# Assessment of Riparian and Wetland Areas within the Buffalo-Stillwater-Gilsonite Allotment Analysis Area, Arapaho National Forest, Grand County, Colorado

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Natural Heritage Program COLORADO

Colorado State University
*Knowledge to Go Places*

**Assessment of Riparian and Wetland Areas within the Buffalo-Stillwater-Gilsonite Allotment Analysis Area, Arapaho National Forest, Grand County, Colorado**

***Prepared for:***

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**December 22, 2003**

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Cover photograph: Montane riparian willow shrubland along Willow Creek.

Photo taken by: Joe Rocchio

Report prepared under U.S. Forest Service Purchase Order 43-82FT-3-0519, FY03 Job Code NFRG12. 2003 Field visits conducted under U.S. Forest Service Purchase Order 43-82FT-3—570, FY03 Job Code NRWF12.

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## *Introduction*

The Buffalo-Stillwater-Gilsonite Allotment Analysis Area is located within the Arapahoe National Forest northwest of Granby, CO. Willow Creek and its tributaries drain much of the analysis area; however, smaller creeks such as Bowen Gulch, North, Middle, and South Supply Creeks, and Stillwater Creek are stream courses which occur east of Buffalo Ridge.

The Buffalo-Stillwater-Gilsonite Allotment Analysis Area consists of four general areas identified as suitable rangelands (Figure 1). Figure 2 shows the stream types in the analysis area. The Buffalo allotment was last grazed in 2002 on a temporary permit with 70 pair from July 8 to Sept 10. Prior, the allotment was annually grazed by 70 cow-calf pair, from July 1 to August 31 through 1993. The Stillwater allotment was last grazed on temporary permit in 1989 with 50 pair from July 6 to Sept 30. Prior to 1989, the allotment was grazed annually by 293 pair from July 5 to Sept 30 through 1986. Incidental trespass has occurred on the Stillwater since 1989, but it was short term. In addition, logging, recreation, and localized mining have occurred in the analysis area. Despite these past activities, most of the riparian areas are remarkably intact. Documenting the conservation and biodiversity significance of the analysis area could greatly aid management decisions. Thus, in response to recently renewed analysis by the U.S. Forest Service, the Colorado Natural Heritage Program (CNHP) was contracted to conduct the following in the analysis area:

1. Identify areas within the analysis area surveyed by CNHP during current and past project efforts;
2. Description of CNHP's past projects in the area;
3. Data interpretation and results overview;
4. Discussion of the importance of the riparian systems within a watershed, state, and regional context;
5. Discussion of the Willow Creek Pass Potential Conservation Area;
6. Management recommendations;
7. Identify data gaps where additional field surveys could help assess the biological significance of the analysis area;
8. Recommendations of any additional field surveys, which could assist management decisions.

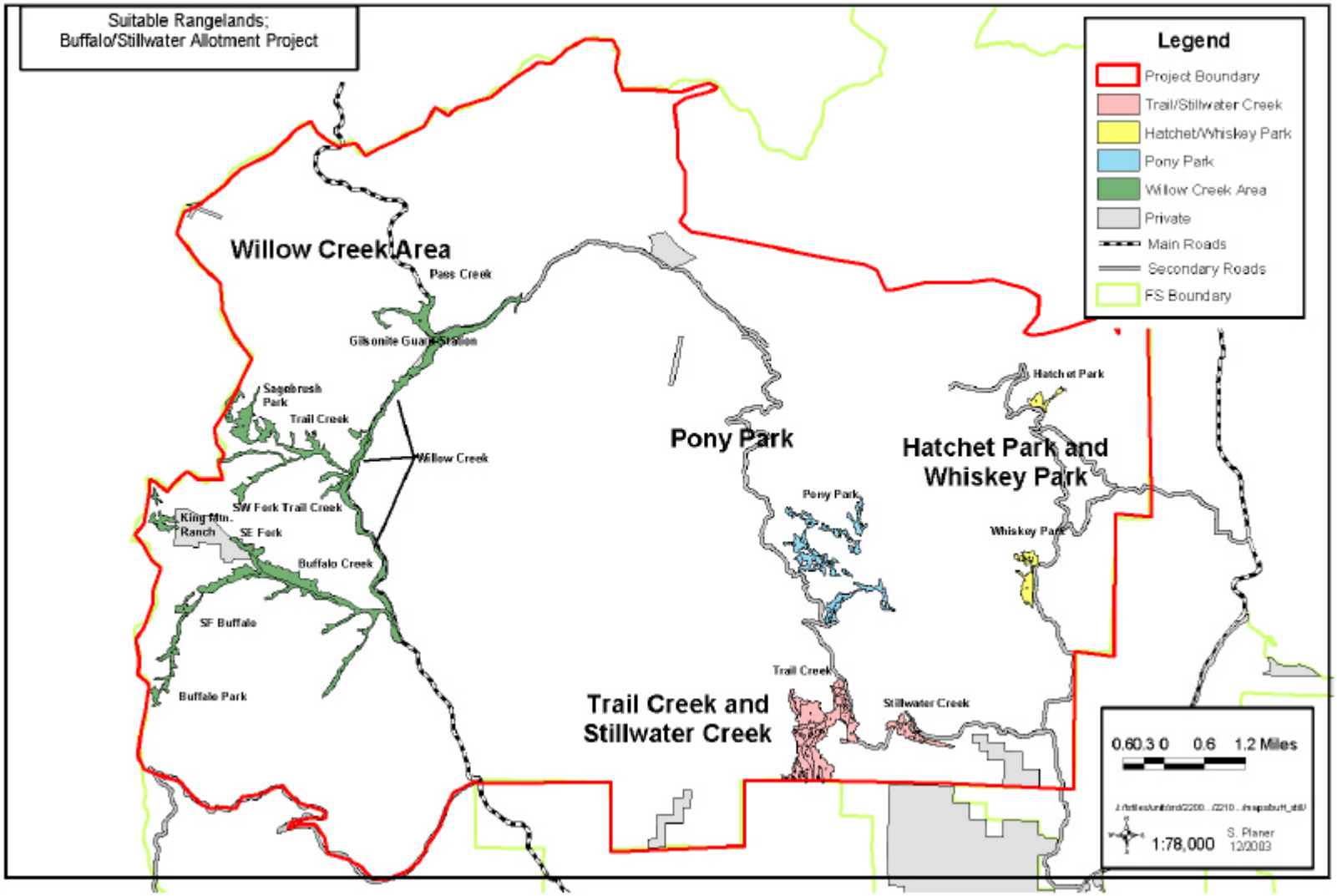



Figure 1. Map of Analysis Area

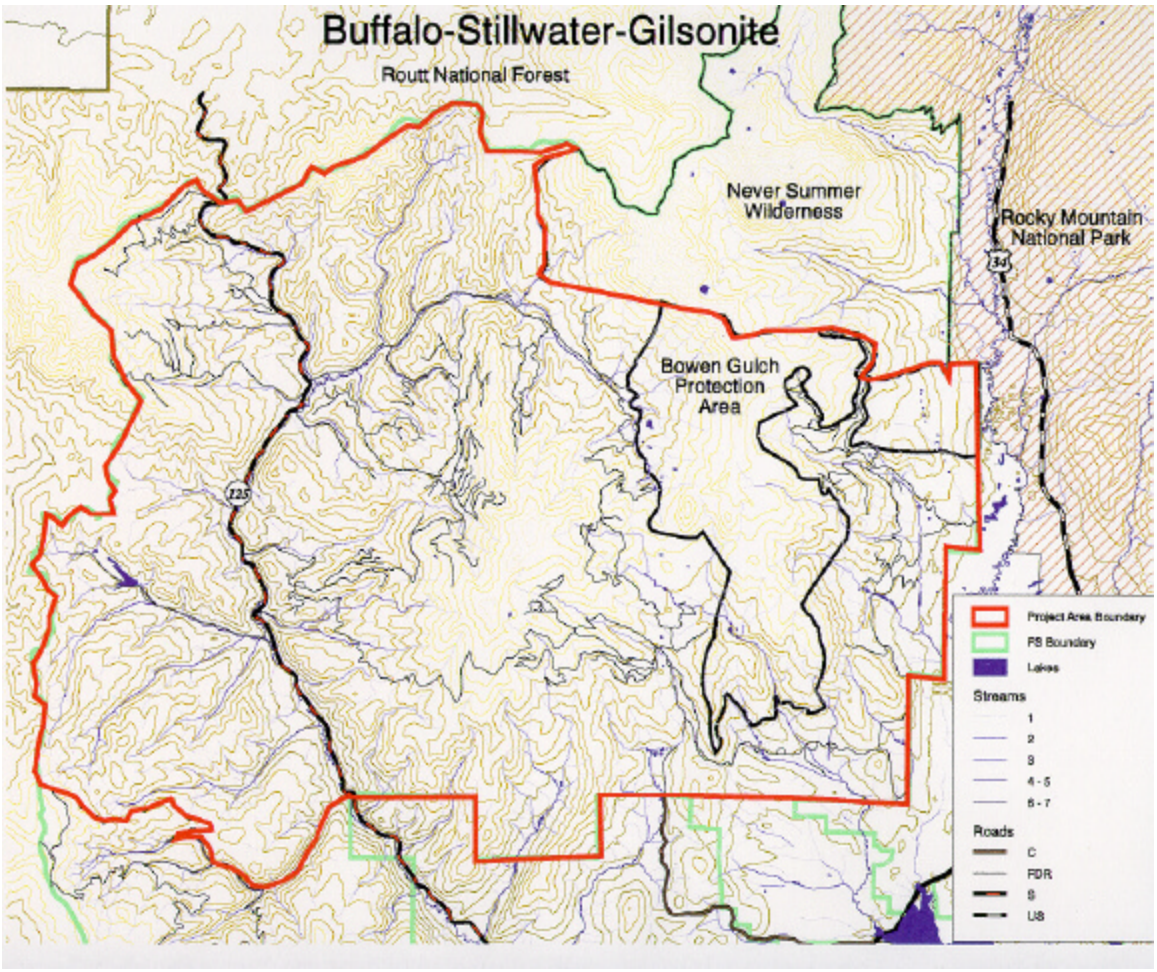



Figure 2. Map of Stream Types in Analysis Area

## *Natural Heritage Methodology*

Just as ancient artifacts and historic buildings represent our cultural heritage, a diversity of plant and animal species and their habitats represent our "natural heritage." Colorado's natural heritage encompasses a wide variety of ecosystems from tallgrass prairie and shortgrass high plains to alpine cirques and rugged peaks, from canyon lands and sagebrush deserts to dense subalpine spruce-fir forests and wide-open tundra.

These widely diversified habitats are determined by water availability, temperature extremes, altitude, geologic history, and land use history. The species that inhabit each of these ecosystems have adapted to the specific set of conditions found there. Because human influence today touches every part of the Colorado environment, we are responsible for understanding our impacts and carefully planning our actions to ensure our natural heritage persists for future generations.

Some generalist species, like house finches, have flourished over the last century, having adapted to habitats altered by humans. However, many other species are specialized to survive in vulnerable Colorado habitats; among them are Bell's twinpod (a wildflower), the Arkansas darter (a fish), and the Pawnee montane skipper (a butterfly). These species have special requirements for survival that may be threatened by incompatible land management practices and competition from non-native species. Many of these species have become imperiled not only in Colorado, but also throughout their range of distribution. Some species exist in less than five populations in the entire world. The decline of these specialized species often indicates disruptions that could permanently alter entire ecosystems. Thus, recognition and protection of rare and imperiled species is crucial to preserving Colorado's diverse natural heritage.

Colorado is inhabited by some 800 vertebrate species and subspecies, and tens of thousands of invertebrate species. In addition, the state has approximately 4,300 species of plants and more than 450 recognized plant associations that represent upland and wetland ecosystems. It is this rich natural heritage that has provided the basis for Colorado's diverse economy. Some components of this heritage have always been rare, while others have become imperiled with human-induced changes in the landscape. This decline in biological diversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that Wilson (1988) has compared the phenomenon to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras.

The need to address this loss in biological diversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biological diversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, scientifically based approach to preserving biological diversity Dr. Robert Jenkins of The Nature Conservancy pioneered the Natural Heritage Methodology in the early 1970s.

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as their biology and known threats. By ranking the relative rarity or imperilment of a species, the quality of its populations, and the importance of associated conservation sites, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community realized that plant associations are equally important as individual species, this methodology has been applied to ranking and preserving rare plant associations, as well as the best examples of common associations.

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. The 85 Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. Information collected by the Natural Heritage Programs can provide a means to protect species before the need for legal endangerment status arises. It can also enable conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

**What is Biological Diversity**

Protecting biological diversity has become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from single-celled organisms such as bacteria and protists through the multicellular kingdoms of plants and animals. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within a single population. On a wider scale, diversity includes variations in the biological associations in which species live, the ecosystems in which associations exist, and the interactions between these levels. All levels are necessary for the continued survival of species and plant associations, and many are important for the well being of humans.

The biological diversity of an area can be described at four levels:

**Genetic Diversity** — the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species varies between populations within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region. Once lost, this unique genetic information cannot be reclaimed.

**Species Diversity** — the total number and abundance of plant and animal species and subspecies in an area.

**Community Diversity** — the variety of plant associations or associations within an area that represent the range of species relationships and inter-dependence. These associations

may be diagnostic or even restricted to an area. Although the terms plant association and community have been described by numerous ecologists, no general consensus of their meaning has developed. The terms are similar, somewhat overlapping, and are often used more or less interchangeably. The U.S. National Vegetation Classification (USNVC) (Anderson et al. 1998), the accepted national standard for vegetation, defines a community as an "assemblage of species that co-occur in defined areas at certain times and that have the potential to interact with one another" (The Nature Conservancy 1999), and a plant association as a type of plant community with "definite floristic composition, uniform habitat conditions, and uniform physiognomy" (Flahault and Schroter 1910). The term plant "association" is hereafter used in lieu of "community" except when referring to a broader definition of community (e.g. natural community). Identifying and protecting representative examples of plant associations ensures conservation of multiple number of species, biotic interactions, and ecological process. Using associations as a "coarse-filter" enables conservation efforts to work toward protecting a more complete spectrum of biological diversity.

**Landscape Diversity** — the type, condition, pattern, and connectedness of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct ecosystems, such as a riparian corridor meandering through shortgrass prairie. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

The conservation of biological diversity should include all levels of diversity: genetic, species, community or association, and landscape. Each level is dependent on the other levels and inextricably linked. In addition, and all too often omitted, humans are also closely linked to all levels of this hierarchy. We at the Colorado Natural Heritage Program believe that a healthy natural environment and a healthy human environment go hand in hand, and that recognition of the most imperiled species is an important step in comprehensive conservation planning.

### *Colorado Natural Heritage Program*

CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in the Colorado Division of Parks and Outdoor Recreation for 14 years, the Program was relocated to the University of Colorado Museum in 1992, and then to the College of Natural Resources at Colorado State University in 1994, where it has operated since.

The multi-disciplinary team of scientists, planners, and information managers at CNHP gathers comprehensive information on the rare, threatened, and endangered species and significant plant associations of Colorado. Life history, status, and locational data are incorporated into a continually updated data system. Sources include published and unpublished literature, museum and herbaria labels, and field surveys conducted by

knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists.

The Biological and Conservation Data System (BCD) was the original database developed by The Nature Conservancy to be used by all Natural Heritage Programs to house data about imperiled species. The database includes taxonomic group, global and state rarity rank, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. Recently, NatureServe, the parent organization to all Heritage programs, has updated BCD utilizing current technology and database capabilities. The new database, BIOTICS (Biodiversity Tracking and Conservation System), is currently being implemented throughout the Natural Heritage Network. The Colorado Natural Heritage Program began using BIOTICS for digitizing and mapping occurrences of rare plants, animals, and plant associations and tracking their distribution and life history information. These rare species and plant associations are referred to as "elements of natural diversity" or simply "elements."

Concentrating on site-specific data for each element enables CNHP to evaluate the significance of each location for the conservation of biological diversity in Colorado and in the nation. By using species imperilment ranks and quality ratings for each location, priorities can be established to guide conservation action. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

To assist in biological diversity conservation efforts, CNHP scientists strive to answer questions like the following:

- What species and ecological associations exist in the area of interest?
- Which are at greatest risk of extinction or are otherwise significant from a conservation perspective?
- What are their biological and ecological characteristics, and where are these priority species or associations found?
- What is the species' condition at these locations, and what processes or activities are sustaining or threatening them?
- Where are the most important sites to protect?
- Who owns or manages those places deemed most important to protect, and what is threatening those places?
- What actions are needed for the protection of those sites and the significant elements of biological diversity they contain?

- How can we measure our progress toward conservation goals?

CNHP has effective working relationships with several state and federal agencies, including the Colorado Department of Natural Resources, the Colorado Division of Wildlife, the Bureau of Land Management, and the U.S. Forest Service. Numerous local governments and private entities, such as consulting firms, educators, landowners, county commissioners, and non-profit organizations, also work closely with CNHP. Use of the data by many different individuals and organizations encourages a cooperative and proactive approach to conservation, thereby reducing the potential for conflict.

### *The Natural Heritage Ranking System*

Key to the functioning of Natural Heritage Programs is the concept of setting priorities for gathering information and conducting inventories. The number of possible facts and observations that can be gathered about the natural world is essentially limitless. The financial and human resources available to gather such information are not. Because biological inventories tend to be under-funded, there is a premium on devising systems that are both effective in providing information that meets users' needs and efficient in gathering that information. The cornerstone of Natural Heritage inventories is the use of a ranking system to achieve these twin objectives of effectiveness and efficiency.

Ranking species and ecological assocations according to their imperilment status provides guidance for where Natural Heritage Programs should focus their information-gathering activities. For species deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, the more common and secure species constitute the majority of most groups of organisms. On the other hand, for those species that are by their nature rare, more detailed information is needed. Because of these species' rarity, gathering comprehensive and detailed population data can be less daunting than gathering similarly comprehensive information on more abundant species.

To determine the status of species within Colorado, CNHP gathers information on plants, animals, and plant associations. Each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences (in other words, the number of known distinct localities or populations). This factor is weighted more heavily than other factors because an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats, and the number of protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than five current locations in Colorado, is ranked G5 S1 (globally-secure, but critically imperiled in this state). The

Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3 S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1 S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 3.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species. As noted in Table 3, ranks followed by a "B," for example S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," for example S4N, refer to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted with an "S" or a "G" respectively, followed by a number or letter. These ranks should not be interpreted as legal designations.

Table 1. Definition of Natural Heritage Imperilment Ranks.

| | |
|---|---|
| **G/S1** | Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction. |
| **G/S2** | Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range. |
| **G/S3** | Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals). |
| **G/S4** | Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals. |
| **G/S5** | Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. |
| **G/SX** | Presumed extinct globally, or extirpated within the state. |
| **G#?** | Indicates uncertainty about an assigned global rank. |
| **G/SU** | Unable to assign rank due to lack of available information. |

| | |
|---|---|
| **GQ** | Indicates uncertainty about taxonomic status. |
| **G/SH** | Historically known, but usually not verified for an extended period of time. |
| **G#T#** | Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5. |
| **S#B** | Refers to the breeding season imperilment of elements that are not 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 SZN is used. |
| **SZ** | Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected. |
| **SA** | Accidental in the state. |
| **SR** | Reported to occur in the state but unverified. |
| **S?** | Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking. |

Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element is uncertain, but falls within the stated range.

**Legal Designations for Rare Species**

Natural Heritage imperilment ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as “Sensitive,” as does the Bureau of Land Management. Table 4 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Candidate species for listing as endangered or threatened under the Endangered Species Act are indicated with a “C." While obsolete legal status codes (Category 1 and 2) are no longer used, CNHP continues to maintain them in its Biological and Conservation Data system for reference.

Table 2. Federal and State Agency Special Designations for Rare Species.

| | |
|---|---|
| **Federal Status:** | |
| **1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)** | |
| LE | Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range. |
| E (S/A) | Endangered: treated as endangered due to similarity of appearance with listed species. |
| LT | Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range. |
| P | Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule). |
| C | Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register. |
| **2. 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:<br>Significant current or predicted downward trends in population numbers or density.<br>Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. |
| **3. 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 C (candidate) species. |
| **4. State Status:** | |
| The Colorado Division of Wildlife has developed categories of imperilment for non-game species (refer to the Colorado Division of Wildlife's Chapter 10 – Nongame Wildlife of the Wildlife Commission's regulations). The categories being used and the associated CNHP codes are provided below. | |
| E | Endangered: those species or subspecies of native wildlife whose prospects for survival or recruitment within this state are in jeopardy, as determined by the Commission. |
| T | Threatened: those species or subspecies of native wildlife which, as determined by the Commission, are not in immediate jeopardy of extinction but are vulnerable because they exist in such small numbers, are so extremely restricted in their range, or are experiencing such low recruitment or survival that they may become extinct. |
| SC | Special Concern: those species or subspecies of native wildlife that have been removed from the state threatened or endangered list within the last five years; are proposed for federal listing (or are a federal listing "candidate species") and are not already state listed; have experienced, based on the best available data, a downward trend in numbers or distribution lasting at least five years that may lead to an endangered or threatened status; or are otherwise determined to be vulnerable in Colorado. |

## Element Occurrences and their Ranking

Actual locations of elements, whether they are single organisms, populations, or plant associations, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. To prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

**Size** – a measure of the area or abundance of the element's occurrence, relative to other known, and/or presumed viable, examples. Takes into account factors such as area of

occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance).

**Condition/Quality** – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes factors such as reproduction, age structure, biological composition (such as the presence of non-native versus native species), structure (for example, canopy, understory, and ground cover in a forest community), and biotic interactions (such as levels of competition, predation, and disease).

**Landscape Context** – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbances. Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological associations and systems, and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are summarized in Table 5.

Table 3. Element Occurrence Ranks and their Definitions.

| | |
|---|---|
| **A** | Excellent viability. |
| **B** | Good viability |
| **C** | Fair viability. |
| **D** | Poor viability. |
| **H** | Historic: known from historical record, but not verified for an extended period of time. |
| **X** | Extirpated (extinct within the state). |
| **E** | Extant: the occurrence does exist but not enough information is available to rank. |
| **F** | Failed to find: the occurrence could not be relocated. |

**Potential Conservation Areas and Their Ranking**

In order to successfully protect populations or occurrences, it is helpful to delineate Potential Conservation Areas (PCAs). These PCAs focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. Potential Conservation Areas may include a single occurrence of a rare element, or a suite of rare element occurrences or significant features.

The goal of the PCA process is to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element

occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic, hydrologic features, vegetative cover; and current and potential land uses. In developing the boundaries of a Potential Conservation Area, CNHP scientists consider a number of factors that include, but are not limited to:

- ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the PCA and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater;
- land intended to buffer the PCA against future changes in the use of surrounding lands;
- exclusion or control of invasive non-native species;
- land necessary for management or monitoring activities.

The boundaries presented are meant to be used for conservation planning purposes and have no legal status. The proposed boundary does not automatically recommend exclusion of all activity. Rather, the boundaries designate ecologically significant areas in which land managers may wish to consider how specific activities or land use changes within or near the PCA affect the natural heritage resources and sensitive species on which the PCA is based. Please note that these boundaries are based on our best estimate of the primary area supporting the long-term survival of targeted species and plant associations. A thorough analysis of the human context and potential stresses has not been conducted. However, CNHP's conservation planning staff is available to assist with these types of analyses where conservation priority and local interest warrant additional research.

**Off-Site Considerations**

Frequently, all necessary ecological processes cannot be contained within a site of reasonable size. For example, taken to the extreme, the threat of ozone depletion could expand every site to include the entire planet. The boundaries described in this report indicate the immediate, and therefore most important, area to be considered for protection. Continued landscape level conservation efforts are necessary as well, which will involve regional efforts in addition to coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

**Ranking of Potential Conservation Areas**

CNHP uses element and element occurrence ranks to assess the overall biological diversity significance of a PCA, which may include one or many element occurrences. Based on these ranks, each PCA is assigned a biological diversity rank (or B-rank). See Table 6 for a summary of these B-ranks.

Table 4. Natural Heritage Program Biological Diversity Ranks and their Definitions.

| | |
|---|---|
| **B1** | Outstanding Significance (indispensable):<br>Only known occurrence of an element<br>A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence)<br>Concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more) |
| **B2** | Very High Significance:<br>B- or C-ranked occurrence of a G1 element<br>A- or B-ranked occurrence of a G2 element<br>One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element.<br>Concentration of A- or B-ranked G3 elements (four or more)<br>Concentration of C-ranked G2 elements (four or more) |
| **B3** | High Significance:<br>C-ranked occurrence of a G2 element<br>A- or B-ranked occurrence of a G3 element<br>D-ranked occurrence of a G1 element (if best available occurrence)<br>Up to five of the best occurrences of a G4 or G5 community (at least A- or B-ranked) in an ecoregion (requires consultation with other experts) |
| **B4** | Moderate Significance:<br>Other A- or B-ranked occurrences of a G4 or G5 community<br>C-ranked occurrence of a G3 element<br>A- or B-ranked occurrence of a G4 or G5 S1 species (or at least C-ranked if it is the only state, provincial, national, or ecoregional occurrence)<br>Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more)<br>D-ranked occurrence of a G2 element<br>At least C-ranked occurrence of a disjunct G4 or G5 element<br>Concentration of excellent or good occurrences (A- or B-ranked) of G4 S1 or G5 S1 elements (four or more) |
| **B5** | General or State-wide Biological Diversity Significance: good or marginal occurrence of common community types and globally secure S1 or S2 species. |

**Protection Urgency Ranks**

Protection urgency ranks (P-ranks) refer to the timeframe in which it is recommended that conservation protection occur. In most cases, this rank refers to the need for a major change of protective status (for example agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to protect the area. Table 7 summarizes the P-ranks and their definitions.

Table 5. Natural Heritage Program Protection Urgency Ranks and their Definitions.

| | |
|---|---|
| **P1** | Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year. |
| **P2** | Protection actions may be needed within 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA within this approximate timeframe. |
| **P3** | Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA if protection action is not taken. |
| **P4** | No protection actions are needed in the foreseeable future. |
| **P5** | Land protection is complete and no protection actions are needed. |

A protection action involves increasing the current level of protection accorded one or more tracts within a potential conservation area. It may also include activities such as educational or public relations campaigns, or collaborative planning efforts with public or private entities, to minimize adverse impacts to element occurrences at a site. It does not include management actions. Situations that may require a protection action are as follows:

- Forces that threaten the existence of one or more element occurrences at a PCA. For example, development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; or timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;

- The inability to undertake a management action in the absence of a protection action; for example, obtaining a management agreement;

- In extraordinary circumstances, a prospective change in ownership or management that will make future protection actions more difficult.

**Management Urgency Ranks**

Management urgency ranks (M-ranks) indicate the timeframe in which it is recommended that a change occur in management of the element or PCA. This rank refers to the need for management in contrast to protection (for example, increased fire frequency, decreased grazing, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of non-natives, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area. Table 8 summarizes M-ranks and their definitions.

Table 6. Natural Heritage Program Management Urgency Ranks and their Definitions.

| | |
|---|---|
| **M1** | Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded. |
| **M2** | New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA. |
| **M3** | New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA. |
| **M4** | Current management seems to favor the persistence of the elements in the PCA, but management actions may be needed in the future to maintain the current quality of the element occurrences. |
| **M5** | No management needs are known or anticipated in the PCA. |

## Methods

### Collect Available Information

CNHP's BIOTICS database was searched for records of biologically significant plant and animal species and plant communities within the analysis area. U.S. Forest Service biologists were consulted about specific land use activities in the analysis area. Geographic Information System (GIS) data layers were used to analyze spatial relationships between elements, land use, and other biotic and abiotic data.

### Identify Targeted Inventory Areas

Those areas not previously visited by CNHP or USFS personnel were targeted for visitation. Also, to incorporate as many areas as possible during the short time allotted for fieldwork, those riparian areas with passable roads were prioritized. These roadside surveys were useful in assessing the extent of human and livestock impacts, which included ditching, adventive native plant species, indicator plant species of intensive livestock use, stream bank destabilization, major hydrologic alterations, excessive cover of non-native plant species, or new construction. To calibrate visual observations from the roadside assessment, a periodic effort was made to walk a portion of each new tributary or creek visited.

### Conduct Field Surveys

The overall significance or integrity of each riparian area, relative to others of the same element, was estimated by rating the size, condition, and landscape context of the community. These factors are combined into an element occurrence rank, which is useful in refining conservation priorities. See the previous section on Natural Heritage Network for more about element occurrence ranking. A qualitative assessment of species composition, structural diversity of vegetation, vegetation volume, soil and hydrological disturbance, and nearby and/or on-site land use was used to assess the integrity of the riparian areas. Indicators of these variables were compared to ecological integrity specifications for Montane/Subalpine Riparian Shrublands (Rondeau 2001; Appendix A) to indicate the relative impairment of riparian areas to known reference conditions for these ecological systems.

Field surveys also included a descriptive, overall, functional evaluation for the riparian areas visited.

### Wetland Functional Assessment

Wetlands perform many functions beyond simply providing habitat for plants and animals. It is commonly known that wetlands act as natural filters, helping to protect water quality, but it is less well known that wetlands perform other important functions. (Adamus et al. 1991) list the following functions performed by wetlands:

- Groundwater recharge--the replenishing of below ground aquifers.
- Groundwater discharge--the movement of ground water to the surface (e.g., springs).
- Floodflow alteration--the temporary storage of potential flood waters.

- Sediment stabilization--the protection of stream banks and lake shores from erosion.
- Sediment/toxicant retention--the removal of suspended soil particles from the water, along with toxic substances that may be adsorbed to these particles.
- Nutrient removal/transformation--the removal of excess nutrients from the water, in particular nitrogen and phosphorous. Phosphorous is often removed via sedimentation; transformation includes converting inorganic forms of nutrients to organic forms and/or the conversion of one inorganic form to another inorganic form (e.g., $NO_3^-$ converted to $N_2O$ or $N_2$ via denitrification).
- Production export--supply organic material (dead leaves, soluble organic carbon, etc.) to the base of the food chain.
- Aquatic diversity/abundance--wetlands support fisheries and aquatic invertebrates.
- Wildlife diversity/abundance--wetlands provide habitat for wildlife.

For this project, CNHP utilized a qualitative, descriptive functional assessment based on the best professional judgment of CNHP ecologists. Wetland functions are evaluated or compared only with respect to other wetlands of the same type, because different types often perform very different functions. For example, a montane kettle pond may provide habitat for rare plant associations never found on a large river but provides little in the way of flood control, while wetlands along a major river perform important flood control functions but may not harbor rare plant species. Thus, the category, **Overall Functional Integrity**, was included in the functional assessment to provide the user of some indication of how a particular wetland is functioning in comparison to its natural capacity, as opposed to comparing it to different wetland types.

Most functions are assigned a rating of “low," “moderate," or “high." Overall Functional Integrity is given as either "At Potential" or "Below Potential." Elemental Cycling is rated as either "Normal" or "Disrupted" depending on unnatural disturbances. The following functions were evaluated for riparian areas in the analysis area:

- Overall Functional Integrity
- Flood attenuation and storage
- Sediment/shoreline stabilization
- Groundwater discharge/recharge
- Dynamic surface water storage
- Elemental Cycling
- Removal of Imported Nutrients, Toxicants, and Sediments
- Habitat diversity
- General wildlife habitat
- General fish/aquatic habitat
- Production export/food chain support
- Uniqueness

***Overall Functional Integrity***
The overall functional integrity of each wetland is a rating indicating how a particular wetland is functioning in comparison to wetlands in its same hydrogeomorphic class and/or subclass. For example, mineral soil flats (salt meadows) do not typically function as high wildlife habitat but do have high capacity for storing surface/groundwater. Thus, a mineral soil flat that is given a low rating for General Wildlife Habitat, General Fish Habitat, and Production Export/Food Chain Support does not necessarily indicate that the wetland is not functioning to its capacity. These ratings may just reflect that mineral soil flats, because of their landscape position and soil chemistry, naturally perform fewer functions than a depressional wetland. However, this particular wetland may be functioning the 'best' that could be expected from a mineral soil flat. The Overall Functional Integrity rating would reflect this by giving this particular wetland a "At Potential" rating, based on the best professional judgment of CNHP ecologists. In summary, a mineral soil flat wetland having more low ratings than a depressional wetland does not necessarily mean that it is functioning improperly. However, if this particular mineral soil flat was given an Overall Functional Integrity rating of "Below Potential," then it could be assumed that the wetland is not functioning to the capacity that it should (relative to other mineral soil flat wetlands).

***Flood Attenuation and Storage***
Many wetlands have a high capacity to store or delay floodwaters that occur from peak flow, gradually recharging the adjacent groundwater table. Decreased flood attenuation and storage capacity can lead to increased flooding frequency, erosion, furthering lowering of water tables, etc. Indicators of flood storage include: debris along streambank and in vegetation, low gradient, formation of sand and gravel bars, high density of small and large depressions, and dense vegetation. This field assesses the capability of the wetland to detain moving water from in-channel flow or overbank flow for a short duration when the flow is outside of its channel.

***Sediment/Shoreline Stabilization***
Shoreline anchoring is the stabilization of soil at the water's edge by roots and other plant parts. The vegetation dissipates the energy caused by fluctuations of water and prevents streambank erosion. The presence of woody vegetation and sedges in the understory are the best indicator of good sediment/shoreline anchoring.

***Groundwater Discharge/Recharge***
Groundwater recharge occurs when the water level in a wetland is higher than the surrounding water table resulting in the movement (usually downward) of surface water. Groundwater discharge results when the groundwater level of a wetland is lower than the surrounding water table, resulting in the movement (usually laterally or upward) of surface water (e.g., springs, seeps, etc.). Ground water movement can greatly influence some wetlands, whereas in others it may have minimal effect (Carter and Novitzki 1988).

Both groundwater discharge and recharge are difficult to estimate without intensive data collection. Wetland characteristics that may indicate groundwater recharge are: porous underlying strata, irregularly shaped wetland, dense vegetation, and presence of a

constricted outlet. Indicators of groundwater discharge are the presence of seeps and springs and wet slopes with no obvious source.

***Dynamic Surface Water Storage***

Dynamic surface water storage refers to the potential of the wetland to capture water from precipitation and upland surface (sheetflow). Sheetflow is nonchannelized flow that usually occurs during and immediately following rainfall or a spring thaw. Wetlands can also receive surface inflow from seasonal or episodic pulses of floodwaters from adjacent streams and rivers that may otherwise not be hydrologically connected with a particular wetland (Mitsch and Gosselink 1993). Spring thaw and/or rainfall can also create a time-lagged increase in groundwater flow. Wetlands providing dynamic surface water storage are capable of releasing these episodic pulses of water at a slow, stable rate thus alleviating short term flooding from such events. This function is applicable to wetlands that are not subject to flooding from in-channel or overbank flow (see Flood Storage and Attenuation). Indicators of potential surface water storage include flooding frequency, density of woody vegetation (particular those species with many small stems), coarse woody debris, surface roughness, and size of the wetland.

***Elemental Cycling***

The cycling of nutrients, or the abiotic and biotic processes that convert elements from one form to another, is a fundamental ecosystem process, which maintains a balance between living biomass and detrital stocks (Brinson et al. 1985). Disrupting nutrient cycles could cause an imbalance between the two resulting in one factor liming the other. Thus, impacts to aboveground primary productivity or disturbances to the soil, which may cause a shift in nutrient cycling rates, could change soil fertility, alter plant species composition, and affect potential habitat functions. Indicators of wetlands with intact nutrient cycling need to be considered relative to wetlands within the same hydrogeomorphic class/subclass. Such indicators include high aboveground primary productivity and high quantities of detritus, within the range expected for that particular hydrogeomorphic class of wetlands.

***Removal of Imported Nutrients, Toxicants, and Sediments***

Nutrient retention/removal is the storing and/or transformation of nutrients within the sediment or vegetation. Inorganic nutrients can be transformed into an organic form and/or converted to another inorganic form via microbial respiration and redox reactions. For example, denitrification, which is a process that is mediated by microbial respiration, results in the transformation of nitrate ($NO_3^-$) to nitrous oxide ($N_20$) and/or molecular nitrogen ($N_2$). Nutrient retention/removal may help protect water quality by retaining or transforming nutrients before they are carried downstream or are transported to underlying aquifers. Particular attention is focused on processes involving nitrogen and phosphorus, as these nutrients are usually of greatest importance to wetland systems (Kadlec and Kadlec 1979). Nutrient storage may be for long-term (greater than 5 years) as in peatlands or depressional marshes or short-term (30 days to 5 years) as in riverine wetlands. Some indicators of nutrient retention include: high sediment trapping, organic matter accumulation, presence of free-floating, emergent, and submerged vegetation, and permanently or semi-permanently flooded areas.

Sediment and toxicant trapping is the process by which suspended solids and chemical contaminants are retained and deposited within the wetland. Deposition of sediments can ultimately lead to removal of toxicants through burial, chemical break down, or temporary assimilation into plant tissues (Boto and Patrick 1979). Most vegetated wetlands are excellent sediment traps, at least in the short term. Wetland characteristics indicating this function include: dense vegetation, deposits of mud or organic matter, gentle sloping gradient, and location next to beaver dams or human-made detention ponds/lakes.

***Habitat diversity***

Habitat diversity refers to the number of physiognomic classes present. Thus, the presence of emergent, scrub/shrub, and forested physiognomic types would have high habitat diversity. The presence of open water in these areas also increases the habitat diversity.

***General Wildlife and Fish Habitat***

Habitat includes those physical and chemical factors which affect the metabolism, attachment, and predator avoidance of the adult or larval forms of fish, and the food and cover needs of wildlife. Wetland characteristics indicating good fish habitat include: deep, open, non-acidic water, no barriers to migration, well-mixed (high oxygen content) water, and highly vegetated. Wetland characteristics indicating good wildlife habitat are: good edge ratio, islands, high plant diversity, diversity of vegetation structure, and a sinuous and irregular basin.

***Production Export/Food Chain Support***

Production export refers to the flushing of organic material (both particulate and dissolved organic carbon and detritus) from the wetland to downstream ecosystems. Production export emphasizes the production of organic substances within the wetland and the utilization of these substances by fish, aquatic invertebrates, and microbes. Food chain support is the direct or indirect use of nutrients, carbon, and even plant species (which provide cover and food for many invertebrates) by organisms, which inhabit or periodically use wetland ecosystems. Indicators of wetlands that provide downstream food chain support are: an outlet, seasonally flooded hydrological regime, overhanging vegetation, and dense and diverse vegetation composition and structure.

***Uniqueness***

This value expresses the general uniqueness of the wetland in terms of relative abundance of similar sites occurring in the same watershed, size, geomorphic position, peat accumulation, mature forested areas, and the replacement potential.

## *Delineate Potential Conservation Area Boundaries*

Available data on the elements present in the analysis area and information from the field survey was used to delineate a Potential Conservation Area. The Potential Conservation Area boundary is an estimation of the minimum area needed to assure persistence of the elements. Primarily, in order to insure the preservation of an element, the ecological

processes that support that occurrence must be preserved. The preliminary potential conservation area boundary is meant to include features on the surrounding landscape that provide these functions. Typically, a minimal buffer of at least 1,000 feet was incorporated into the boundaries. 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 PCA or the element may call for alterations of the boundaries.

## Results

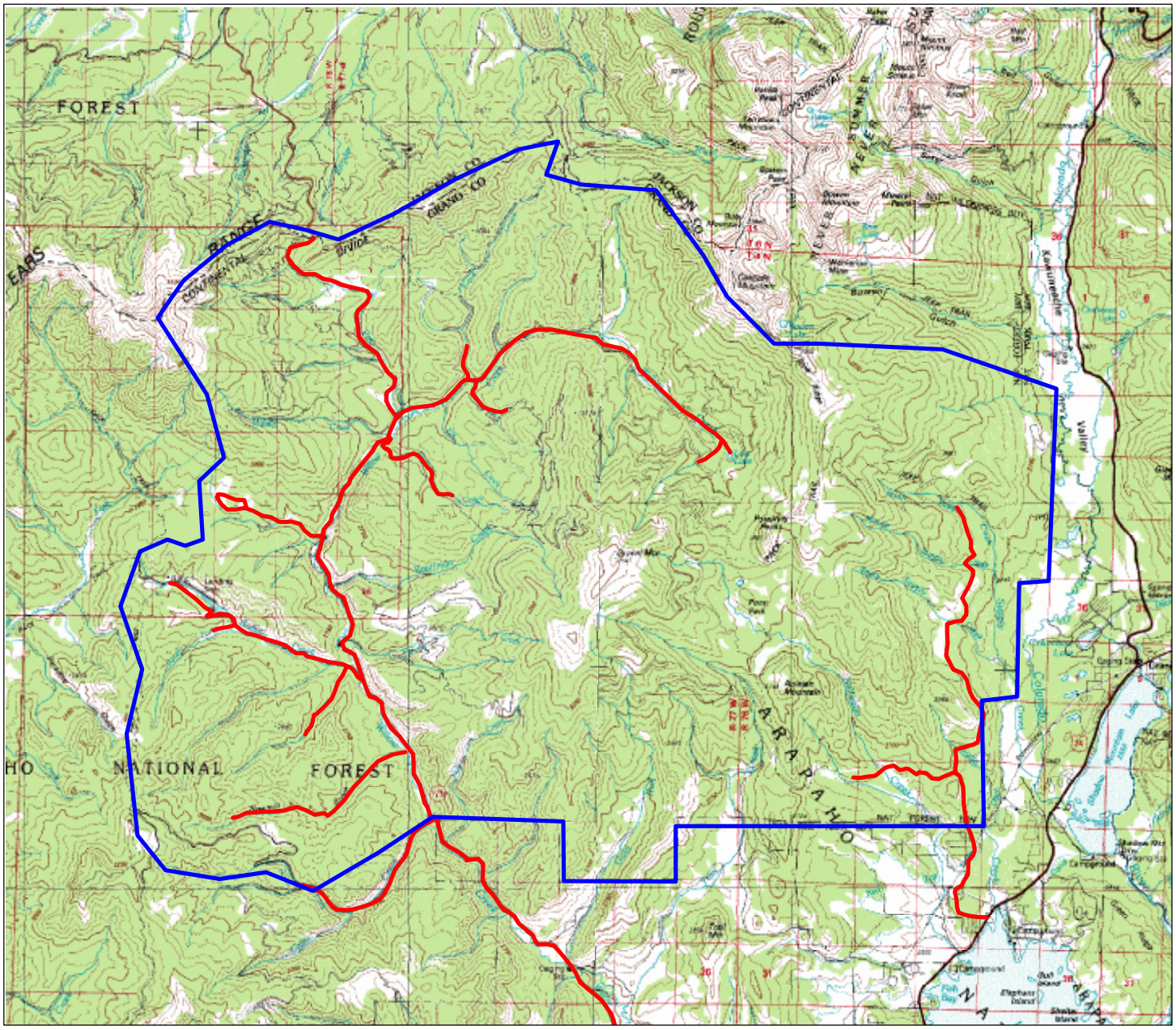
### CNHP Inventory Efforts

Figure 3 depicts those areas CNHP visited in previous efforts in 1993 and during the field visit in 2003. As part of a coordinate survey effort, Steve Popovich visited Whiskey Park (in addition to CNHP visit), Hatchet Park, Pony Park, Lower Trail Creek (south of Pony Park), Sagebrush Park, "Sawmill Meadows", and various tributaries of Buffalo Creek. His findings are reported in a U.S. Forest Service document on file with the Sulphur Ranger District and the Supervisor's Office. Those areas designated "significant" by Mr. Popovich are indicated on Figure 4. Previously, CNHP only conducted one study in the analysis area. This project, "Classification of the Riparian Vegetation of the White and Colorado River Basin, Colorado" was conducted in 1993 as apart of a statewide riparian classification effort. Plot locations were randomly chosen, thus there was no targeted effort to document biologically significant areas during the course of the project. Six plots were established within the Buffalo-Stillwater-Gilsonite Allotment Analysis Area. All of these resulted in high quality plant community element occurrences (Figure 4). Element occurrence records for two state-rare plant species, Nagoon berry (*Rubus arcticus* ssp. *acaulis*) and purple lady's-slipper (*Cypripedium fasciculatum*) as well as one globally imperiled upland plant community, Western slope sagebrush shrublands (*Artemisia cana*/*Festuca thurberi*) are also documented in the analysis area (Figure 4). The plot forms and the element occurrence records for these on in Appendix B.

Based on the element occurrences from 1993, the Willow Creek Potential Conservation Area was delineated (Figure 4 and 5). The Willow Creek Potential Conservation Area is a B3 site, indicating it has High Biodiversity Significance. No additional element occurrences were documented in 2003 as this was beyond the scope of this report.

Additional element occurrences were found in BIOTICS but are not contained within a Potential Conservation Area (Figure 6).

Of the suitable rangelands identified in Figure 1, the Willow Creek Area, Whiskey Park, and Stillwater Creek were visited, although only via a brief roadside survey. Hatchet Park, Trail Creek (the one near Pony Park), and Pony Park were not visited.




Projection: UTM, Zone13, NAD27

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

*map created 22 December 2003*

Disclaimer

*The data contained herein are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.*

***LEGEND***

**Analysis Area**

**Areas visited by CNHP in 1993 and 2003**

U.S.G.S 7.5 Minute Series OR 30 x 60 Minute Series Quadrangles*
Strawberry Lake, 4010517

Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Study Area


# Figure 3. Areas Visited By CNHP in 1993 and 2003.

### *Willow Creek Pass Potential Conservation Area*

**Biodiversity Rank: B3 (High significance)**
This PCA contains six good to excellent examples of riparian/wetland communities within a hydrologically intact watershed. Included are good examples of three globally vulnerable (G3) riparian plant communities.

**Protection Urgency Rank: P3 (Moderate urgency)**
Most of the land within the site is within the Arapaho National Forest. A few private parcels are included and some BLM land occurs along lower stretches. Neither the public or private land has any special conservation designation.

**Management Urgency Rank: M4 (Moderate urgency)**
Current management seems to favor the persistence of the elements in the PCA, but management actions may be needed in the future to maintain the current quality of the element occurrences. In order to maintain the riparian habitat and its extensive willow carr-sedge meadow ecosystem, a natural hydrological regime must be maintained. Changes in current management, such as reintroduction of livestock grazing, increased recreation or logging, would likely impair the quality of the riparian areas.

**Location:** Grand County. From Granby take Hwy 40 west to Hwy 125. The site begins along Willow Creek approximately 4 miles north of the Hwy 40 and Hwy 125 junction. The site includes all tributaries of the Willow Creek drainage up to the headwaters (approx. 10 miles to Willow Creek Pass).

**Legal Description:** USGS 7.5 minute quadrangles: Bowen Mountain, Cabin Creek, Corral Peaks, Parkview Mountain, Radial Mountain, and Trail Mountain.

T5N R77W Section 34; T4N R77W Sections 2-11, 13, 14, 17-20, 24, 25, 29-32; T3N R77W Sections 5-9, 14, 17-20, 22, 23, 27-30, 33, 34; T2N R77W Sections 3, 4; T4N R78W Sections 1, 2, 11-14, 21-28, 33-36; T3N R78W Sections 1-4, 8-17, 22-26.

**Size:** 9,065 acres (3,770 ha)

**Elevation**: 8,200 to 12,300 feet (2,500 to 3,750 meters).

**General Description:** Willow Creek begins its 25-mile journey to the Colorado River at the Continental Divide between the Rabbit Ears Range and Never Summer Mountains. It is the first drainage west of the headwaters of the Colorado River and west of Lake Granby. The drainage runs primarily north to south in the Troublesome Range through rolling spruce-fir and lodgepole forested mountains. The high peaks in this drainage reach over 12,000 feet; the confluence with the Colorado River is at 7,900 feet. The boundaries for site include the headwaters and all of the tributaries down to Trail Creek (8,200 feet). The hydrology of Willow Creek is nearly entirely natural, a unique feature in the Colorado Basin. Floods are uncontrolled and no diversions exist. The natural

hydrologic regime, along with nearly 20 miles of excellent riparian habitat, makes this site unique within the Colorado Basin.

Nearly the entire length of Willow Creek is a meandering wide-valley stream with a mosaic of willow carrs and sedge meadows dominating the wider stretches. The sedge meadows are dominated by either water sedge (*Carex aquatilis*) or beaked sedge (*C. utriculata*), while the willow carrs are dominated by mountain willow (*Salix monticola*). Geyer's willow (*S. geyeriana*), or Wolf willow (*S. wolfii*). Many of its tributaries, such as Pass, Trout, Buffalo, and Bronco Creeks are also willow dominated on the lower reaches. The narrow stretches of Willow Creek and its tributaries support lodgepole pine (*Pinus contorta*), blue spruce (*Picea pungens*), and alder (*Alnus incana*) with few willows. Below 8,400 feet near Cabin Creek, approximately 10 miles above the Colorado River confluence, cottonwood trees (*Populus angustifolia*) replace the willows. The floodplain is a mixture of cottonwood and Engelmann spruce (*Picea engelmannii*) trees along with willows.

On the south-facing slopes north of Trail Creek are large open stands of Western Slope Sagebrush Shrublands (*Artemisia cana/Festuca thurberi*). Most patches are thick with bunchgrasses and are in excellent ecological condition. The open park near the head of Trail Creek appears to have been grazed more recently than other sagebrush parks along this creek, as indicated by cow pies, a lower density of bunchgrasses, and an increase in shrubby cinquefoil (*Pentaphylloides floribunda*) relative to other local sagebrush areas.

The Willow Creek drainage does contain a number of roads. Hwy 125 runs parallel to Willow and Pass Creeks, gravel or unpaved roads parallel Cabin and Buffalo Creeks, and 4-wheel drive roads parallel a few of the other smaller tributaries. Two Forest Service campgrounds are along Hwy 125. Logging has or is taking place within the drainage, although this seems to be at a minimum. Much of the area has been free of grazing since the early 1990's; however, incidental trespass occurs (Doreen Sumerlin, personal communication, 2003). These impacts appear to have only minor observed effects on the riparian ecosystems within the Willow Creek watershed.

**Biodiversity Rank Comments:** This PCA contains three good occurrences of globally vulnerable (G3) riparian plant communities. Also included are three good to excellent occurrences of globally secure (G4 and G5) riparian/wetland plant communities. The hydrology of upper Willow Creek is nearly entirely natural, a unique feature in the Colorado River Basin. There are impacts to the creek and along some of the tributaries associated with camping, roads, and recreation.

Extensive communications with U.S. Forest Service and Bureau of Land Management personnel regarding vacant grazing allotments was beyond the scope of this report. However, following 10 years of statewide wetland and riparian surveys, CNHP is currently unaware of other comparatively sized areas in the state, which exhibit such high quality riparian areas**.** Portions of other rivers or creeks of similar quality do exist in Colorado, but there are few entire watersheds at a similar elevation, which exhibit the same quality and functional integrity as the Willow Creek watershed, remaining in the

state. Thus, the Willow Creek Pass Potential Conservation Area provides an invaluable resource as a *reference watershed* from which the quality and integrity of riparian areas, water quality, and wildlife populations from other portions of the Southern Rocky Mountain Ecoregion could be compared. Such areas are uncommon as few have been without human-induced disturbance for any extended amount of time. For example, nearly 70% of U.S. Forest Service lands in the Southern Rocky Mountain Ecoregion are under active grazing allotments (Southern Rockies Ecosystem Project 2000). These resource reference areas are invaluable as they provide land managers with baseline conditions for which management can strive, they provide numerous opportunities for researchers, and they likely harbor greater biological diversity than other areas, which have commonly been more impacted.

Table 7. Natural Heritage element occurrences at the Willow Creek Pass PCA.

| **Element** | **Common Name** | **Global Rank** | **State Rank** | **Federal /State Status** | **Federal Sensitive** | **EO Rank*** |
|---|---|---|---|---|---|---|
| **Riparian/Wetland Plant Communities** | | | | | | |
| *Salix wolfii/Calamagrostis canadensis* | Subalpine riparian willow carr | G3 | S2S3 | | | B |
| *Picea pungens/Alnus incana* | Montane riparian forest | G3 | S3 | | | B |
| *Salix monticola/Calamagrostis canadensis* | Montane riparian willow carr | G3 | S3 | | | B |
| *Salix wolfii/Carex utriculata* | Subalpine riparian willow carr | G4 | S3 | | | A |
| *Carex aquatilis-Carex utriculata* | Montane wet meadow | G4 | S4 | | | A |
| *Carex utriculata* | Montane wet meadow | G5 | S4 | | | B |
| **Upland Plant Communities** | | | | | | |
| *Artemisia cana/Festuca thurberi* | Western Slope sagebrush shrublands | G2G3 | S2S3 | | | E |
| **Plants** | | | | | | |
| *Rubus arcticus ssp. acaulis* | Nagoon berry | G5T5 | S1 | | FS | E |
| *Cypripedium fasciculatum* | Purple lady's-slipper | G4 | S3 | | FS | H |

*EO = Element Occurrences

**Boundary Justification:** The boundaries for Willow Creek site encompass over two thirds of the Willow Creek watershed. All major tributaries are included within the boundary. In order to protect the riparian elements, the entire watershed must be considered. A natural hydrologic regime is necessary to support and maintain riparian communities and all seral stages.

**Protection Rank Comments:** About 90% of the land within the site is managed by the Arapaho National Forest. A few private parcels exist in the lower part of the site below Cabin Creek and along a one-mile section of Willow Creek near Bronco and Pass Creeks and another less than one-mile reach in the upper reach. Small BLM parcels occur along the lower stretches. Neither the public or private land has any special conservation designation.

**Management Rank Comments:** In order to maintain the riparian habitat and its extensive willow carr-sedge meadow ecosystem, a natural hydrological regime must be maintained. Invasions from non-native species should be monitored and controlled. Logging or other activities which cause erosion may adversely affect stream quality and the riparian vegetation, thus these practices should be monitored closely. Upland slopes should be managed so as to minimize sedimentation and exotic species invasion. Livestock grazing and recreational uses (including off road vehicles) are additional management concerns should they deteriorate the ecological integrity of the riparian areas.

Roads occur adjacent to the mainstem and many of its major tributaries. Aside from Hwy 125, these roads are primarily recreation roads. A few pack trails are scattered throughout. Two Forest Service campgrounds are maintained along the main stem. Fishing is a popular sport throughout the area. Placer mining has taken place along Bronco Creek during the early part of the century, but no mining operation is taking place currently.

Doreen Sumerlin, wildlife biologist with the Sulphur Ranger District, Arapaho National Forest, noted the following in 1995: "Cabin Creek has been significantly impacted by roads and dispersed camping along the creek. There is a lot of beaver activity. Sawmill Gulch is relatively pristine, but there is a major campground at the confluence. Gold Run has no public access; grazing has been discontinued. Hall Creek is unimpacted by human activity. The main fork of Buffalo Creek is heavily impacted by unpaved road. There are a lot of beaver. All forks have moderate livestock grazing, but the riparian areas are fairly healthy. Denver Creek and Kaufman Creek are heavily logged with many roads. Trail Creek is moderately grazed but is in good shape. There are a lot of beaver here. Bronco Creek is degraded. There is a road bed running right up the creek and mining with high pressure water hoses. Upper Bronco Creek is logged as well. Pass Creek and Elk Creek are in good shape. Trout Creek and Trail Creek have motorized trails for dirt bikes and there are some problems in the wetlands. The Forest Service is aware of these areas and is improving them. The headwaters of Willow Creek were logged extensively in the 50's and 60's. There are a lot of old roads (closed now) and natural landslides. There are lots of natural sediment sources up high."

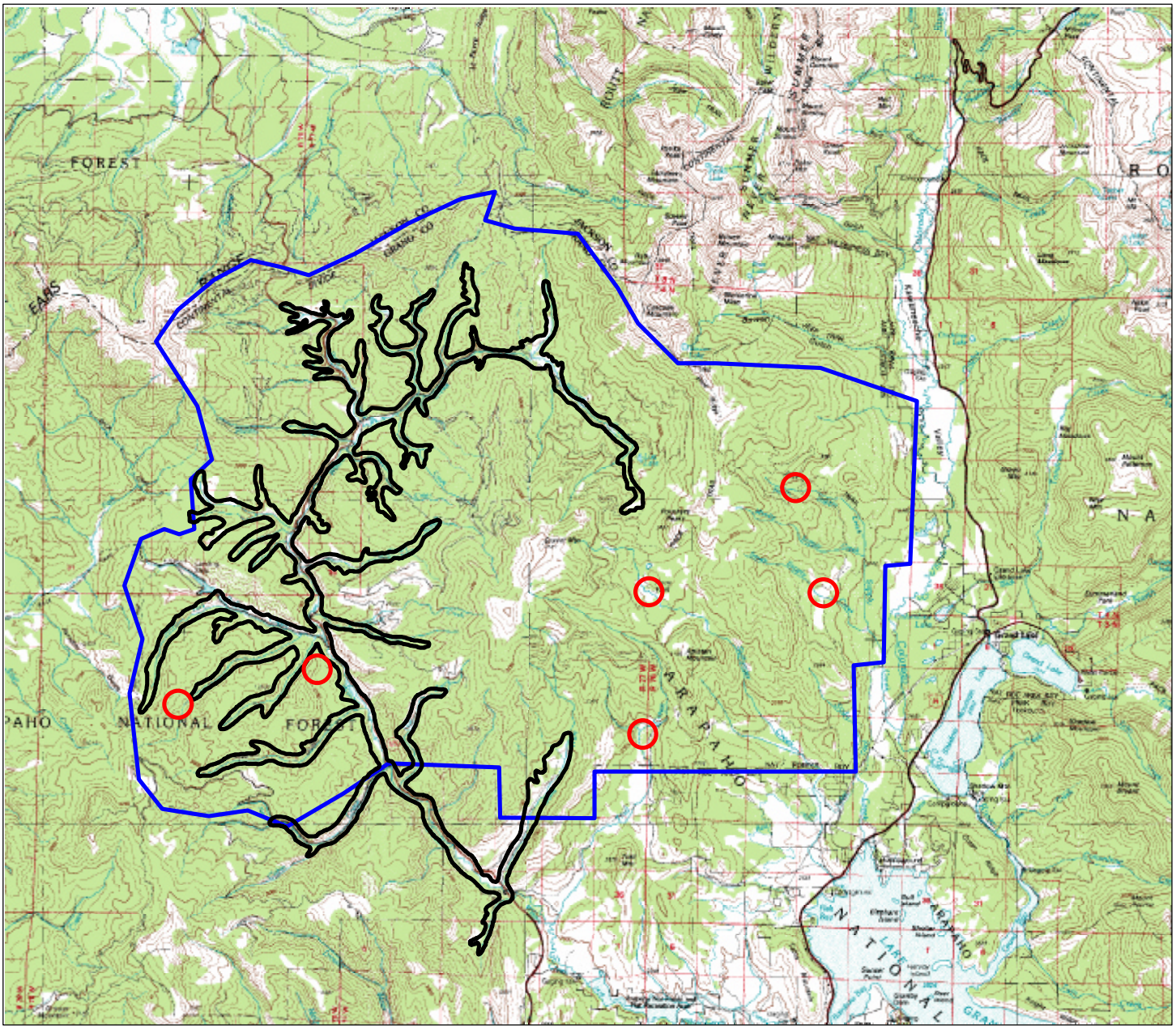
**Wetland Functional Assessment:** Headwater streams (zero, first, and second order streams) typically comprise well over half the total length of channels in a watershed and thus are the locations where the greatest exchange between terrestrial and aquatic ecosystems occurs (Meyer et al. 2003). Thus, they are very important links between terrestrial and aquatic ecosystems and are critical to the health and integrity of downstream rivers, lakes, and wetlands. Properly functioning headwaters streams and wetlands result from their hydrological, biological, and geomorphic processes remaining intact (Meyer et al. 2003). Because they comprise the largest proportion of total stream length within a watershed, headwater streams and wetlands are most important for flood control, sediment retention, groundwater discharge/recharge, nutrient cycling, and production export and food chain support.

The headwater streams and wetlands in the upper Willow Creek watershed are remarkably intact, despite past impacts from grazing, logging, mining, and recreation. As such, they provide high functional value for flood control, sediment retention, groundwater discharge/recharge, nutrient cycling, and production export and food chain support (Table 8). The integrity of the Willow Creek watershed and downstream aquatic environments is largely influence by the quality and functional integrity of these headwater streams.

Table 8. Wetland functional assessment for the Willow Creek Pass Potential Conservation Area.

| Function | Rating | Comments |
|---|---|---|
| Overall Functional Integrity | At Potential | The riparian areas appear to be functioning at potential. |
| **Hydrological Functions** | | |
| Flood Attenuation and Storage | High | A moderate size floodplain with a high density of shrubs, trees, and herbaceous vegetation along the creeks slow floodflow velocity and temporarily store water during high flows. These riparian areas were much larger in extent than many of a similar elevation elsewhere in the state due minimal impacts from disturbance. |
| Sediment/Shoreline Stabilization | High | Dense stands of herbaceous and woody species protects streambanks from erosion and have allowed a sinuous, slow channel to form within the riparian areas. |
| Groundwater Discharge/ Recharge | Yes | There are springs within the floodplain. The headwater streams likely recharge local groundwater tables. |
| Dynamic Surface Water Storage | N/A | These wetlands flood via overbank flow. |
| **Biogeochemical Functions** | | |
| Elemental Cycling | Normal | A diverse canopy of herbaceous and woody species plus large quantities of woody debris, leaf litter, and soil organic matter suggest intact and functioning nutrient cycles. |
| Removal of Imported Nutrients, Toxicants, and Sediments. | High | Intact nutrient cycles and a dense and diverse cover of vegetation remove excess nutrients, toxicants, and sediment. Inputs are mainly from Hwy. 125 and upstream sediment sources (Doreen Sumerlin, personal communication). Beaver ponds add to sediment removal potential. |
| **Biological Functions** | | |
| Habitat Diversity | High | There are forested, scrub-shrub, emergent, and open water wetland habitats. |
| General Wildlife Habitat | High | The forest, shrub, and herbaceous canopies provide a diversity of vegetation structure, which along with high vegetation volume, provide excellent habitat for birds, mammals, and insects. The riparian areas and surrounding sagebrush and forested uplands provide a continuous range of habitat and corridors. |
| General Fish/Aquatic Habitat | High | Habitat structure appears to be high as there are a diversity of pools, riffles, overhanging vegetation, litter inputs, etc. along the streams. CNHP does not have information regarding specific fish occurrences. |
| Production Export/Food Chain Support | Moderate | Permanent water sources and large quantities of allochthonous organic substrates provide various sources of carbon (both dissolved and particulate) and nutrients for local and downstream ecosystems. The presence of open |

| | | |
|---|---|---|
| | | water areas and density of herbaceous and woody vegetation suggest that the area support healthy invertebrate populations. |
| Uniqueness | Moderate | The extent of high quality riparian habitat in the analysis area is unusual in Colorado. |




Projection: UTM, Zone13, NAD27

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

*map created 22 December 2003*

Disclaimer

*The data contained herein are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.*

***LEGEND***

Analysis Area

Areas determined to be significant by USFS

Willow Creek Pass PCA

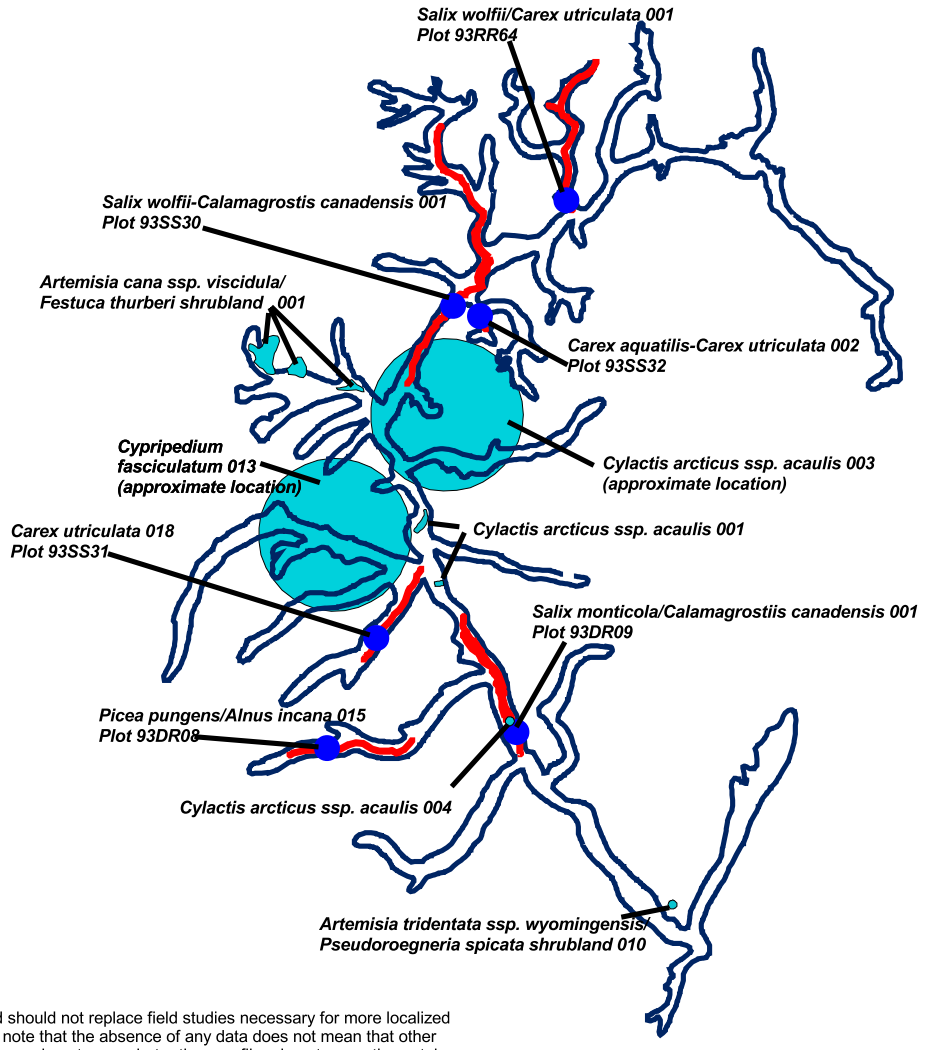
U.S.G.S 7.5 Minute Series OR 30 x 60 Minute Series Quadrangles*
Strawberry Lake, 4010517

Digital Raster Graphics produced by the U.S. Geological Survey, 1996

Location in Study Area


# Figure 4. Willow Creek Pass PCA & USFS Significant Areas.

# Figure 5. Element Occurrences within the Willow Creek Pass Potential Conservation Area






1 0 1 2 Miles

N

The Colorado Natural Heritage Program
Colorado State University
8002 Campus Delivery
Fort Collins, CO 80523
Phone: (970) 491-1309
Fax: (970) 491-3349

map date: Nov 2003
GIS department: gd

PCA Boundary

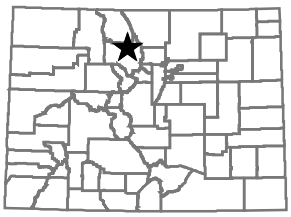
Plot location and ID (e.g. 93RR64)

Element Occurrence Record

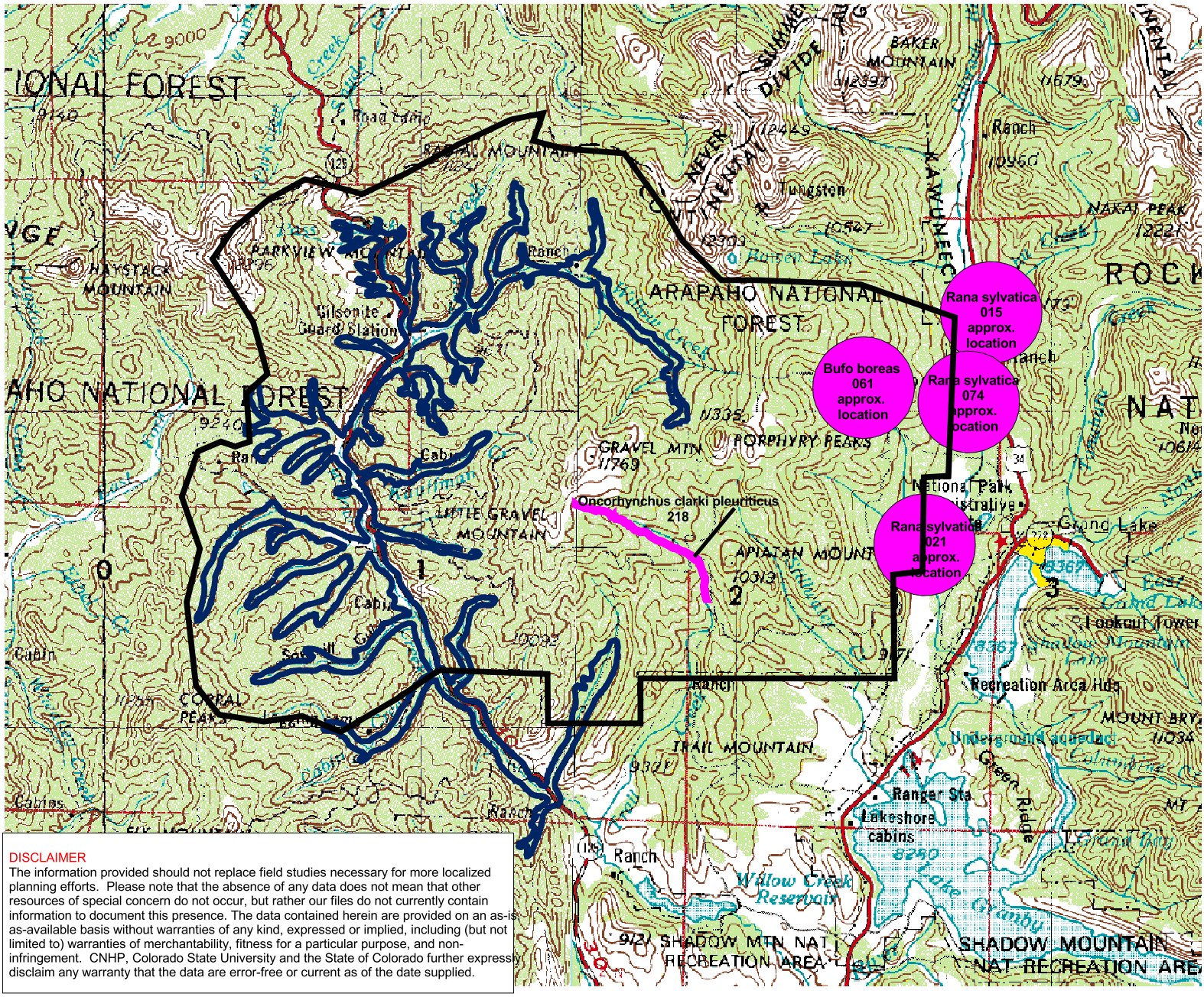
Riparian Community

Plant or Upland Community

Location in Colorado



# Figure 6. Element Occurrences contained outside of the Willow Creek Pass Potential Conservation Area but within the Buffalo-Stilllwater Allotment Project Area




DISCLAIMER
The information provided should not replace field studies necessary for more localized planning efforts. Please note that the absence of any data does not mean that other resources of special concern do not occur, but rather our files do not currently contain information to document this presence. The data contained herein are provided on an as-is as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.

1 0 1 2 Miles

N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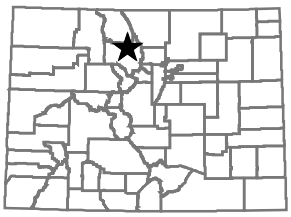
Fax: (970) 491-3349


map date: Dec 2003
GIS department: gd

Study Area
Willow Creek Pass PCA
Element Occurrence Record (see Fig. 4 for EORS within Willow Creek Pass PCA)

U.S.G.S. 1x2 Degree Quadrangles*
Craig, 40106-A1
Greeley, 40104-A1
*Digital Raster Graphics (DRGs) produced by the U.S.G.S., 1996

Location in Colorado



### *Recommendations*

As mentioned above, the Willow Creek Pass Potential Conservation Area provides an invaluable resource as a *reference watershed* from which the quality and integrity of riparian areas, water quality, and wildlife populations from other portions of the Southern Rocky Mountain Ecoregion could be compared. Such areas are uncommon as few have been without human-induced disturbance for any extended amount of time. For example, nearly 70% of U.S. Forest Service lands in the Southern Rocky Mountain Ecoregion are under active grazing allotments (Southern Rockies Ecosystem Project 2000). These reference areas are invaluable as they provide land managers with baseline conditions which management can strive for, they provide numerous opportunities for researchers, and they likely harbor greater biological diversity than other areas, which have been impacted.

The upper Willow Creek watershed also provides critical functions for maintaining water quality and quantity, fish and wildlife habitat, sediment control, and food web support for local and downstream aquatic environments.

CNHP recommends that the Buffalo-Stillwater-Gilsonite Allotment Analysis Area continue to be managed for the protection and maintenance of its high-quality riparian areas, especially in the Willow Creek, Stillwater Creek, and Whiskey Park areas. Such areas provide important wildlife and fish habitat, serve as important water quality filters, moderate flooding potential, and maintain year-round stream flow. It has been estimated that riparian areas, which account for only 1% of the landscape, are used by greater than 70% of wildlife species (Knopf 1988). The reintroduction and/or increase of grazing, increased recreation, and logging activities could impair the quality and integrity of the riparian areas. Given that the majority of Colorado's riparian systems are already affected by such impacts, it is imperative to protect those riparian areas which have been allowed to recover or have remained free of human-induced disturbance to preserve biological diversity, water quality and quantity, prevent erosion, and to provide research opportunities.

Additional research should be conducted to determine how many areas of similar size and quality to the Buffalo-Stillwater-Gilsonite Allotment remain in the Southern Rocky Mountain Ecoregion. This would entail researching current U.S. Forest Service and U.S. Bureau of Land Management resource management plans and allotment records to determine which areas are and have been free of human-induced disturbance long enough to result in high quality, intact riparian ecosystems. Depending on the rarity of such areas, CNHP recommends the Buffalo-Stillwater-Gilsonite Allotment Analysis Area be considered as a Research Natural Area or minimally receives some sort of protection from future human-induced activities, including livestock grazing.

Additional, more intensive fieldwork may result in locating additional element occurrences, especially riparian plant communities. Lack of field time did not allow CNHP ecologists to visit the Hatchet Park, Trail Creek (the one near Pony Park), and Pony Park areas. Although, these areas have been visited by U.S. Forest Service staff and appear to exhibit high ecological integrity (Steve Popovich, personal communication,

2003). Additional fieldwork would also allow an assessment of the biological significance and quality of upland plant communities in the analysis area.

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## *Appendix A: Ecological Specifications for Montane/Subalpine Riparian Shrubland*

**SOUTHERN ROCKY MOUNTAINS ECOREGION**
**MONTANE/SUBALPINE RIPARIAN SHRUBLAND ECOLOGICAL SYSTEM—LINEAR**

*Alnus incana - Salix drummondiana* Shrubland
*Alnus incana* -(mixed *Salix*) Shrubland
*Alnus incana / Cornus sericea* Shrubland
*Alnus incana / Equisetum arvense* Shrubland
*Alnus incana /* Mesic Forbs Shrubland
*Alnus incana* / Mesic Graminoids Shrubland
*Betula glandulosa* / Mesic forb-mesic graminoid
*Betula occidentalis / Cornus sericea* Shrubland
*Betula occidentalis* / Mesic Forb Shrubland
*Betula occidentalis* / Mesic Graminoid Shrubland
*Cornus sericea* Shrubland [Provisional]
*Pentaphylloides floribunda / Deschampsia cespitosa* Shrubland
*Pentaphylloides floribunda* Shrubland [Provisional]
*Salix bebbiana / Mesic Graminoids Shrubland*
*Salix bebbiana* Shrubland
*Salix boothii / Calamagrostis canadensis* Shrubland
*Salix boothii / Carex rostrata* Shrubland
*Salix boothii / Deschampsia cespitosa-Geum rossii* Shrubland
*Salix boothii / Mesic Forbs Shrubland*
*Salix boothii* / Mesic Graminoids Shrubland
*Salix brachycarpa / Calamagrostis canadensis* Shrubland
*Salix brachycarpa / Carex aquatilis* Shrubland
*Salix brachycarpa* / Mesic Forbs Shrubland
*Salix drummondiana - Salix monticola* / Mesic Forbs Shrubland
*Salix drummondiana - Salix planifolia / Calamagrostis canadensis* Shrubland
*Salix drummondiana / Calamagrostis canadensis* Shrubland
*Salix drummondiana / Carex rostrata* Shrubland
*Salix eriocephala* var. *ligulifolia* Shrubland
*Salix geyeriana - Salix monticola / Calamagrostis canadensis* Shrubland
*Salix geyeriana - Salix monticola / Carex aquatilis* Shrubland
*Salix geyeriana - Salix monticola* / Mesic graminoid Shrubland
*Salix geyeriana / Calamagrostis canadensis* Shrubland
*Salix geyeriana / Carex aquatilis* Shrubland
*Salix geyeriana / Carex rostrata* Shrubland
*Salix geyeriana* / Mesic Graminoids Shrubland
*Salix ligulifolia - Cornus sericea* Shrubland
*Salix lucida* ssp. *caudata* Shrubland [Provisional]
*Salix monticola / Calamagrostis canadensis* Shrubland
*Salix monticola / Carex aquatilis* Shrubland

*Salix monticola / Carex rostrata* Shrubland
*Salix monticola* / Mesic Forb Shrubland
*Salix monticola* / Mesic Graminoids Shrubland
*Salix planifolia / Calamagrostis canadensis* Shrubland
*Salix planifolia / Caltha leptosepala* Shrubland
*Salix planifolia / Carex aquatilis* Shrubland
*Salix planifolia / Carex scopulorum* Shrubland
*Salix planifolia / Deschampsia caespitosa* Shrubland
*Salix planifolia* / mesic forb Shrubland
*Salix pseudomonticola* Thicket Shrubland
*Salix wolfii / Carex aquatilis* Shrubland
*Salix wolfii / Carex rostrata* Shrubland
*Salix wolfii / Deschampsia cespitosa* Shrubland
*Salix wolfii* / Mesic Forbs Shrubland
*Shepherdia argentea* Shrubland [Provisional]

**SCALE AND RANGE:** LINEAR AND SMALL PATCH; WIDESPREAD

Montane/subalpine riparian shrubland ecological system is a linear and small patch system, confined to specific environments occurring on floodplains or terraces of rivers and streams and shallow broad valleys. This ecological system is also found in other Rocky Mountain ecoregions. Although the montane/subalpine riparian shrubland ecological system occupies less than 1% of the Southern Rocky Mountains ecoregion it can be found throughout the region within a broad elevation range from approximately 8,000 to 11,000 feet. This system often occurs as a mosaic of multiple communities that are shrub dominated. The dominant shrubs reflect the large elevational gradient and include *Alnus incana, Betula glandulosa, B. occidentalis, Cornus sericea, Salix bebbiana, S. boothii, S. brachycarpa, S. drummondiana, S. eriocephala, S. geyeiriana, S. moniticola, S. planifolia,* and *S. wolfii.* Generally the upland vegetation surrounding these riparian systems are of either conifer or aspen forests, while adjacent riparian systems range from herbaceous dominated communities to tree dominated communities.

Beavers are primary users as well as maintainers to this system. In addition to beavers, the primary abiotic ecological process necessary to maintain this ecological system is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining this system. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant composition as well as community composition (Kittel et al. 1999). In addition, upstream activities that effect water quality, e.g., mining, may be important to the vertebrates and invertebrate species that use this system (add citation).

Aquatic species and water quality may be as important an indicator of health of the system as is the vegetation. For example one study on ptarmigan show that what appears to be a healthy willow community is in reality a sink for ptarmigan due to the excessive heavy metals that are found in the willows below mining areas (add citation).

**MINIMUM SIZE**: 0.5 mile by 30 feet.

**SEPERATION DISTANCES:** 1) substantial barriers to natural processes or species movement, including cultural vegetation or very degraded example of same community greater than ¼ mile long, major highways, urban development, large bodies of water, 2) different natural community (system) longer than 1 mile along a river corridor, or ¼ mile in other situations, 3) major break in topography, soils, geology, etc., especially one resulting in a hydrologic break. Natural breaks include changes in the stream gradient and other features of the geomorphic setting (e.g. waterfalls). Unnatural breaks are bridges, roads, channelized sections, and heavily degraded reaches that alter the natural hydrologic flow, scour and deposition dynamics of the stream/river.

Justification: Primary criteria to be considered is the reaction to natural flooding. The separation distance for intervening natural or semi-natural communities assumes dynamic movements due to natural flooding regimes.

**RANK PROCEDURE:** 1) condition, 2) size, 3) landscape context. Equal weighting should be given to all ranking factors.

**CONDITION SPECIFICATIONS:**
**A –rated condition:** Natural hydrologic regime intact, including an unaltered floodplain. No or little evidence of alteration due to drainage, flood control, irrigation canals, livestock grazing, digging, burming, mining, or vehicle use. No or very few exotic species present with no potential for expansion. Species composition is primarily of native species with a diverse physiognomic structure. Stream banks are not overly steepened, the channel not overly widened, nor unvegetated by excessive grazing.

**B- rated condition:** Natural hydrologic regime intact or slightly altered by local drainage, flood control, irrigation canals, livestock grazing, digging, mining, vehicle use, or roads. Alteration is easily restorable by ceasing such activities. Few exotic species with little potential for expansion if restoration occurs. Although species composition is primarily of native species, the physiognomic structure is less diverse than above. Stream banks may show some local deleterious effects from excessive livestock grazing or other human activity.

**C-rated condition:** Natural hydrologic regime altered by upstream dams, local drainage, diking, filling, digging, mining, or dredging. Alteration is extensive but potentially restorable over several decades. Vehicle use or grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition and soil compaction, causing excessive erosion. Exotic species (e.g., *Taraxacum officianalis, Trifolium repens, Poa pratensis, Agrostis stolonifiera*) may be widespread but potentially manageable with restoration of most natural processes. Stream banks have been severely altered by excessive grazing or other human activity, e.g, channeling, or road construction.

**D –rated condition:** Natural hydrologic regime or disturbance to site not restorable. System remains fundamentally compromised despite restoration of some processes. Invasive exotic species, e.g, *Phalaris arundinaceae,* may be dominant over significant portions of area, with little potential for control.

Justification for A-rated criteria: Subalpine/montane riparian shrublands are dependent on specific hydrologic regimes, soils, and ability to move both up and down the stream as well as side to side within the floodplain. A-ranked occurrences have natural flooding processes, species composition, and physical environment intact.

Justification for C/D threshold: C-ranked occurrences have potential for restoration over several decades. D-ranked occurrences have little or no potential for restoration because of extensive degradation.

**SIZE SPECIFICATIONS:**
**A – rated size:** Very large (> 1.5 linear miles)
**B –rated size:** Large (1 to 1.5 linear miles)
**C –rated size:** Moderate (.5 to 1 linear miles)
**D –rated size:** Small (< .5 linear mile)

Justification for A-rated criteria: Subalpine/montane riparian shrublands are often composed of a mosaic of different plant associations, often including patches of herbaceous vegetation dictated by soils and hydrology. Occurrences of this size have a wide range of plant associations within the complex that show a wide range of variation in hydrology, soil texture, and geomorphology. Occurrences of this size would likely contain sufficient internal variability to capture characteristic biophysical gradients and retain natural geomorphic and hydrologic disturbance. They are long enough to respond to inundations, burial and scour disturbance, and wide enough to allow for lateral migration of the active channel and associated response of the vegetation to that change. Riparian areas of this size can adequately buffer runoff, sedimentation and non-point pollution from uplands. In addition, stands of this size can withstand the impacts of small hydrologic alterations.

Justification for C/D threshold: C-ranked occurrences are large enough to sustain some natural or human caused perturbations. While D-ranked occurrences are too small to remain viable with a catastrophic event. They are also extremely susceptible to invasions by non-natives making them subject to loss of plant associations and their associated plants and animals.

**LANDSCAPE CONTEXT SPECIFICATIONS:**
**A-rated landscape context:** No evidence of human-caused alteration of hydrology, especially upstream of occurrence and within the watershed. Uplands surrounding occurrence and within the watershed are largely unaltered by urban or agricultural uses (> 90% natural), and have few to no recent (< 20 years) clearcuts (<25% of landscape). No unnatural barriers present. Connectivity to habitats allows natural processes and species migration to occur.

**B-rated landscape context:** Little evidence of human-caused alteration of hydrology, especially upstream of occurrence and within the watershed. Uplands surrounding occurrence and within the watershed are largely unaltered by urban or agricultural uses (60 to 90% natural), and retain much connectivity. Uplands may be managed forest landscape with limited clearcuts, mining, or numerous roads. Few barriers present. Some natural processes such as flooding, may be slightly compromised. No regional dam upstream.

**C-rated landscape context:** Uplands surrounding occurrence or upstream watershed are fragmented by urban or agricultural alteration (20 to 60% natural), with limited connectivity. Some barriers are present, and natural processes few. Local or moderate human-caused alteration of hydrology may be present, for example small tributary dams or irrigation ditches.

**D-rated landscape context:** Major human-caused alteration of hydrology. Uplands surrounding occurrence mostly converted to agricultural or urban uses, including ski area development. Riparian occurrence may be reduced to a narrow strip with a significant edge effect. Connectivity and natural processes are nonexistent. Large dams and numerous diversions are within watershed.

Justification for A-rated criteria: These are occurrences with nearly intact watersheds exhibiting excellent water quality and natural hydrologic regime. Riparian areas are fully connected with uplands, and can fully buffer upland influences.

Justification for C/D threshold: C-ranked occurrences have limited buffering capacity from upland influences. D-ranked occurrences offer no buffering capacity, and are subject to siltation, pollutions, and invasive species. Large dams disrupt the natural flooding process as well as regulating the annual flows.

**AUTHORSHIP**: Renée Rondeau
**Date:** July 19, 2000 (edited February 24, 2001)

**LITERATURE CITED**

Kittel G., E. VanWie, M. Damm, R. Rondeau, S. Kettler and J. Sanderson. 1999. A classification of the riparian vegetation of the Rio Grande and Closed Basin watersheds, Colorado. Colorado State University, Fort Collins, CO: Colorado Natural Heritage Program.

## *Appendix B: Photos (on enclosed CD-Rom)*

| Roll K | Date: 10/02/03 & 10/03/03 |
|---|---|
| **Frame #** | **Comments** |
| PA020001 | upper Willow Creek (off FR 107) |
| PA020002 | upper Willow Creek (off FR 107) |
| PA020003 | upper Willow Creek (off FR 107) |
| PA020004 | upper Willow Creek (off FR 107) |
| PA020005 | upper Willow Creek (off FR 107) |
| PA020006 | upper Willow Creek (off FR 107) |
| PA020007 | upper Willow Creek (off FR 107) |
| PA020008 | upper Willow Creek (off FR 107) |
| PA020009 | Trail Creek (Artemisia cana/Festuca thurberi in foreground and high quality riparian area in background) |
| PA020010 | Trail Creek (Artemisia cana/Festuca thurberi in foreground and high quality riparian area in background) |
| PA020011 | Artemisia cana/Festuca thurberi stand along Trail Creek |
| PA020012 | Artemisia cana/Festuca thurberi stand along Trail Creek |
| PA020013 | Artemisia cana/Festuca thurberi stand along Trail Creek |
| PA020014 | Artemisia cana/Festuca thurberi stand along Trail Creek - closeup of species |
| PA020015 | Artemisia cana/Festuca thurberi stand along Trail Creek - closeup of species |
| PA020016 | Trail Creek riparian area |
| PA020017 | Trail Creek riparian area |
| PA020018 | Trail Creek riparian area |
| PA020019 | Trail Creek riparian area |
| PA020020 | Trail Creek riparian area |
| PA020021 | Trail Creek riparian area |
| PA020022 | Trail Creek riparian area |
| PA020023 | Trail Creek riparian area |
| PA020024 | Trail Creek riparian area |
| PA020025 | Trail Creek riparian area |
| PA020026 | small tributary to Trail Creek |
| PA020027 | small tributary to Trail Creek |
| PA020028 | small tributary to Trail Creek |
| PA020029 | small tributary to Trail Creek |
| PA020030 | small tributary to Trail Creek |
| PA020031 | small tributary to Trail Creek |
| PA020032 | small tributary to Trail Creek |
| PA020033 | small tributary to Trail Creek |
| PA020034 | small tributary to Trail Creek |
| PA020035 | lodgepole stand near large sagebrush park at head of Trail Creek |
| PA020036 | lodgepole stand near large sagebrush park at head of Trail Creek |
| PA020037 | lodgepole stand near large sagebrush park at head of Trail Creek |
| PA020038 | lodgepole stand near large sagebrush park at head of Trail Creek |
| PA020039 | Catabrosa aquatica in small rivulet in large sagebrush park at head of Trail Creek |
| PA020040 | Catabrosa aquatica in small rivulet in large sagebrush park at head of Trail Creek |

| | |
|---|---|
| PA020041 | Catabrosa aquatica in small rivulet in large sagebrush park at head of Trail Creek |
| PA020042 | Catabrosa aquatica in small rivulet in large sagebrush park at head of Trail Creek |
| PA020043 | Catabrosa aquatica in small rivulet in large sagebrush park at head of Trail Creek |
| PA020044 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020045 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020046 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020047 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020048 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020049 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020050 | Artemisia cana/Festuca thurberi stand (one which has been somewhat degraded) in large sagebrush park at head of Trail Creek |
| PA020051 | tributary to Trail Creek |
| PA020052 | tributary to Trail Creek |
| PA020053 | tributary to Trail Creek |
| PA020054 | tributary to Trail Creek |
| PA020055 | tributary to Trail Creek |
| PA020056 | tributary to Trail Creek |
| PA020057 | tributary to Trail Creek |
| PA020058 | tributary to Trail Creek |
| PA020059 | tributary to Trail Creek |
| PA020060 | tributary to Trail Creek |
| PA020061 | tributary to Trail Creek |
| PA020062 | tributary to Trail Creek |
| PA020063 | tributary to Trail Creek |
| PA020064 | tributary to Trail Creek |
| PA020065 | tributary to Trail Creek |
| PA020066 | tributary to Trail Creek |
| PA020067 | tributary to Trail Creek |
| PA020068 | tributary to Trail Creek |
| PA020069 | tributary to Trail Creek |
| PA020070 | tributary to Trail Creek |
| PA020071 | tributary to Trail Creek |
| PA020072 | Salix geyeriana or Salix drummondiana stand at mouth of Buffalo Creek |
| PA020073 | Salix geyeriana or Salix drummondiana stand at mouth of Buffalo Creek |
| PA020074 | Salix geyeriana or Salix drummondiana stand at mouth of Buffalo Creek |
| PA020075 | Salix geyeriana or Salix drummondiana stand at mouth of Buffalo Creek |
| PA020076 | Salix geyeriana or Salix drummondiana stand at mouth of Buffalo Creek |
| PA020077 | Salix geyeriana or Salix drummondiana stand at mouth of Buffalo Creek |

## *Appendix C: Element Occurrence Records*