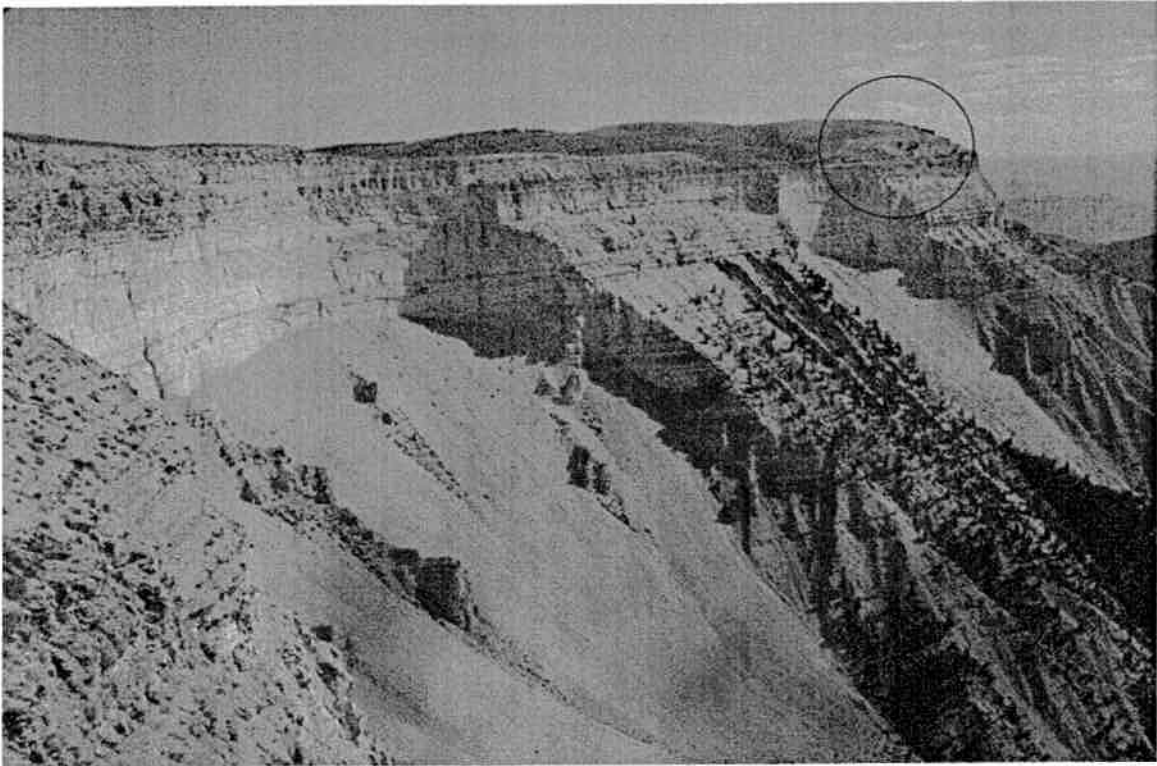
R. J. Rondeau

The Parachute penstemon is a prostrate herbaceous perennial with large purple flowers found only on the Parachute Creek Member of the Green River Formation (O’Kane and Anderson 1987). It is among the rarest of plants in North America, known only from four locations, all in Garfield County, Colorado (O’Kane 1988; Spackman et al. 1997). This narrowly distributed oil-shale endemic occupies the steep southern escarpment of the Mt. Callahan ridge crest, with thousands of plants in ca. 90 ha (O’Kane and Anderson 1987; Spackman et al. 1997). A smaller population resides within NOSR-1 near the Roan Cliffs rim. We visited the NOSR-1 site in both August and September 1995 and located less than 50 plants, although we believe there may be more, as this was not the ideal search time. O’Kane (1988) and Spackman et

al. (1997) believe this taxon is likely limited to its currently known range as inventories of oil shale lands are relatively thorough (e.g., Harner and Associates 1984; Peterson and Baker 1982; Union Oil Company of California 1984; O’Kane 1988).

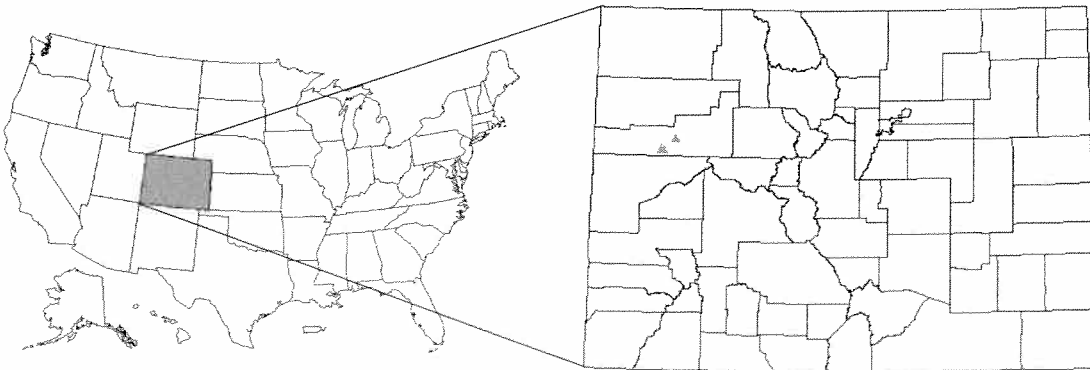
Parachute penstemon is limited to sparsely vegetated, steep, decomposing Green River Formation shale between 8200 and 9000 feet in elevation (O’Kane and Anderson 1997; CNHP 1997). The soil is a mixture of thin shale fragments and clay. Buried stems progressively elongate downslope from the initial point of rooting to a surface sufficiently stable to allow the development of a tuft of leaves and flowers. Stems continue to elongate as the leaves are buried by shifting talus (O’Kane and Anderson 1987; Colorado Native Plant Society 1989).

During our 1995 survey of the NOSR-1 Parachute penstemon population we located occurrences of three other Green River Formation shale endemics: *Astragalus lutosus*, *Festuca dasyclada*, and *Mentzelia argillosa*. See next page and Appendix A for the specific locations of these occurrences.



**Habitat:** Book Cliffs at Twin Peaks (NOSR-1).  
Circle denotes actual habitat.

R. J. Rondeau



Global distribution (CNHP 1997)

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Penstemon debilis*.**



Wild hollyhock *Iliamna grandiflora* G3?/SU

R. J. Rondeau

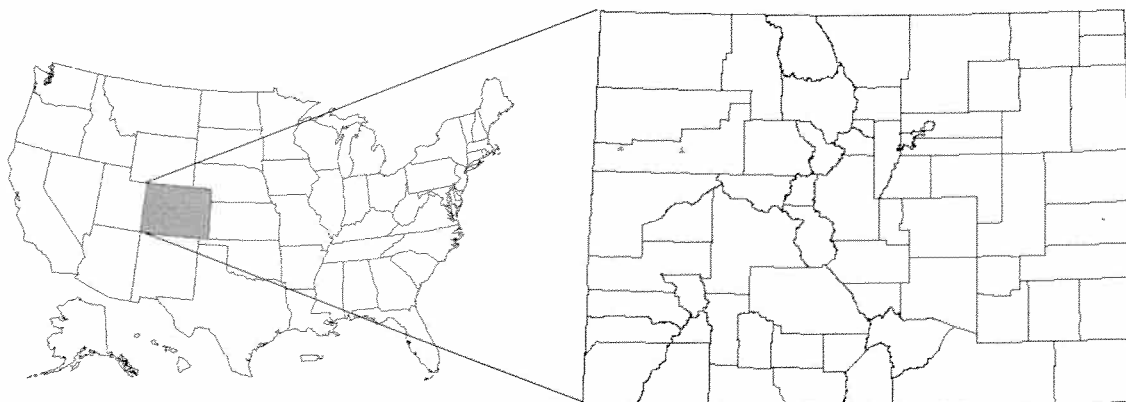
The Wild hollyhock is a tall herbaceous perennial which dies back to the ground every year. The large white flowers, usually seen in July, make this plant very conspicuous. In spite of this plant's noticeable character, it has rarely been collected or noted. The Natural Heritage Network has documented 8 occurrences in the world, all of them in western Colorado (see next page). This plant species is usually found in mesic areas such as streamsides and aspen forests, although it is also known to occur in drier communities such as oak scrub (CNHP 1997).

The taxonomy of this species has been confusing. It most closely resembles *I. rivularis*, a more common hollyhock. The most distinguishable difference is in the size of the calyx lobes and bracts (Wiggins 1936). Due to this subtle difference more field observations are needed for this group (Weber and Wittmann 1996).

On NOSR-1 we found this species in two places, both in section T6S R95W Sec 12 (Figure 5 and Appendix A). Both of these occurrences are along the side of the road in Aspen forests near West Anvil Point.



**Habitat:** Slope of West Anvil Point (NOSR-1). R. J. Rondeau



Global distribution (and Wittmann 1996)

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Iliamna grandiflora*.**

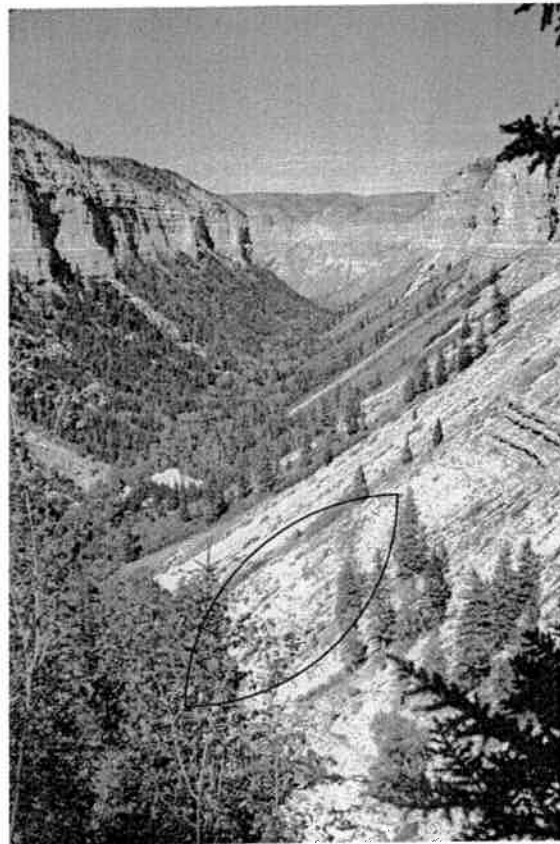
**Arapien stickleaf (*Mentzelia argillosa*) G3/S3**

G. Kittel

The Arapien stickleaf is another oil shale restricted herbaceous plant favoring steep south-facing, regularly moving talus or scree slopes at elevation of 5800 to 9000 feet (Weber and Wittmann 1983). This low to the ground and nearly creeping plant has bright yellow flowers which primarily open up in the late afternoon. Often it is one of the first plants to colonize a newly disturbed Green River Formation shale slope. Once a slope has stabilized, other species immigrate to the area and the Arapien stickleaf may eventually be pushed out of existence at that site. It is frequently found with other oil shale restricted plants such as *Astragalus lutosus*, *Thalictrum heliophilum*, *Penstemon debilis*, and *Festuca dasyclada*.

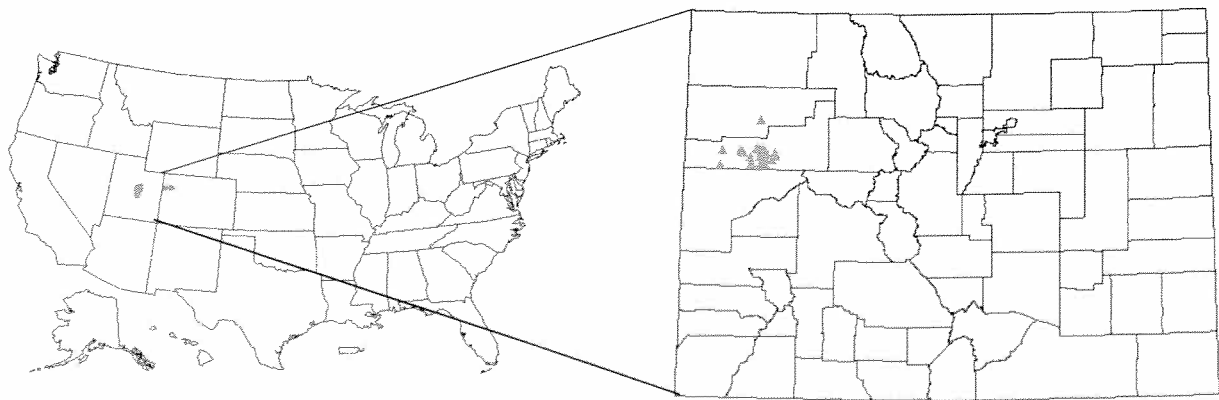
The world-wide range of Arapien stickleaf is restricted to two small, widely separated (200 miles) oil shale areas (see next page). In Utah it is found at a few sites in Sanpete and Sevier counties growing on Arapien shale (Welsh and Chatterly 1985). In Colorado it is limited to Green River Formation shale scree slopes of the Piceance Basin, primarily in Garfield County (O'Kane 1988; CNHP 1997). It is possible that the plants found in Utah are actually a separate species or subspecies (J. Coles pers. comm.), lending greater significance to the Colorado occurrences.

Our field survey determined that Arapien stickleaf occurs in 4 sections of NOSR-1; T5S R94W S35 (two occurrences), T6S R94W S5, T6S R95W S12 and T5S R95W S35. Figure 5 and Appendix A give the specific locations of the occurrences.



**Habitat:** Talus slopes of East Fork Parachute Creek.  
Polygon denotes actual habitat.

R. J. Rondeau

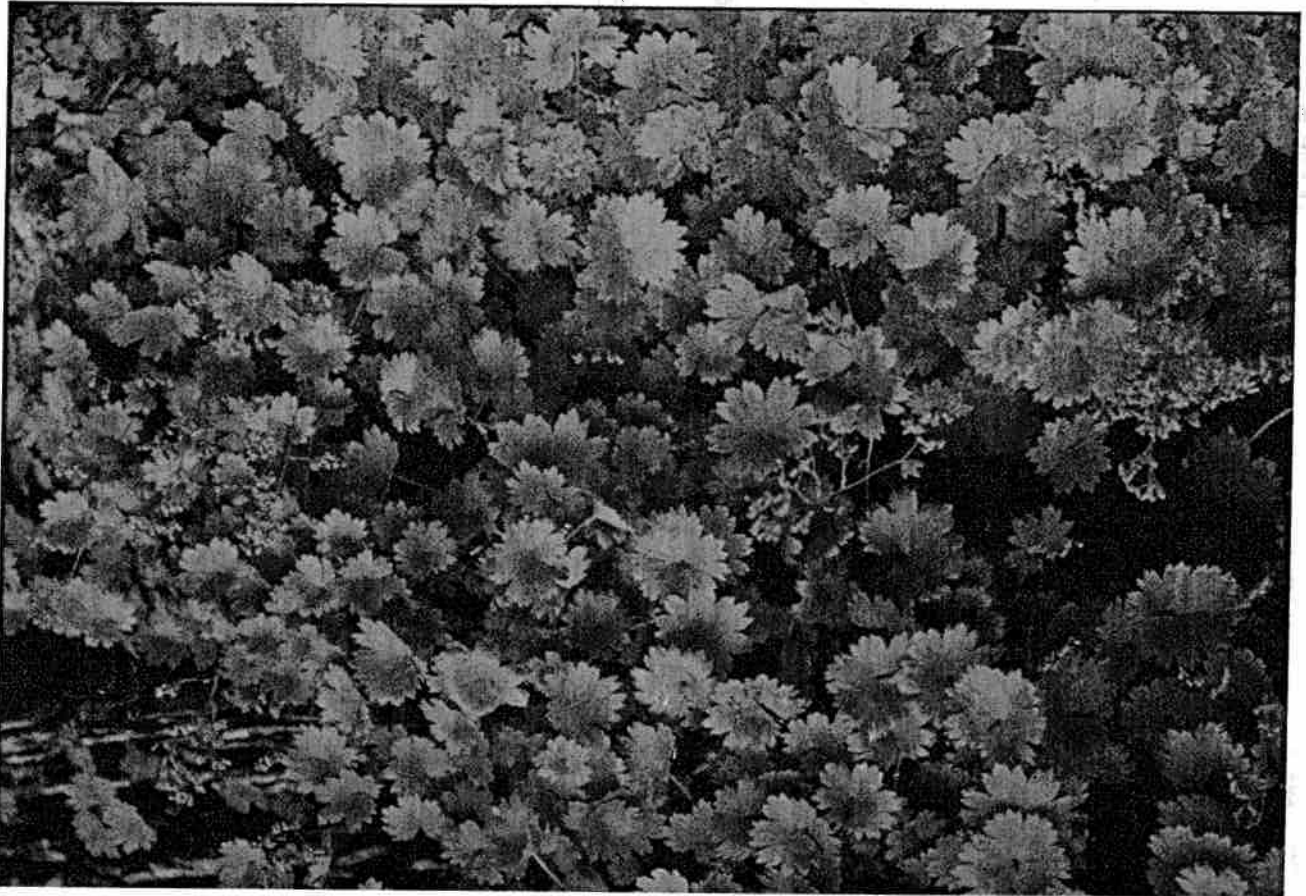


Global distribution (Welsh et al. 1993)

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Mentzelia argillosa*.**

**Hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*) G3T3/S3**

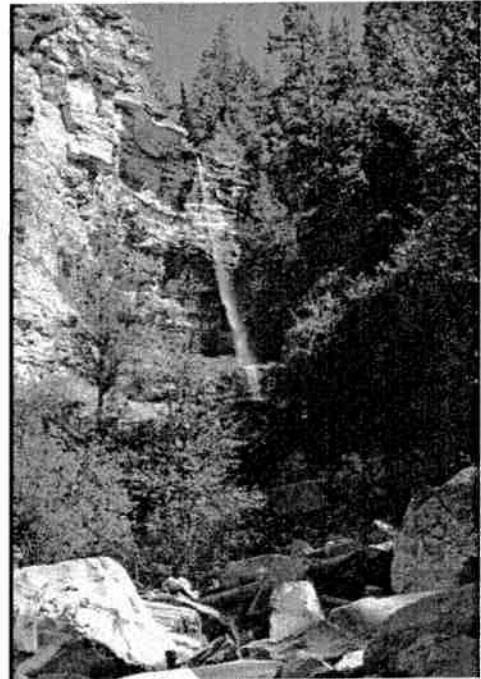
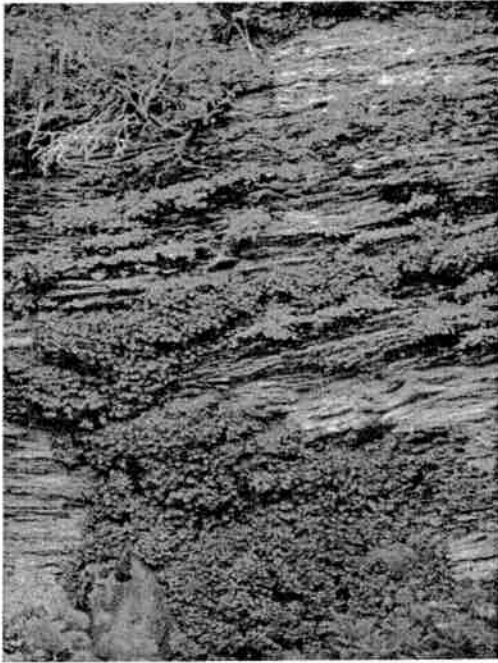


R. J. Rondeau

Of all of the biologically significant plants found on NOSR-1, this one probably wins the scenic landscape award. The Hanging garden sullivantia is restricted to waterfalls and moist cliffs of calcareous substrates, e.g., Green River Formation shale (Scheck 1994; Goodrich and Neese 1986; Weber 1987). Hanging garden sullivantia is only known from Western Colorado from Rio Blanco, Gunnison, Garfield, Montrose, and Pitkin Counties (See next page). It often occurs with other hanging garden species such as Columbine (*Aquilegia barnebyi*). This plant and its habitat appear relatively secure at this time due to their natural inaccessibility. However, changes to the local hydrologic regime may have severe effects on this plant and its habitat.

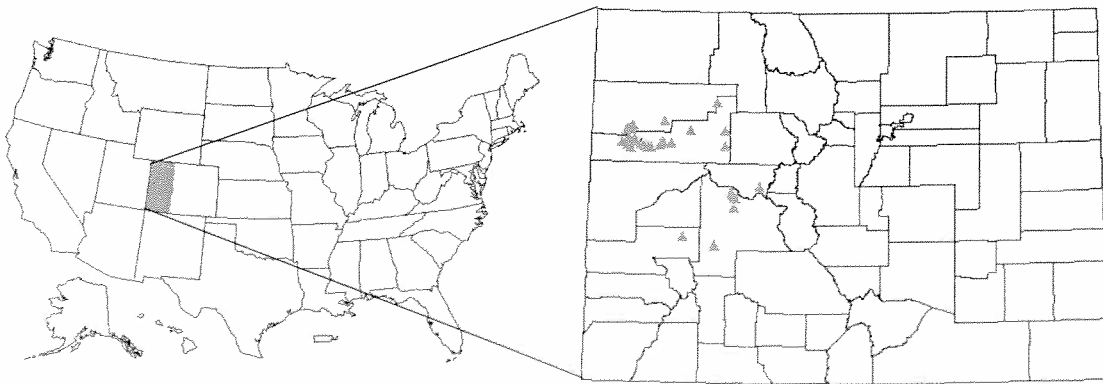
The Hanging garden sullivantia was the most common of the rare plants on NOSR-1. It is abundant on East Fork Parachute Creek and its tributaries as well as in the Northwater Creek canyon. It is conspicuously absent from Trapper Creek. Most occurrences were on north-facing cliffs with a continuous seep of water. The most notable occurrences are: Golden Castle Gulch, JQS, and East Fork Parachute Creek Falls.

Our field survey determined that the Hanging garden sullivantia occurs in 15 sections. Figure 5 and Appendix A give the specific locations of the occurrences.



**Habitat:** Golden Castle Gulch hanging garden (left) and East Fork Parachute Creek Falls (right).

R. J. Rondeau



Global distribution (Soltis 1991)

Colorado distribution (CNHP 1997)

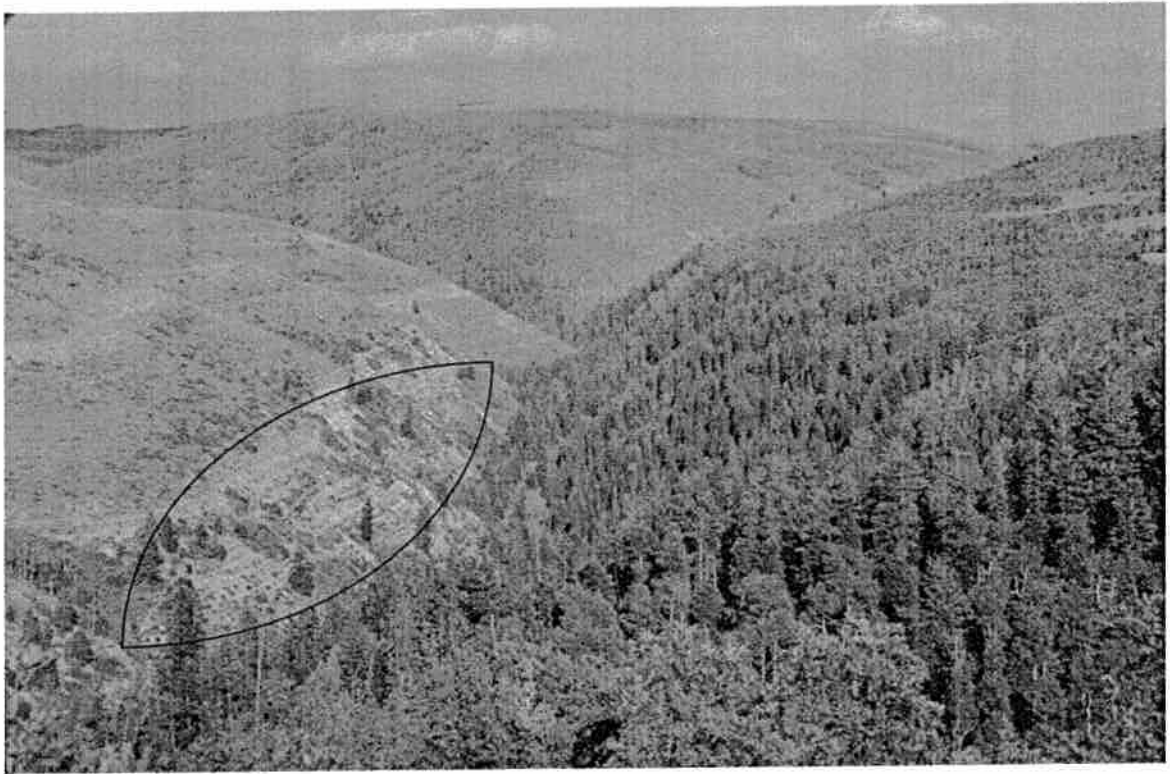
**Habitat and global/state distribution of *Sullivantia hapemanii* var. *purpusii*.**

**Utah fescue (*Festuca dasyclada*) G3/S3**

This perennial grass is an oil shale endemic found in eastern Utah and western Colorado on Green River Formation shale and Uinta Formation sandstone (Scheck 1994; see next page). The grass is atypical of most members of *Festuca*, and has been placed in its own genus (*Argillochloa*) by William Weber (1984). It was first collected in Utah by Parry in 1875 (Cronquist et al. 1977) and later described in 1896 by Hackel (1896). The taxon was not collected again, except at the type locality, until James Irvine located it in 1976 along the Roan Cliffs in Garfield County, Colorado (Irvine and West 1978).

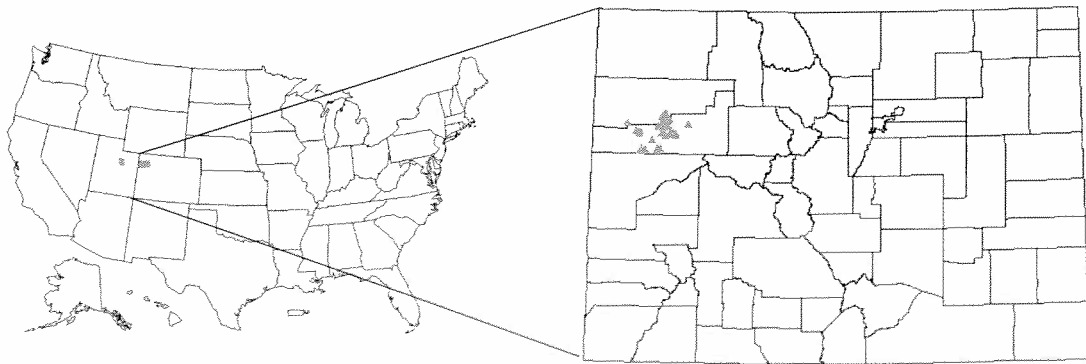
The Utah fescue grows primarily on outcrops of Green River Formation shale on barren scree slopes of any aspect, or in sparsely vegetated communities dominated by Douglas fir. The documented locations range from elevations of 6500 to 9300 feet (O'Kane 1988).

Within NOSR-1, we found that this species occurs in the Indian rice grass plant community and on sparsely vegetated shale slopes. It is scattered throughout NOSR-1 and has been found in 14 sections. Figure 5 and Appendix A give the specific locations of the occurrences.



**Habitat:** East Fork Parachute and First Anvil Creeks.  
Circle denotes habitat.

R. J. Rondeau



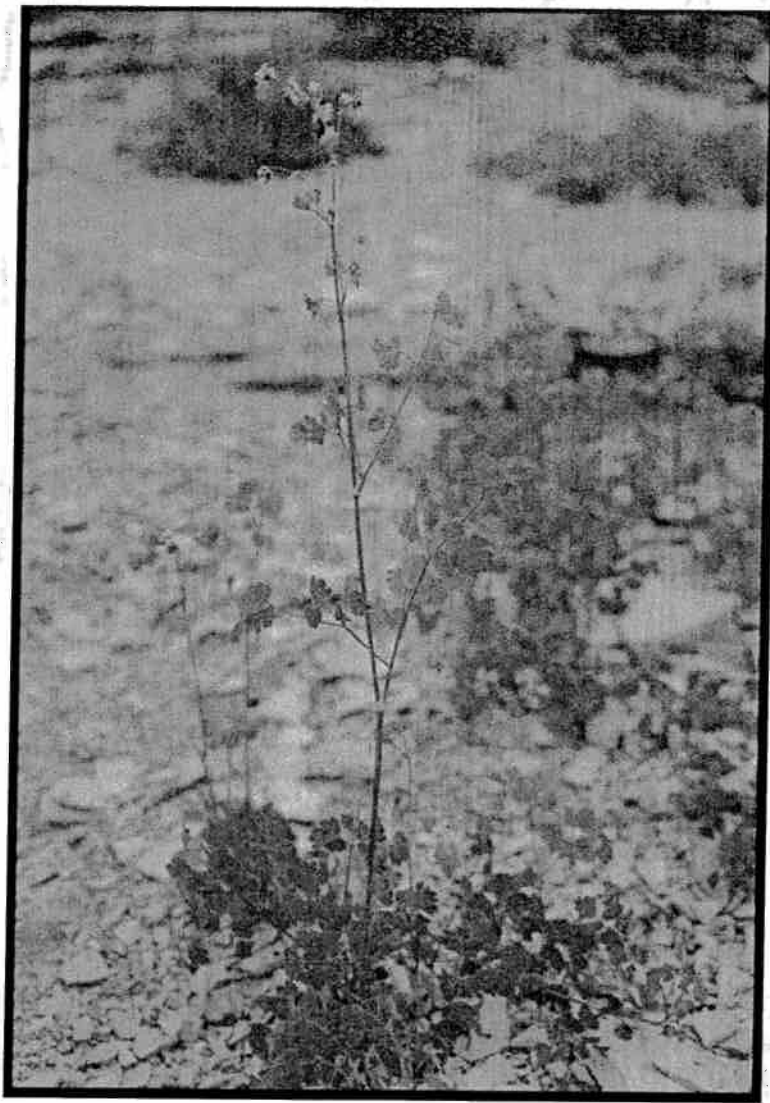
Global distribution (Cronquist et al. 1977)

State distribution (CNHP 1997)

**Habitat and global/state distribution of *Festuca dasyclada*.**



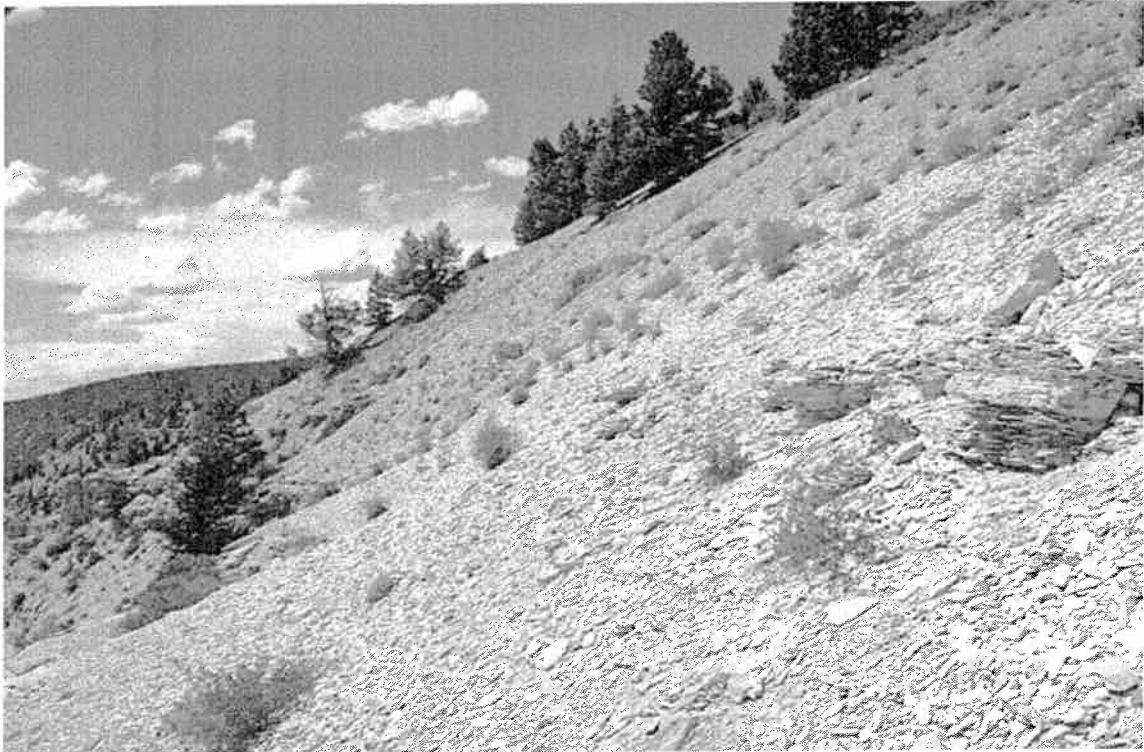
Sun-loving meadowrue (*Thalictrum heliophilum*) G3/S3



S, Spackman

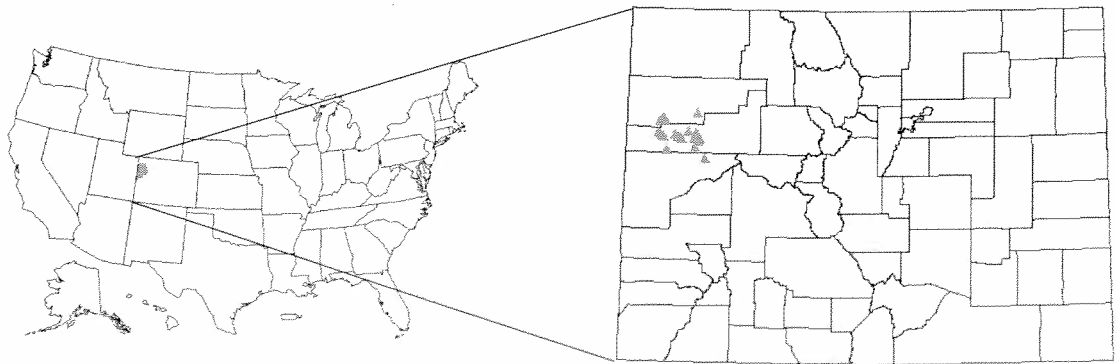
The Sun-loving meadowrue is an herbaceous perennial restricted to steep south-facing Green River Formation shale barrens. While most other *Thalictrum* prefer at least some shade, *T. heliophilum* grows in extremely sunny areas. *T. heliophilum* differs from other species of this group by having larger leaflets and fewer carpels (Weber and Wittmann 1996). It is frequently found with other oil shale restricted plants such as *Astragalus lutosus*, *Mentzelia argillosa*, and *Fesctuca dasyclada*.

Its world-wide range is restricted to the Green River Formation of the Piceance Basin, Colorado (see next page). Our survey found this plant only in two disjunct sections of NOSR-1 (T6S R95W, Sections 19 and 30; Figure 5 and Appendix A).



**Habitat:** Shale barrens at Allen Point (NOSR-1).

R. J. Rondeau



Global distribution (CNHP 1997)

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Thalictrum heliophilum*.**

**Fragrant horsemint (*Monardella odoratissima*) G4G5/S2**

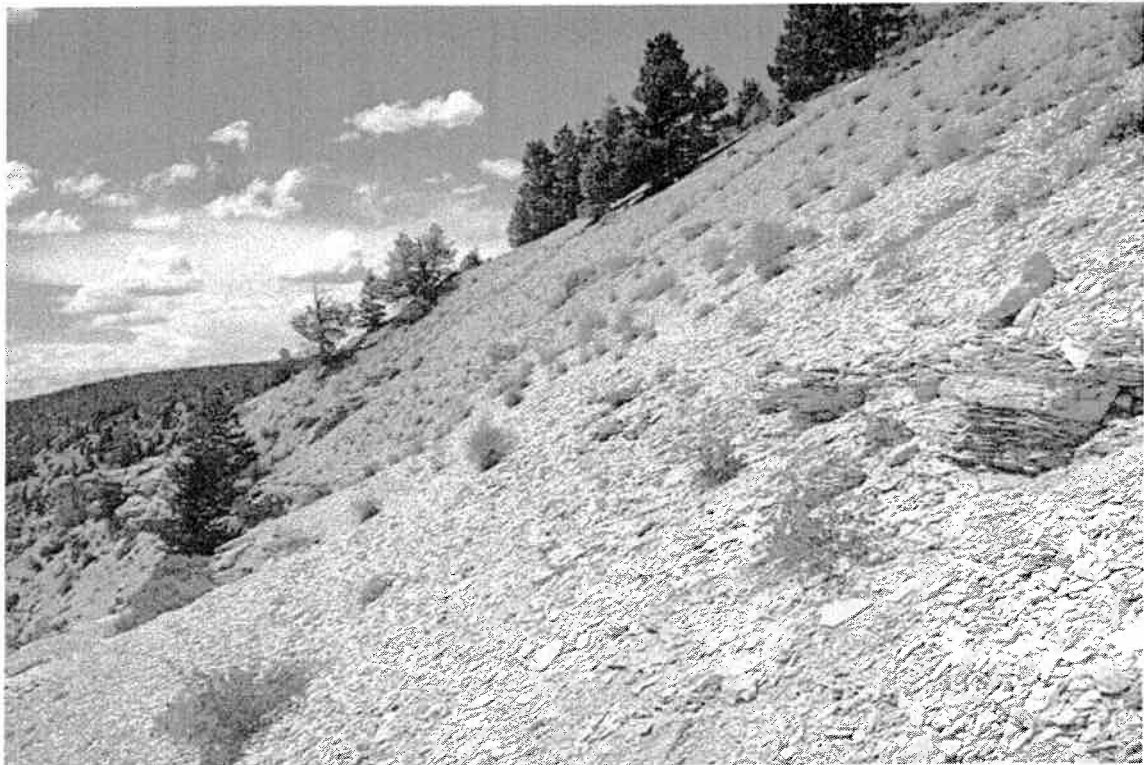
S. Spackman

This short and compact mint is most notable for its very strong fragrance -- just brushing a stem while walking creates a memorable aroma. Along with this distinct fragrance is a showy bloom. Numerous purple-pink flowers cover this perennial herb in July and August. Throughout its range, the Fragrant horsemint is found in a variety of communities including Sagebrush, mountain shrubland, Pinyon-Juniper, Ponderosa pine, Aspen, tall forb, and Spruce-Fir communities (Welsh et al. 1993).

This is a wide ranging plant, found in all western states of the U. S. Western Colorado is on the eastern edge of its range, with only 6 known locations in 4 counties (see next page).

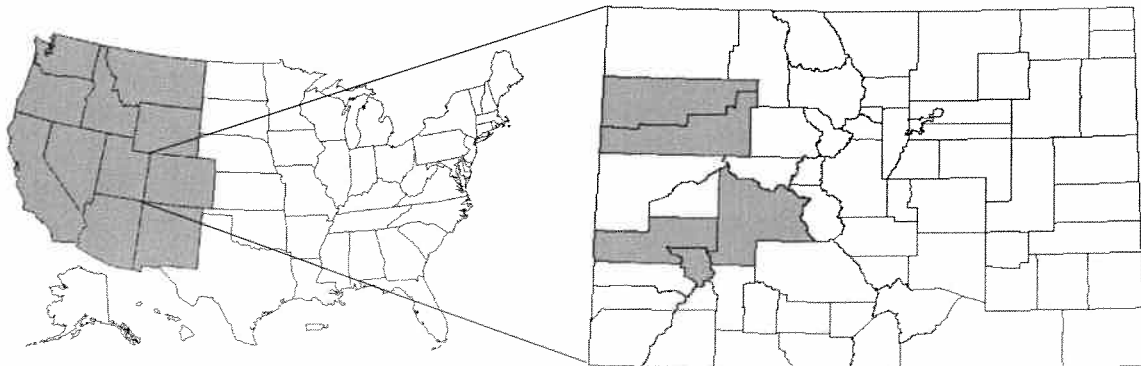
In Rio Blanco and Garfield counties, Colorado it is found on scree slopes of Green River Formation shale. It is often found with oil shale endemics, e. g., Arapien stickleaf (*Mentzelia argillosa*), Sun-loving meadow rue (*Thalictrum heliophilum*), Parachute penstemon (*Penstemon debilis*), and Dragon milkvetch (*Astragalus lutosus*).

On NOSR-1 we found this only along the shale barrens above the Book Cliffs on the eastern edge of the study area in T5S R94W S25 and 35 (Figure 5 and Appendix A).



**Habitat:** Shale barrens at Allen Point (NOSR-1).

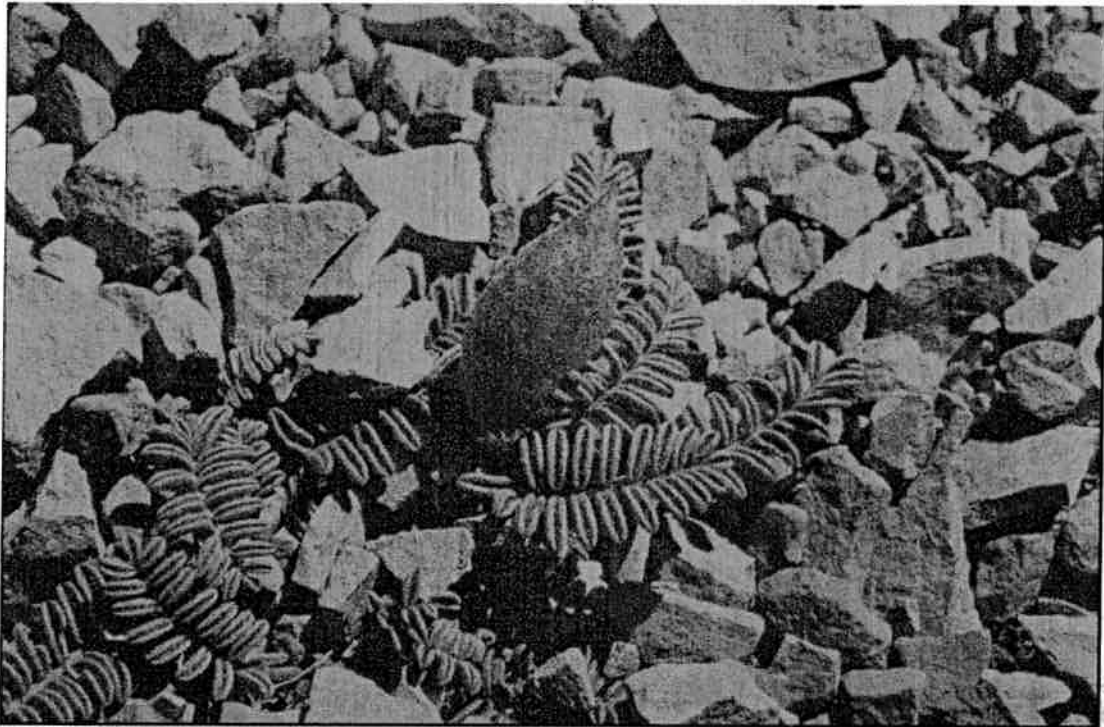
R. J. Rondeau



Global distribution (Welsh et al. 1993).

Colorado distribution (CNHP 1997).

**Habitat and global/state distribution of *Monardella odoratissima*.**

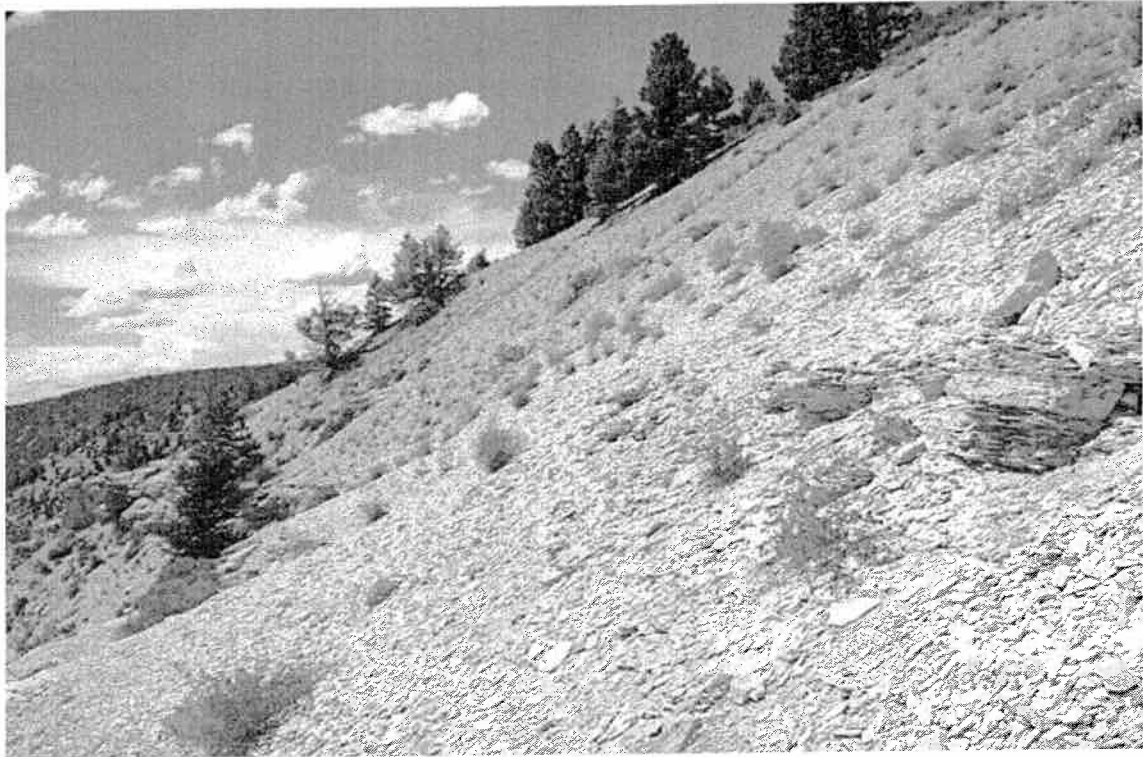
**Dragon milkvetch (*Astragalus lutosus*) G4/S3S4**

R. J. Rondeau

Dragon milkvetch is a member of the Fabaceae, or pea family. This plant is a dwarf, loosely tufted, low to the ground plant of the Green River Formation shale barrens from 5200 to nearly 9000 feet in elevation. It is frequently found with other oil shale restricted plants such as Sun-loving meadow rue (*Thalictrum heliophilum*), Parachute penstemon (*Penstemon debilis*), Arapien stickleaf (*Mentzelia argillosa*), and Utah fescue (*Festuca dasyclada*).

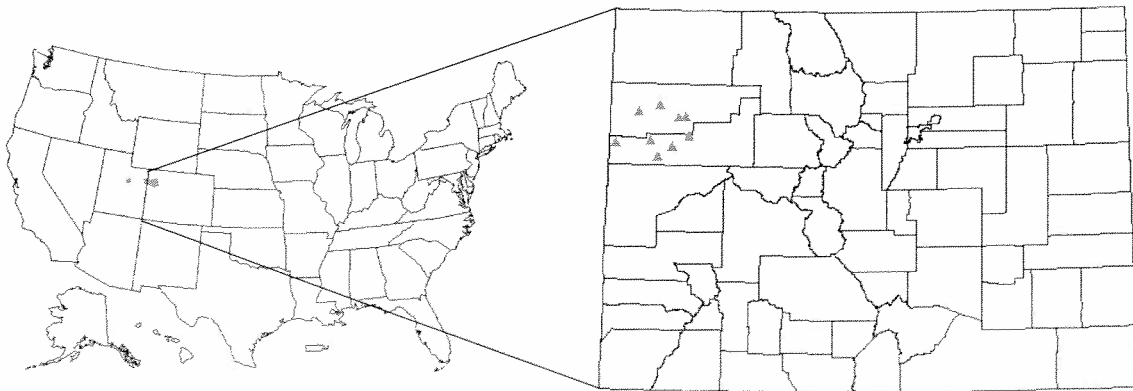
This species is primarily restricted to the Piceance Basin, Colorado, although a few locations in Utah have been reported (See next page). Due to the numerous locations and individuals of the milkvetch throughout the Piceance Basin, the Natural Heritage program considers this a watchlisted species. However, future oil shale or gas development may affect the status of this species.

Our field survey determined that dragon milkvetch occurs only along the shale barrens above the Book Cliffs in T5S R94W S24, 25, 35, and 36. See Figure 5 and Appendix A for specific locations.



**Habitat:** Shale barrens at Allen Point (NOSR-1).

R. J. Rondeau



Global distribution (Barneby 1964).

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Astragalus lutosus*.**

**Osterhout's penstemon (*Penstemon osterhoutii*) G3G4/S3S4**

C. Slater

Osterhout's penstemon is a purple-flowered snapdragon indigenous to western Colorado and eastern Utah (Cronquist et al. 1984; Goodrich and Neese 1986). It occurs between 5300 and 8800 feet in elevation, on sandy to clay soils in a wide range of habitats including sagebrush, salt desert shrub, pinyon-juniper, and mountain shrubland communities typically in gulches and canyons (Goodrich and Neese 1986).

The taxonomy of this plant is confusing as *Penstemon osterhoutii* and *P. pachyphyllus* var. *pachyphyllus* are similar taxa (Harrington 1954; Cronquist et al. 1984; Welsh et al. 1987.)

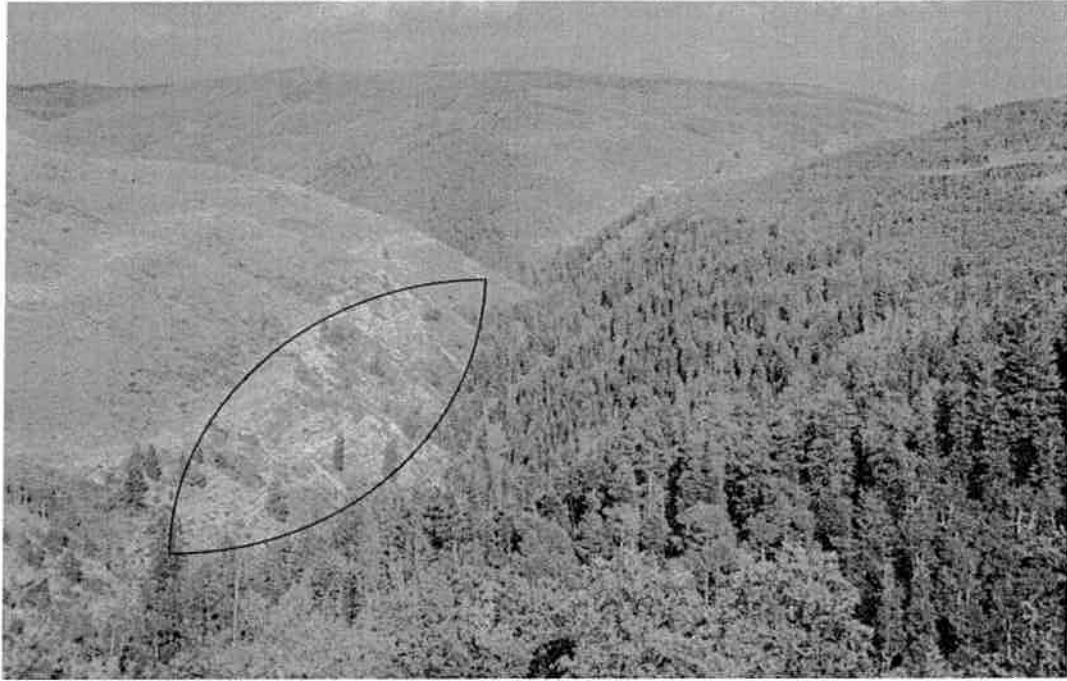
According to Cronquist et al. (1984) the primary difference between these two taxa are with the leaves. *P. osterhoutii* has lanceolate to ovate, acuminate leaves 4-9 cm long and 16-45 mm wide.

*Penstemon. pachyphyllus* var. *pachyphyllus* has oblanceolate to obovate or spatulate leaves, 5-10

cm long and 12-35 mm wide. Harrington (1954) states the primary difference as between the staminodes: *P. pachyphyllus* has about 1 mm wide, densely bearded staminodes with the hairs much longer than the width of the staminode. Specimens of *P. osterhoutii* through most of its range have 2-3 mm wide staminodes and is densely short-bearded with the hairs much shorter than the width of the staminode.

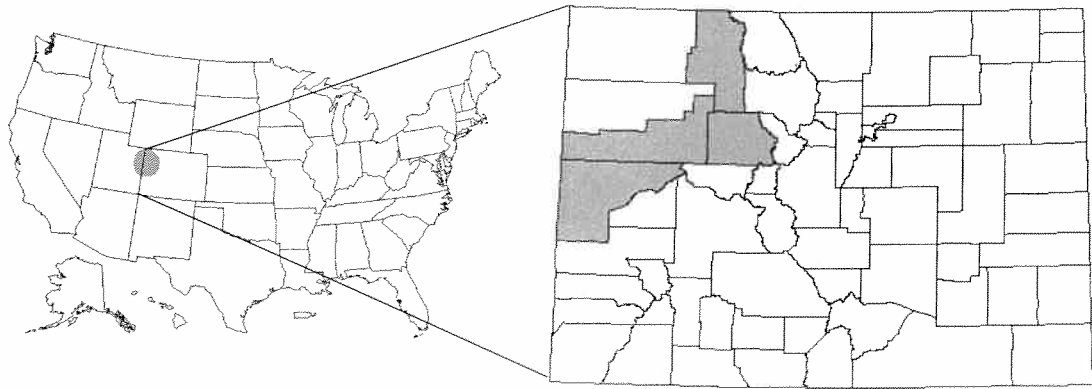
Due to its limited range CNHP is tracking this species, although this species is locally common in at least 4 counties (see next page).

In NOSR-1 we found this to be locally common in 9 sections, primarily on south-facing sparsely vegetated slopes adjacent to creeks. It occurs in T5S R94W S5, 6, 7, and 18; T5 S R95W S11, 13, 26, and 36; and T6S R95W S4. See Figure 5 and Appendix A for specific locations.



**Habitat:** East Fork Parachute and First Anvil Creeks.  
Polygon denotes habitat.

R. J. Rondeau



Global distribution (Cronquist et al. 1984;  
Goodrich and Neese 1986)

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Penstemon osterhoutii*.**





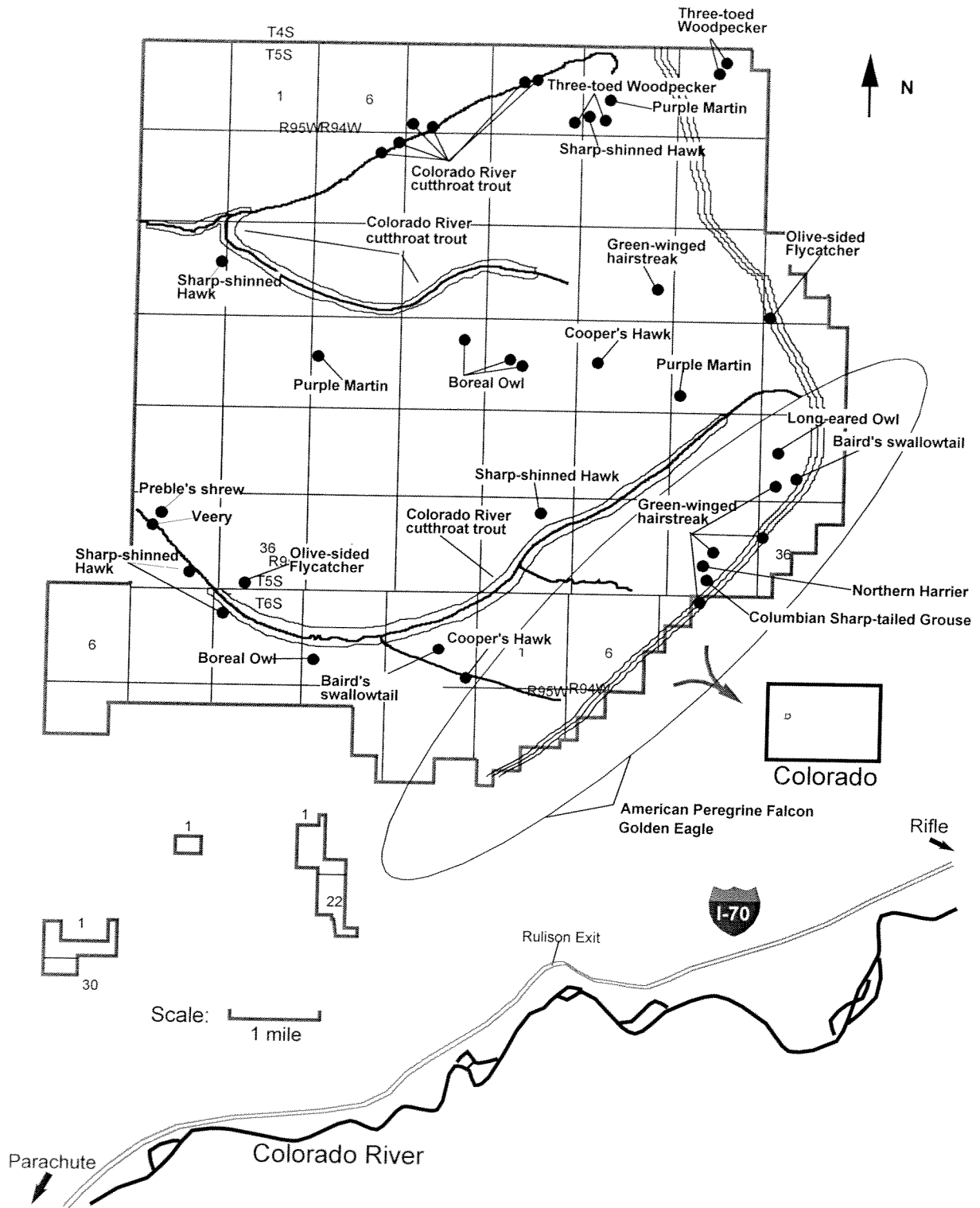
## Animals

Surveys of NOSR-1 yielded new locations for 13 species of rare or imperiled animals, and updated previously-known locations of three additional species. The three previously-known species include the Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), the Golden eagle (*Aquila chrysaetos*), and the federally endangered American peregrine falcon (*Falco peregrinus anatum*). Table 9 lists all of the known rare and imperiled animals of NOSR-1. Figure 6 and Appendix A provide locations for each species see Appendix C for state map with county names.

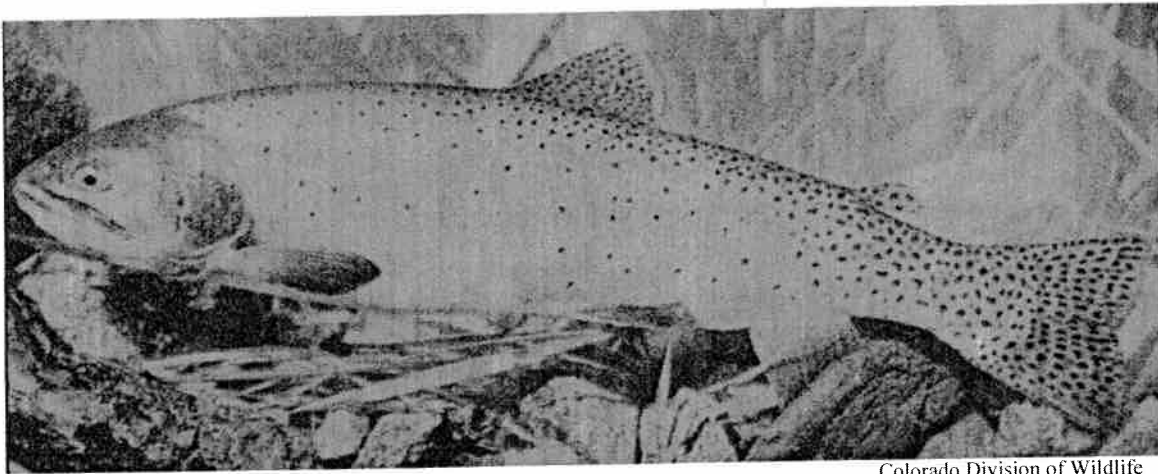
It is extremely important that any mitigation for the conservation of any animal species consider the mobility of the species, and therefore strive to incorporate areas beyond simple point-locations of occurrence. In other words, animals move, and therefore conservation plans would benefit by incorporating the extent of any habitat used by a given species, or at least a viable population. Conservation plans for animals are best designed at an ecosystem level. See the previous Recommended Conservation Sites section for recommended boundaries which would help ensure the survival of NOSR-1's most rare and imperiled species.

**Table 9.** Rare or biologically significant animal species of NOSR-1 with natural heritage ranks (global and state) and federal status (see introduction for explanation of heritage ranks). Bolded ranks and federal status indicate a high level of imperilment. An asterisk indicates a watchlisted species.

Common Name	Scientific Name	Global Rank	State Rank	Fed. Status
<b>Fish</b>				
Colorado River cutthroat trout	<i>Oncorhynchus clarki pleuriticus</i>	<b>G5T2T3</b>	<b>S2</b>	<b>(C2)</b>
<b>Birds</b>				
*Veery	<i>Catharus fuscenscens</i>	G3	S3S4B,SZN	
Columbian sharp-tailed grouse	<i>Tympanuchus phasianellus columbianus</i>	<b>G5T3</b>	<b>S2</b>	<b>(C2)</b>
American peregrine falcon	<i>Falco peregrinus anatum</i>	<b>G4T4</b>	<b>S2B,SZN</b>	<b>LE</b>
*Cooper's hawk	<i>Accipiter cooperii</i>	G4	S3S4B,S4N	
Boreal owl	<i>Aegolius funereus</i>	<b>G5</b>	<b>S2</b>	
Purple martin	<i>Progne subis</i>	G5	S3B	
*Three-toed woodpecker	<i>Picoides tridactylus</i>	G5	S3S4	
*Golden eagle	<i>Aquila chrysaetos</i>	G5	S3S4B,S4N	
*Long-eared owl	<i>Asio otus</i>	G5	S3S4B,SZN	
*Northern harrier	<i>Circus cyaneus</i>	G5	S3S4B,S4N	
*Olive-sided flycatcher	<i>Contopus borealis</i>	G5	S3S4B,S4N	<b>(C2)</b>
*Sharp-shinned hawk	<i>Accipiter striatus</i>	G5	S3S4B,S4N	
<b>Mammals</b>				
Preble's shrew	<i>Sorex c.f. preblei</i>	G5	SU	
<b>Insects</b>				
*Baird's swallowtail	<i>Papilio bairdii</i>	G4	S3S4	
*Green-winged hairstreak	<i>Callophrys affinis</i>	G4T?	S3S4	



**Figure 6.** Vertebrate and Invertebrate Occurrences on NOSR-1, Garfield County, CO.

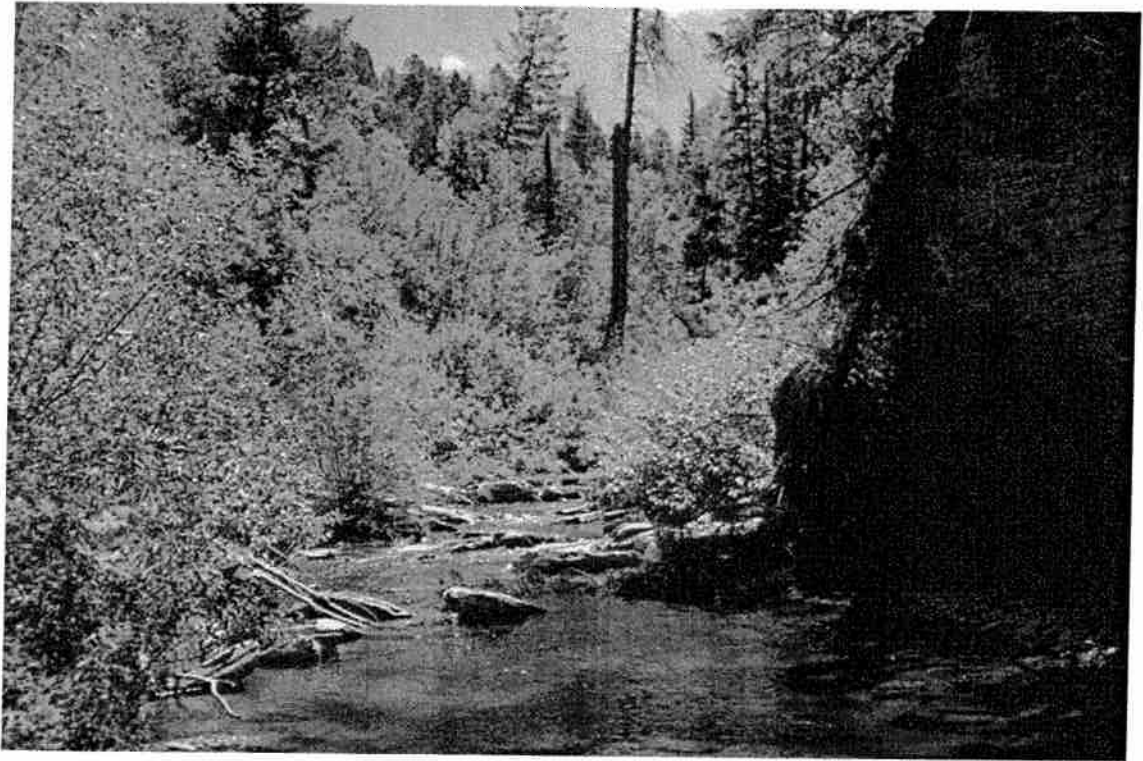
**Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) G5T2/S2**

Colorado Division of Wildlife

The only trout species native to Colorado is the cutthroat (Sealing et al. 1992). Drainage histories have isolated four distinct subspecies of cutthroat trout in Colorado; the Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), the Greenback cutthroat trout (*O. clarki stomias*), the Yellowfin cutthroat trout (*O. clarki macdonaldi*), and the Rio Grande cutthroat trout (*O. clarki virginalis*). Of these four, the Yellowfin cutthroat trout is extinct, and the distributions of the remaining three have been reduced to a fraction of their respective historic ranges (Behnke 1988; Sealing et al. 1992). Historic distributions of the Colorado River cutthroat trout extended from the headwaters of the Colorado River basin downstream to the Dirty Devil River in Utah and to the San Juan River drainage in Colorado, New Mexico, and Arizona (Sealing et al. 1992). Refer to the following page for current distributions. The introduction of non-native trout species, dating to 1872 in Colorado, is considered a primary cause for the decline in numbers and genetic purity of Colorado River cutthroat trout (Sealing et al. 1992; Wiltzius 1985). Wernsman (1973) reported only three populations of relatively pure Colorado River cutthroat trout in Colorado. These were in Cunningham Creek (Pitkin County), Northwater Creek (Garfield County), and the headwater area of the Colorado River in Rocky Mountain National Park (Grand County).

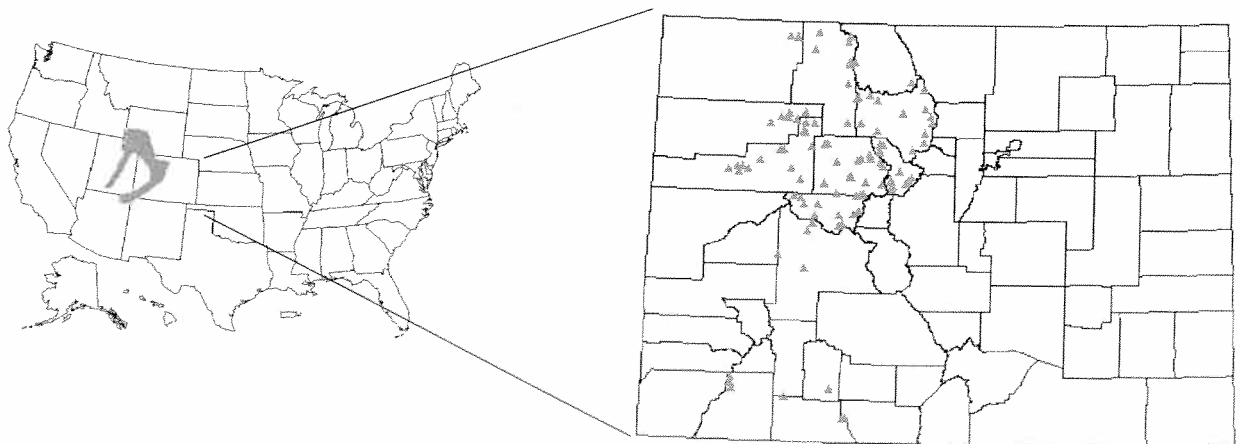
Most of the remaining Colorado River cutthroat trout are found in small headwater streams or alpine lakes that have resisted colonization of non-native trout (Proebstel 1994). Good stream conditions for Colorado River cutthroat trout include cold, clear-running water with high oxygen content, rocky substrates, fairly high stream gradients, and a pH ranging from 6 to 9 (Binns 1977; Sealing et al. 1992). Spawning occurs from late spring through early summer (Behnke and Zarn 1976; Sealing et al. 1992). Sexual maturity is usually reached between the ages of 2 and 4 years (Martinez 1988; Sealing et al. 1992).

The Colorado River cutthroat trout population in Northwater Creek is still intact. We also found this fish in Trapper Creek and East Fork Parachute Creek on NOSR-1 (see Figure 6 and Appendix A), though the population in Trapper Creek was apparently impacted from degraded stream conditions. The lack of shrub cover along the stream likely causes increased water temperatures that are detrimental to the fish. This lack of cover apparently stems from a long history of grazing by domestic livestock.



**Habitat:** East Fork Parachute Creek, above falls

R. J. Rondeau



Global distribution (Sealing et al. 1992)

Colorado distribution (CNHP 1997)

**Habitat and global/state distribution of *Oncorhynchus clarki pleuriticus*.**

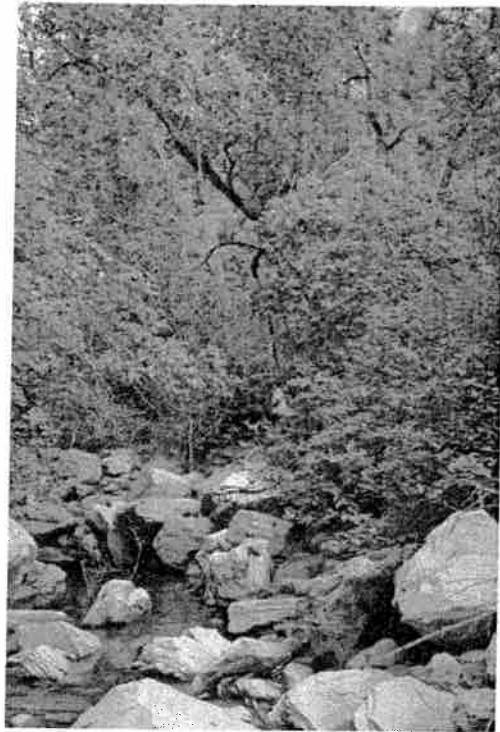
**Veery (*Catharus fuscescens*) G3/S3S4B,SZN**

B. Dyer (for Cornell Lab of Ornithology)

The Veery is one of the North American thrushes of the genus *Catharus*, which include the Swainson's Thrush (*Catharus ustulatus*), the Gray-cheeked Thrush (*Catharus minimus*), and the Hermit Thrush (*Catharus guttatus*). There are two recognized subspecies of *Catharus fuscescens* in North America; *Catharus fuscescens fuscescens* occurs in the eastern extent of its range and is the paler of the two, while the western portion of the Veery's range in North America is occupied by the darker *Catharus fuscescens salicicolus*. The latter subspecies occurs in Colorado and on NOSR-1 property.

The Veery is a neotropical migrant that breeds in North America and winters in Central and South America (Andrews and Righter 1992). The summer distribution of the Veery in Colorado is poorly understood, but see the next page for currently known distributions. Summer sightings in Colorado are scarce, and at only three sites has nesting been confirmed (Andrews and Righter 1992). Breeding habitat for the Veery is described as dense riparian thickets including Cottonwood, Willow, or Dogwood (Andrews and Righter 1992). Breeding begins in May or June and young are generally fledged within a month.

We found a Veery singing below the falls in a Box elder-Narrowleaf cottonwood/Red-osier dogwood riparian forest along East Fork Parachute Creek (Township 5S, Range 95W, section 35) on NOSR-1 property during early June of 1996. Refer to Figure 6 and Appendix A for exact locations.

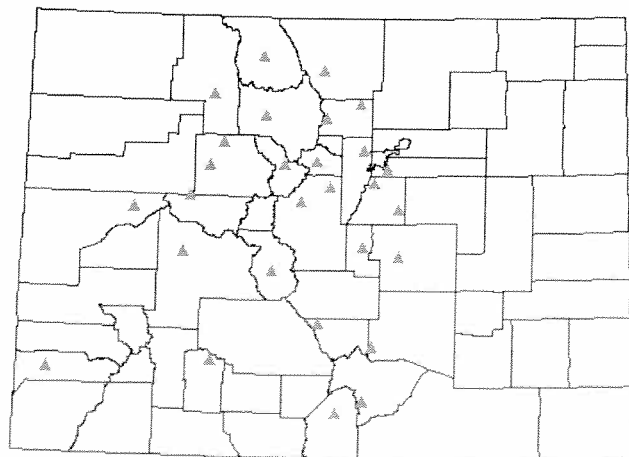


**Habitat:** East Fork Parachute Creek below falls.

R. J. Rondeau



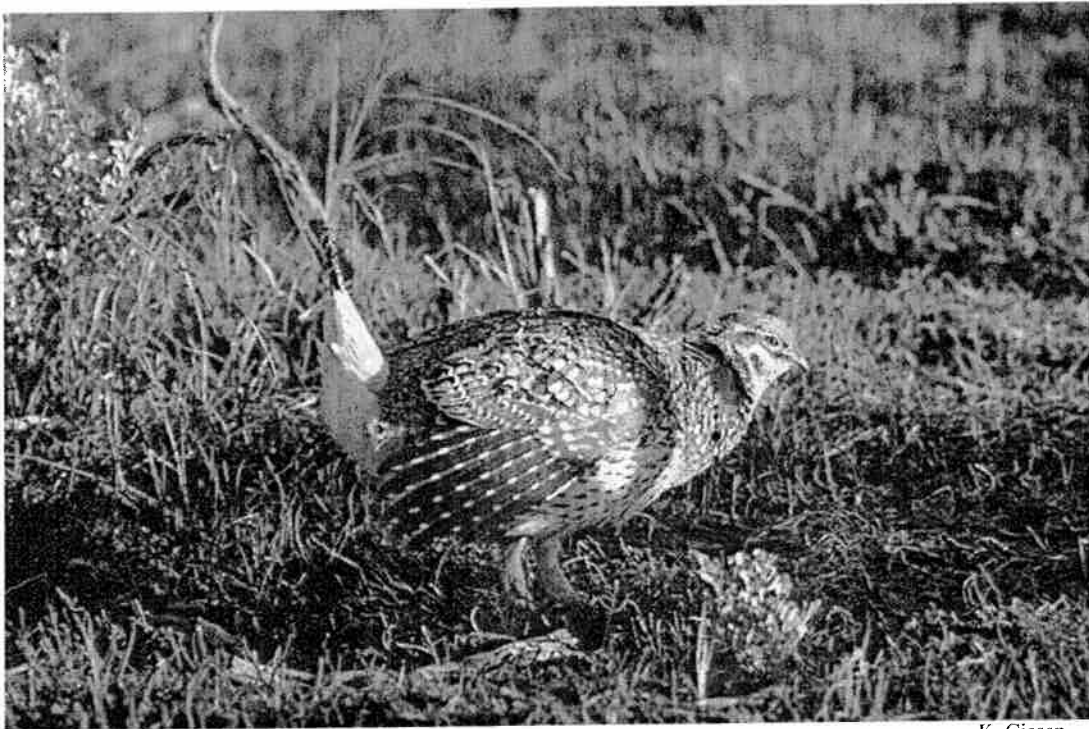
Global breeding season distribution  
(Moskoff 1995)



Colorado breeding season distribution  
(Andrews and Righter 1992)

**Habitat and global/state distribution of *Catharus fuscescens*.**



**Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) G5T3/S2**

K. Giesen

The Sharp-tailed grouse consists of two subspecies in North America: *Tympanuchus phasianellus jamesii* on the Great Plains, and *T. phasianellus columbianus* in the western mountains. *T. phasianellus columbianus* is described as a local resident in northwestern Colorado (Andrews and Righter 1992). Specifically, it is known from Routt and eastern Moffat counties, with smaller, localized populations south to Montezuma County, where it is a year-round resident (see next page). Populations of Columbian sharp-tailed grouse have declined over the years due to habitat alteration (Braun et al. 1991).

This is a bird of mountain shrublands, including Gambel oak, Serviceberry, and Sagebrush (Andrews and Righter 1992; Saab and Marks 1992), where it feeds on insects during the summer and berries in the fall. Typical breeding seasons begin in late March and early April, when males of the species congregate on prominent hilltops to drum, or “broadcast their mating call” (R. Hoffman pers. comm.). Drumming attracts nearby females to the area, who then proceed to select a male for breeding, mate, and finally leave to nest elsewhere. This behavior is commonly known as lekking.

Columbian sharp-tailed grouse were found near the southeastern rim of the Book Cliffs (Township 5S, Range 94W, section 35) on NOSR-1 property in July of 1996 (Figure 6 and Appendix A). The female observed had a brood of young birds in trail, which indicated breeding nearby. The Colorado Division of Wildlife plans to conduct breeding season surveys in 1997 on the Roan Plateau in response to the report of this species there; since we do not yet know if NOSR-1 is a lekking site for Columbian sharp-tailed grouse. They will also be examining the area as a potential location for transplanting or reintroducing this species (R. Hoffman pers. comm.).

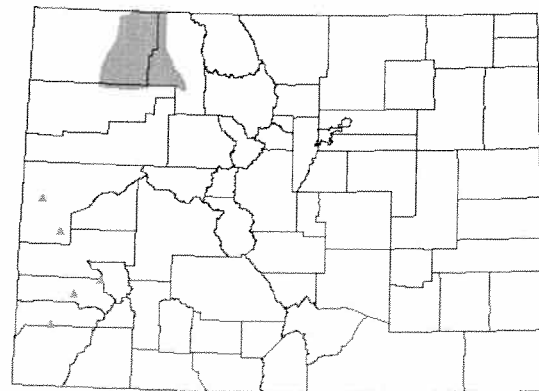


**Habitat:** Lek site in Moffat County.

K. Giesen



Global year-round distribution  
(National Geographic Society 1987)



Colorado year-round distribution  
(Andrews and Righter 1992; CNHP 1997)

**Habitat and global/state distribution of *Tympanuchus phasianellus columbianus*.**

**American peregrine falcon (*Falco peregrinus anatum*) G3/S2B,SZN**

P. O'Conner

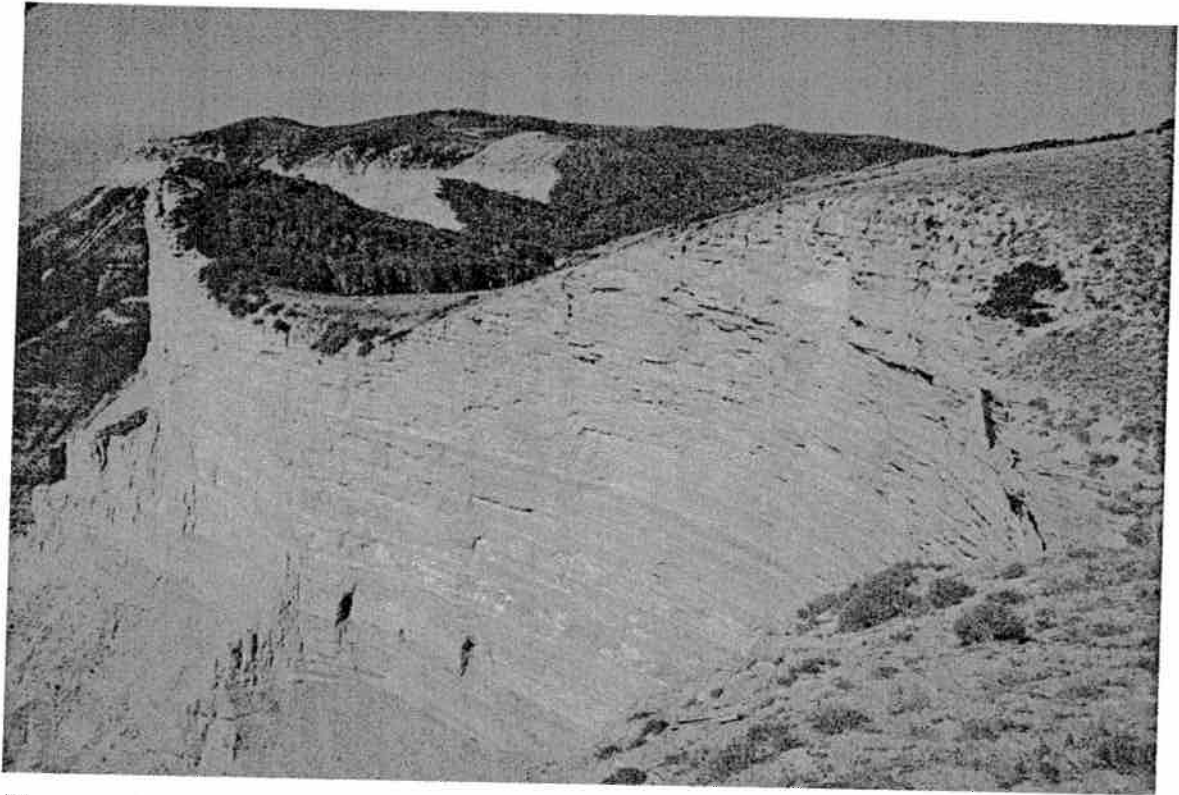
The peregrine falcon in North America includes three morphologically and geographically distinct subspecies: *Falco peregrinus tundrius*, *F. p. pealei*, and *F. p. anatum*. *F. p. tundrius* ranges across the arctic tundra of North America, while *F. p. pealei* occurs on the northwest coast of North America, and *F. p. anatum* is the intermediate subspecies of the west that once ranged the continent (Natl. Geo. Soc. 1987). Refer to the next page for current distributions of *F. p. anatum*.

Populations of the American peregrine falcon declined rapidly as a result of the use of DDT and other pesticides (Fuller et al. 1995). In 1972 the U.S. placed a ban on DDT within the U.S. Despite this ban, the American peregrine falcon was extirpated as a breeding bird in the eastern U.S. and declared endangered elsewhere (Fuller et al. 1995). Peregrine recovery has been accomplished in the western U.S. by the release of thousands of captive-bred peregrines (Ehrlich et al. 1992). Several generations originating from these captive-bred peregrines have survived and produced young in the wild (Fuller et al. 1995). There are now more than 70

pairs breeding in Colorado (J. Craig pers. comm.).

The American peregrine falcon prefers nesting in cracks or on small shelves on the sides of cliffs. They generally use adjacent forests and riparian woodlands for hunting (Andrews and Righter 1992). The American peregrine falcon will take other birds, reptiles, and small mammals as prey items. This species is a year-round resident of North America, and migrates only locally from season to season.

A peregrine eyrie on the Book Cliffs near NOSR-1 has been known and active for a number of years. Five peregrines were observed flying near that nest in August of 1996. Three of those birds were juvenile and are assumed to have fledged from the nearby nest. Exact locations are not printed on any included maps due to the sensitive nature of the data. Refer to Figure 6 and Appendix A for approximate locations.

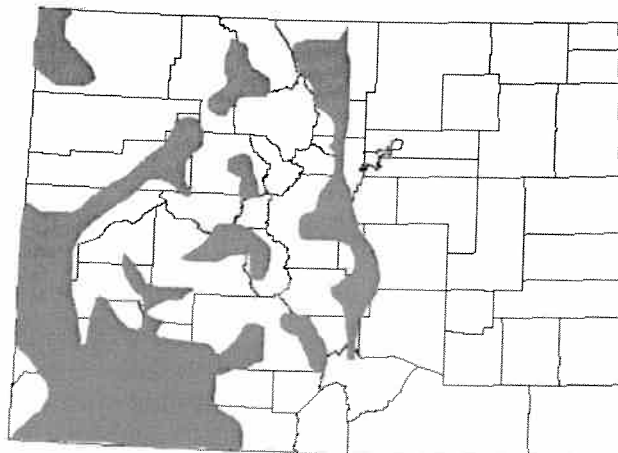


**Habitat:** Book Cliffs at Anvil Points.

R. J. Rondeau

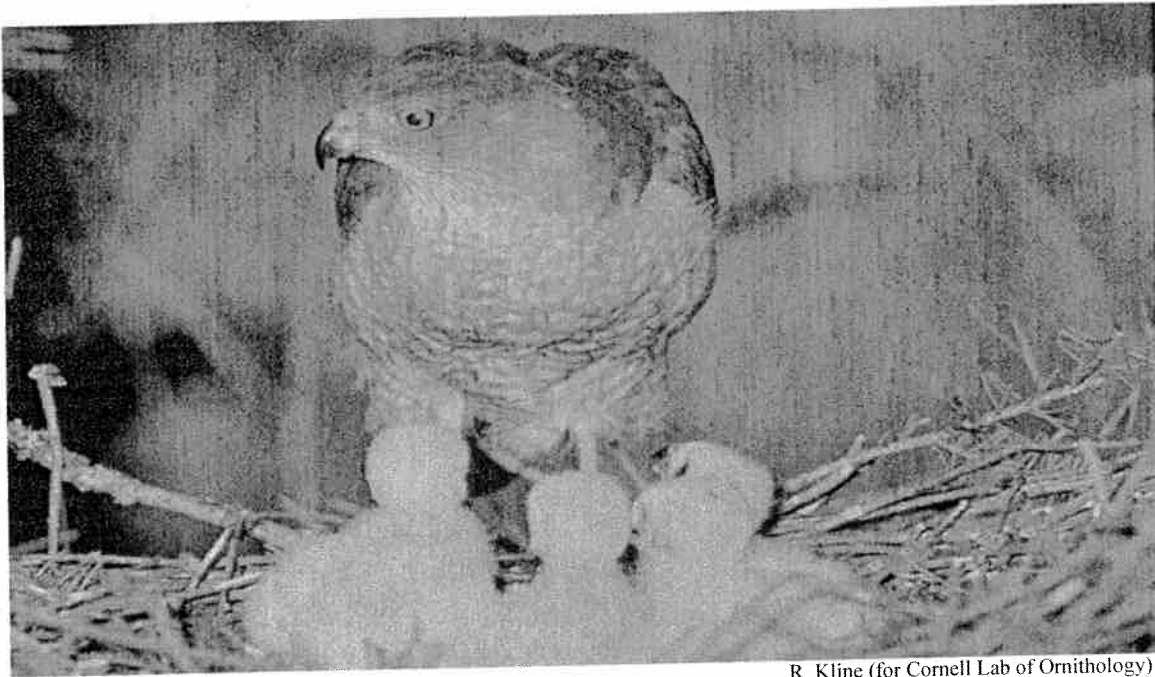


Global distribution (National Geographic 1987)



Colorado distribution (Andrews and Righter 1992; CNHP 1997)

**Habitat and global/state distribution of *Falco peregrinus anatum*.**

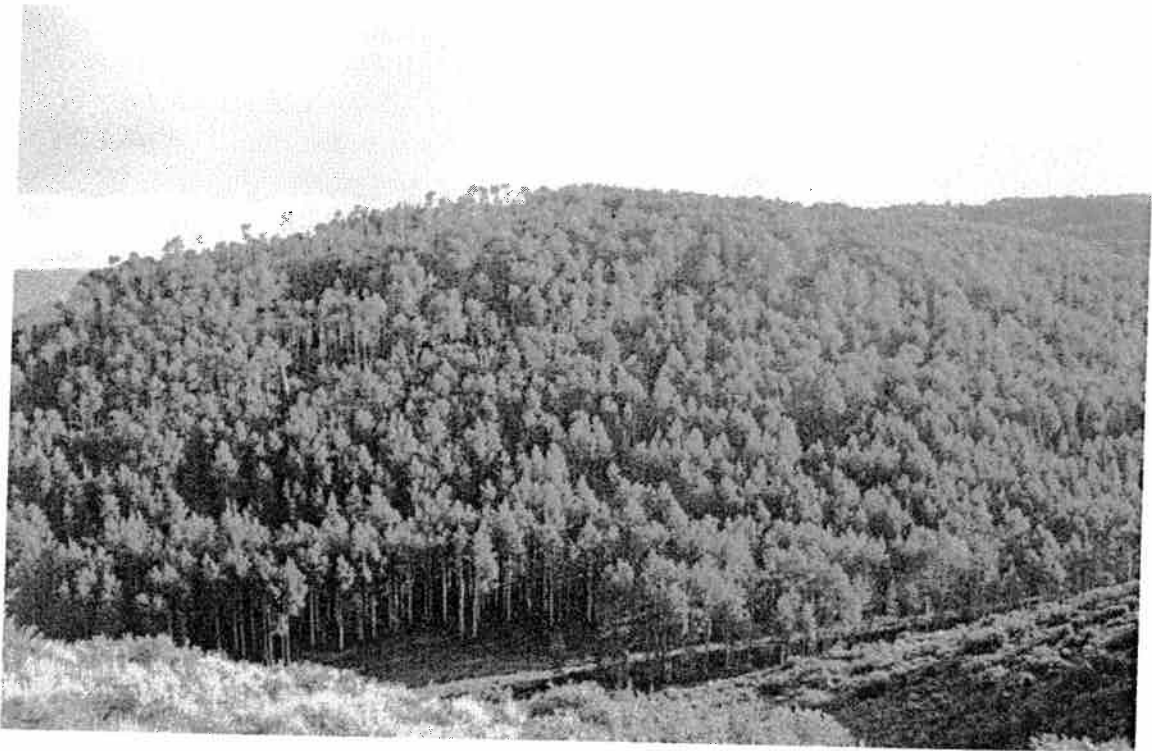
**Cooper's hawk (*Accipiter cooperii*) G4/S3S4B,S4N**

R. Kline (for Cornell Lab of Ornithology)

The Cooper's hawk is the mid-sized species of the genus *Accipiter* occurring in North America. The Northern goshawk (*Accipiter gentilis*) is larger, and the Sharp-shinned hawk (*Accipiter striatus*) is smaller. In other parts of the United States the Cooper's hawk may be declining in numbers (Natl. Geo. Soc. 1987), but in Colorado, numbers appear stable. Therefore, the species is "watchlisted" by the Colorado Natural Heritage Program.

The Cooper's hawk, like all the accipiters, is a hawk of the forest. It can be found during the breeding season in Ponderosa pine, Douglas fir, Lodgepole pine, Aspen, Spruce-Fir, Pinyon-Juniper, and riparian forests (Andrews and Righter 1992). It is a year-round resident in some parts of North America, but will also migrate as far south as Central America (Natl. Geo. Soc. 1987). Refer to the following page for distribution maps and habitat photo. This species feeds on small to medium-sized birds and small mammals, and occasionally reptiles (Bielefeldt et al. 1992). Breeding begins in May, and young usually fledge by late July to August.

Two Cooper's hawk nests were located during the 1996 field season (Township 5S, Range 94W, section 22; Township 6S, Range 95W, section 2). In order to report an occurrence of a raptor species, the Colorado Natural Heritage Program requires some evidence of breeding. Therefore, only the two locations in Figure 6 and Appendix A are recorded as occurrences in this case. There are probably a number of additional Cooper's hawk nests on NOSR-1, as we observed individuals in several different areas of the property during the breeding season. However, since we found no additional nests, no additional locations are reported. During fall migration, as many as ten Cooper's hawks were seen at one time along the eastern rim of the Book Cliffs in Township 5S, Range 94W, section 24. This area proved to be an important staging area for many species of raptor during fall migration.

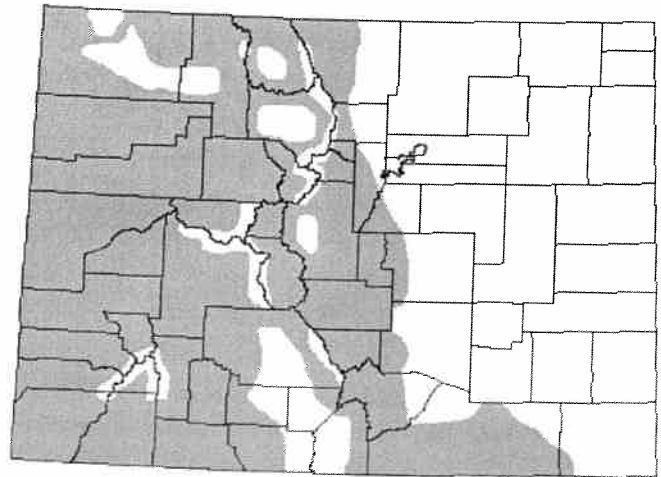


**Habitat:** Old growth aspen stand at West Anvil Point.

R. J. Rondeau

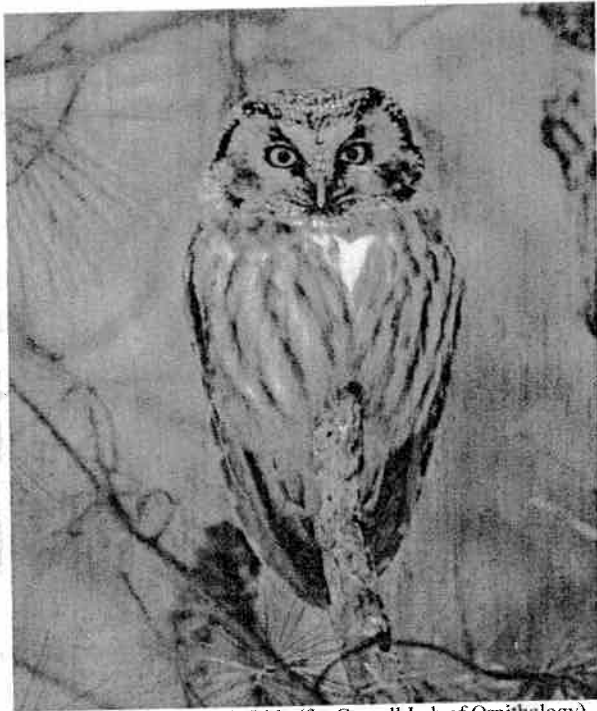


Global breeding season distribution  
(Rosenfield and Bielefeldt 1993)



Colorado breeding season distribution  
(Andrews and Righter 1992)

**Habitat and global distribution of *Accipiter cooperii*.**

**Boreal owl (*Aegolius funereus*) G5/S2**

R. S. Litle (for Cornell Lab of Ornithology)

All Boreal owls in North America belong to one subspecies: *Aegolius funereus richardsoni*. Colorado marks the southern extreme of the Boreal owl distribution range (see next page). The bulk of its range occurs in the boreal forests of Canada (Natl. Geo. Soc. 1987). This species is ranked as a G5/S2 by the Colorado Natural Heritage Program, which translates to stable populations on a global scale, but less than twenty known occurrences or small numbers of individuals in Colorado. This type of rank can indicate that populations in the state are at the extreme edge of the distribution range of the species.

This small, secretive montane owl is generally associated with mature Spruce-Fir and/or Lodgepole pine forests with scattered clearings (Palmer 1984; Ryder et al. 1987; Andrews and Righter 1992). These clearings are important for hunting during the bulk of the breeding season, and are usually grassy areas that support various small mammal populations preferred as prey items by this owl. Though these clearings are important hunting areas for the owls during the breeding season, the dense conifer forests provide nesting cavities and also provide winter hunting areas. The conifer forests shade winter snows from the sun, which works to prevent the formation of a layer of crust on the surface of that snow. Snow in open meadows during the winter is exposed to the sun, and the top layer will melt during the day, only to refreeze during the night. This process forms a crust on the top of the snow that is impenetrable by these little owls. Hunting in the winter by the Boreal owl consists of detecting movement just below the surface of the snow, and then plunging through it to catch the prey; a layer of crust on the surface of winter snows prevents not only the catching of prey beneath the surface, but the detection of it as well. This owl is a secondary cavity nester, and depends on old woodpecker holes or natural cavities for nesting (Harrison 1978). A favored prey item is the Southern red-backed vole (*Clethrionomys gapperi*), but it will take other small mammals just as readily, and sometimes even birds and insects (Bent 1938; Ryder et al. 1987; Hayward 1987). The Boreal owl is a year-round resident in Colorado and begins breeding in February and March. Clutch initiation generally begins in mid-April (Hayward 1987).

The Boreal owl was found breeding in the dense spruce/fir forests on north-facing slopes of Raspberry Creek (Township 5S, Range 94W, sections 20, 21), East Fork Parachute Creek (Township 6S, Range 95W, section 3) on NOSR-1 property during 1996 surveys (Figure 6 and Appendix A). It is not known whether these owls winter on NOSR-1, but the habitat is well suited for that possibility.

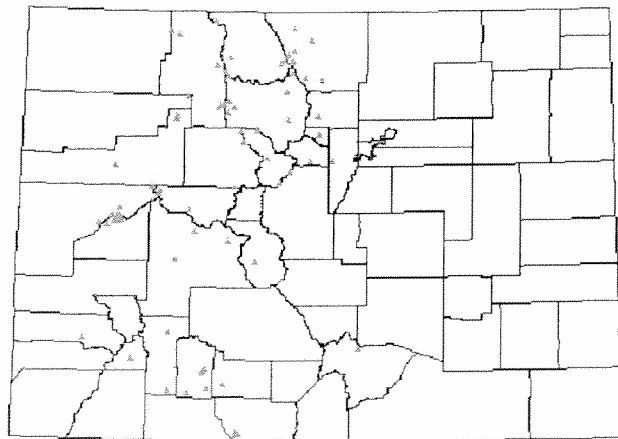


**Habitat:** East Fork Parachute Creek at Camp Gulch.

R. J. Rondeau



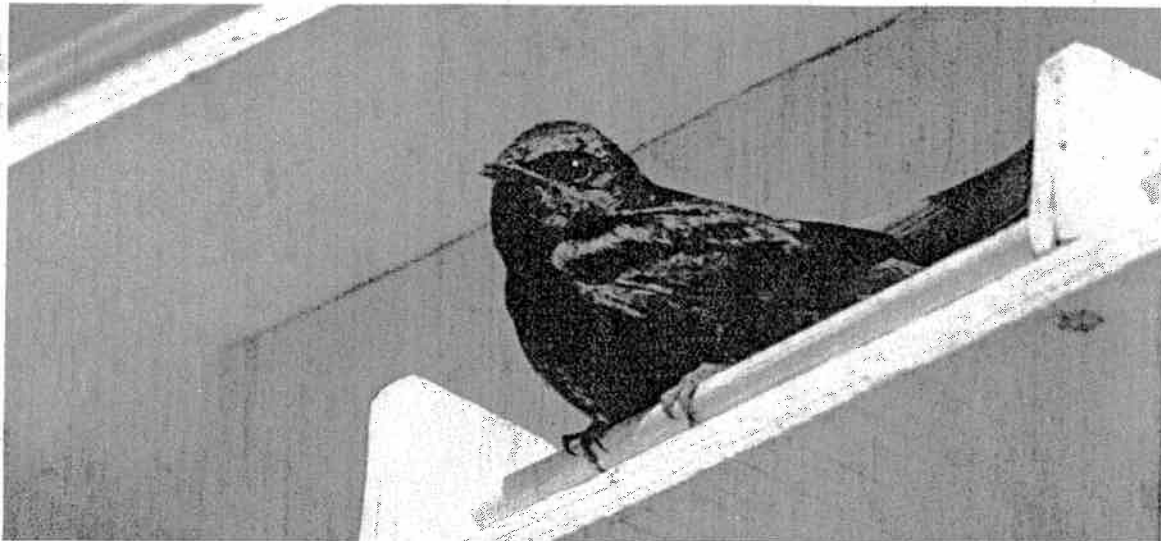
Global year-round distribution  
(Hayward and Hayward 1993)



Colorado year-round distribution (Andrews  
and Righter 1992; CNHP 1997)

**Habitat and global/state distribution of *Aegolius funereus*.**



**Purple martin (*Progne subis*) G5/S3B**

W.A. Paff (for Cornell Lab of Ornithology)

Purple martins belong to the genus *Progne*, which is ill-defined. Some authors treat *Progne subis*, *Progne cryptoleuca*, *Progne dominicensis*, *Progne sinaloae*, and *Progne chalybea* as the same species, but the American Ornithologists Union defines Purple martin (*Progne subis*) as a distinct species (AOU 1983; Sheldon and Winkler 1993). This neotropical migrant nests in North America and winters in South America, primarily in southern Brazil (Hilty and Brown 1986; Ridgely and Tudor 1989; Stiles and Skutch 1989). The Purple martin may have been adversely impacted by the use of DDT and other pesticides when these were used heavily in North America. Additionally, habitat loss has been a primary factor in the decline of this species throughout its range. Populations in the eastern United States have been on the rebound with the introduction of martin houses (nest boxes), but western population trends remain largely unknown. Some authors speculate that competition with European Starling (*Sturnus vulgaris*) for nesting cavities may be a factor in potentially declining numbers in the west (Natl. Geo. Soc. 1987). Purple martin nesting colonies remain relatively rare in Colorado (see next page), and are generally restricted to the western half of the state. For this reason, the Purple martin is ranked as S3B by the Colorado Natural Heritage Program.

Breeding begins in late May to July depending on climate. Purple martins will generally rear one brood or two if conditions are favorable. This species seeks vacant woodpecker holes and natural cavities in trees for nesting. It nests colonially near water in forests with dead trees that support abundant woodpecker holes. The Purple martin forages over fields, marshes, and water in search of insects. In areas of favorable habitat, Purple martins can be rather abundant.

We found three breeding colonies on NOSR-1 property in 1996. All sites were in dead aspen stands near water. One was located at the D.O.E. cabin (Township 5S, Range 94W, section 23), one on the north-facing slopes of Long Ridge near a spring (Township 5S, Range 94W, section 19), and the third near the headwaters of Trapper Creek (Township 5S, Range 94W, section 3). Refer to Figure 6 and Appendix A for exact locations.

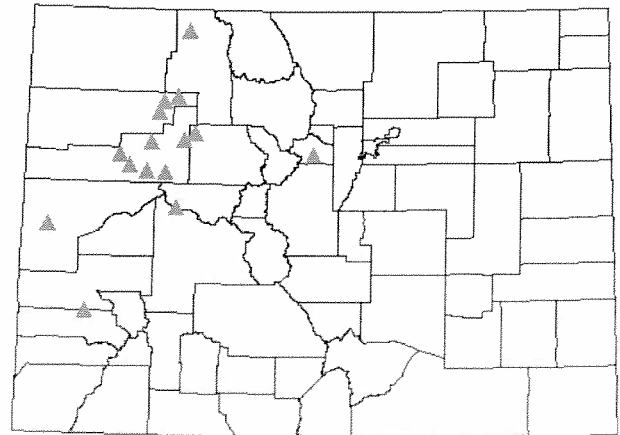


**Habitat:** Aspen stand at DOE cabin (NOSR-1).

R. J. Rondeau



Global breeding season distribution  
(National Geographic Society 1987)



Colorado breeding season distribution  
(Andrews and Righter 1992; CNHP 1997)

**Habitat and global/state distribution of *Progne subis*.**

**Three-toed woodpecker (*Picoides tridactylus*) G5/S3S4**

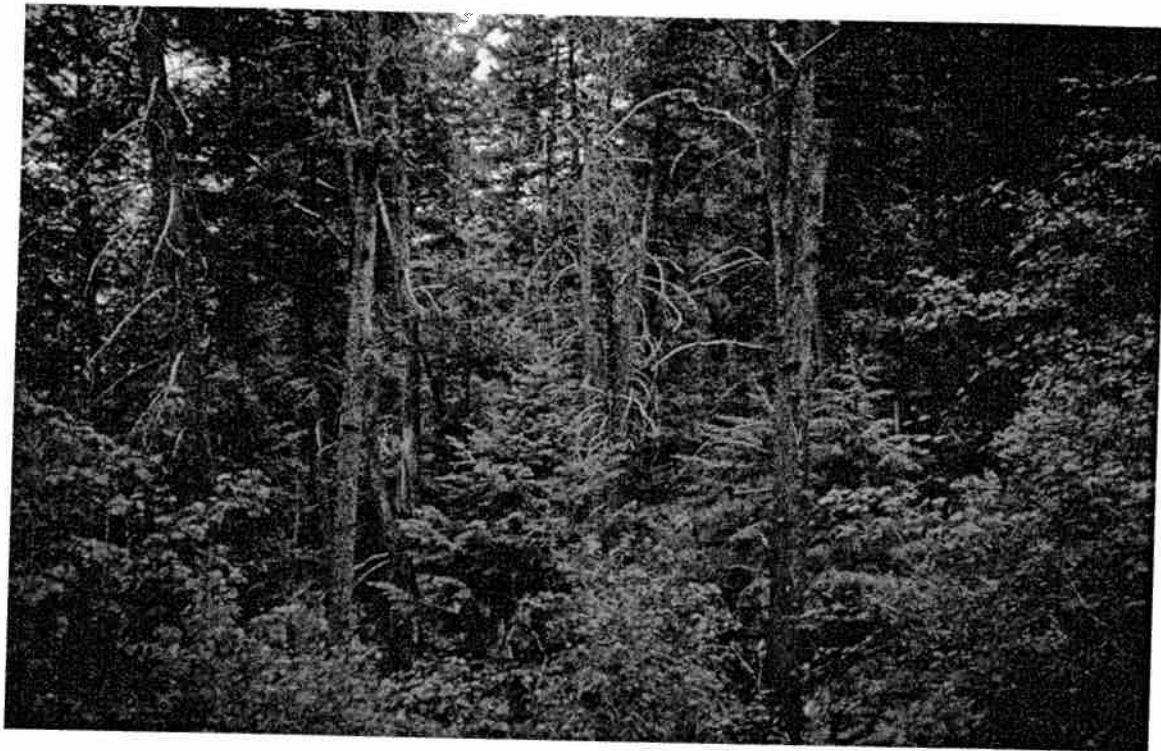
M. Tremaine (for Cornell Lab of Ornithology)

The Three-toed woodpecker is aptly named, both by its Latin name and its common English name. This bird really does have only three toes, whereas most other birds have four. It belongs to the genus *Picoides*, which encompasses most of the North American woodpeckers (AOU 1983). This species is described as a rare or very locally uncommon resident in the higher mountains of Colorado (Andrews and Righter 1992). Refer to the following page for range maps. This species has declined in numbers since the advent of fire suppression in the 1930's. For these reasons, it is "watchlisted" by the Colorado Natural Heritage Program and listed as a sensitive species by the US Forest Service.

Primarily associated with spruce-fir forests, the Three-toed woodpecker can inhabit Ponderosa pine, Douglas fir, and Lodgepole pine forests when insect infestations or fires occur. The Three-toed woodpecker thrives in conifer forests that have

either just burned or succumbed to an insect infestation (Andrews and Righter 1992). From three to five years after a fire, the burned area will support a local increase in woodpeckers, including the Three-toed woodpecker (Spahr et al. 1991). The Three-toed woodpecker gleans insects from the trunks of dead trees by chipping away the bark with its bill and then foraging in the exposed area (Terres 1980). For this reason, local burns and insect kills should be considered part of a natural and healthy forest ecosystem. This species builds its own nest and by later abandoning it, provides a nesting cavity for many of the secondary cavity nesters, including some of those mentioned previously in this section. Breeding generally occurs in late spring and early summer. The Three-toed woodpecker will stay on territory year-round, moving only locally toward insect or fire infestations.

We found two areas on NOSR-1 property (Township 5S, Range 94W, sections 2, 3, and 4) supporting nesting Three-toed woodpeckers during 1996 (Figure 6 and Appendix A). All of these areas were conifer forests that had been somewhat recently infested with insects.

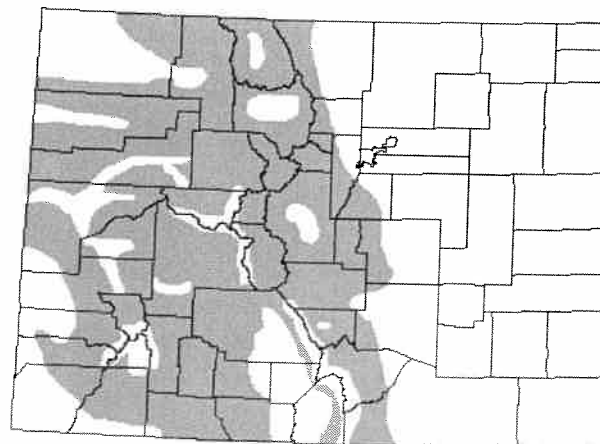


**Habitat:** Old growth Douglas fir below Book Cliffs (NOSR-1).

M. B. Wunder

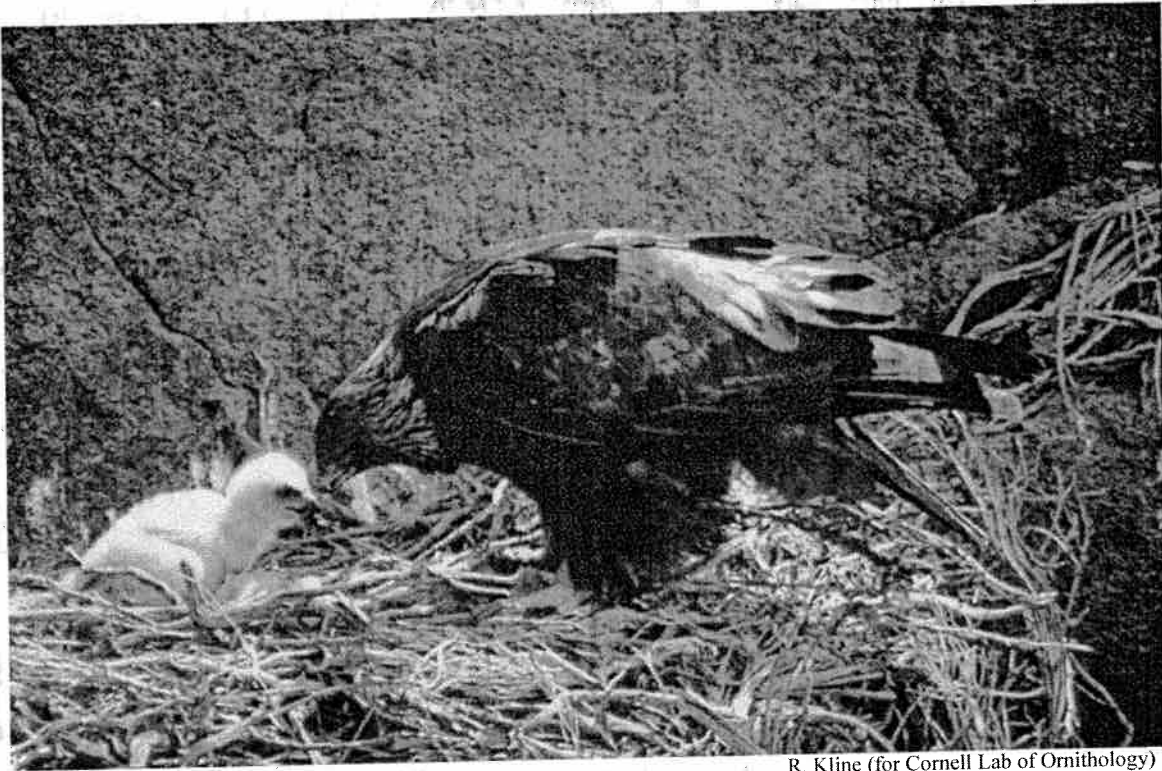


Global distribution (National Geographic Society 1987)



Colorado year-round distribution (Andrews and Righter 1992)

**Habitat and global/state distribution of *Picoides tridactylus*.**

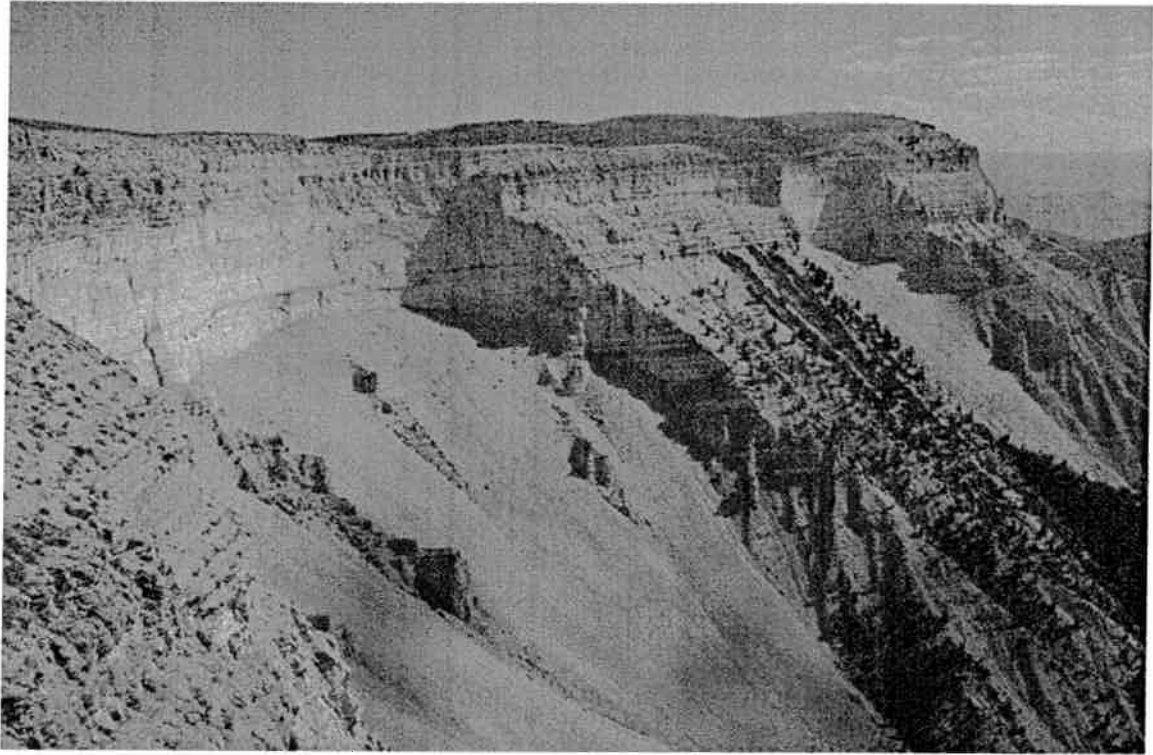
**Golden eagle (*Aquila chrysaetos*) G5/S3S4B,S4N**

R. Kline (for Cornell Lab of Ornithology)

The Golden eagle is the only bird in North America belonging to the genus *Aquila*. This species has been watchlisted by the Colorado Natural Heritage Program due to uncertainty of population trends in Colorado. It is a year-round resident in parts of Colorado, but far fewer birds breed in Colorado than migrate to this state for the winter (see next page).

The Golden eagle prefers to build nests in rugged areas, usually on cliff faces or in large trees in fairly arid habitats including grasslands, shrublands, Pinyon-Juniper and Ponderosa pine forests (Andrews and Righter 1992). This species is both a carnivore and a scavenger, taking primarily small mammals, snakes and birds. The Golden eagle can take prey up to the size of a juvenile ungulate (Terres 1980). During the winter, they are found throughout the state where open lands exist; these areas are suited to the Golden eagle's style of hunting on the wing. Often, winter concentrations will be found near productive prairie dog colonies.

Golden eagles nested on NOSR-1 property in 1996, very near the active American peregrine falcon eyrie along the Book Cliffs (Figure 6 and Appendix A). There were two nestlings in the nest in early July (J. Broderick, pers. comm.). Golden eagles were seen hunting in other areas of NOSR-1, presumably one or the other of the nesting pair. During migration in September, three additional adult eagles arrived at the staging area (Township 5S, Range 94W, section 24) described in the Cooper's hawk profile.

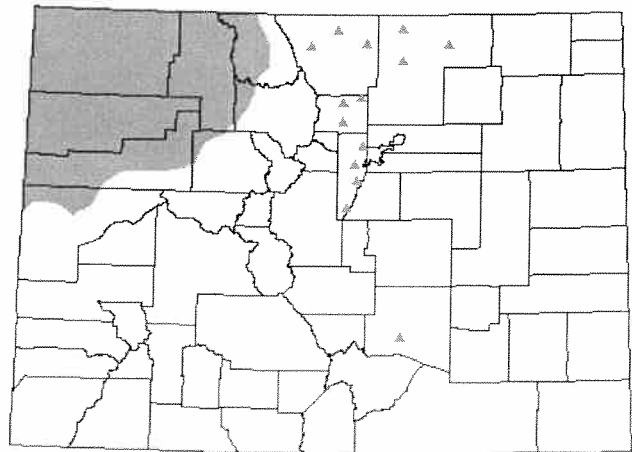


**Habitat:** Book Cliffs at Twin Peaks (NOSR-1).

R. J. Rondeau



Global distribution (National Geographic Society 1987)



Colorado breeding season distribution (Andrews and Righter 1992; CNHP 1997)

**Habitat and global/state distribution of *Aquila chrysaetos*.**

**Long-eared owl (*Asio otus*) G5/S3S4B,SZN**

J. Weaver (for Cornell Lab of Ornithology)

The genetic distance between the Long-eared owl (*Asio otus*) and the Short-eared owl (*A. flammeus*) is unusually large for birds of the same genus (Randi et al. 1991). The Long-eared owl is a year-round resident in Colorado. Despite the fact that Long-eared owls are fairly common in Colorado (see next page), its numbers appear to be declining in some areas of the state (Jones 1988). The long-eared owl has been watchlisted by the Colorado Natural Heritage Program.

This species prefers dense forested areas for nesting that are adjacent to vast open areas for hunting (Bent 1938; Marks 1984; Marks 1987). Furthermore, since this species does not build nests, those dense forested areas must include abundant natural cavities large enough for the Long-eared owls, or, more commonly, abandoned Corvid (Crow, Jay, Magpie) nests. Breeding starts early in March to get a head start on any

former occupants of abandoned nests. The female of this species selects the actual nest site, and clutch initiation begins in April. Young are usually fledged by July. This species hunts both from perches and on the wing, taking small mammals opportunistically. In the eastern United States, the bulk of their diets consist of Meadow voles (*Microtus pennsylvanicus*) taken from agricultural areas, whereas in the west they take large numbers of Deer mice (*Peromyscus maniculatus*) from open rangelands (Marti 1976; Marks 1984).

A single Long-eared owl was observed on NOSR-1 property (Township 5S, Range 94W, section 26) during the 1996 field survey in appropriate breeding habitat during the appropriate breeding season (Figure 6 and Appendix A). This single owl was hunting, and suitable nesting habitat is found in nearby Golden Castle Gulch, but no nest-searching efforts were undertaken.

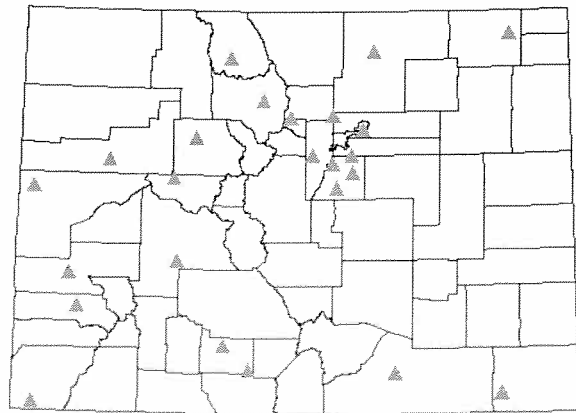


**Habitat:** Dense forested areas for nesting adjacent to open areas for hunting; (NOSR-1).

R. J. Rondeau



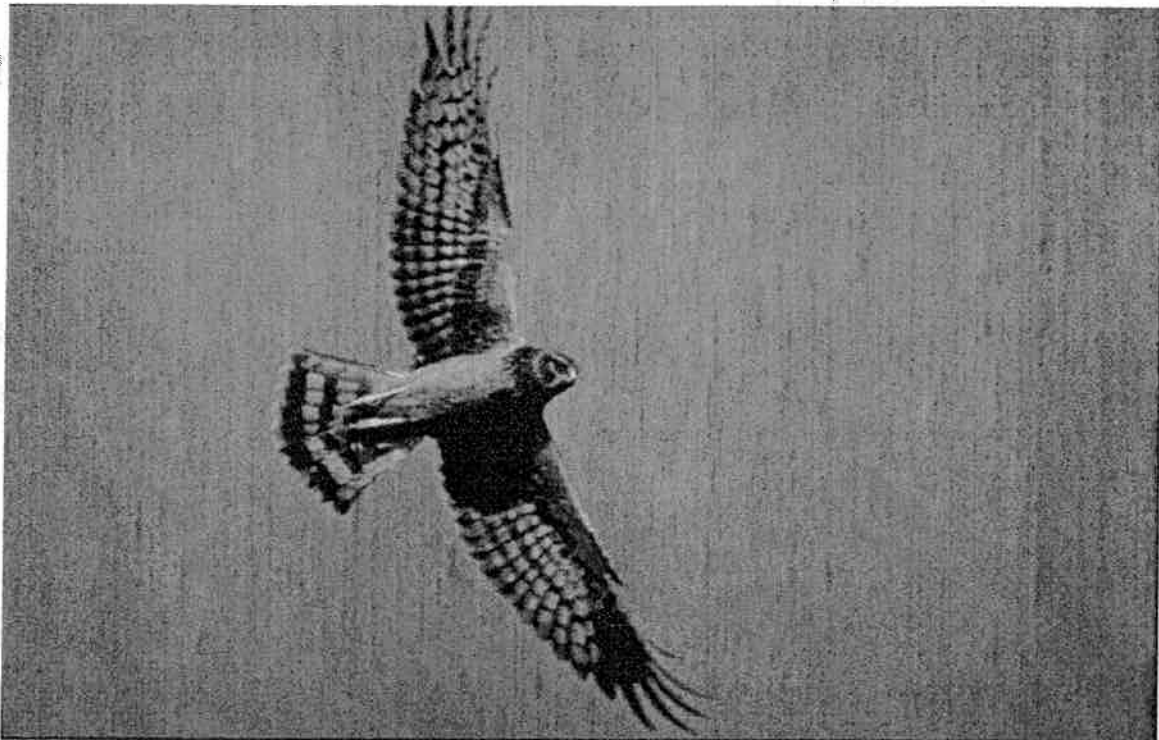
Global distribution (Marks *et al.* 1994)



Colorado year round distribution (Andrews and Righter 1992)

**Habitat and global/state distribution of *Asio otus*.**



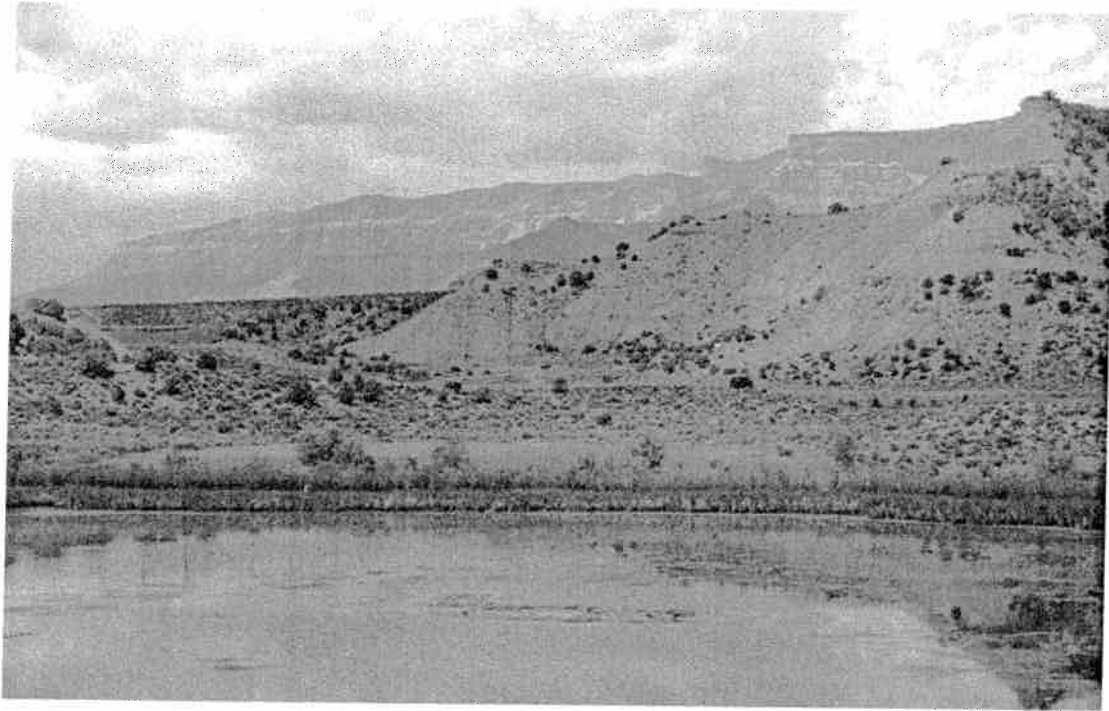
**Northern harrier (*Circus cyaneus*) G5/S3S4B,S4N**

F. Schleicher (for Cornell Lab of Ornithology)

The Northern harrier is one of the more adaptable species of hawk in the world. It occurs in some form on every continent except Antarctica (Dunn et al. 1988). However, the harrier is considered a separate species on each continent, and genetic mixing is minimal and sporadic. Sometimes the European form is considered a separate species, in which case the North American form is referred to *Circus hudsonius*, and sometimes the South American form (*Circus cinereus*) is considered *Circus cyaneus* (AOU 1983). Refer to the next page for current distributions of *Circus cyaneus* in North America and Colorado.

Common names for this bird have changed over the years as well, as it was once referred to as Marsh hawk. This old common name perhaps stemmed from the fondness of this species for breeding in marshes, but it will also breed in grasslands and agricultural areas (Andrews and Righter 1992). It takes primarily small mammals as prey as it hunts on the wing close to the ground. The Northern harrier is considered rare to uncommon as a breeding species in Colorado, and for that reason it has been watchlisted by the Colorado Natural Heritage Program.

A male Northern harrier was observed hunting in the grasslands and shrublands near the southeastern cliffs of NOSR-1 (Township 5S, Range 94W, section 35 and vicinity) on several occasions, and the species nests in marshes below the Roan Plateau near Rifle. Refer to Figure 6 and Appendix A for exact locations of observations on NOSR-1. As many as five additional individuals of this species were observed in September during fall migration at the staging area (Township 5S, Range 94W, section 24) described under the Cooper's hawk profile.

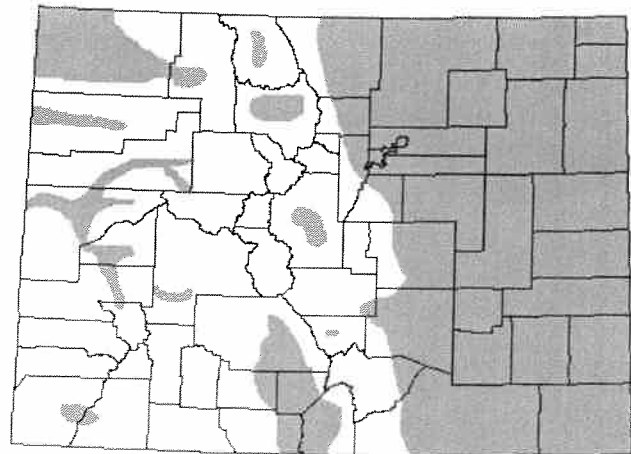


**Habitat:** Book Cliffs of NOSR-1 and southeastern edge of Roan Plateau - breeding habitat in foreground, hunting in background.

R. J. Rondeau

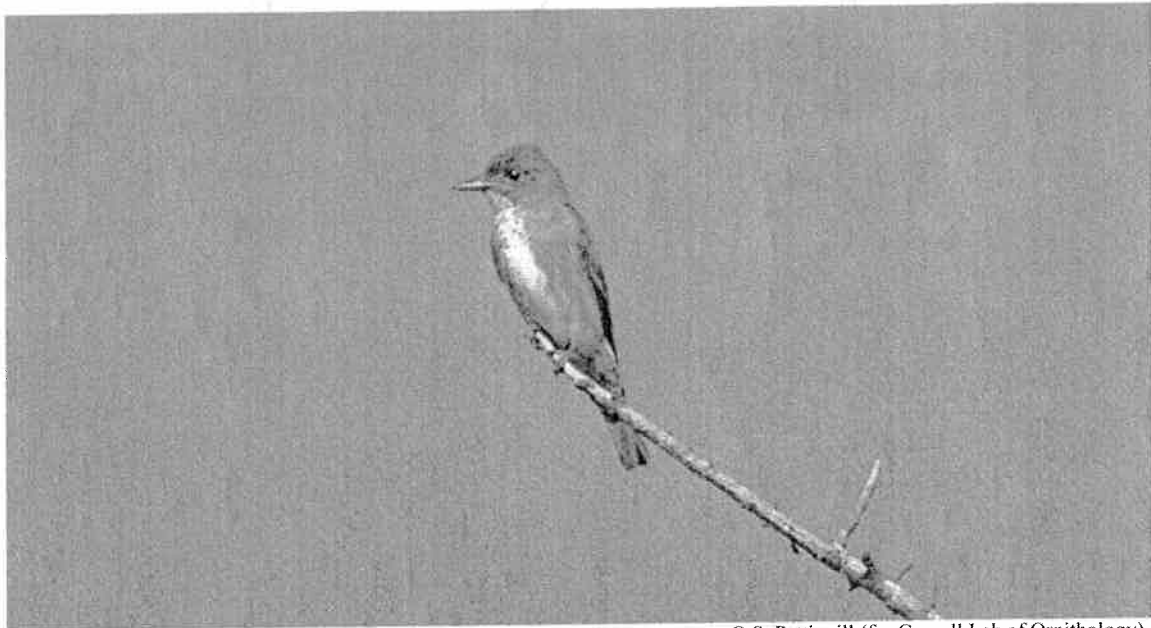


Global distribution (National Geographic Society 1987)



Colorado breeding season distribution (Andrews and Righter 1992)

**Habitat and global/state distribution of *Circus cyaneus*.**

**Olive-sided flycatcher (*Contopus borealis*) G5/S3S4B, S4N**

O.S. Pettingill (for Cornell Lab of Ornithology)

The Olive-sided flycatcher was formerly the only species in the genus *Nuttallornis* (AOU 1983). It now belongs to the genus *Contopus* with all the North American pewees. This neotropical migrant species has been steadily declining in numbers reported from various Breeding Bird Survey routes in the western United States since 1966 (USFWS 1987; Sauer and Droege 1992). For this reason, as much as any other, this species has been watchlisted by the Colorado Natural Heritage Program and designated a sensitive species by the US Forest Service. Reasons for the decline are unclear, but fire suppression is often considered a primary factor. Refer to the following page for current distribution maps.

As the common name for this species suggests, the Olive-sided flycatcher is an insect forager. It prefers to nest in forests and woodlands, and is particularly fond of forests that have been recently burned or cleared with ample standing dead trees. These snags provide singing and hunting perches (Ryke et al. 1994). Breeding starts in late May to early June and both adults and juveniles will have begun migration by mid-August. These migrants pass through Costa Rica from late August to late October, and again in the spring from mid-March to early June (Stiles and Skutch 1989).

Olive-sided flycatchers were observed in two locations on NOSR-1 property during 1996 surveys. They were observed repeatedly on different days and at different times of the day in these two areas. This territoriality during the appropriate breeding season implies nesting. One location was near the bottom of Bull Gulch, just above the falls on East Fork Parachute Creek (Township 5S, Range 95W, section 36). This area is best described as a few Douglas fir trees scattered in a mountain shrub community. The other area was just below the eastern rim of the Book Cliffs (Township 5S, Range 94W, section 13), where a male repeatedly sang from a dead aspen on a steep east-facing slope near a Douglas fir forest in a mixed mountain shrub community. See Figure 6 and Appendix A for exact locations.

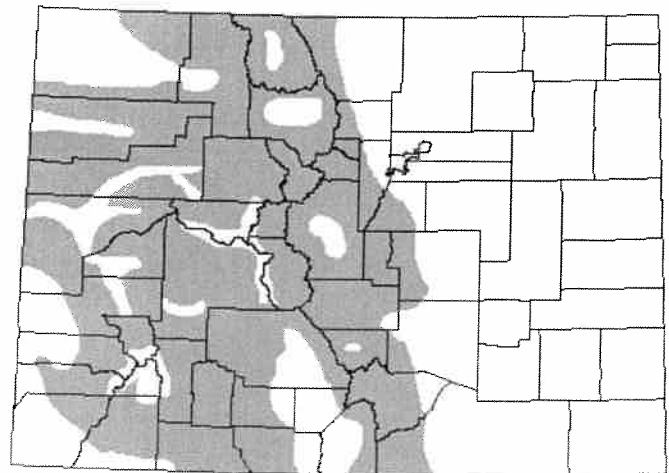


**Habitat:** Northeast corner of Book Cliffs; old growth Douglas fir with oaks in foreground.

R. J. Rondeau



Global breeding season distribution (National Geographic Society 1987)



Colorado breeding season distribution (Andrews and Righter 1992)

**Habitat and global/state distribution of *Contopus borealis*.**

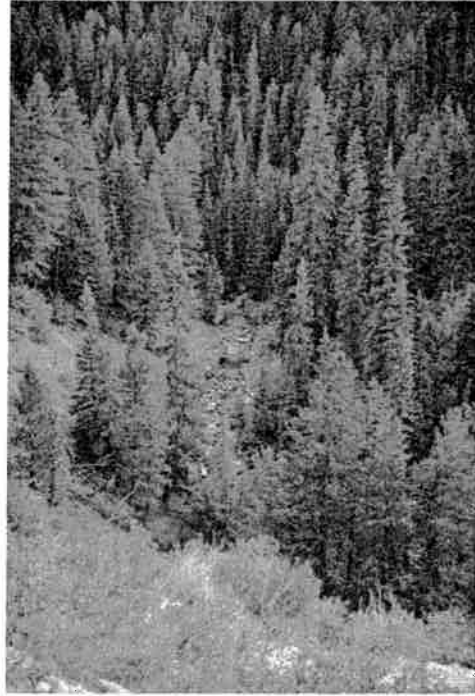
**Sharp-shinned hawk (*Accipiter striatus*) G5/S3S4B,S4N**

I. Jeklin (for Cornell Lab of Ornithology)

The Sharp-shinned hawk is the smallest hawk of the genus *Accipiter* that occurs in North America. Some authors describe as many as three species of Sharp-shinned hawk in the Americas (AOU 1983; Sibley and Monroe 1990). The Sharp-shinned hawk is a year-round resident in Colorado, but more northern populations will migrate as far south as Costa Rica in Central America (Stiles and Skutch 1989). The Sharp-shinned hawk is described as a rare to uncommon summer resident in the foothills and mountains of Colorado (Andrews and Righer 1992). See the next page for distribution maps. Accurate population estimates are difficult to determine, as this bird is often overlooked. For this reason, population trends are poorly understood and the Colorado Natural Heritage Program has watchlisted the Sharp-shinned hawk.

This cousin of the Cooper's hawk also prefers dense forests for breeding and hunting, but is often associated with conifer forests at higher elevations than the Cooper's hawk. Forest types often used by the Sharp-shinned hawk include Ponderosa pine, Lodgepole pine, Douglas fir, Aspen, and Spruce-Fir forests (Andrews and Righer 1992). Prey is primarily small birds, but this Robin-sized hawk will take birds as large or larger than itself. Breeding begins in late May to early June, and young are generally fledged by August.

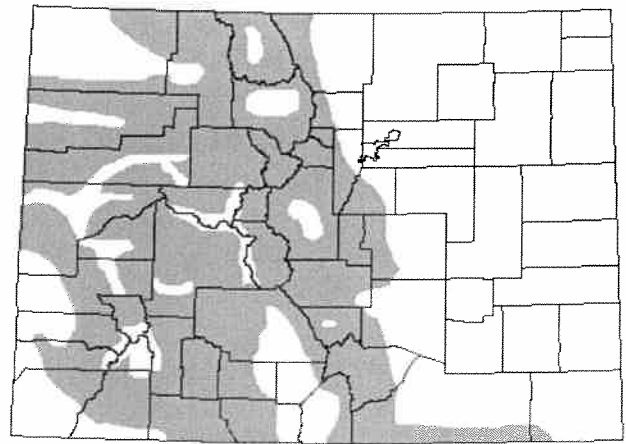
Sharp-shinned hawks were observed in many woodland locations on NOSR-1 property (Township 5S, Range 95W, sections 13, 14, 35; Township 5S, Range 94W, section 4), and were nesting in the conifer forests just above East Fork Parachute Creek Falls (Township 6S, Range 95W, section 4). Refer to Figure 6 and Appendix A for exact locations.



**Habitat:** Spruce-fir forest just upstream of falls on East Fork Parachute Creek. R. J. Rondeau



Global breeding season distribution (National Geographic Society 1987)



Colorado breeding season distribution (Andrews and Righter 1992)

**Habitat and global/state distribution of *Accipiter striatus*.**

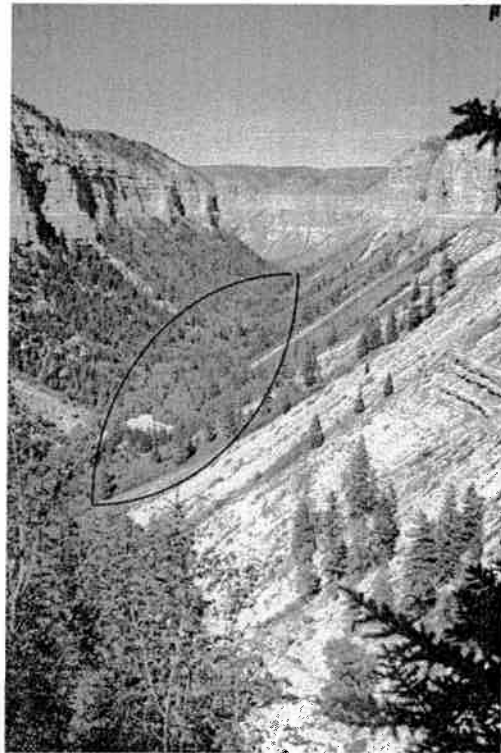
**Preble's shrew (*Sorex c.f. preblei*) G5/S1?**



B.A. Wunder

Not to be confused with the Preble's jumping mouse subspecies, the Preble's shrew is a species with no identified subspecies. Long-tailed shrews are difficult enough to discern at the species level, and identification is generally only accurately accomplished with cranial (skeletal) analysis. Not surprisingly, almost nothing is known of the Preble's shrew anywhere in its range (Fitzgerald et al. 1994). The Preble's shrew is primarily described as a species of the upper Great Basin and Columbian Plateau (see next page), where habitats are generally described as semi-arid shrublands, including sagebrush, grasslands, alpine tundra, and sagebrush openings in subalpine forest (Hoffman and Fisher 1978; Fitzgerald et al. 1994). This species is similar to all North American shrews in that it is insectivorous.

Three Preble's shrew specimens were taken from NOSR-1 during 1996 surveys. They all were from oakbrush habitat on the south-facing slopes below the falls on East Fork Parachute Creek (Township 5S, Range 95W, section 35). Refer to Figure 6 and Appendix A for exact locations. The only formally documented record for this species in Colorado is that of a single specimen taken in 1966 from the south rim of the Black Canyon of the Gunnison (Long and Hoffmann 1992). Since submission of the specimens to shrew specialists in New Mexico, we have learned that specimens were also taken from Mesa Verde National Park in Colorado. These locations mark the only known records of the species in Colorado, which may help to explain the S1? rank assigned by the Colorado Natural Heritage Program. There is not enough information to estimate the distribution of the species in Colorado.



**Habitat:** East Fork Parachute Creek below falls. Circle denotes habitat.

R. J. Rondeau

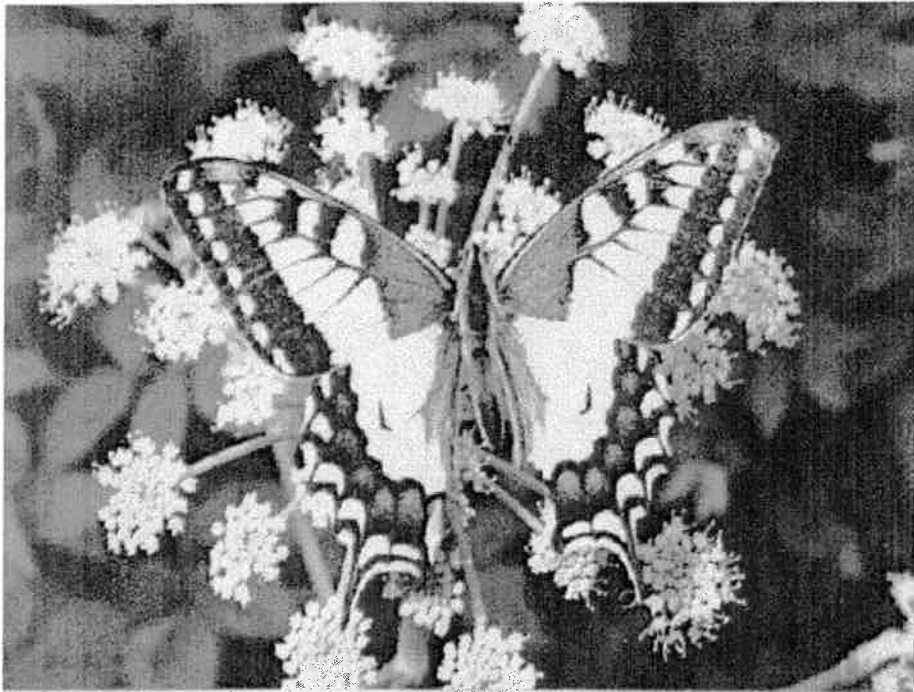


Global distribution (Fitzgerald et al. 1994)

Colorado distribution (Fitzgerald et al. 1994; CNHP 1997)

**Habitat and global/state distribution of *Sorex c.f. preblei*.**



**Baird's swallowtail (*Papilio bairdii*) G4/S3S4**

M. Klepikov

The Baird's swallowtail has two forms: *hollandi* and *brucei*. The *hollandi* form is the more typical black phenotype of this butterfly, while the *brucei* is the yellow phenotype. We found one individual of each phenotype on NOSR-1 property. The Baird's swallowtail occurs from New Mexico, Arizona, and Southern California north into Canada

(see next page). The type locality for this species is near Glenwood Springs, Garfield county, Colorado (Stanford and Opler 1993).

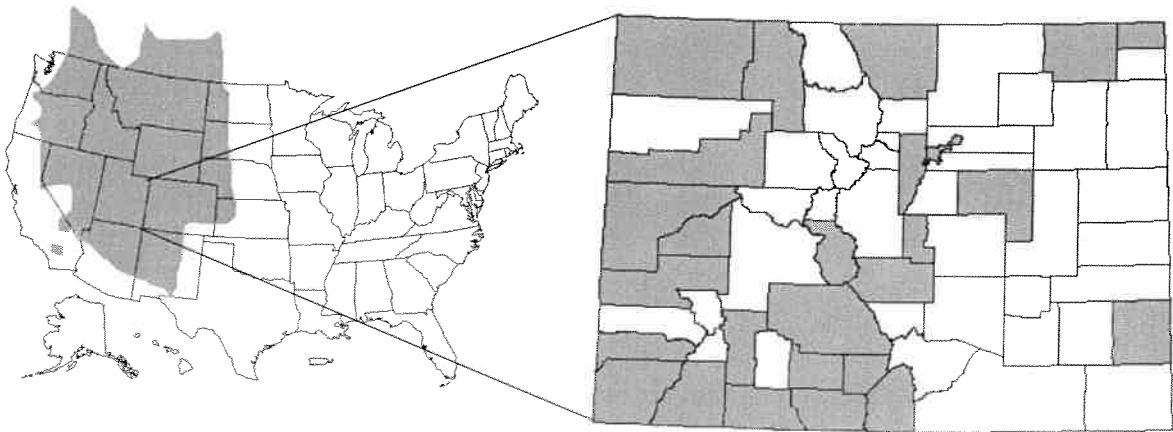
This species prefers semi-arid mountains in the upper Sonoran zone to elevations of approximately 9000 feet (3000 m) for its primary breeding habitat (Pyle 1981). Baird's swallowtail will rear two broods per year; one during the spring hatch (May), where climate permits, and one during the late-summer (July-August) hatch. The food plant is Tarragon (*Artemisia dracuncula*) (Ferris and Brown 1981). This butterfly shows strong tendencies for hilltopping, or lekking, during the reproductive season. Males will congregate on the highest hilltops of an area, and will wait for the females to emerge and arrive. Often the females will fly just off the windward side of the hill, perhaps to encourage the strongest and most persistent fliers for reproduction (C. Slater pers. comm.). The Baird's swallowtail is watchlisted by the Colorado Natural Heritage Program, which generally indicates that populations of the species are reasonably secure (but that specific occurrence data are collected and periodically analyzed to determine whether or not to actively track the species).

Baird's swallowtail was found at two locations on NOSR-1 during 1996 surveys. One location, in Township 5S, Range 94W, section 25, was a grassy hilltop along the eastern rim of the Book Cliffs, and the other area, in section 2 of Township 6S, Range 95W, was a mountain shrub community along the top of a ridge between First and Second Anvil Creeks (Figure 6 and Appendix A).



**Habitat:** Gardner Peak, headwaters of East Fork Parachute Creek (NOSR-1).

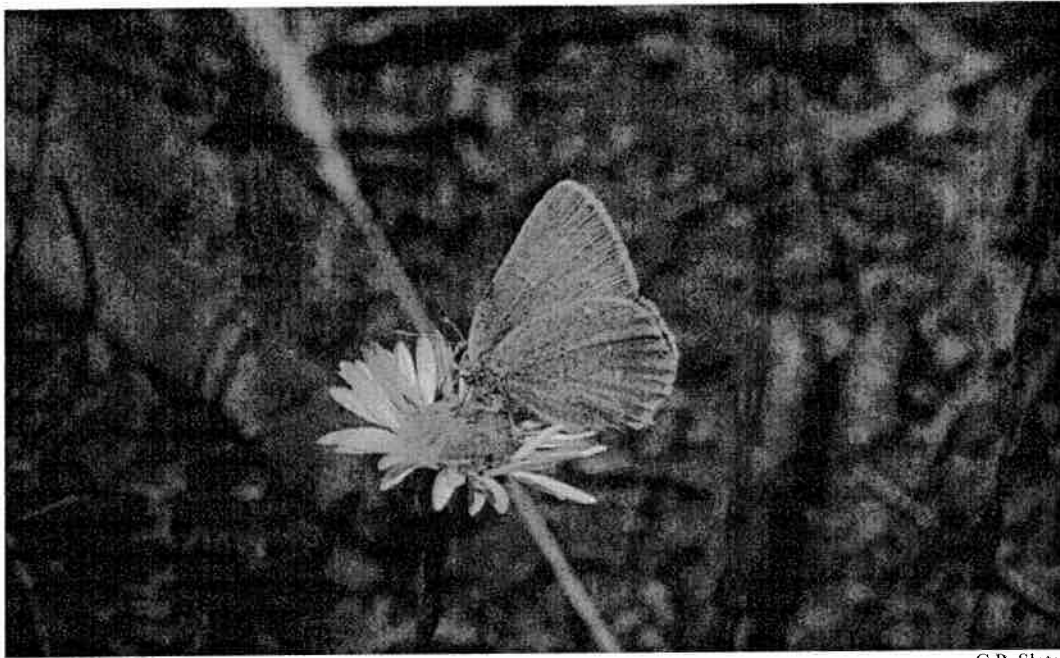
R.J. Rondeau



Global distribution (Scott 1986)

Colorado distribution (Stanford and Opler 1993)

**Habitat and global/state distribution of *Papilio bairdii*.**

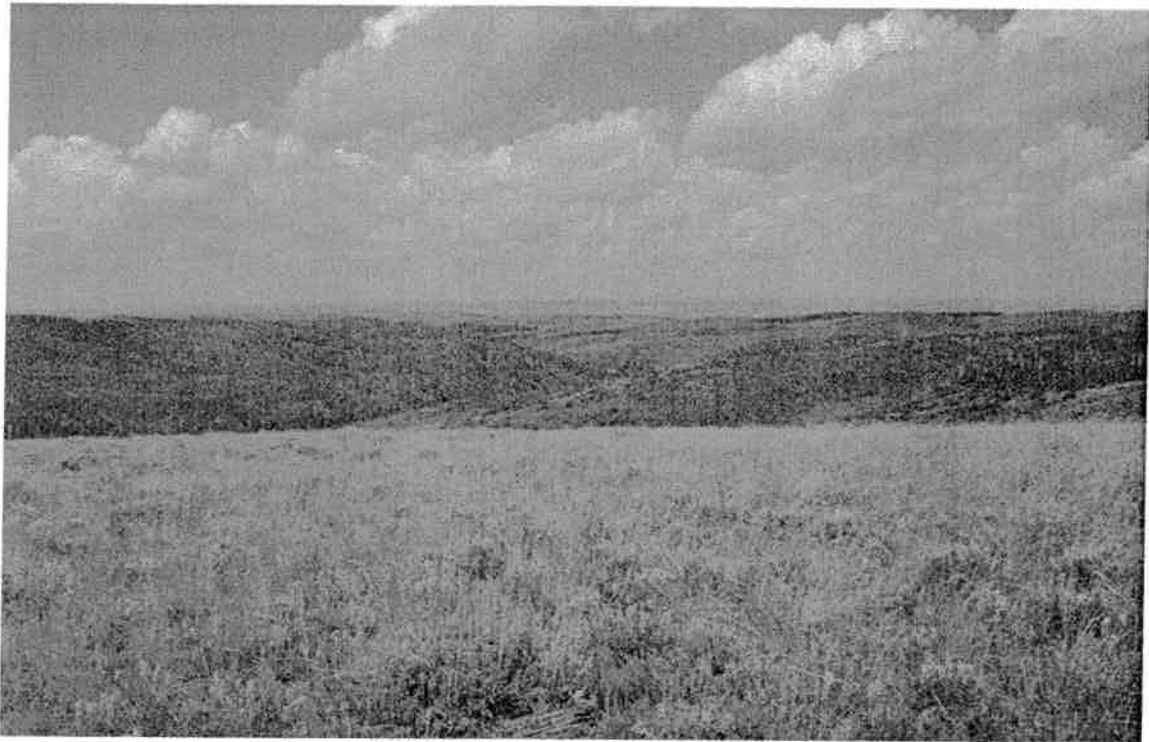
**Green-winged hairstreak (*Callophrys affinis affinis*) G4T?/S3S4**

C.P. Slater

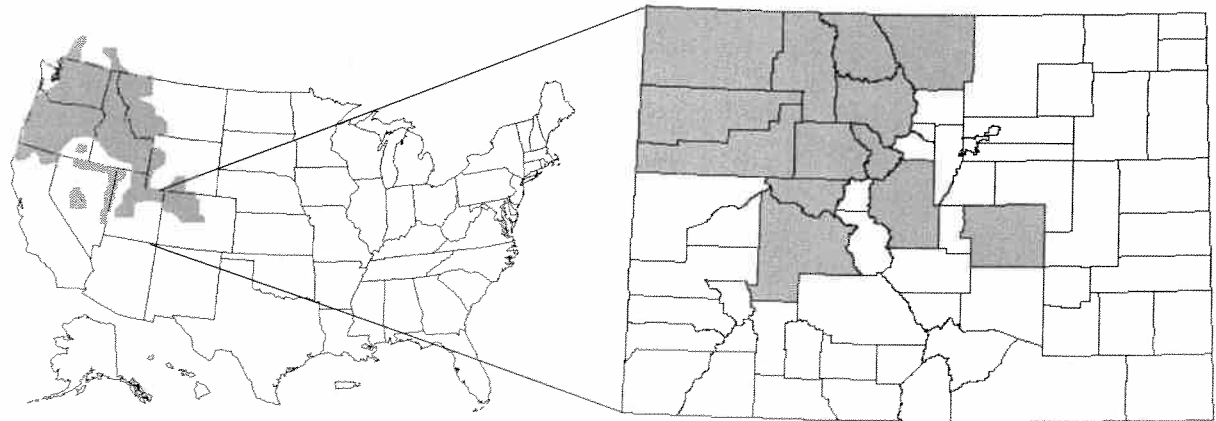
The Green-winged hairstreak in Colorado is referred to as the subspecies *affinis*. The global status of this subspecies appears stable, but the subspecies is “watchlisted” by the Natural Heritage Program in Colorado in efforts to further analyze its status. The Green-winged hairstreak occurs from El Paso and Gunnison counties in Colorado north through the Great Basin and Rockies into Canada (Stanford and Opler 1993). See next page for global and state distribution.

This species prefers woodlands, chaparral, scrub dunes, and sagebrush shrublands in the upper Sonoran and Canadian zones for breeding (Scott 1986). Generally, only one brood is reared each year (Ferris and Brown 1981). This hatch can occur from April through July, depending on climate (Pyle 1981). The host plants for this subspecies include members of the family Polygonaceae, including Buckwheats (*Eriogonum umbellatum* and *E. flavum*), and from the family Rhamnaceae, including Buckbrush (*Ceanothus fendleri*) (Scott 1986). This species also shows a tendency for hill topping, and males will often perch all day on a hilltop waiting for females to arrive (Scott 1986).

The Green-winged hairstreak was observed nectaring on Buckwheats (*Eriogonum umbellatum*) in several locations on NOSR-1 during 1996 surveys. All locations were in Township 5S, Range 94W. The Green-winged hairstreak was found on the same hilltop as the Baird’s swallowtail in section 25. This species was found in two locations in section 35: one at the top of Gardner Peak, and the other on the same slope as the Parachute penstemon (*Penstemon debilis*). We also found Green-winged hairstreaks in section 36, near the eastern rim of the Book Cliffs. Additionally, Green-winged hairstreaks were located on a hilltop further north, in section 23, along Long Ridge Road. Finally, the Green-winged hairstreak was found in a sedge meadow along Northwater Creek in section 15. Refer to Figure 6 and Appendix A for exact locations.



**Habitat:** Gardner Peak, headwaters of East Fork Parachute Creek (NOSR-1). R. J. Rondeau



Global distribution (Scott 1986)

Colorado distribution (Stanford and Opler 1993)

**Habitat and global/state distribution of *Callophrys affinis*.**



## Significant Natural Communities

Over 15 plant communities tracked by the Colorado Natural Heritage Program were documented for NOSR-1 (Table 10). The following section describes these communities. The order of this section follows the order in Table 10. Figure 7 and Appendix A give exact locations. Each description includes both a global and Colorado distribution map as well as a photo of the communities and its habitat. See Appendix C for a state map with the county names.



Aspen/Snowberry and Mountain sagebrush/Snowberry communities

R. J. Rondeau

**Table 10.** Rare or biologically significant plant communities of NOSR-1 with natural heritage ranks and federal status (see Table 1, page 7, for explanations). An asterisk before the common name indicates a watchlisted community.

Common Name	Scientific Name	Heritage	Fed
<b>Natural Communities</b>			
<b>Riparian Forests</b>			
Boxelder riparian forest	<i>Acer negundo</i> - <i>Populus angustifolia</i> / <i>Cornus sericea</i>	G2/S2	
Cottonwood riparian forest	<i>Populus angustifolia</i> / <i>Cornus sericea</i>	G3/S3	
Montane riparian forest	<i>Picea pungens</i> / <i>Cornus sericea</i>	G2/S2	
Spruce-fir/ Drummond's willow	<i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> / <i>Salix drummondiana</i>	G3/S3	
<b>Riparian Shrublands</b>			
Drummond's willow/mesic forb	<i>Salix drummondiana</i> /mesic forb	G3/S3	
Rocky Mountain willow/mesic forb	<i>Salix monticola</i> /mesic forb	G3/SU	
<b>Riparian Graminoids</b>			
Montane wet meadow	<i>Carex utriculata</i> wetland	G5/S3	
Tufted hairgrass wetland	<i>Deschampsia cespitosa</i> - <i>Carex</i> spp.	G4/SU	
<b>Upland Forests</b>			
*Aspen wetland forest	<i>Populus tremuloides</i> / <i>Pteridium aquilinum</i>	G4/S3S4	
Montane aspen forest	<i>Populus tremuloides</i> / <i>Acer glabrum</i>	G1G2/S1S2	
Lower montane forest	<i>Pseudotsuga menziesii</i> / <i>Carex geyeri</i>	G5Q/S3	
<b>Upland Shrublands</b>			
Western slope sagebrush shrubland	<i>Artemisia tridentata vaseyana</i> / <i>Festuca thurberi</i>	GU/S1S2	
Sagebrush bottomland shrubland	<i>Artemisia tridentata vaseyana</i> / <i>Leymus cinereus</i>	G4/S2	
<b>Upland Grasslands</b>			
Montane grassland	<i>Festuca thurberi</i> - <i>Lathyrus leucanthus</i>	G4/S4	
Western slope grassland	<i>Oryzopsis hymenoides shale barren</i>	G2/S2	
Great Basin grassland	<i>Pseudoroegneria spicata inermis</i>	G2?/S2?	
Great Basin montane grassland	<i>Pseudoroegneria spicata inermis</i> - <i>Poa secunda</i>	G4/S1	

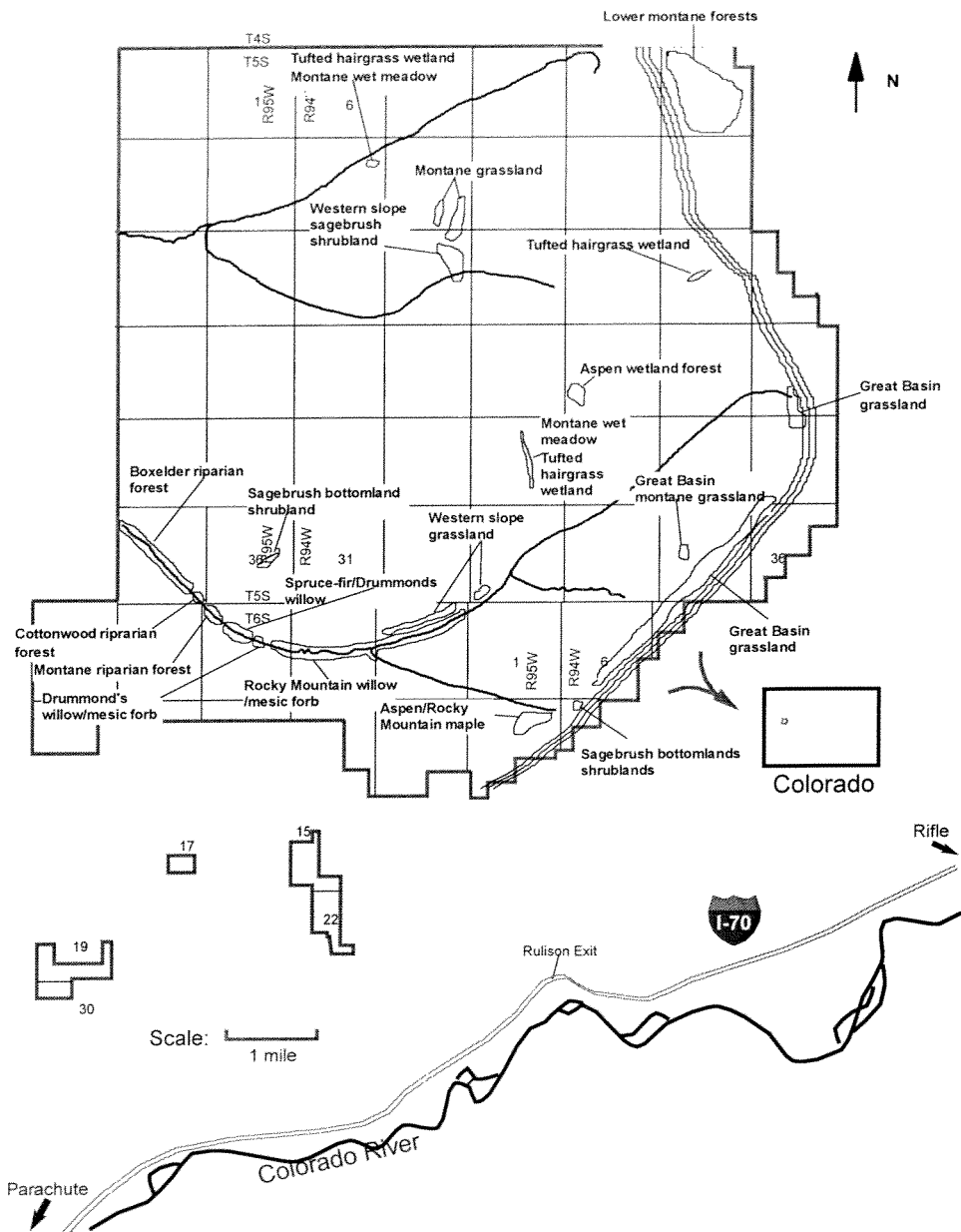


Figure 7. Community Occurrences on NOSR-1, Garfield County, CO.

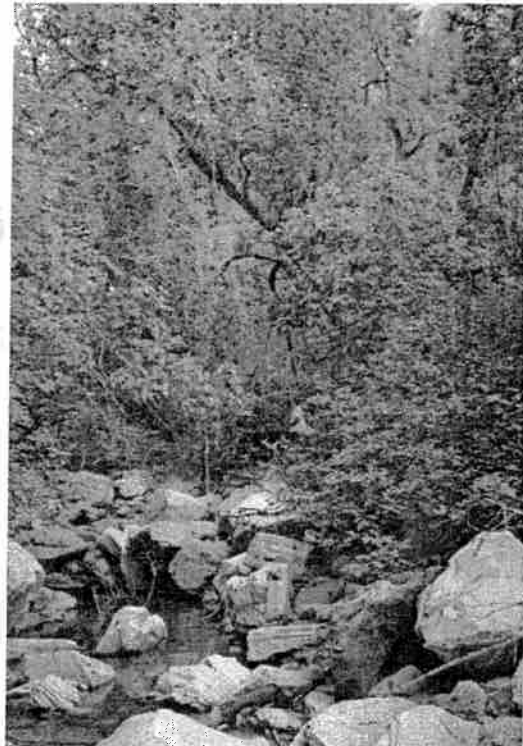


## Riparian Forests

**Boxelder riparian forest (*Acer negundo*-*Populus angustifolia*/*Cornus sericea*) G2/S2**  
also known as **Boxelder-Narrowleaf cottonwood/Red-osier dogwood**



East Fork Parachute Creek R.J. Rondeau

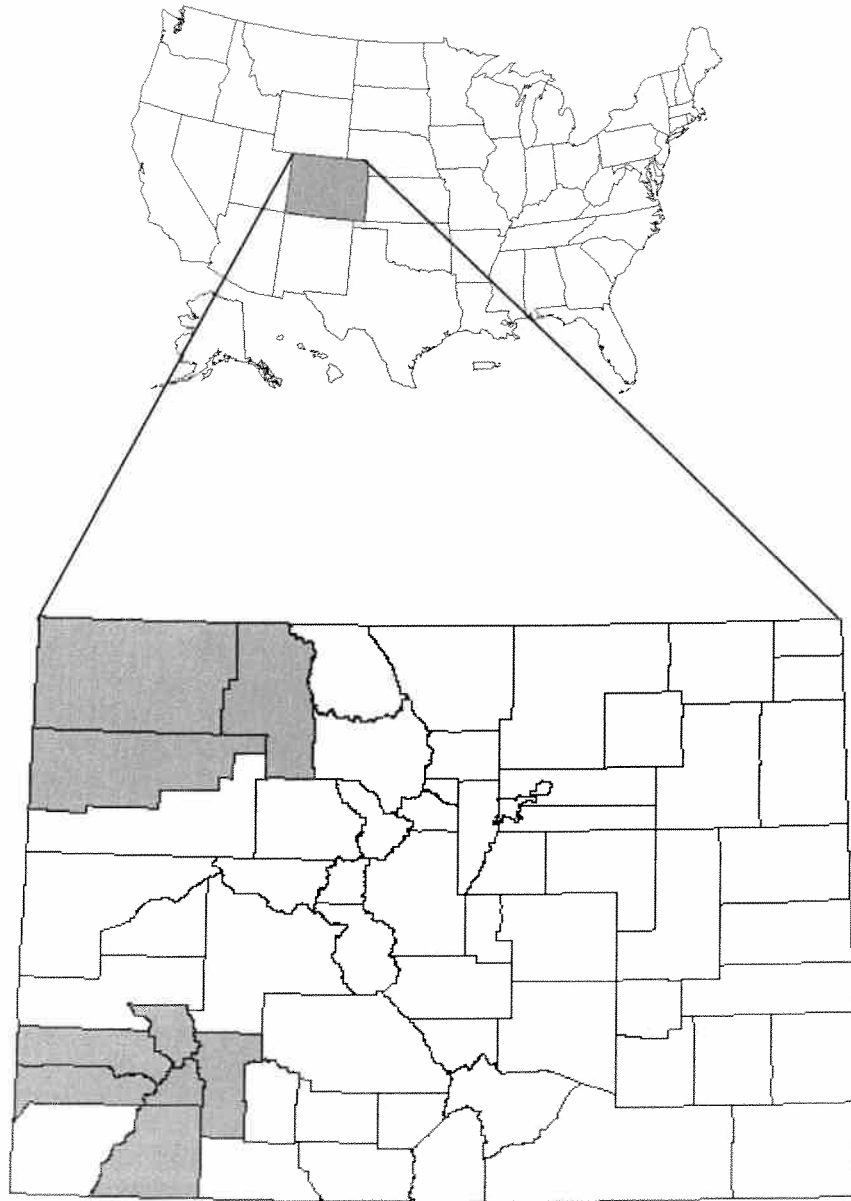


East Fork Parachute Creek R.J. Rondeau

This plant association is restricted to just a few riparian areas in western Colorado between 6,200 and 7,700 feet in elevation (see next page for global and state distribution). It occurs along moderately sinuous stream reaches in narrow valleys to broad alluvial floodplains.

On NOSR-1 we found an excellent example of this rare community along East Fork Parachute Creek below the falls (see Figure 7 and Appendix A for the exact location). This occurrence is in a box canyon with a narrow riparian strip bounded by Douglas Fir forest on the north-facing aspect and Gambel's oak on the south-facing side. The Boxelder-Narrowleaf cottonwood/Red-osier dogwood plant association within this site is characterized by a dense canopy of Boxelder (40-75%), scattered with Narrowleaf cottonwood (5-30%) and Douglas fir (*Pseudotsuga menziesii*) (0-15%) forming the tree canopy. The shrub layer is diverse with Red-osier dogwood (*Cornus sericea*) dominating (20-50%), but other shrubs, e.g., Choke cherry (*Prunus virginiana*) and Wood's rose (*Rosa woodsii*), White stem currant (*Ribes inerme*), Rocky Mountain maple (*Acer glabrum*), and Utah serviceberry (*Amelanchier utahensis*), are present. The herbaceous layer is rather sparse and few forbs and grasses are represented.

Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (CNHP 1997; Kittel pers. comm.)

**Global and state distribution of *Acer negundo-Populus angustifolia/Cornus sericea*.**

**Cottonwood riparian forest (*Populus angustifolia*/*Cornus sericea*) G3/S3**  
also known as **Narrowleaf cottonwood/Red-osier dogwood**



East Fork Parachute Creek

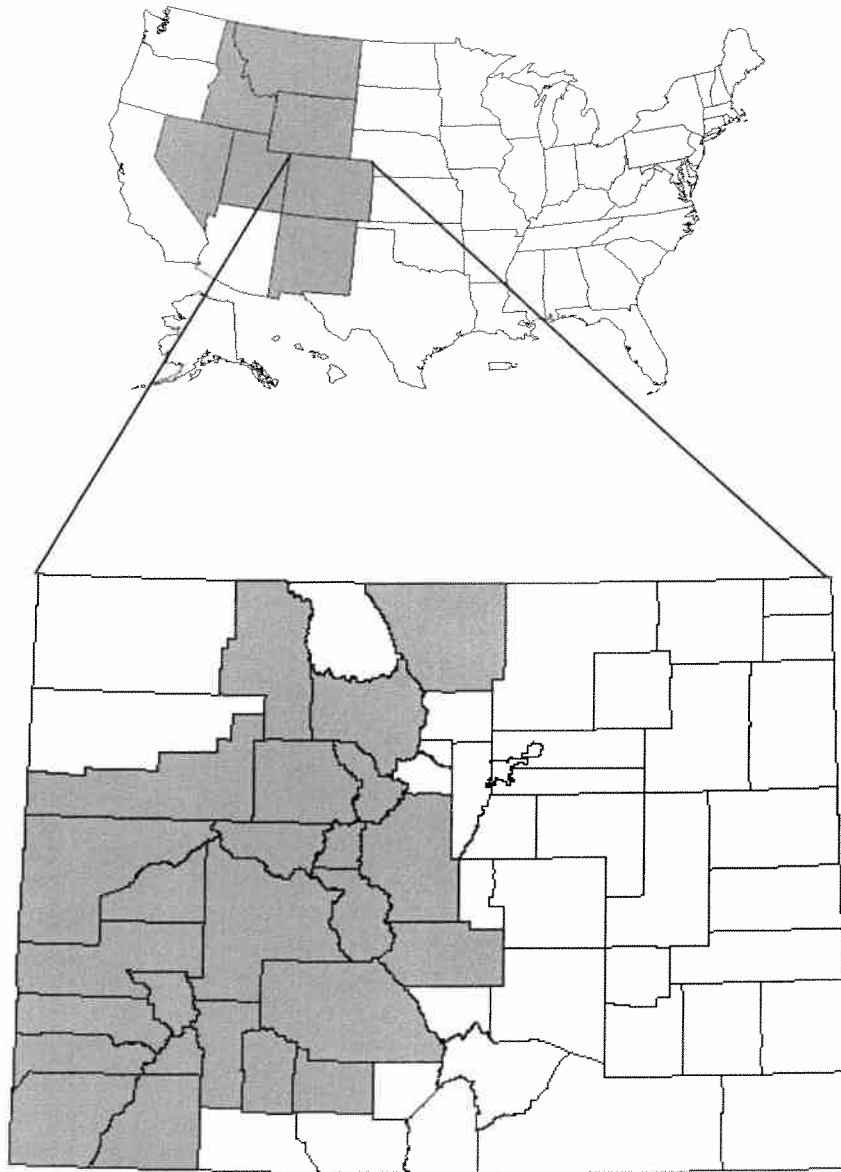
R. J. Rondeau

The global distribution of the Narrowleaf cottonwood/Red-osier dogwood plant association is scattered along the Rocky Mountains in Montana, Idaho, Wyoming, Nevada, Utah, Colorado, and New Mexico (Bourgeron and Engelking 1994). In spite of this relatively large range, less than 100 occurrences are known; only 20 stands are known to occur in Colorado (Kittel et al. 1994). See the following page for the global and state distribution maps.

This riparian community occurs along stream banks and terraces adjacent to rocky streams from approximately 6,500 to 8,300 feet in elevation (Kittel et al. 1994). On NOSR-1 this plant association occurs only along East Fork Parachute Creek, immediately above and below the Falls. See Figure 7 and Appendix A for the exact location. The NOSR-1 occurrence is characterized as a small occurrence in good condition. Narrowleaf cottonwood is the dominant tree with approximately 50% canopy cover. The shrub layer is diverse, with Red-osier dogwood comprising 50% of the shrub canopy cover. Wood's rose (*Rosa woodsii*), White stem currant (*Ribes inerme*) and Rocky Mountain maple (*Acer glabrum*) are present but not dominant.

See the previous description (Box elder-Narrowleafcottonwood/Red osier dogwood) for management comments.

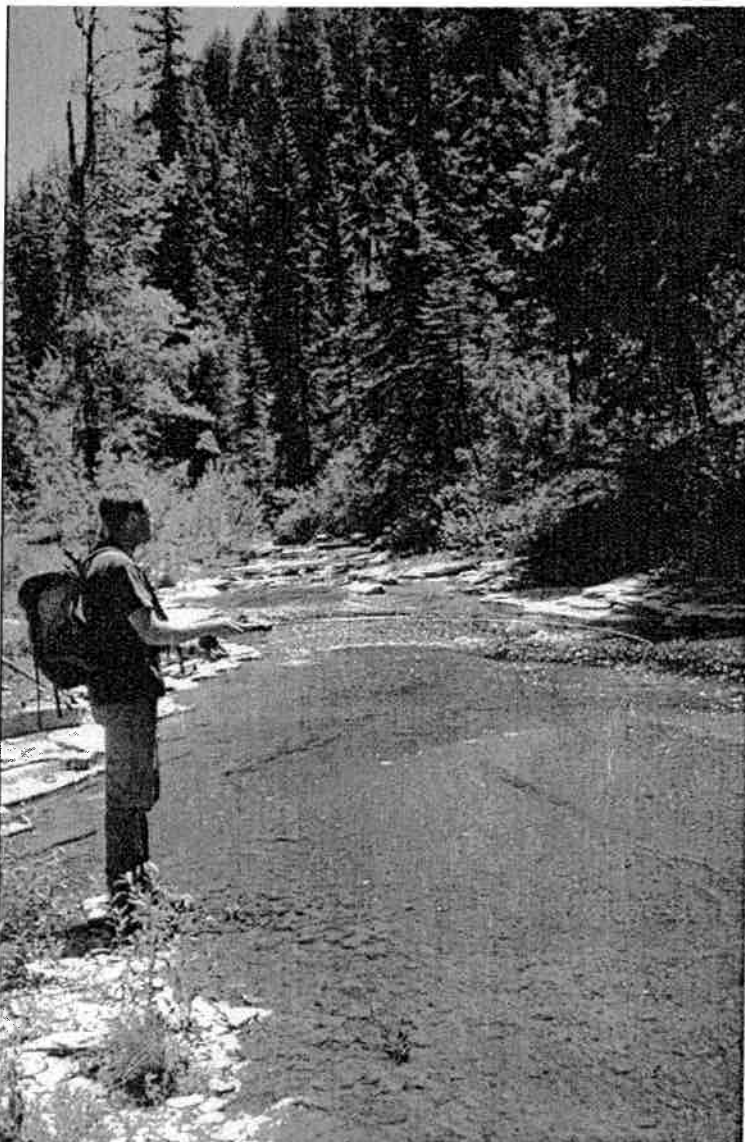
Global distribution (Padgett et al . 1989; Bourgeron and Engelking 1994)



Colorado distribution (G. Kittel pers. comm.)

**Global and state distribution of *Populus angustifolia*/*Cornus sericea*.**

**Montane riparian forest (*Picea pungens*/*Cornus sericea*) G2/S2**  
 also known as **Colorado blue spruce/Red-osier dogwood**



East Fork Parachute Creek

R. J. Rondeau

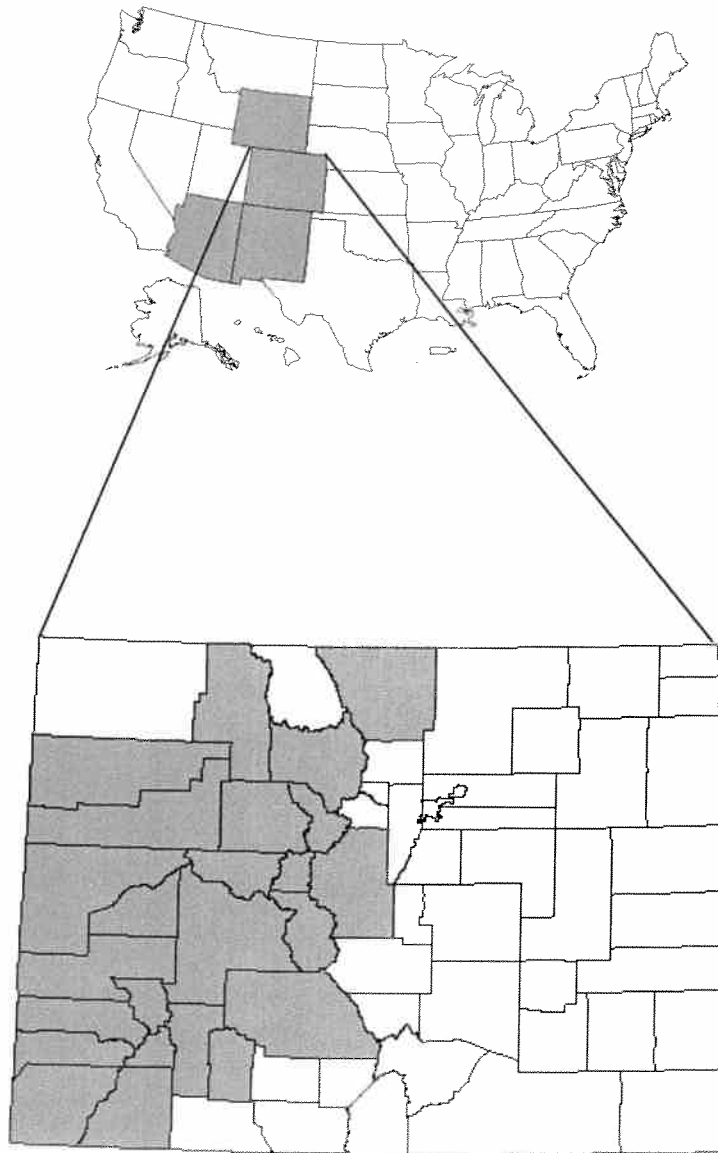
The Colorado blue spruce/Red-osier dogwood plant association is a globally uncommon riparian forest. Its global distribution is limited to western Wyoming, western Colorado, northern New Mexico, and Arizona (Bourgeron and Engelking 1994). See the following page for the global and state distribution maps.

This plant association occurs on floodplains and benches in narrow valleys with variable stream gradients (1-10%) in low to mid montane elevations (7,000-8,500 feet). It generally occurs along broad, slightly meandering channel reaches.

On NOSR-1 we found this plant association along East Fork Parachute Creek near the Falls and above the Narrowleaf cottonwood/Red-Osier dogwood plant association. See Figure 7 and Appendix A for the exact location.

The NOSR occurrence is a narrow occurrence at the base of a steep conifer dominated slope. Colorado blue spruce is the dominant tree with approximately a 15-20% canopy cover. Dense stands of Red-Osier dogwood (10-70%) comprise the shrub layer. Although Red-Osier dogwood is the most abundant shrub, other shrubs are present, e.g., Drummond's willow (*Salix drummondiana* 5-10%) and Twinberry (*Lonicera involucrata* 5-10%). The herbaceous layer is sparse with less than 20% cover. This plant association is a transition community between the Narrowleaf cottonwood/Red-osier dogwood community and the Sub-alpine fir-Engelmann spruce/Drummond's willow type.

Global distribution (Bougeron and Engelking 1994; Kittel et al. in prep.)

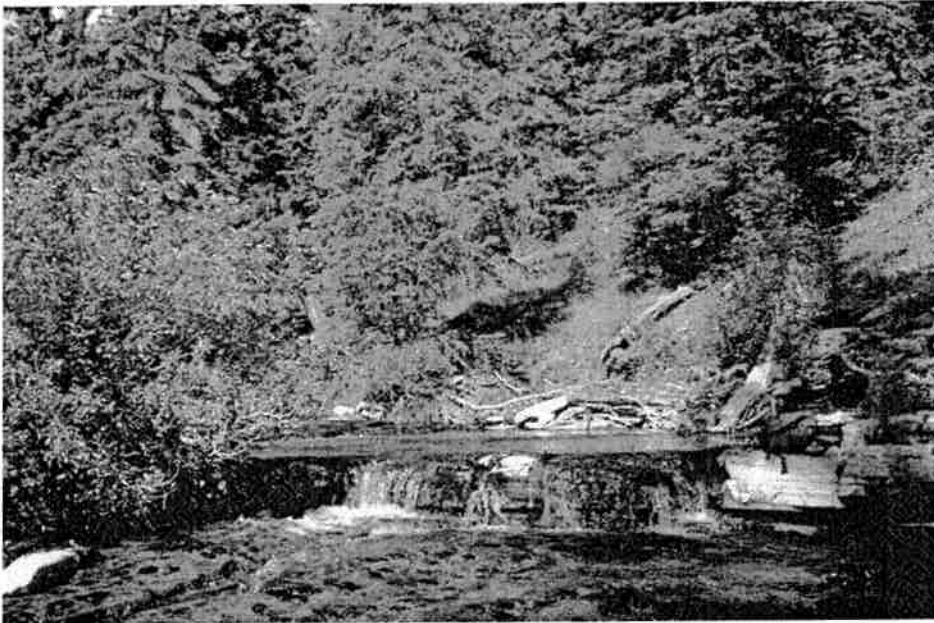


Colorado distribution (CNHP 1997; G. Kittel pers. comm.)

**Global and state distribution of *Picea pungens*/*Cornus sericea*.**

**Spruce-fir/Drummond's willow (*Abies lasiocarpa*-*Picea engelmannii*/*Salix drummondiana*) G3/S3**

also known as **Subalpine fir-Engelmann spruce/Drummond's willow**



East Middle Fork Parachute Creek

R. J. Rondeau

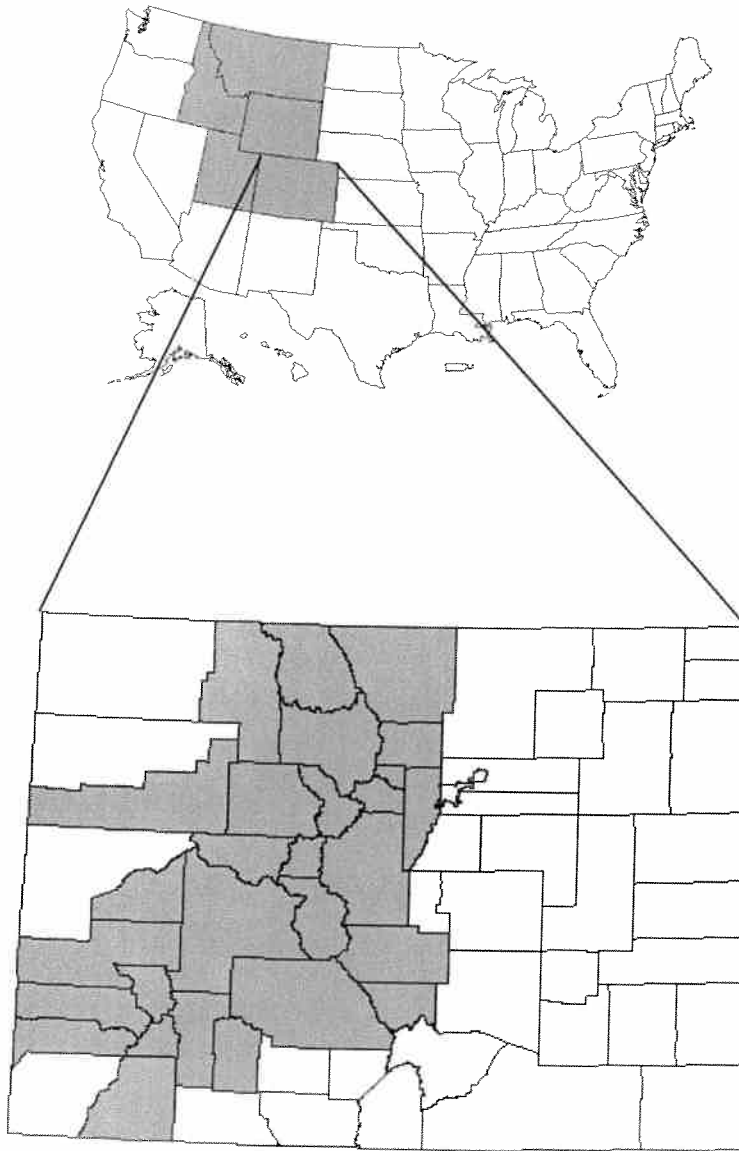
This forested riparian plant association has many closely related plant associations and community types common throughout the Rocky Mountains in Montana, Wyoming, eastern Idaho, northern Utah, and Colorado (Youngblood et

al. 1985; Hansen et al. 1995; Baker 1989; Reid and Bourgeron 1991; and Kittel et al. 1995). See the following page for the global and state distribution maps. In Colorado this plant association is common along first order streams on the western slope, e.g., the San Juan Mountains, and the Gunnison and Arkansas River Basins (Richard et al. 1996; Reid and Bourgeron 1991; Kittel et al. 1995). It is likely to occur throughout the high montane regions of Colorado.

The Subalpine fir-Engelmann spruce/Drummond's willow plant association is found along steep, narrow first order streams between 8,400 and 10,900 feet in elevation.

On the NOSR-1 property this plant association is represented by a small occurrence on East Fork Parachute Creek, just above the Colorado blue spruce/Red-osier dogwood community. See Figure 7 and Appendix A for the exact location. The NOSR site is characterized by an open conifer canopy, primarily Subalpine fir, Engelmann spruce, and Blue spruce (10-20%) with a thick shrub canopy of Drummond's willow (40%) restricted to a narrow strip along the rocky stream bank. Other shrubs within this occurrence are Red-osier dogwood (5%), Twinberry (*Lonicera involucrata* 20%) and Rocky Mountain willow (*Salix monticola* 10%). The herbaceous undergrowth is dominated by Cow parsnip (*Heracleum lanatum* 30%). This type occurs between the Red-osier dogwood type described above to the Drummond's willow/mesic forb type described below.

Global distribution (Johnston 1987)



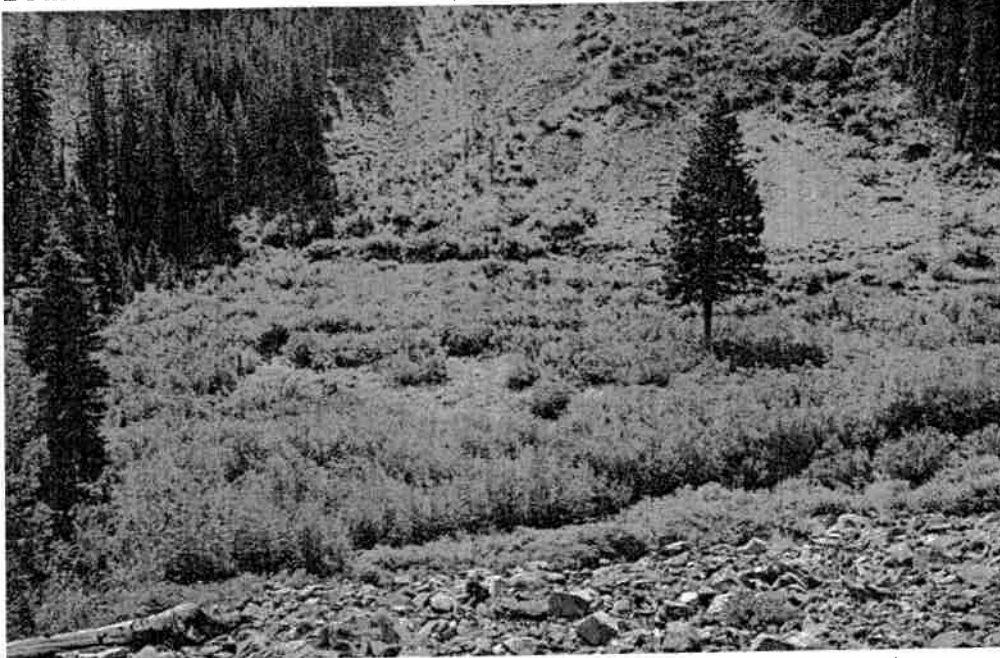
Colorado distribution (G. Kittel pers. comm.)

**Global and state distribution of *Abies lasiocarpa*-*Picea engelmannii*/*Salix drummondiana*.**



## Riparian Shrublands

### Drummond's willow/mesic forb (*Salix drummondiana*/mesic forb) G3/S3



Bilk Creek in White River Basin

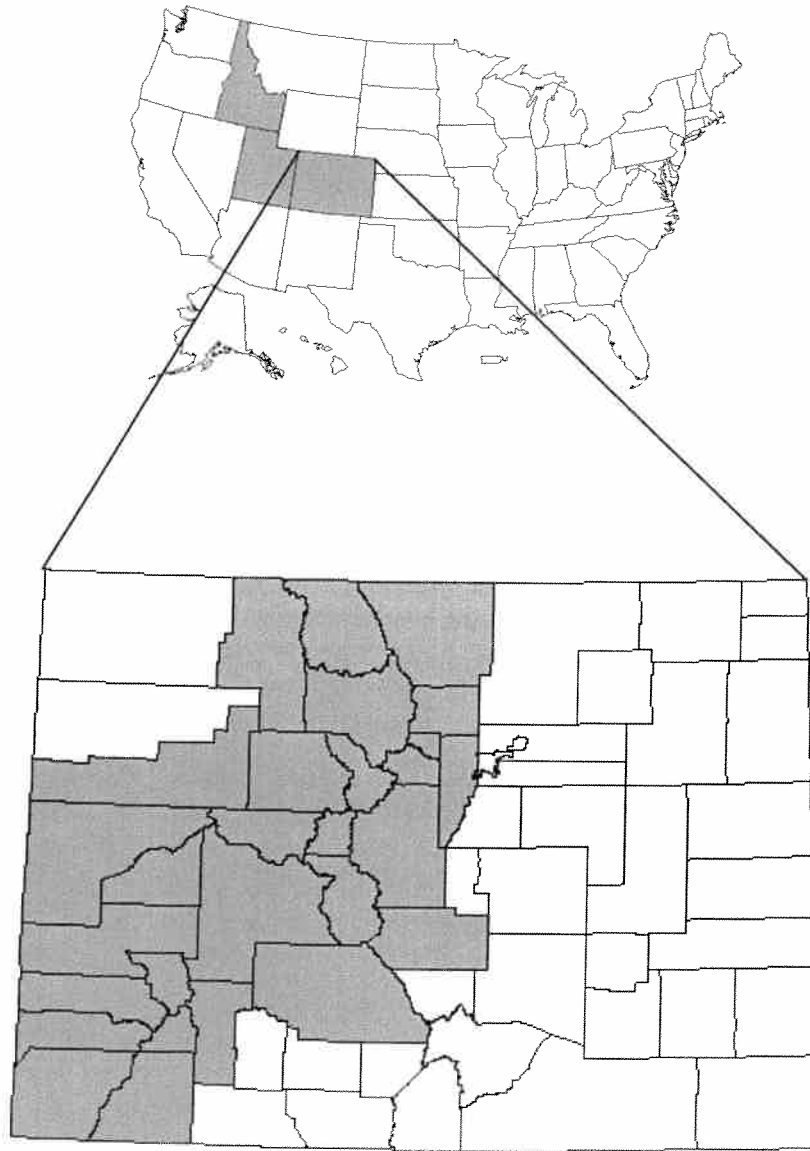
N. Lederer

The Drummond's willow/mesic forb plant association is a riparian shrub community restricted to the Rocky Mountains of Idaho, Utah, and Colorado (Kittel et al. 1995). See the following page for the global and state distribution maps.

This montane willow dominated riparian plant association grows along steep to moderately steep reaches in canyons and gulches (Kittel et al. 1996). At times it may form solid bands along the stream edge, but it seldom forms broad willow carrs, or shrublands such as the similar Geyer's willow (*S. geyeriana*).

On NOSR-1 this plant association only occurs along East Fork Parachute Creek near the Sheep Hollow Trail Gulch confluence. See Figure 7 and Appendix A for exact location. The NOSR-1 occurrence is a dense willow carr approximately 1/4 mile long, characterized by a moderately closed canopy of Drummond's willow (approximately 60-70%) with scattered clumps of Rocky Mountain willow (*Salix monticola* 0-30%). Bebb's willow (*Salix bebbiana* 0-5%) and Twinberry (*Lonicera involucrata* 0-10%) are also present. The herbaceous undergrowth is diverse, but relatively degraded from nearly a century of livestock grazing. Cow parsnip (*Heracleum lanatum* 5-10%), Stinging nettle (*Urtica dioica* 5-10%), Kentucky bluegrass (*Poa pratensis* 5-10%), Parsnip (*Angelica grayi*), Blue bells (*Mertensia ciliata*), and Arrowleaf groundsel (*Senecio triangularis*) are the characteristic forbs. The NOSR-1 occurrence of this plant association is part of a larger riparian mosaic comprised of Rocky Mountain willow/mesic forb (*Salix monticola*/mesic forb) upstream and the Subalpine fir-Engelmann spruce/Drummond's willow (*Abies lasiocarpa*-*Picea engelmannii*/*Salix drummondiana*) downstream.

Global distribution (Baker 1989; Padgett et al. 1989)



Colorado distribution (G. Kittel pers. comm.)

**Global and state distribution of *Salix drummondiana*/mesic forb.**

### Rocky Mountain willow/mesic forb (*Salix monticola*/mesic forb) G3/S3?



East Fork Parachute Creek

R. J. Rondeau

The Rocky Mountain willow/mesic forb plant association is a riparian shrub community restricted to the Rocky Mountains of Idaho, Utah, and Colorado. It is a major type in the upper montane areas of central Colorado but less common in Utah and Idaho (Brunsfeld and Johnson 1985; Padgett et al. 1989; Cooper and

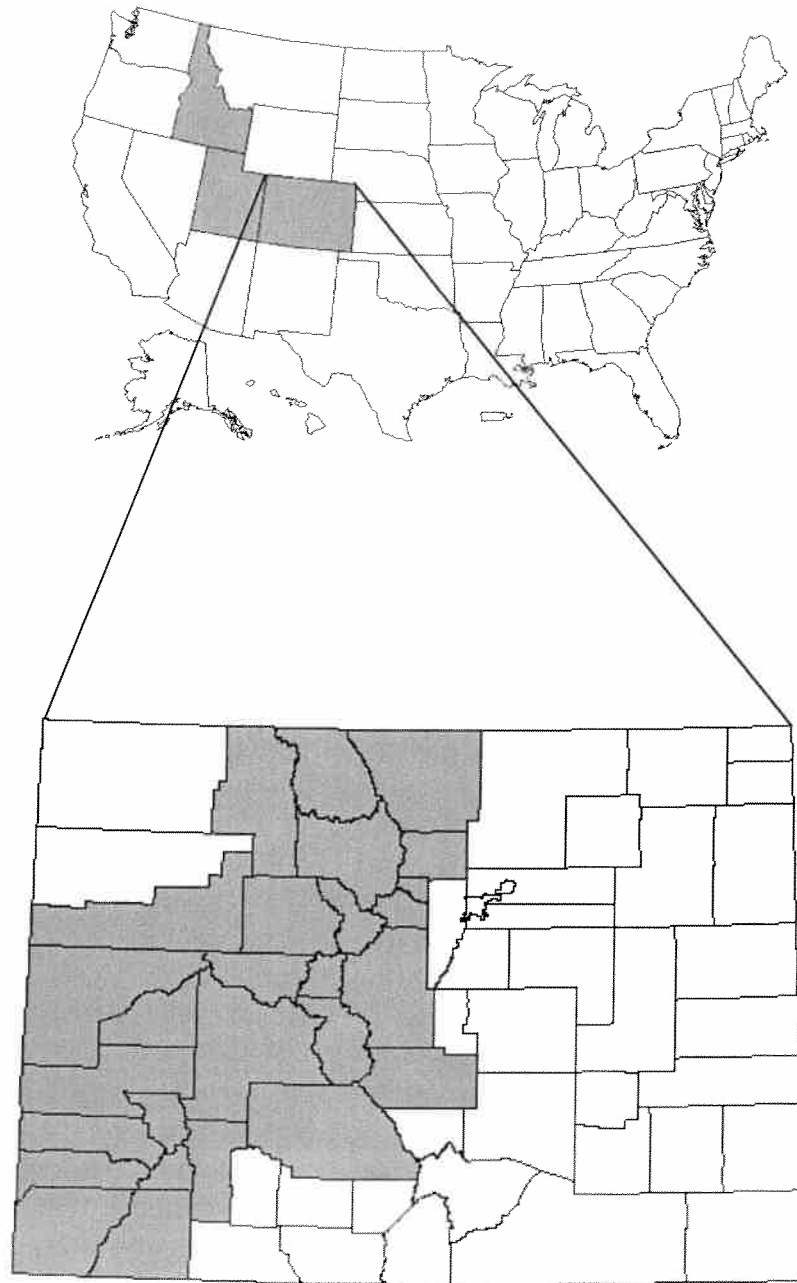
Cottrell 1990; Kittel et al. 1995). See the following page for the global and state distribution maps.

This plant association typically occurs along stream reaches in moderately wide to narrow valleys with broad, swift-moving water and active floodplains (Kittel et al. 1995).

On NOSR-1 this plant association primarily occurs on East Fork Parachute Creek. See Figure 7 and Appendix A for the exact location. The NOSR-1 occurrences of this type can be characterized by a moderately dense to open canopy (30-70%) with a very diverse and rich forb layer. The herbaceous ground cover was often degraded with numerous weedy species, e.g., Hounds tongue (*Cynoglossum officinale*), Dandelion (*Taraxacum officinale*), Kentucky bluegrass (*Poa pratensis*), and Cone flower (*Rudbeckia laciniata*). Along the steeper and harder to access parts of the East Fork Parachute Creek canyon the herbaceous layer was in better condition, with Tufted hairgrass (*Deschampsia cespitosa*) and Canada reed grass (*Calamagrostis canadensis*) forming dense clumps along the banks. The NOSR-1 occurrence of this plant association is important habitat for the native Colorado River cutthroat trout as it provides shade--which helps keep the water temperatures low, overhanging banks of vegetation and root masses--which provide important hiding sites, and a non to low eroding stream bank--important for low sediment load.

We believe this plant association probably occurred along Trapper Creek prior to the extreme stream degradation that has taken place after a century of livestock grazing and a historically dense population of beavers.

Global distribution (Kittel *et al.* 1995)



Colorado distribution (G. Kittel pers. comm.)

**Global and state distribution of *Salix monticola/mesic forb.***

## Riparian Meadows

### Montane wet meadow (*Carex utriculata*) G5/S3



Within enclosure on Trapper Creek

R. J. Rondeau

The Montane wet meadow (*Carex utriculata*) is a common wetland plant association found throughout most of the western United States (Bourgeron and Engelking 1994). In Colorado it is common in the montane elevations of the Rocky Mountains (Youngblood et al.

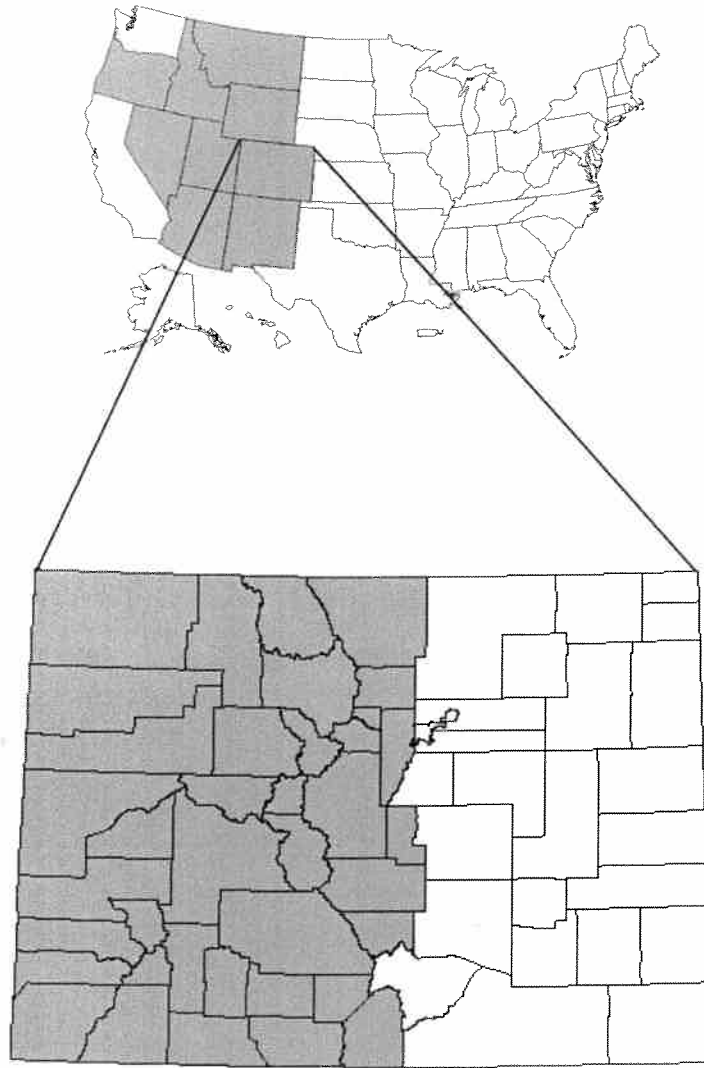
1985; Padgett et al. 1989). See the following page for the global and state distribution maps.

The montane wet meadows (*Carex utriculata*) occupy the wettest meadow sites on mineral soils, often occurring adjacent to, or mixed with, *C. aquatilis*. This plant association requires standing water and saturated soils around lakes and beaver ponds; it also grows in wet swales and overflow channels where standing water occurs. It seldom forms large stands and is normally in patches of one acre or less.

On NOSR-1 this plant association was found within the livestock enclosure on Trapper Creek. The occurrence is characterized as a nearly monotypic stand of the Beaked sedge (*Carex utriculata*, 90%). Other sedges and grasses can occur but usually comprise less than 1% of the species composition. The Trapper Creek livestock enclosure, which has had approximately seven years of rest from livestock grazing, has allowed a wetland mosaic to be restored. This plant association is part of the Tufted hairgrass-sedge species (*Deschampsia cespitosa*-*Carex* spp.) wetland complex. This is an important site for a sub-population of the Colorado River cutthroat trout, as it supplies stable vegetated overhanging banks for hiding purposes and shade which helps maintain a temperature suitable for trout.

See Figure 7 and Appendix A for the exact location.

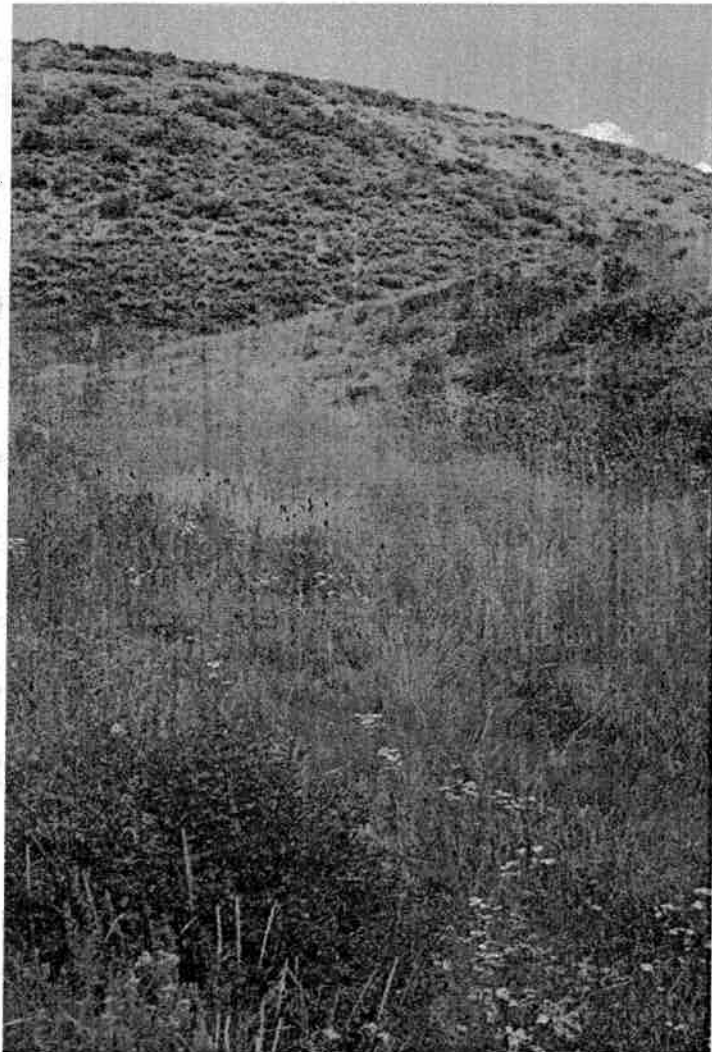
Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (CNHP staff)

**Global and state distribution of *Carex utriculata*.**

### Tufted hairgrass wetland (*Deschampsia cespitosa*-*Carex* spp.) G4/SU



Northwater Creek

R. J. Rondeau

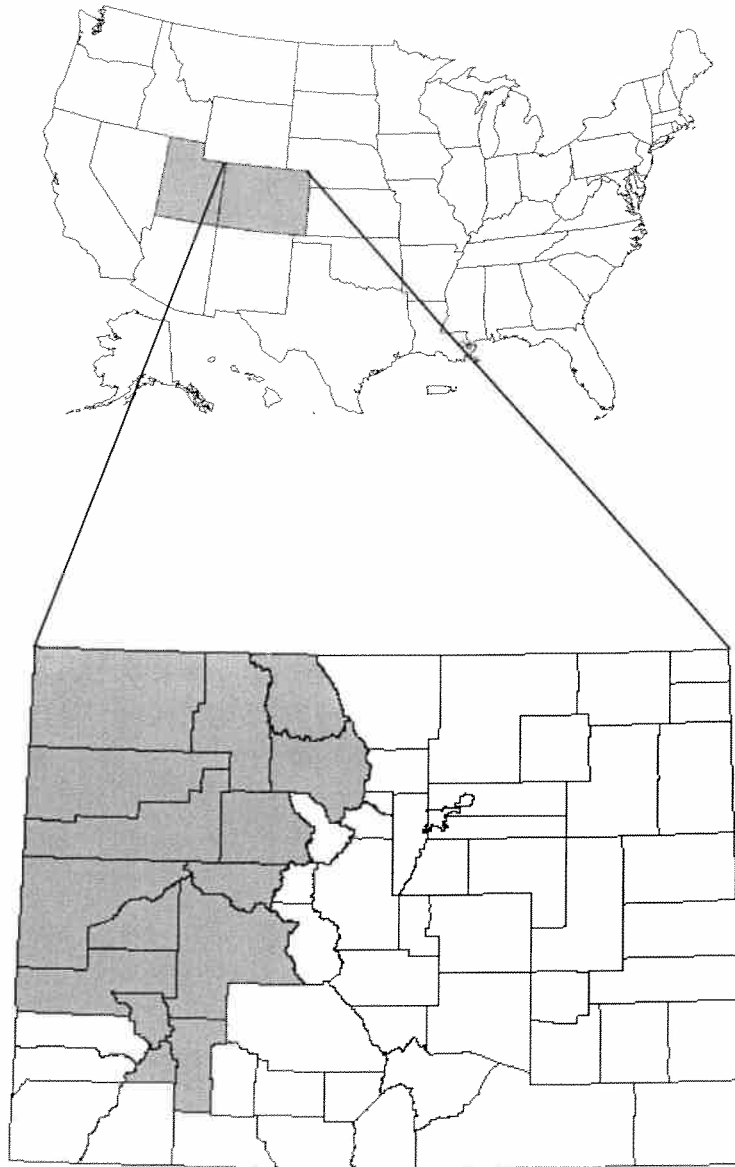
The Tufted hairgrass wetland plant association has been described from eastern Oregon, eastern Idaho, western Montana, Wyoming, northern Utah, and western Colorado (Bourgeron and Engelking 1994; Kittel et al. 1994). See the following page for the global and state distribution maps.

This plant association typically occurs at upper montane elevations (9,000-12,000 feet), on well drained ridges and hummocks with moist soils (Kittel et al. 1994). It is usually associated with other wetland plant associations.

On NOSR-1 this plant association is scattered, but primarily found at the headwaters of the major creeks as well as the tributaries. Some of the better examples of this type are along the headwaters of Northwater Creek and in the enclosure on Trapper Creek. Most of the occurrences on NOSR-1

have been severely degraded from nearly a century of grazing. This plant association was probably once common throughout NOSR-1. Today most sites are so degraded that just a few plants of Tufted hairgrass are left. The better occurrences on NOSR-1 are typically comprised of approximately a 40-50% canopy cover of Tufted hairgrass, 1-20% Small-wing sedge (*Carex microptera*), and 10-30% Beaked sedge (*Carex utriculata*). Common non-native plants include Dandelion (*Taraxacum officinale*), Kentucky bluegrass (*Poa pratensis*), and Hounds tongue (*Cynoglossum officinale*).

Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (Johnston 1987)

**Global and state distribution of *Populus tremuloides* / *Pteridium aquilinum*.**



**Montane aspen forest (*Populus tremuloides*/*Acer glabrum*) G1G2/S1S2**  
 also known as **Aspen/Rocky Mountain maple forest**



West Anvil Point

R. J. Rondeau

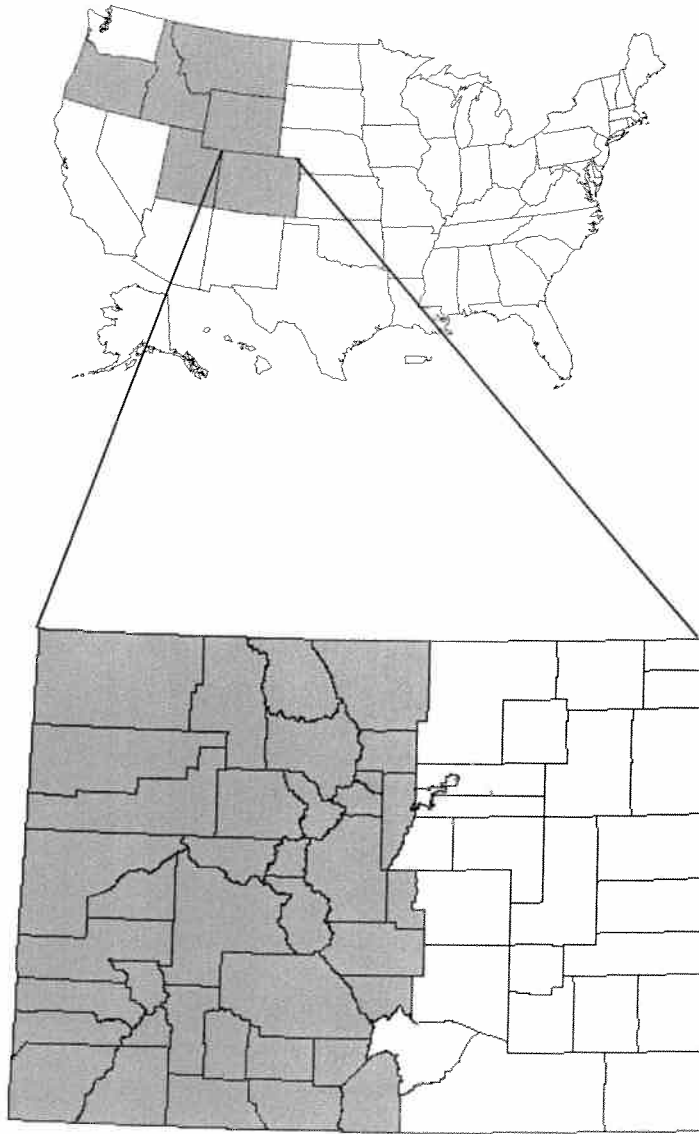
This plant association has been described from one drainage of the Sawatch Range of south-central Colorado, in the San Isabel National Forest (Powell 1988 as cited in Reid et al. 1994) and from a few other scattered locations in the mountainous region of western Colorado (CNHP 1997). D. Culver (pers.

comm.) has observed this plant association in Montana. See the following page for the global and state distribution maps.

The Aspen/Rocky Mountain maple association occurs on north- to northeast-facing moist alluvial terraces at approximately 9,000 feet (Reid et al. 1994). Slopes are moderately steep (11-13%) and undulating, and soils are saturated or poorly drained (Reid et al. 1994).

On NOSR-1 we found a good-quality occurrence of this association near West Anvil Point at the headwaters of First Anvil Creek. See Figure 7 and Appendix A for exact location. This is approximately a 40 acre stand in good condition. It is characterized by a dense Aspen cover (70%), and a diverse shrub layer with Rocky Mountain maple dominant (30%). Other common shrubs are: Choke cherry (*Prunus virginiana* 10%), White stem currant (*Ribes inerme* 30%), Wood's rose (*Rosa woodsii* 3%), and Elderberry (*Sambucus microbotrys* 10%). The herbaceous layer is well developed and diverse with: Water leaf (*Hydrophyllum fendleri* 20%), Meadow rue (*Thalictrum fendleri* 5%), False Saloman's seal (*Smilacina amplexicaule* 3% and *S. stellata* 20%), Sweet cicely (*Osmorhiza depauperata* 30%), Bane berry (*Actaea rubra* 20%) and American vetch (*Vicia americana* 3%). This appears to be a climax Aspen stand as mature Subalpine fir has approximately a 1% canopy cover, the soils are well developed, and several age classes of Aspen are represented. The rare and CNHP tracked Wild hollyhock (*Iliamna grandiflora*) occurs within this habitat on NOSR-1.

Global distribution (Johnston 1987; Bourgeron and Engelking 1994)



Colorado distribution (CNHP staff; Johnston 1987)

**Global and state distribution of *Deschampsia cespitosa*-*Carex* spp.**

## Upland Forests

### Aspen wetland forest (*Populus tremuloides*/*Pteridium aquilinum*) G4/S3S4



Headwaters of Second Water Gulch

R. J. Rondeau

The Aspen wetland forest is fairly common in the localized Rocky Mountain region of Colorado and Utah, hence the Natural Heritage rank of G4/S3S4 (Bourgeron and Engelking 1994; Johnston 1987). Although common elsewhere, this

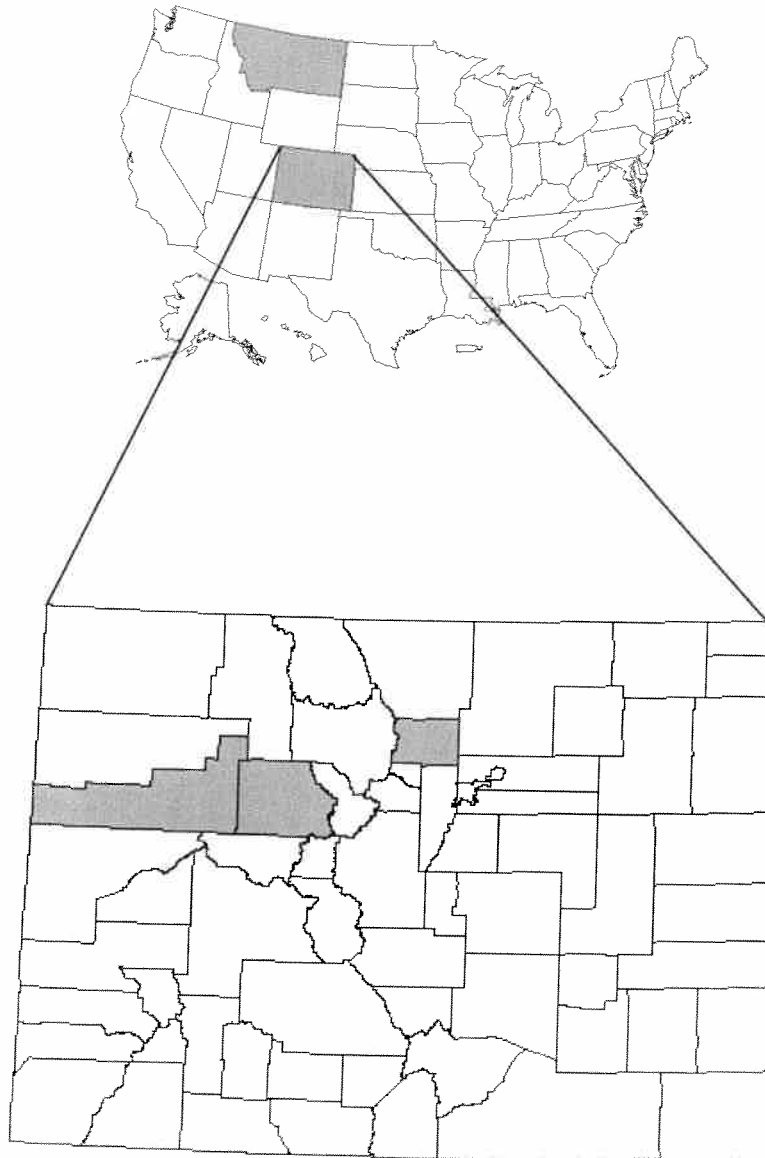
plant association is rare within the Piceance and Uinta Basins (Graham 1937; CNHP 1997). See the following page for the global and state distribution maps.

This plant association generally occurs in small pockets and protected depressions on flat to fairly steep slopes (0-30%) in mountainous terrain from 6,900 to 10,200 feet in elevation (Johnston 1987). This Aspen forest prefers northeast, east and south aspects, on poorly drained loam to sandy loam medium-coarse residual shallow soils (Johnston 1987).

On NOSR-1 we found a single small occurrence of this community along the headwaters of Second Water Gulch. See Figure 7 and Appendix A for the exact location. The NOSR-1 occurrence is characterized by a dense canopy cover of Aspen (60%) and a dense herbaceous layer dominated by the Bracken fern (*Pteridium aquilinum* 60%). The herbaceous layer is fairly diverse with numerous forbs and grasses: e.g., Meadow rue (*Thalictrum fendleri* 10%), Blue wild rye (*Elymus glaucus* 20%), Larkspur (*Delphinium barbeyi* 3%), and numerous other forbs with approximately 1% cover or less.

Graham (1937) notes that if the Bracken fern is eaten in large quantities, it is considered slightly poisonous to cattle, horses, and probably sheep, but its rarity in the Uinta and Piceance Basin prevents it from being a seriously harmful plant there.

Global distribution (D. Culver pers. comm.; CNHP 1997)

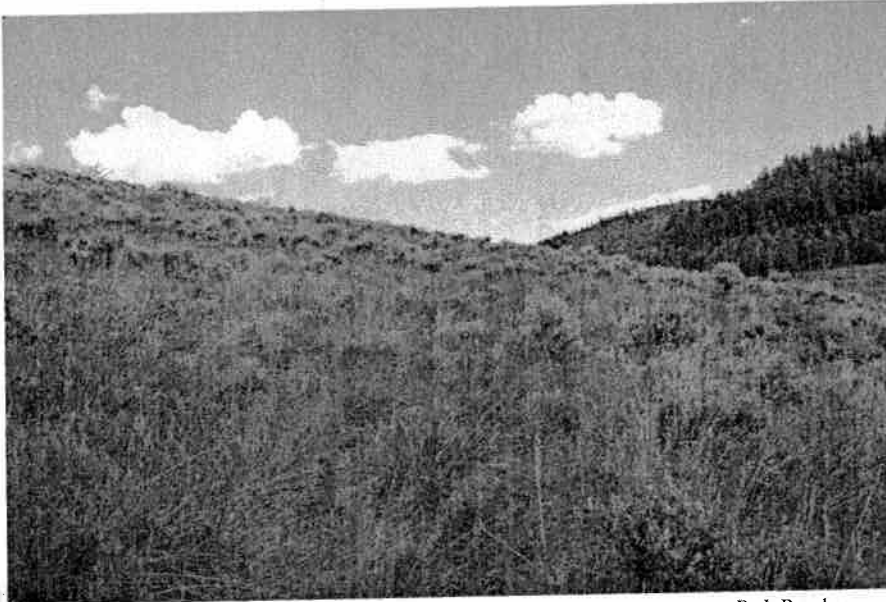


Colorado distribution (CNHP 1997; Powell, D.C. 1988 as cited in Reid et al. 1994)

**Global and state distribution of *Populus tremuloides/Acer glabrum*.**

## Upland Shrublands

### Western slope sagebrush shrublands (*Artemisia tridentata* ssp. *vaseyana*/*Festuca thurberi*) GU/S1S2



Northwater Creek tributary

R. J. Rondeau

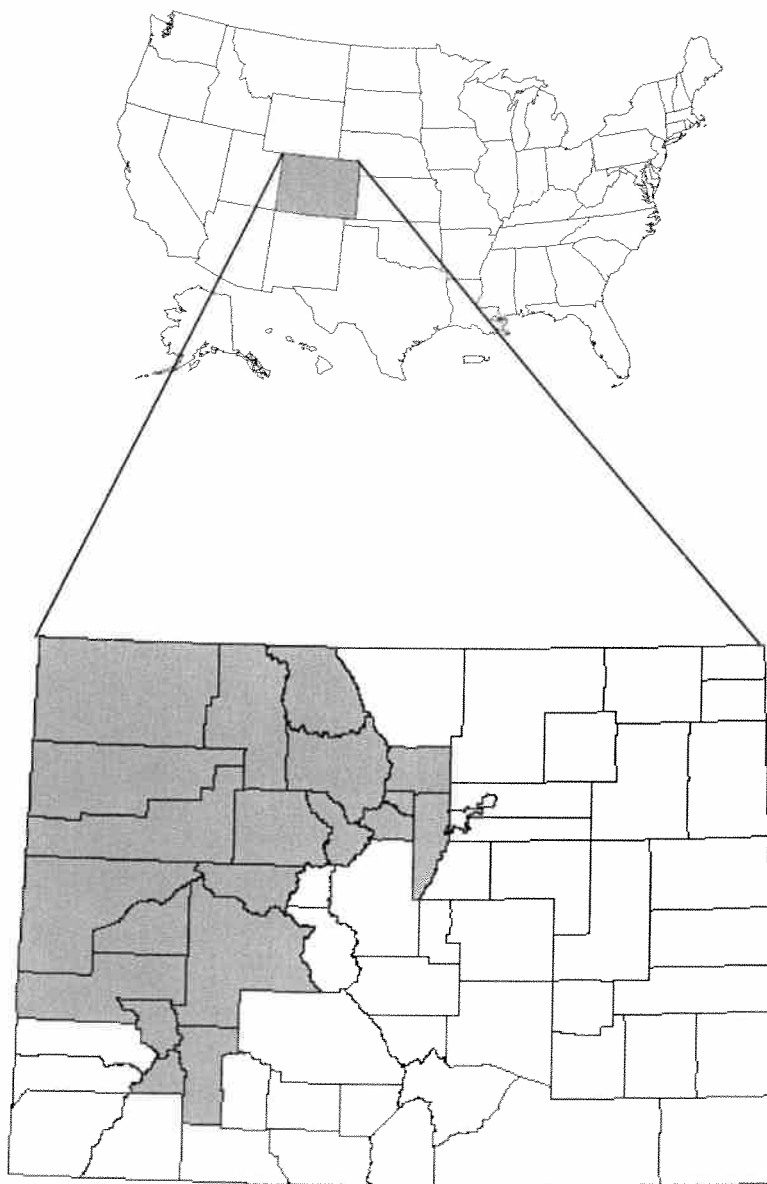
This plant association has only been described from the western slope of Colorado (Johnston 1987), although there is no apparent reason why this type could not be found in Utah and Wyoming as well, especially since the two dominant species occur in these adjacent states. See the following page for the global and state distribution maps.

The western slope sagebrush shrubland generally occurs on exposed gentle slopes of mid elevations (8,000-10,500 feet) on deep, well-drained, moderate permeable soils (Johnston 1987).

On NOSR-1, this plant association was located along the gentle slopes of a Northwater Creek tributary. See Figure 7 and Appendix A for the exact location. The general character of this site is a mixed shrub/grass community. The dominant shrub is the Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*), with a 20-50% canopy cover. Thurber fescue (*Festuca thurberi*) is the dominant grass with a 20-50% canopy cover. Two other shrubs within this site are: Snowberry (*Symphoricarpos rotundifolius* 10%) and Rabbitbrush (*Chrysothamnus viscidiflorus* 0-10%).

Thurber fescue is uncommon on NOSR-1, therefore this is a very unusual site. The Northwater site also has an adjacent pure stand of Thurber fescue. It is possible that Thurber fescue was once a more common grass on NOSR-1 and that a century of grazing has favored sagebrush over Thurber fescue.

Global distribution (Johnston 1987)



Colorado distribution (Johnston 1987)

**Global and state distribution of *Artemisia tridentata vaseyana/Festuca thurberi*.**

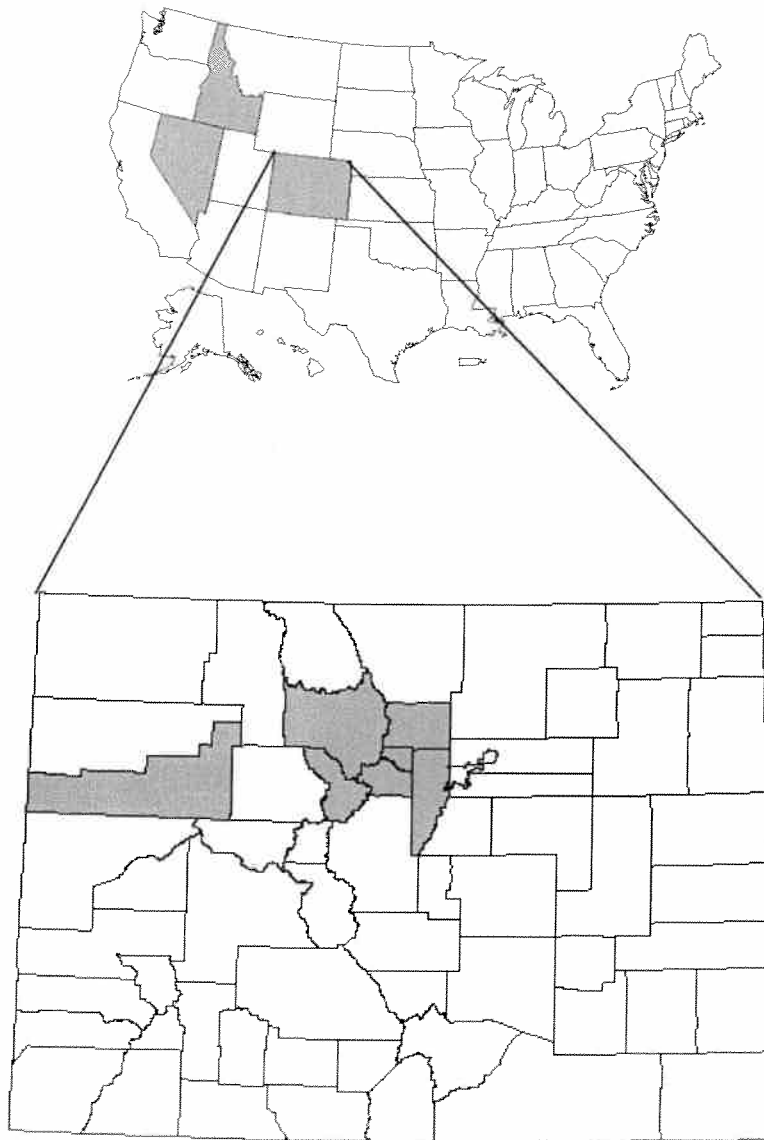
**Sagebrush bottomland shrubland (*Artemisia tridentata* ssp. *vaseyana*/*Leymus cinereus*)  
G4/S2**

The sagebrush bottomland shrubland has been recorded for Idaho, Nevada, and Colorado (Bourgeron and Engelking 1994; Kittel et al. 1994). Within Colorado it is limited to the northwest corner of the state (see the following page for the global and state distribution maps).

This association requires fairly unusual conditions of moist, but not saturated deep soils along flat to gently sloping areas. It occurs in a narrow elevation band from 7,500 to 8,800 feet (Johnston 1987). These unusual conditions probably help explain its limited distribution. Another reason for its rarity may be due to a century of livestock grazing. The Wild rye grass (*Leymus cinereus*) is very palatable for cattle and is quickly utilized. It is suspected that heavy utilization and/or lack of fires will favor Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and weaken conditioned Wild rye grass (*Leymus cinereus*). Baker (1986) believes this may have been a more common plant association in Colorado prior to the 1900's.

On NOSR-1 we found three occurrences of this plant association: two near Anvil Points and one along Bull Gulch. All of these occurrences were in fair to moderate condition. See Figure 7 and Appendix A for exact location. The occurrences are characterized by nearly equal dominance of the Mountain sagebrush (30-60%) and the Wild rye grass (20-50%).

Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (CNHP 1997)

**Global and state distribution of *Artemisia tridentata vaseyana*/*Leymus cinereus*.**



## Upland Grasslands

### Montane grassland (*Festuca thurberi*-*Lathyrus leucanthus*) G4/S4



Northwater Creek tributary

R. J. Rondeau

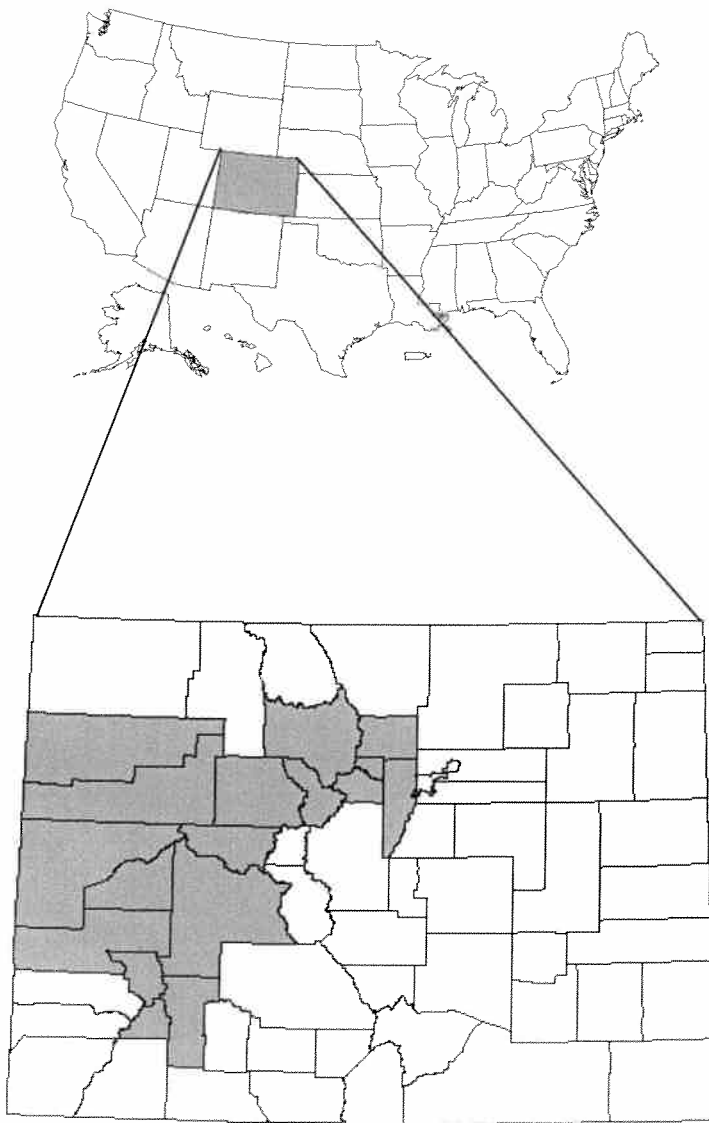
The montane grassland (*Festuca thurberi*-*Lathyrus leucanthus*) has only been reported from Colorado (Johnston 1987; Bourgeron and Engelking 1994). In reviewing the distribution maps, we believe it may be also found in Utah. See the following page for the global and state distribution maps.

This grassland generally occurs on south to southwest facing slopes of variable steepness (0-55%) in expansive openings in the montane to subalpine forest or valley bottoms from 8,200 to 12,500 feet in elevation (Johnston 1987). The soils are very deep and well-drained loams (Johnston 1987).

On NOSR-1 we found this plant association is represented by a single occurrence along a tributary to Northwater Creek. It grades into the adjacent Western slope sagebrush shrubland plant association (*Artemisia tridentata* ssp. *vaseyana*/*Festuca thurberi*). See Figure 7 and Appendix A for the exact location. Thurber fescue is an uncommon grass on NOSR-1, therefore this is a very unusual site. Apparently a fire swept through the area recently, as dead and burnt Aspen trees and Utah serviceberry shrubs are still standing. Potentially, Thurber fescue was once more widespread on NOSR-1, but a century of grazing and lack of fires may have favored Snowberry and Sagebrush over grasslands.

The NOSR-1 occurrence is characterized by Thurber fescue dominating the landscape with a 60-70 % cover, although other grasses and sedges are present: Kentucky blue grass *Poa pratensis* 0-5%), Beardless bluebunch wheatgrass (*Pseudoroegneria spicata* ssp. *inermis* 0-5%), and sedges (*Carex* spp 0-5%).

Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (Johnston 1987)

**Global and state distribution of *Festuca thurberi-Lathyrus leucanthus*.**

### Western slope grassland (*Oryzopsis hymenoides* shale barren) G2/S2



East Fork Parachute Creek; circle denotes occurrence.

R. J. Rondeau

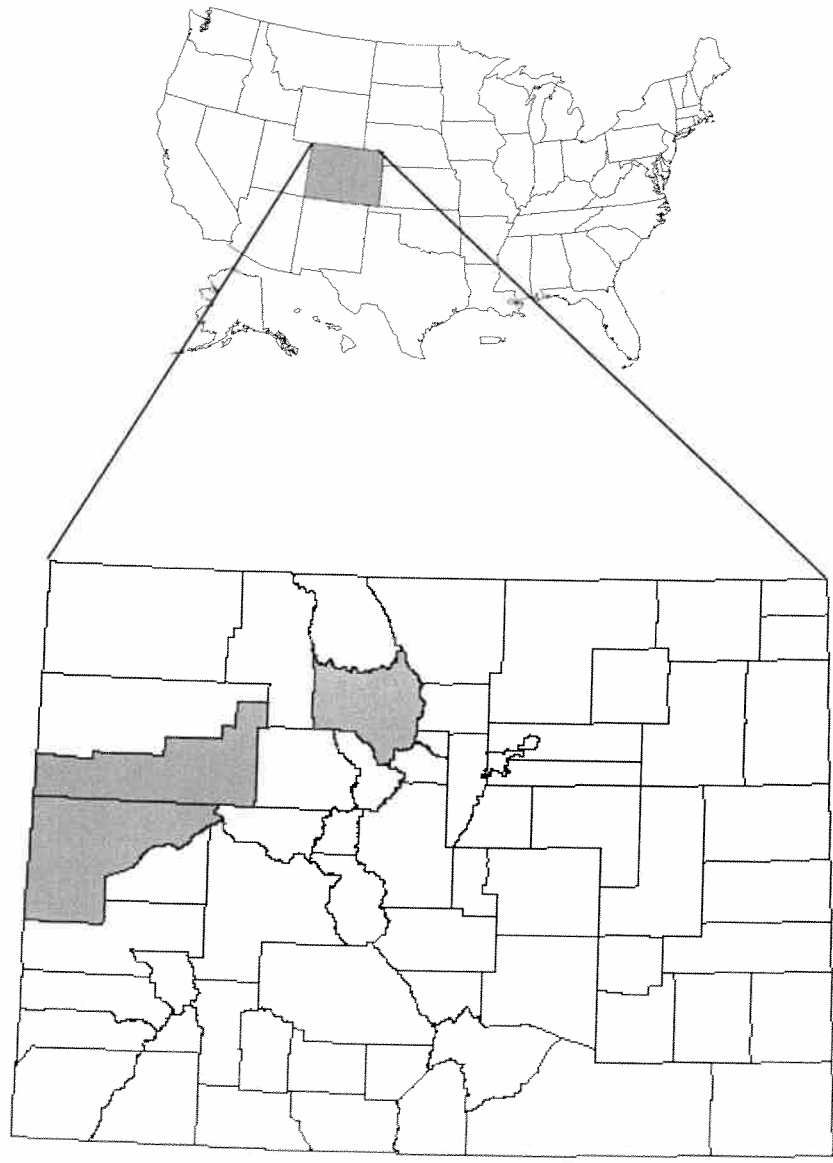
This sparsely vegetated grassland is extremely limited in its distribution, only known from three counties in western Colorado, from approximately 7,000 to 8,500 feet in elevation (see the following page for global and state distribution maps). It is restricted to south-facing slopes with soils derived from shales or mudstones. These soils are normally clayey,

loamy, calcareous and shallow, often capped by a thin gravel layer (Reid et al. 1994).

Total vegetative cover is sparse, and bare soils may cover up to 75% of the ground surface (Keammerer and Peterson 1981; Reid et al. 1994). Keammerer and Peterson (1981) characterized this plant association from NOSR as being a mixture of both shrubs and herbaceous plants with the overall canopy cover rather sparse. The perennial bunchgrass, Indian ricegrass (*Oryzopsis hymenoides*), is the dominant grass, while Mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and occasionally Snowberry (*Symphoricarpos rotundifolius*) are scattered. Reid et al. (1994) describes a slightly different composition from Middle Park. The Middle Park occurrences have the low, mat-forming woody forb Shortstem buckwheat (*Eriogonum brevicaulis*) as the co-dominant, with the shrub Winter fat (*Kraschennikovia lanata*) and the forb Thrifty golden weed (*Haplopappus armeroides*) as associated species (Reid et al. 1994).

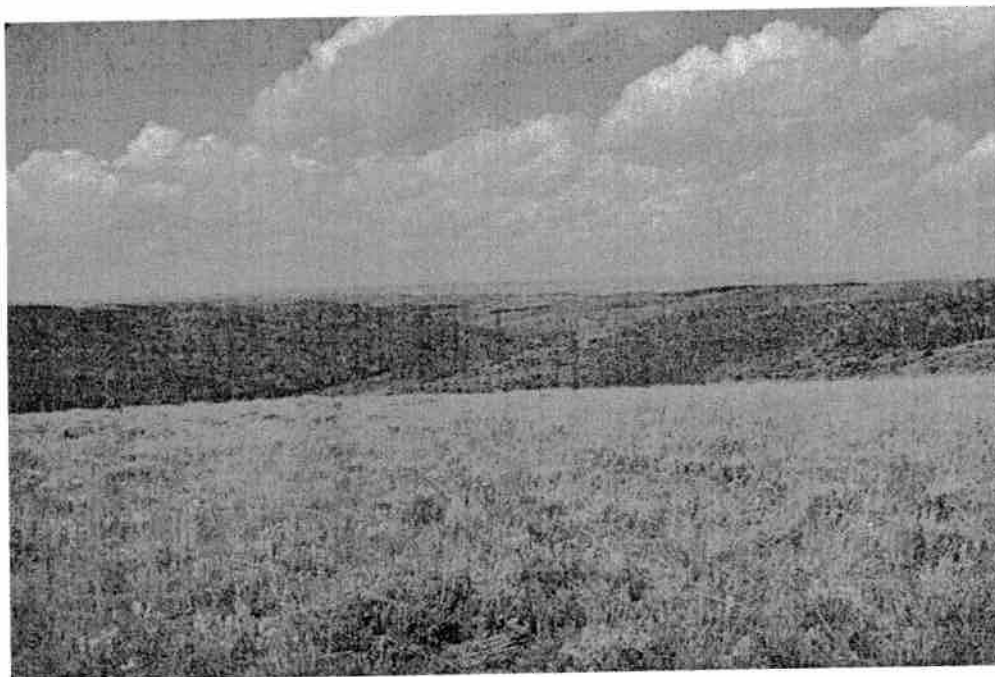
On the NOSR-1 property, we found this plant association on south-facing slopes of East Fork Parachute, Northwater, Trapper and Ben Good Creeks. See Figure 7 and Appendix A for exact locations. This plant association is the habitat for two of NOSR-1's rare plants: Utah fescue (*Festuca dasyclada*) and Osterhout's penstemon (*Penstemon osterhoutii*).

Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (CNHP 1997; Reid et al. 1994)

**Global and state distribution of *Oryzopsis hymenoides* shale barren.**

**Great Basin grassland (*Pseudoroegneria spicata* ssp. *inermis*) G2?/S2?**

NOSR-1 rim near Twin Peak

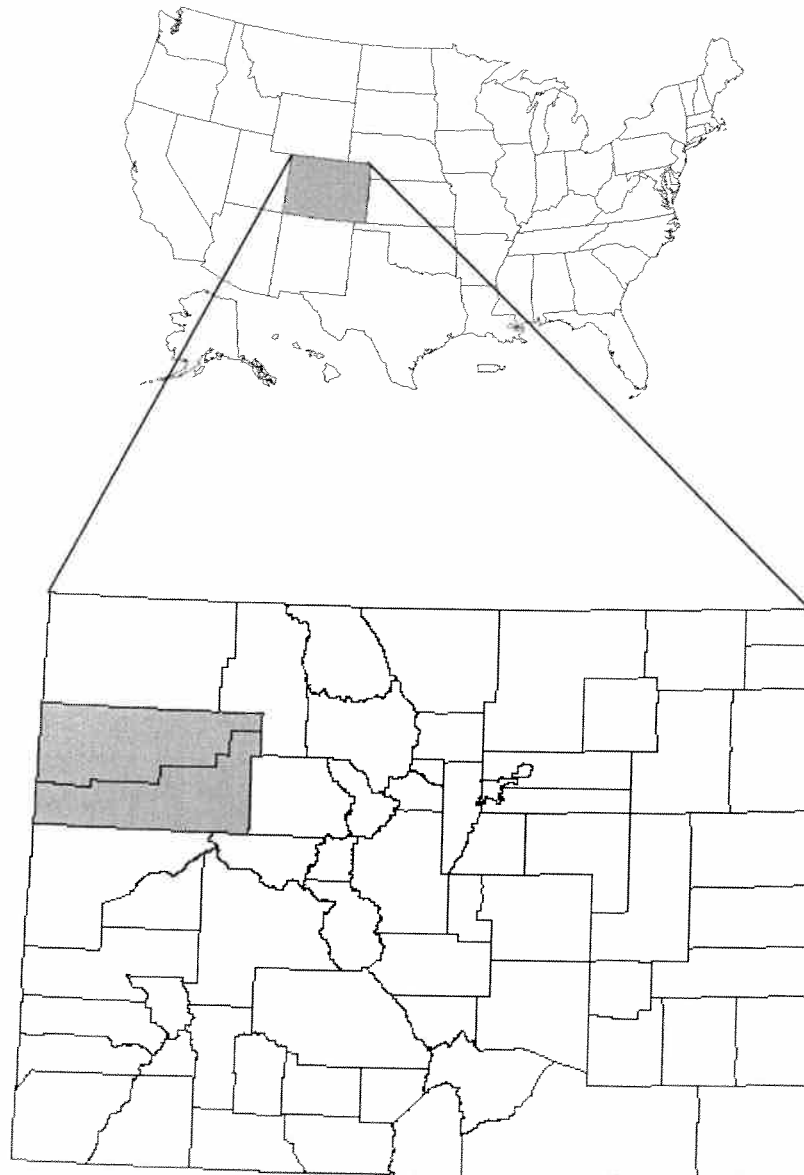
R. J. Rondeau

The Great Basin grassland plant association has only been recorded from the Piceance Basin of Colorado, specifically Rio Blanco and Garfield Counties (Baker 1983; CNHP 1997). It may occur on either south-facing slopes or on broad ridge tops and plateaus that are often gently south or southwest facing (Baker 1983).

On NOSR-1, this plant association occurs along the eastern rim of the Roan Plateau from East Anvil Point to the vicinity of the JQS trail. See Figure 7 and Appendix A for the exact location. The site is characterized as a windswept area dominated by grasses and devoid of tall shrubs. The Beardless bluebunch wheatgrass (*Pseudoroegneria spicata* ssp. *inermis*) dominates (20-40%), with occasional patches of Sandberg bluegrass (*Poa secunda* 0-15%) present. Several low-to-the-ground forbs are present, but not dominant: Silky locoweed (*Oxytropis sericea* 3-10%), Fringed sage (*Artemisia frigida* 5-10%), Longleaf buckwheat (*Eriogonum lonchophyllum* 5-10%), and Mat penstemon (*Penstemon cespitosus* 3-10%). Bare ground ranges from 35-80%.

Baker (1986) recognized five succession stages, based on increasing amounts of grazing impact to this association: 1) Bluebunch wheatgrass dominated climax; 2) Bluebunch wheatgrass-June grass (*Koeleria cristata*); 3) June grass dominated, with occasional small patches of Bluebunch wheatgrass; 4) Snakeweed (*Gutierrezia sarothrae*)-Rabbitbrush (*Chrysothamnus* spp.) dominated with patches of June grass; and 5) bare ground.

Global distribution (Bourgeron and Engelking 1994)



Colorado distribution (CNHP 1997)

**Global and state distribution of *Pseudoroegneria spicata ssp. inermis*.**

**Great Basin montane grassland (*Pseudoroegneria spicata* ssp. *inermis*/*Poa secunda*)  
G4/S1**



Gardner Peak

R. J. Rondeau

The Great Basin montane grassland reaches its southern limit in Utah and Colorado (Bourgeron and Engelking 1994). See the following page for the global and state distribution maps. It occurs on extremely dry windswept knolls and exposed upper slopes of 2-10%, with variable aspects, on loam soils, often derived from residuum igneous-metamorphic substrates

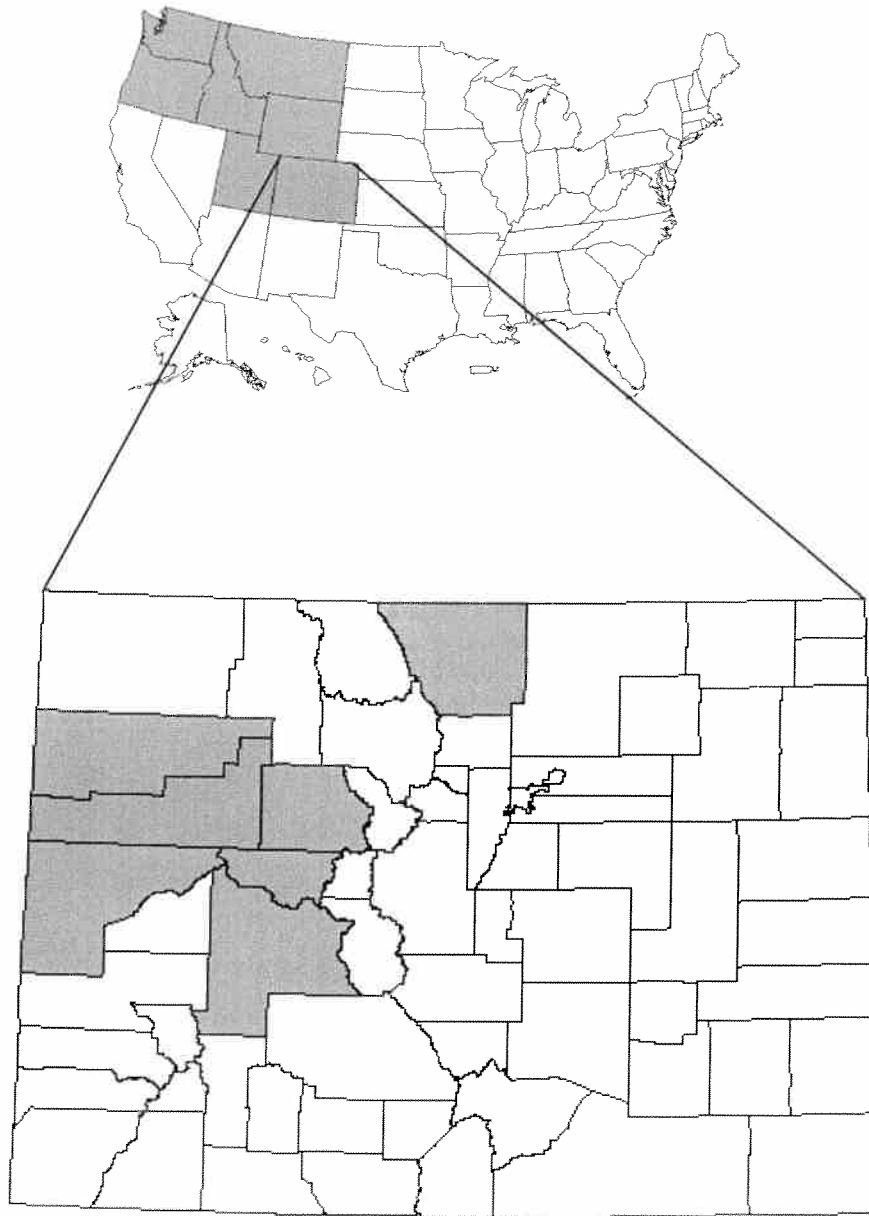
(Johnston 1987). In Colorado the normal elevation range for this plant association is between 8,200 and 9,000 feet (Johnston 1987).

On NOSR-1 this plant association is represented by a single occurrence on Gardner Peak, and is part of the larger grassland dominated by Beardless bluebunch wheatgrass (*Pseudoroegneria spicata* ssp. *inermis*) without Sandberg bluegrass (*Poa secunda*). See Figure 7 and Appendix A for the exact location. The Gardner Peak occurrence of the Great Basin montane grassland plant association is characterized by nearly equal dominance of two grasses: Beardless bluebunch wheatgrass (35%) and Sandberg bluegrass (40%). Other herbaceous species in this occurrence include Longleaf buckwheat (*Eriogonum lonchophyllum* 10%), Fringed sage (*Artemisia frigida* 10%) and Silky locoweed (*Oxytropis sericea* 4%). Bare ground is approximately 25%.

The Beardless bluebunch wheatgrass is a subspecies which has caused considerable taxonomic confusion and undergone several revisions. At times it has been considered a variety and other times its own species. Passey and Hugie (1963) present convincing data that *Pseudoroegneria spicata* ssp. *inermis* and *Pseudoroegneria spicata* ssp. *spicata* are two entities which differ in morphological and habitat characters. Subspecies *inermis* is the awnless plant which dominates areas with high precipitation (greater than 10 inches/year). Subspecies *spicata* dominates harsher environments with low rainfall.

Regardless of its taxonomic status, the Gardner Peak grassland is very important to NOSR-1's biological integrity. It is an important site for mating butterflies and sheep moths and it is potentially a breeding ground for the Columbian sharp-tailed grouse.

Global distribution (Johnston 1987; Bourgeron and Engelking 1994)



Colorado distribution (CNHP 1997; Johnston 1987)

**Global and state distribution of *Pseudoroegneria spicata* ssp. *inermis*-*Poa secunda*.**





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