Survey of Critical Wetlands and Riparian Areas in Archuleta County

April 2006

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Prepared for:

Colorado Department of Natural Resources
Division of Wildlife
Wetlands Program
6060 Broadway
Denver, Colorado 80216

Prepared by:

Karin Freeman, Maggie March, and Denise Culver

Colorado Natural Heritage Program
Warner College of Natural Resources, Colorado State University
254 General Services Building
8002 Campus Mail
Fort Collins, CO 80523-8002
(970) 491-1309
email: heritage@lamar.colostate.edu
http://www.cnhp.colostate.edu

April 2006

Cover photograph:
Riverine wetlands on Stollsteimer Creek near Chimney Rock, dominated by sandbar willow (Salix exigua), silver buffaloberry (Shepherdia argentea), and Rocky Mountain juniper (Juniperus scopulorum).
(San Juan National Forest and private property)
Photo by Karin Freeman.

ACKNOWLEDGEMENTS

Financial support for this study was provided by the Colorado Division of Wildlife Wetlands Program (CDOW) in cooperation with the Southwest Wetlands Focus Area Committee. We greatly appreciate the support and assistance of Bill Goosmann of the Colorado Division of Wildlife, Catherine Ortega, biology professor for Fort Lewis College and Coordinator for the Southwest Wetlands Focus Area Committee, and Alex Chappell (retired), CDOW.

This project would not have been possible without the help of many dedicated individuals. We appreciate the support of the members of the Southwest Wetland Focus Area Committee for providing their local knowledge of important wetlands in Archuleta County and for the suggestions of private properties to survey. District Wildlife Managers (DWM) Mike Reid and Justin Krall patiently waded through many maps and questions to assist us in targeting wetland areas and along with DWM Doug Purcell provided an immense knowledge base from their combined years of experience in the County. Many thanks go to Steve Whiteman and Aran Johnson of the Southern Ute Indian Tribe Wildlife Resources Management Division who provided excellent recommendations for site visits and facilitated access to many locations on tribal lands. Michael Whiting, executive director of the Southwest Land Alliance (SLA), was invaluable in assisting us in gaining access to exceptional habitats on privately owned lands, and had amazing personal knowledge of the county's natural resources though he had only lived in the county for three months at the time. Our thanks also go out to Penny Holmes (Secretary/past Chair of SLA) who was our initial Southwest Land Alliance contact and started our project off in the right direction. Sara Brinton and Becca Smith at the U.S. Forest Service Pagosa Ranger District provided valuable information on the locations of many remote wetland sites and contacts with private landowners / ranch managers, and along with USFS ecology technicians Dan Williams and Holly Miller, shared with us many memorable moments of lighthearted levity while pondering plants. We also received help and advice from Mark Roper at the Pagosa Ranger District, who provided us with current GIS forest and wetland data, and Anthony Garcia who shared his knowledge of riparian-dependant and sensitive wildlife species on San Juan Public Lands. Jerry Archuleta at the Natural Resources Conservation Service – Pagosa Springs Field Office generously donated his time and knowledge of local riparian areas, as well as GIS data which proved to be a well-used and much-relied upon resource. Our gratitude also extends to Blair Leist, the Director of County Development for Archuleta County, and his staff for providing information on county long-range planning, current land use regulations, and the Community Plan.

We are also grateful to all the landowners who gave us permission to survey their property. We enjoyed meeting each of them, and in some cases, having a personally guided tour of their property.

Many thanks to our staff at CNHP, including Mark Kerwood, Brad Lambert, Melissa Landon, Peggy Lyon, Michael Menefee, Joe Rocchio, Jeremy Siemers, and John Sovell, who all worked with us patiently and with good humor. Special thanks go to Jodie Bell, Jill Handwerk, Amy Lavender, Mary Olivas, and Wayne Tenney for their exceptional patience with our never-ending questions; your knowledge of your specialties leaves us in awe.

EXECUTIVE SUMMARY

Although the rate of wetland loss in Archuleta County is difficult to quantify, it is clear that many wetlands have been lost or profoundly altered from their pre-settlement state. Development (residential and commercial), agriculture, grazing, construction of reservoirs, water diversions, logging and mining have had many impacts on wetlands throughout the County. The rapid and widespread construction of housing developments across the County and the expansion of commercial construction near population centers often impacts wetland and riparian areas through direct disturbance or disturbance of the groundwater table. Fertile soils and available water for irrigation make floodplains productive areas for agriculture. Since the nineteenth century, hydrological diversions have been developed for irrigation and drinking water supplies, and even for transporting water out of the basin to supplement distant agriculture and communities. Such activities have eliminated or altered some wetlands, and created other wetlands very different from those in existence prior to European settlement.

It is clear that with the current rate of land use conversion and the lack of comprehensive wetland protection programs, wetlands will continue to be lost or dramatically altered. However, the likelihood for human conflicts with biologically important wetlands is minimized if there is the opportunity to proactively plan for managing human activity or managing for the species or habitat of interest. The purpose of this project is to provide a data resource for managers and planners in Archuleta County, the Town of Pagosa Springs, Colorado Department of Natural Resources, Colorado Division of Wildlife, Southwest Wetland Focus Area Committee, Southern Ute Indian Tribe, US Forest Service, US Bureau of Land Management, Southwest Land Alliance, and the citizens of Archuleta County for conducting proactive planning. This document should be considered a tool for managing lands that support imperiled and sensitive wetland-dependent species and plant communities within Archuleta County.

In 2005, the Colorado Natural Heritage Program (CNHP) received funding from the Colorado Department of Natural Resources (CDNR) Division of Wildlife (DOW) Wetlands Program to survey for critical wetlands within Archuleta County as part of a statewide effort to identify significant wetland habitat. The goal of the project was to systematically identify the localities of significant species and plant communities dependent on wetland and riparian areas. Field surveys began in May 2005 and continued through October 2005, with the goal of locating and documenting rare or imperiled plant and animal species and significant plant communities.

Results of the wetland and riparian survey confirm that Archuleta County contains areas with high biological significance and a diverse array of wetlands that support a wide variety of plants, animals, and plant associations. At least 40 major wetland/riparian plant communities, 8 plants, one bird, and 2 fish species from CNHP's Tracking List of plants, animals, and plant communities are known to occur in, or are associated with, wetlands and riparian areas in Archuleta County. Despite the best efforts during one field season, it is likely that some elements that are present in the County were not documented during the survey due to either lack of access, phenology (reproductive timing) of species, or time constraints.

Thirty-six wetland and riparian sites of biodiversity significance are profiled in this report as Potential Conservation Areas (PCAs). These PCAs represent the best examples of wetland and riparian communities and their ecological processes observed on the private and public lands visited. The delineation of PCA boundaries in this report does not confer any regulatory protection on recommended areas, and rather are intended to support wise planning and decision making for the conservation of these significant areas. Of the 36 PCAs described in this report, we identified four as being of **nearly irreplaceable biodiversity significance** (B2), twenty-one of **high biodiversity significance** (B3), ten of **moderate biodiversity significance** (B4), and one of **general biodiversity significance** (B5). The highest ranking PCAs are the highest priorities for conservation action. Overall, the concentration and quality of imperiled elements and habitats attest to the fact that wetland conservation efforts in Archuleta County will have both state and global significance.

Several PCAs stand out as very significant such as the East Side of Chalk Mountains PCA where several new occurrences of the state-rare retrorse sedge (*Carex retrorsa)* occur. Along the upper reaches of Devil Creek, including the Devil Creek State Wildlife Area PCA and Devil Creek at Middle Mountain PCA, there are several good occurrences of riparian plant communities considered globally imperiled. These communities include narrowleaf cottonwood/river hawthorn (*Populus angustifolia/Crataegus rivularis*) and narrowleaf cottonwood/bluestem willow (*Populus angustifolia/Salix irrorata*). Another significant area for Archuleta County is the area around Buckles Lake PCA and Harris Lake PCA. These sites support diverse wetland and riparian resources, including emergent sedge wetlands, fens, willow carrs and thinleaf alder (*Alnus incana* ssp. *tenuifolia*)-dominated plant communities, as well as several imperiled plant species.

In addition to the PCAs, six Sites of Local Significance (SLS) are profiled within this report to encourage restoration and conservation of these areas, or as in one SLS, to identify positive efforts in local restoration of critical riparian and wildlife corridors.

The results of the survey will be provided to the Colorado Division of Wildlife's Wetlands Program, CDOW Division Wildlife Managers, the Southern Ute Indian Tribe, the Archuleta County Planning Department, the Town of Pagosa Springs Planning Department, the Southwest Wetland Focus Area Committee, the USFS San Juan National Forest-Pagosa District and Columbine District, the Natural Resources Conservation Service District office, the Southwest Land Alliance, Colorado State University (CSU) in Fort Collins, the CSU Extension Office in Pagosa Springs, the Ruby M. Sisson Memorial Public Library in Pagosa Springs, and will be available to the public on CNHP’s website (http:\\www.cnhp.colostate.edu).

For a broader understanding of the wetland and riparian resources of the Upper San Juan Basin and San Juan Mountain region surrounding Archuleta County, additional reports may be downloaded form CNHP’s website, including the *Upper San Juan Basin Biological Assessment* (2003), which documents additional wetland and riparian PCAs, upland PCAs, and zoologic PCAs in Archuleta County, as well recent surveys of adjacent counties including *Survey of Critical Wetland and Riparian Areas in La Plata County* (2004), the *Biological Inventory of Rio Grande and Conejos Counties, Colorado: Volumes I & II* (2000), and the *Biological Survey of Mineral County* (1999).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

INTRODUCTION

Wetlands are places where soils are inundated or saturated with water long enough and frequently enough to significantly affect the plants and animals that live and grow there. Until recently, most people viewed wetlands as a hindrance to productive land use. Consequently, many wetlands across North America were purposefully drained. Since 1986, wetlands have been lost at a rate of 58,500 acres/year (Dahl 2000). In Colorado an estimated 1 million acres of wetlands (50% of the total for the state) were lost prior to 1980 (Dahl 1990).

Although the rate of wetland loss in Archuleta County is difficult to quantify, it is clear that many wetlands have been lost or profoundly altered from their pre-settlement state. Agriculture, grazing, development, construction of reservoirs, water diversions, logging, and mining have had many impacts on wetlands throughout the study area. Fertile soils and available water for irrigation make floodplains productive areas for agriculture. Since the nineteenth century, hydrological diversions have been developed for irrigation and drinking water supplies. Such activities have eliminated or altered some wetlands, and created other wetlands very different from those in existence prior to European settlement. For example, the development of an extensive network of canals and irrigation agriculture has created irrigation-induced wetlands where none previously existed. This same activity has altered many natural wetlands by changing hydrological patterns across the landscape. It is clear that with the current rate of land use conversion and the lack of comprehensive wetland protection programs, wetlands will continue to be lost or dramatically altered.

Because of the profound hydrological alterations within Archuleta County, restoring degraded wetlands and riparian areas to pre-settlement conditions is probably not realistic. However, by enacting a watershed level wetland protection and enhancement program, many of the beneficial functions and values performed by wetlands could be enhanced or restored.

Increasingly, local Colorado governments, federal agencies, and non-profit organizations, particularly in rapidly growing parts of the state, are expressing a desire to better understand their natural heritage resources, including wetlands. The Colorado Natural Heritage Program approached this project with the intent of addressing this desire. Rare plants, animals, and plant associations are usually the least understood organisms in a landscape. Some of these organisms are only understood after their rarity is recognized, as in the case of federal threatened and endangered species. However, conservation of these organisms can often be accomplished more quickly and less expensively if there is a clear understanding of their distribution and abundance. Furthermore, the likelihood for human conflicts is minimized if there is the opportunity to proactively plan for managing human activity or managing the species or habitat of interest.

The *Survey of Critical Wetlands and Riparian Areas in Archuleta County*, conducted by the Colorado Natural Heritage Program (CNHP), is a part of ongoing wetland surveys of Colorado counties by CNHP. To date, similar surveys have been conducted in all or parts of 23 counties, including Archuleta County. An associated survey to this Archuleta County survey was completed by CNHP for the Upper San Juan Basin in 2003, which included Archuleta County and parts of Hinsdale County, documented not only imperiled wetland and riparian plants and plant communities, but also upland plants, animal and invertebrate species, and plant communities. Some wetland and riparian areas documented within the *Upper San Juan Basin Biological Assessment* (2003) were revisited during the 2005 field season in Archuleta County. Where significant changes were noted to previously documented sites, they have been included within this report as updates.

CNHP has also completed the Comprehensive Statewide Wetland Characterization and Classification Project (CSWCC) (Carsey *et al*. 2003b). This project compiled data from multiple sources, including CNHP's Riparian Classification (Kittel *et al.* 1999), to produce a comprehensive wetland and riparian classification for the State of Colorado. The publication of the *Field Guide to the Wetland and Riparian Plant Associations of Colorado* (Carsey *et al.* 2003a), was a result of this comprehensive project, and was used extensively in identification of the plant associations encountered during the Archuleta County survey.

The purpose of this project is to provide a data resource for the Colorado Division of Wildlife Wetlands Program Southwest Wetland Focus Area Committee; federal, state, and local agencies; and local land conservation organizations in conducting proactive planning for wetland conservation within Archuleta County. This document should be considered a tool for managing lands that support rare wetland/riparian species and plant associations within Archuleta County, although there are limitations to the information within it. In particular, the survey work was conducted over a one-year period. The distribution and abundance of all organisms change with time, and it is anticipated that the conservation areas described in the report will also change with time. Also, all areas of Archuleta County were not surveyed. Due to limitations of time and land access, this report only includes information from readily observed species and natural communities or from areas that biologists received permission to visit. Finally, this report does not include all wetland species or associations found within Archuleta County. This project specifically targeted the organisms that are tracked by CNHP (CNHP has a methodology specific to Natural Heritage Programs and this study was intended to survey for those species believed to be the most rare or the least known). The primary objective was to identify biologically significant wetlands and riparian areas within Archuleta County. The *Survey of Critical Wetlands and Riparian Areas in Archuleta County* used the methodology that is used throughout Natural Heritage Programs in North, South, and Central America. The primary focus was to identify the locations of the wetland or riparian plant and animal populations and plant associations on CNHP's list of rare and imperiled elements of biodiversity, assess their conservation value, and to systematically prioritize these for conservation action.

The locations of biologically significant wetlands were identified by:

- Examining existing biological data for rare or imperiled plant and animal species, and significant plant associations (collectively called **elements)**;
- Accumulating additional existing information from local knowledgeable citizens, local agency staff, National Wetland Inventory maps, topographic maps, soils maps, and aerial photographs; and,
- Conducting extensive field surveys.

Locations in the county with natural heritage significance (those places where elements have been documented) are presented in this report as Potential Conservation Areas (PCAs). The goal is to identify a land area that can provide the habitat and ecological needs upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, soils, and hydrologic features, as well as vegetative cover, and current and potential land uses to delineate PCA boundaries.

The PCA boundaries delineated in this report do not confer any regulatory protection of the PCA, nor do they recommend automatic exclusion of all activity. It is hypothesized that some activities will prove degrading to the element(s) or the ecological processes on which they depend, while others will not. The boundaries represent the best professional estimate of the primary area supporting the long-term survival of the targeted species or plant associations and are presented for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection of natural heritage resources and sensitive species. Please note that these boundaries are based primarily on our understanding of the ecological systems. A thorough analysis of the human context and potential stresses was not conducted. All land within the PCA planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

CNHP uses the Heritage Ranking Methodology to prioritize conservation actions by identifying those areas that have the greatest chance of conservation success for the most imperiled elements. The PCAs are prioritized according to their **biodiversity significance rank**, or “B-rank,” which ranges from B1 (irreplaceable) to B5 (general or statewide biodiversity significance). These ranks are based on the conservation (imperilment or rarity) ranks for each element and the element occurrence ranks (quality rank) for that particular location. Therefore, the highest quality occurrences (those with the greatest likelihood of long-term survival) of the most imperiled elements are the highest priority (receive the highest B-rank). PCAs ranked B1-B3 are the highest priorities for conservation actions. More detailed information on the biodiversity significance ranking system is described within the section of this report entitled, “The Natural Heritage Network Ranking System”.

The sum of all the PCAs in this report represents the area CNHP recommends for protection in order to preserve the natural heritage of Archuleta County's wetlands.

WETLAND DEFINITIONS, REGULATIONS, AND CONDITION ASSESSMENT

Wetland Definitions

The federal regulatory definition of a jurisdictional wetland is found in the regulations used by the U.S. Army Corps of Engineers (Corps) for the implementation of a dredge and fill permit system required by Section 404 of the Clean Water Act Amendments (Mitsch and Gosselink 1993). According to the Corps, wetlands are “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” For Corps programs, a wetland boundary must be determined according to the mandatory technical criteria described in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). In order for an area to be classified as a jurisdictional wetland (i.e., a wetland subject to federal regulations), it must have all three of the following criteria: (1) wetland plants; (2) wetland hydrology; and (3) hydric soils.

The U.S. Fish and Wildlife Service defines wetlands from an ecological point of view. *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin *et al*. 1979) states that “wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water." Wetlands must have *one or more* of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (wetland plants); (2) the substrate is predominantly undrained hydric soil; and/or (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year. This definition only requires that an area meet one of the three criteria (vegetation, soils, and hydrology) in order to be classified as a wetland.

CNHP prefers the wetland definition used by the U.S. Fish and Wildlife Service, because it recognizes that some areas display many of the attributes of wetlands without exhibiting all three characteristics required to fulfill the Corps’ criteria. Additionally, riparian areas, which often do not meet all three of the Corps' criteria, should be included in a wetland conservation program. Riparian areas perform many of the same functions as other wetland types, including maintenance of water quality, storage of floodwaters, and enhancement of biodiversity, especially in the western United States (National Research Council 1995).

Wetland Regulation in Colorado

Wetlands in Colorado are currently regulated under the authority of the Clean Water Act. A permit issued by the Corps is required before placing fill in a wetland and before dredging, ditching, or channelizing a wetland. The Clean Water Act exempts certain filling activities, such as normal agricultural activities.

The 404(b)(1) guidelines, prepared by the Environmental Protection Agency in consultation with the Corps, are the federal environmental regulations for evaluating projects that will impact wetlands. Under these guidelines, the Corps is required to determine if alternatives exist for minimizing or eliminating impacts to wetlands. When unavoidable impacts occur, the Corps requires mitigation of the impacts. Mitigation may involve creation or restoration of similar wetlands in order to achieve an overall goal of no net loss of wetland area.

The U.S. Fish and Wildlife Service has conducted inventories of the extent and types of our nation’s wetlands. The Cowardin *et al*. (1979) classification system provides the basic mapping units for the U.S. National Wetlands Inventory (NWI). Photo-interpretation and field reconnaissance was used to refine wetland boundaries according to the wetland classification system. The information is summarized on 1:24,000 and 1:100,000 maps.

The NWI maps provide important and accurate information regarding the location of wetlands. They can be used to gain an understanding of the general types of wetlands in the county and their distribution. The NWI maps cannot be used for federal regulatory programs that govern wetlands for two reasons. First, the U.S. Fish and Wildlife Service uses a definition for a wetland that differs slightly from Corps, the agency responsible for executing federal wetland regulations. Secondly, there is a limit to the resolution of the 1:24,000 scale maps. For example, at this scale, the width of a fine line on a map represents about 5 m (17 ft) on the ground (Mitsch and Gosselink 1993). For this reason, precise wetland boundaries must be determined on a project-by-project basis. Colorado's state government has developed no guidelines or regulations concerning the management, conservation, and protection of wetlands, but a few county and municipal governments have, including the City of Boulder, Boulder County, and San Miguel County.

Wetland Functions and Values

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).
- Flood flow 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.

Adamus and Stockwell (1983) include two items they call "values" which also provide benefits to society:

- Recreation--wetlands provide areas for fishing, bird watching, etc.
- Uniqueness/heritage value--wetlands support rare and unique plants, animals, and plant associations.

"Values" are subject to societal perceptions, whereas "functions" are biological or physical processes, which occur in wetlands, regardless of the value placed on them by society (National

Research Council 1995). The actual value attached to any given function or value listed above depends on the needs and perceptions of society.

Wetland Condition Assessment

For past county wetland survey and assessment projects, CNHP has utilized a qualitative, descriptive functional assessment based on the best professional judgment of CNHP ecologists while incorporating some of the principles of the hydrogeomorphic (HGM) assessment method. The assessment was used to provide a rapid determination of each wetland's functional integrity. This functional assessment method used various qualitative indicators of structure, composition, and land use to represent and estimate of the degree to which a function was being performed. This, as well as most functional assessments, requires the following assumptions: (1) the combination of variables adequately represents the function and (2) their combination results in an estimated "amount" of the function being performed. The result is that most functional assessments are not rapid and do not directly measure functions (Cole in press).

The element occurrence rank (see the Natural Heritage Network section) used by CNHP is a rapid assessment of the condition of on-site and adjacent biotic and abiotic processes that support and maintain the element. Recently, NatureServe and CNHP (Faber-Langendoen *et al.* 2005) revised this method making it more transparent and repeatable. The condition assessments are 'holistic' in that they consider ecological integrity to be an "integrating super-function" (Fennessy *et al.* 2004). Condition assessments or ecological integrity assessments provide insight into the integrity of a wetland's natural ecological functions that are directly related to the underlying integrity of biotic and abiotic processes. In other words, a wetland with excellent ecological integrity will perform all of its functions at full levels expected for its wetland class or type. Ecological integrity assessments are simply concerned with measuring the condition of the wetland and assume that ecological functions follow a similar trend. This assumption may not be true for all functions, especially ecological services or those functions which provide specific societal value. For example, ecological services such as flood abatement or water quality improvement may still be performed even if ecological integrity has been compromised. However, given that CNHP is attempting to identify and prioritize ecologically significant wetlands it seemed more pertinent to focus the assessment on ecological integrity or condition of each wetland.

For this report, CNHP evaluated the condition of a wetland to reflect its ecological integrity in lieu of the qualitative function assessment. For the upcoming field season, CNHP will use ecological integrity scorecards that will improve the repeatability and accuracy of the condition assessment.

THE NATURAL HERITAGE NETWORK RANKING SYSTEM

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 tall grass prairie and short grass 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 greenback cutthroat trout, 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 communities that represent terrestrial 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 its 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 communities are equally important as individual species, this methodology has been applied to ranking and preserving rare plant communities, as well as the best examples of common communities.

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, 11 Canadian provinces and territories, and many countries and territories in Latin 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 communities in which species live, the ecosystems in which communities exist, and the interactions between these levels. All levels are necessary for the continued survival of species and plant communities, 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 communities within an area that represent the range of species relationships and inter-dependence. These communities may be diagnostic of or even restricted to an area.

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 short grass 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.

The conservation of biological diversity should include all levels of diversity: genetic, species, community, and landscape. Each level is dependent on the other levels and inextricably linked. In addition and all too often omitted, humans and the results of their activities are also closely linked to all levels of this hierarchy and are integral parts of most landscapes. 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

To place this document in context, it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP).

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 communities 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.

All Natural Heritage Programs house data about imperiled species and are implementing use of the Biodiversity Tracking and Conservation System (BIOTICS) developed by NatureServe. This database includes taxonomic group, global and state rarity ranks, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. BIOTICS also has an ArcView based mapping program for digitizing and mapping occurrences of rare plants, animals, and plant communities. These rare species and plant communities 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 communities 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 communities 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 may be threatening the biodiversity at 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 communities 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 communities. 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 1.

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 1, 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.

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 2 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

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.
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.
PDL	Proposed for delisting.
XN	Nonessential experimental population.
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: Significant current or predicted downward trends in population numbers or density. 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 communities, 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. 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). This factor for an occurrence is evaluated relative to other known, and/or presumed viable, examples.
- **Condition/Quality** – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes measures such as reproduction, age structure, biological composition (such as the presence of exotic 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 communities 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 rank and D representing a poor rank. These ranks for each factor 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 3.

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
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 PCA is designed 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, and hydrologic features; vegetative cover; and current and potential land uses. In developing the boundaries of a PCA, 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 exotic 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 communities. 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 PCA of reasonable size. For example, taken to the extreme, the threat of ozone depletion could expand every PCA 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 that may extend far beyond PCA boundaries are necessary as well. This 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 4 for a summary of these B-ranks.

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

B1	Outstanding Significance (indispensable): only known occurrence of an element A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence) concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)
B2	Very High Significance: B- or C-ranked occurrence of a G1 element A- or B-ranked occurrence of a G2 element One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element. Concentration of A- or B-ranked G3 elements (four or more) Concentration of C-ranked G2 elements (four or more)
B3	High Significance: C-ranked occurrence of a G2 element A- or B-ranked occurrence of a G3 element D-ranked occurrence of a G1 element (if best available occurrence) 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: Other A- or B-ranked occurrences of a G4 or G5 community C-ranked occurrence of a G3 element 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) Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more) D-ranked occurrence of a G2 element At least C-ranked occurrence of a disjunct G4 or G5 element 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 5 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 may include the following:

- 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 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 exotics, mowing, etc.) or people and site management (building barriers, re-routing 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 6 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.

COLORADO DIVISION OF WILDLIFE RIPARIAN MAPPING PROJECT

Riparian Mapping Project Background and History

The following sections are summarized from DOW's Riparian web page (http://ndis1.nrel.colostate.edu/riparian/riparian.htm):

The Colorado Division of Wildlife (DOW) has been involved with mapping riparian vegetation since 1990. Initially, it started out as a cooperative project with the Pike/San Isabel National Forest and Comanche/Cimarron National Grasslands in southern Colorado. At the time, the U.S. Forest Service had the funding and the desire to map riparian vegetation but lacked a Geographic Information System (GIS) necessary to digitally process the information. The DOW lacked the funding but had the desire and the GIS expertise. As a result, an interagency cooperative project was developed that mapped approximately 200 USGS quadrangle maps over a six year period from 1990-1996. The only limitation of this project, due to the source of the funding, was that the delineation ended at the Forest Service's administrative boundary.

Mapping Methodology

The DOW uses NAPP (National Aerial Photography Program) aerial infrared photographs to map riparian vegetation. These photos are flown at a height of 20,000 feet and purchased from the USGS as a 9" x 9" film positive at a nominal scale of 1:40,000. These photos are obtained in stereo to allow for 3-D viewing that aids in the mapping process. Riparian vegetation is mapped on a 7.5' Quadrangle basis at a scale of 1:24,000. Approximately ten aerial photos per quad are needed for stereo overlay.

The photos are arranged on a stereo zoom transfer scope and registered to the corresponding topographic mylar for purposes of spatial accuracy. Although the maps are produced at a scale of 1:24,000 the delineation is performed at a scale of 1:12,000 which greatly increases both the spatial and classification accuracy. Combining the use of a pre-defined Classification Scheme, and while viewing the imagery in stereo to better ascertain vegetative and geomorphologic structure, the photo-interpreter delineates riparian vegetation as either a polygon or line feature using a '000' Rapidograph pen. The minimum mapping unit (MMU) is 1/2 acre and groupings this size or larger are depicted as polygons. In many cases, polygons as small as 1/10 acre have been delineated by the photo-interpreter during the course of this project. Riparian vegetation less than 80 feet in width is recorded as a line feature. A line feature must be at least 500 feet in length to be recorded. If a line feature is less than 500 feet long it is then incorporated into another riparian type. Delineation of the line and polygon features is done on a separate piece of stable-based mylar registered to the topographic mylar.

Once the initial delineation is complete, the photo-interpreter makes a second pass and assigns attributes to the features, again, using the riparian classification scheme. The classification scheme makes use of a dominant/subdominant methodology for describing riparian vegetation. Unless a polygon is at least 75% homogeneous it is broken out with the dominant category listed first followed by the subdominant category. The dominant/subdominant attributes are separated by a slash (/). For example, RS/RH equals "riparian shrub/riparian herbaceous" with shrub being the dominant category within the mapped polygon. Annotation labels are delineated on a separate sheet of stable-based mylar from that used to delineate the riparian lines and polygons. This facilitates the scanning, editing, and digital processing of the data.

The delineations were then reviewed by CNHP using known occurrences of riparian plant communities located in the Biological Conservation Database (BCD) System, as well as previous field work knowledge.

After the riparian vegetation is delineated and annotated it is mechanically scanned at a minimum resolution of 300 dpi. This resolution achieves optimal results for digital editing and attributing. The digital file is edited and attributed using LTDOS, LTPLUS, ARCSCAN, or a similar line tracer program. The resulting digital files, along with the original delineation, are then provided to the DOW for final digital processing into an ArcInfo Geographic Information System (GIS).

DOW Riparian Mapping Classification Scheme

The photo interpretation of riparian vegetation is accomplished as outlined in the Mapping Methodology section (above) using the classification scheme outlined below. Potential riparian habitats are not delineated. Mixed communities are delineated when obvious spectral differences in vegetation can be discerned within a common area.

For each of the classes (Table 10), a single label indicates that the class is dominant and comprises at least 75% or more of the vegetation. Other vegetation may be present but less than the Minimum Mapping Unit (MMU) of 1/2 acre. Mixed communities consist of classes that are less than 75% cover with a lesser amount of one or more other groups. The dominant type is annotated first with the lesser type following. For example, if a polygon is attributed as RT1/RS1, the vegetation in the area is less than 75% dominant of any particular class but is a mixed community of Aspen and Willow with Aspen dominant between the two classes. A forward slash (/) is used to separate the dominant/subdominant classes both on the hard copy and within the digital data.

Results of the analysis of the DOW riparian mapping project for Archuleta County are summarized in the section entitled, "Colorado Division of Wildlife Riparian Mapping Analysis Results" later in this report.

PROJECT BACKGROUND

Location of Study Area

Archuleta County is located in southwestern Colorado on the border with New Mexico and comprises approximately 1,364 square miles (872,960 ac/353,276 ha) (Figure 1). Elevations in the County range from about 6,100 feet (1,859 m) in the southwest corner where the San Juan River drains into New Mexico, to 13,300 (4,054 m) feet at Summit Peak on the Continental Divide in the northwest corner. Pagosa Springs, the largest town and County Seat, sits near the center of the County on the San Juan River at 7,079 feet (2,158 m) elevation. Archuleta County is bordered in Colorado by La Plata County on the west, Hinsdale, Mineral, and Rio Grande Counties on the north, and Conejos County to the east. Rio Arriba and San Juan counties in New Mexico form the southern border of the County. The County boundaries are generally straight political boundaries, though the eastern boundary runs close to but does not directly follow the Continental Divide.

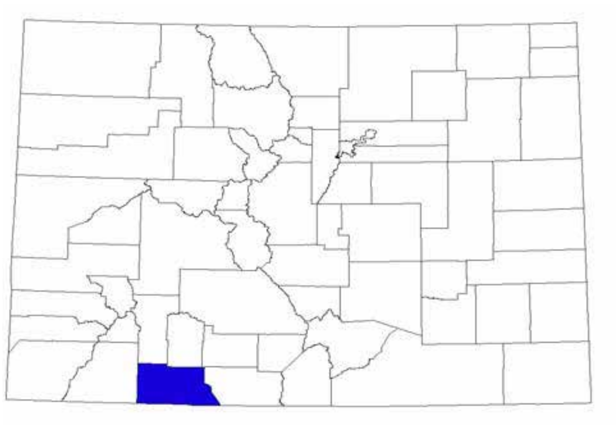


Figure 1. Location of Archuleta County in Colorado

Ecoregions

The vast majority of Archuleta County falls within the Southern Rocky Mountains Ecoregion as defined by The Nature Conservancy, with a very small portion of the southwest corner occurring within the Colorado Plateau Ecoregion (based on Bailey *et al.* 1994) (Figure 2). The Southern Rocky Mountain Ecoregion includes two major mountain systems and the intervening valleys and parks from southern Wyoming to northern New Mexico. The major ecological zones are alpine, subalpine, upper montane, lower montane and foothill (Neely *et al*. 2001). The Colorado Plateau Ecoregion is a geologically diverse region, containing mesas, buttes, canyons, badlands and isolated mountain ranges. The diversity of topography and geologic features in the ecoregion support unique flora and fauna, many of which are found nowhere else in the world (Tuhy *et al*. 2002).

Figure 2. Ecoregions of Archuleta County (Bailey 1994).

Climate
Precipitation and climate across Archuleta County vary greatly with elevation. The lower elevations in the southern part of the County are typically dry and sunny, whereas the higher elevations near the Continental Divide are significantly cooler and receive more precipitation from prevailing westerly winds that carry storms from the Pacific, and southwesterly flows from systems circulating over Mexico and the Gulf of Mexico. Although temperature varies widely across the County depending on elevation, July highs are typically near 80° F, while lows are 40° F to 50° F. January highs are typically 30° F to 40° F and lows average 5° F to 10° F.

Climate data from Pagosa Springs (7,079 feet/2,158 m) is fairly typical of the lower and mid-elevation valleys in the County. Climate data from Wolf Creek Pass (10,850 feet / 3,307 m; Mineral County), just north of the northeast County line is fairly typical of the higher elevation mountainous parts. Across the area, January is typically the coldest month, with an average low temperature of 1° F in Pagosa Springs, and 4° F at Wolf Creek Pass. July is generally the warmest month with highs averaging 83° F in Pagosa Springs, and 65° F at Wolf Creek Pass (WRCC 2006). The growing season is about 75 days in Pagosa Springs, and 29 days at Wolf Creek Pass (Whiting 2002; USDA-SCS 1981).

Average annual precipitation across the County varies; the southwest corner of the County receives only 12 to 16 inches of precipitation annually, while the highest mountainous areas receive 50 to 60 inches (WRCC 2006) (Figure 3). The Western Regional Climate Center reports an annual average total precipitation in Pagosa Springs of 21 inches and an average snowfall of 101 inches (from averaged monthly data, 1906-1998). Wolf Creek Pass records an annual average of 45 inches of precipitation, and an average snowfall of 435 inches (from averaged monthly data, 1957-2005).

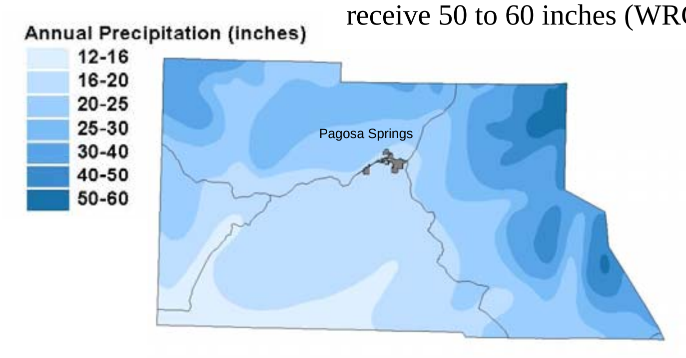


Figure 3. Average Annual Precipitation in Archuleta County (from USDI-BLM 1991).

Comparatively, the low-elevation town of Ignacio (6,450 feet / 1,966 m; La Plata County), just west of the southwest County border reports an average annual total precipitation of 14 inches and an average snowfall of 29 inches (WRCC 2006). The driest month in Archuleta County is June and the wettest is August, when the summer monsoons are typically at their peak in the Four Corners region.

Population
According to the 2000 Census, Archuleta County is the 36th largest County out of 63 Colorado counties, with a year 2000 population of 9,898 and a projected 2004 population of 11,616 persons (US Census Bureau 2000). Since the early 1990's the County has been experiencing rapid human population growth and development across the County and within the only incorporated town of Pagosa Springs, but the highest growth is occurring in unincorporated and rural areas of the County (Graves 2006). Archuleta County's population increased 85% from 1990 to 2000, ranking it the 14th fastest growing County in the U.S. and 5th fastest growing County in Colorado during that time period (US Census Bureau 2000). Beginning in earnest in the early 1990's, beautiful scenery and convenient amenities have been shifting what was once a timber and agriculturally based regional economy into a second home and tourist mecca (Region 9 EDD 2004). A recent

study found that of all residential units within the County, 38% are considered second homes (Graves 2006). Additionally, over 13,000 acres of ranchland has been converted by development between 1990 and 2000 (Shapins Associates 2000).

The major population centers in Archuleta County are Pagosa Springs on the San Juan River, Chromo on the Navajo River, and Arboles at Navajo Reservoir (Figure 4). Small population clusters occur at Edith on the Navajo River; Trujillo, Juanita, and Pagosa Junction on the San Juan River; and Piedra and Stollsteimer on the Piedra River. Growth within the County is concentrated in the

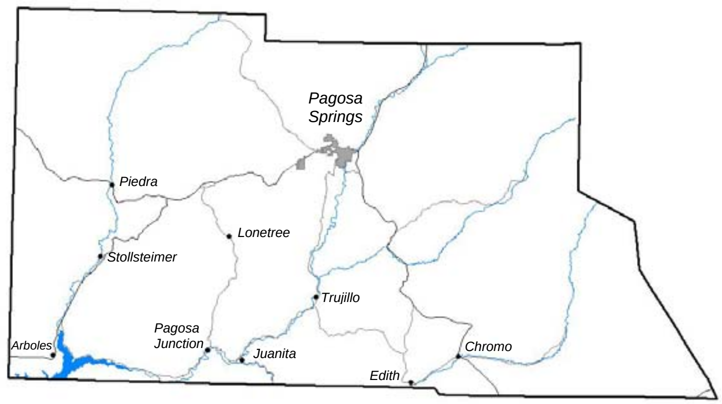


Figure 4. Towns and Population Centers in Archuleta County

Pagosa Springs area at Aspen Springs, Pagosa Lakes, and the Timber Ridge and Meadows developments along South Pagosa Boulevard, at the San Juan River Resort subdivisions north of town on the river, and at several large subdivisions along U. S. Highway 84 south of Pagosa Springs. But development has spread into the rest of the County including the Navajo River watershed in rural southeast Archuleta County where several developments including Alpine Lakes Ranch, Navajo River Ranch, and Crowley and Spring Valley Ranches encroach on productive ranchland. There is also strong development in the vicinity of the Navajo Reservoir at Arboles in southwest Archuleta County. Residential densities in many of these subdivisions range in size from 2 to 35+ acre lots. This rapidly expanding human population continues to place increasing demands on the region's natural resources, open space and ranchlands (Sovell *et al.* 2003).

Land Ownership

Archuleta County primarily consists of National Forest lands, private lands, and Southern Ute Indian tribal lands (Figure 5). National Forest lands, including Wilderness Areas, comprise about 50% of County lands, and dominate the northern section of the County (Graves 2006). These lands are managed predominately as the San Juan National Forest, with a small amount of forest on the eastern County boundary managed by the adjacent Rio Grande National Forest. Southern Ute tribal lands comprise 14% of County lands and are largely located in the southwestern section of the County (Graves 2006).

Private lands (34%) are found primarily in the central and southeastern corner of the County, with many scattered parcels elsewhere in the County. A recent study found that 59% of the private lands in Archuleta County are owned by non-locals; that is, property owners with mailing addresses outside of the County, including Texas (22%), California (15%), New Mexico (12%) and other areas of Colorado (18%) (Graves 2006).

The BLM controls very little land in Archuleta County, and those lands along with state-owned parcels and State Wildlife Areas (Echo Canyon Reservoir, Devil Creek, and Navajo Reservoir State Wildlife Areas) are distributed throughout the County. The Bureau of Reclamation owns lands surrounding Navajo Reservoir in the southwest corner of the County, but through agreements these lands are managed by the State of Colorado (Colorado State Parks).

Land Use

The first known residents of Archuleta County were Ancestral Puebloans between 850 and 1125 AD, who settled near the Piedra River and farmed the land. Remnants of their stone structures can

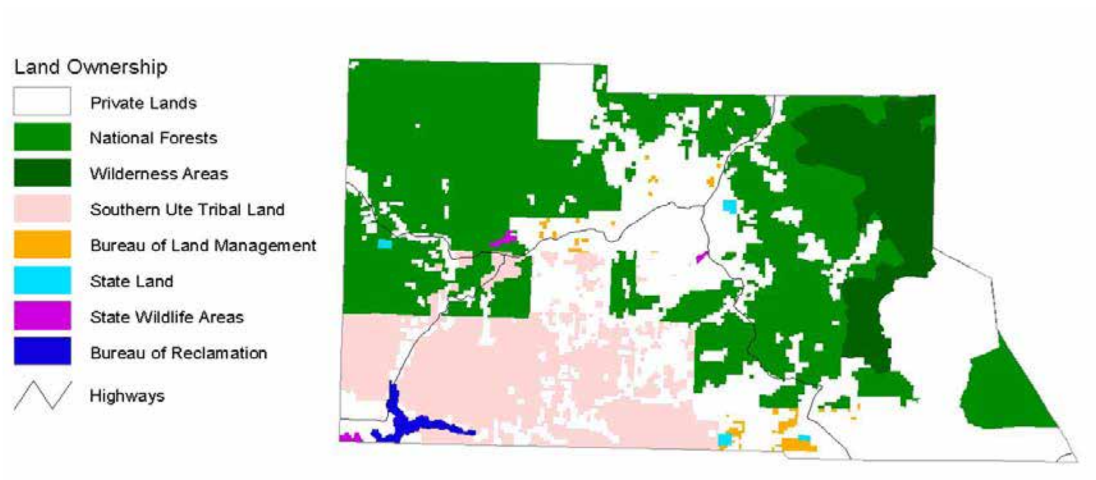


Figure 5. Land Ownership in Archuleta County.

be found at Chimney Rock Archeological Area, west of Pagosa Springs on the Piedra River. Later, modern Native American tribes such as the Ute and the Navajo used the area, and both tribes were known to frequent the Great Hot Springs. The Spanish began exploring the area in the mid-eighteenth century, and the famed Dominguez-Escalante expedition camped along the San Juan River in 1776 (Masco 1973). Trappers, including Kit Carson, began using the area in the mid-1800's, and Camp Lewis was established as a military outpost near the Great Hot Springs in 1878 to protect settlers in the region. Though it was later renamed Fort Lewis and moved to Durango, settlers continued to stream into the area. Archuleta County was divided off from Conejos County in 1885 and the Town of Pagosa Springs, which grew on the site of Camp Lewis, was incorporated in 1891. With the growth of cattle and sheep ranching, and the development of the timber industry, the area began to flourish in the 1890s and early 1900s. The arrival of the railroad in 1900 and the opening of Wolf Creek Pass in 1916 opened the area for economic development and commerce (Pierce and Raby 2003; Masco 1973).

Current land uses in Archuleta County are highly variable. Agriculture, including beef ranching and irrigated hay crops, occurs in the river valleys and montane basins. Residential development, especially of 5- to 35-acre lots, is predominantly clustered around Pagosa Springs and the other population centers in the County. Pagosa Springs has been developing its tourism economy over the last fifteen years, and Arboles (at Navajo Reservoir) also depends on recreation and tourism to boost its economy.

Unlike other San Juan Mountain counties, mineral mining has not been especially lucrative in Archuleta County. However, coal mining at the north edge of the San Juan Basin still continues, and has been augmented recently with rapid development of shallow coalbed methane resources, resulting in a renewed energy boom in the Basin. Traditional gas and oil extraction has been a significant land use in the basin for years and continues along with the development of the coalbed methane wells (Topper *et al.* 2003).

Geology

Archuleta County lies at the junction of two distinct geological regions: the San Juan Mountains and the San Juan Basin (Weimer and Haun 1960). These two regions were formed from dramatically different geologic activities in different geologic periods. The mesas, hogbacks and canyons of central and southwest Archuleta County and the San Juan Basin were formed by sedimentary deposits from Cretaceous period inland seas, which were later tilted and warped by the uplifting San Juan Mountains. The San Juan Basin's semi-circular northern rim crosses southwest Archuleta County and continues east across adjacent La Plata County, with the majority of the basin lying to the south in New Mexico. The San Juan Mountains make up the eastern part of the County and include the Continental Divide. These mountains were formed by intense volcanic activity and ash and lava deposition in the Tertiary period (See Table 7 for review of the geologic time scale). Geothermal vents formed during this period on the south flank of the San Juan Mountains create the many hot springs found around the County, including the Great Pagosa Hot Springs (Foutz 1994).

A general timeline for the creation of the features of Archuleta County covers a series of dramatic uplifts and volcanic activity broken by periods of erosion and sedimentation. The Ancestral Rocky Mountains began forming about 320 million years ago (mya) through uplifts, including the Uncompahgre and San Luis Highland uplifts. Subsequently, inundation by Cretaceous age seas (140-70 mya) laid down the sedimentary layers now seen in the San Juan Basin as Mancos Shale, Lewis Shale, and the mixed-sedimentary composition Kirtland, Fruitland and Animas Formations. Intervening periods of receding seas, sand dune creation, and river depositions formed the Mesaverde Group sandstone and shale and Pictured Cliffs sandstone sandwiched between the shale layers (Raby 2004). Today, Pagosa Springs lies in a valley floored with Mancos shale and surrounded by hills of tilted Dakota and Mesaverde sandstones laid down in the Cretaceous Period (Chronic and Williams 2002).

ERA	PERIOD	YEARS AGO	EPOCH
	Quaternary		Pleistocene
		2 million	
CENOZOIC			
			Pliocene
			Miocene
	Tertiary		Oligocene
			Eocene
			Paleocene
		65 million	
	Cretaceous		
MESOZOIC	Jurassic		
	Triassic		
		248 million	
	Permian		
	Pennsylvanian		
	Mississippian		
PALEOZOIC	Devonian		
	Silurian		
	Ordovician		
	Cambrian		
		590 million	
PRECAMBRIAN			
		4.5 billion	

Table 7. The geologic timescale (after Foutz 1994).

The modern Rocky Mountains then began forming about 75 million years ago during the Laramide Orogeny (mountain-building period) when the land began uplifting again, tilting and folding the horizontal sediment layers of today's San Juan Basin and raising the mountains. A period of intense volcanic activity (40 mya) was triggered by these uplifts, creating the San Juan Volcanic Field in the area now known as the San Juan Mountains. Archuleta County lies along the southern edge of this volcanic field. A large complex of volcanic calderas (large basin-shaped volcanic depressions formed by explosion or collapse of a volcano) and ash flows developed during this time, including the largest recognized caldera in the world, a 22- by 47-mile oval called the La Garita Caldera (Lipman *et al.* 1997; Steven and Lipman 1976). This intense volcanic activity formed the high peaks of the San Juan Mountains, but these peaks have been worn by glacial advance and retreat and glacial meltwater floods in a series of ice ages beginning 2.6 million years ago and ending only 20,000 years ago. The area of the San Juan Basin has also been reduced by wind and water erosion, creating the mesas, cuestas, and canyons of the area, including the striking Chimney Rock formation (Raby 2004).

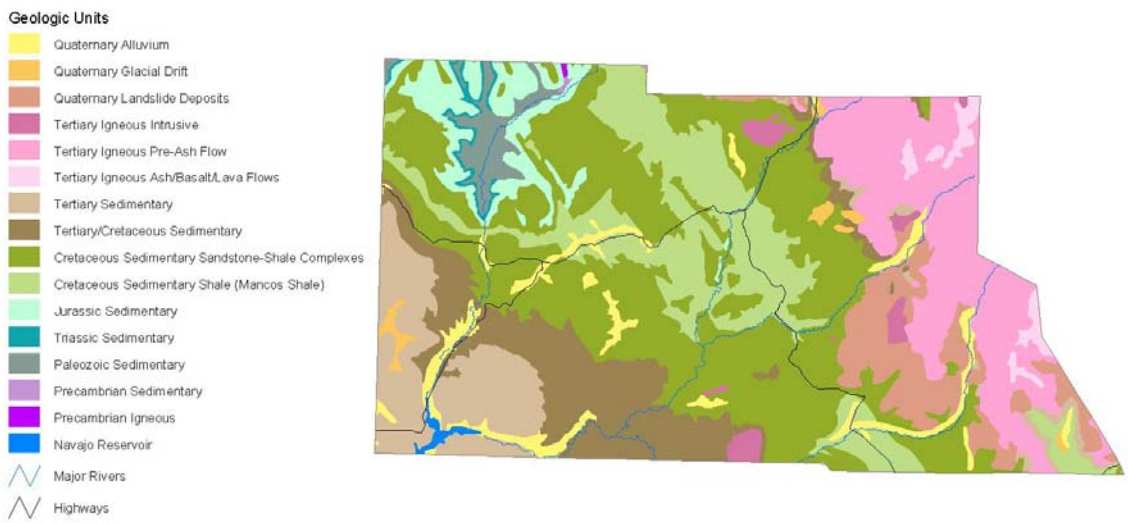


Figure 6. Generalized Geology of Archuleta County (adapted from Tweto 1979).

At the northern rim of the San Juan Basin, the layered sedimentary depositions of sandstone, limestone, shale and coal have been folded and warped toward the surface. These layers are incorporated within several geologic formations, including the Fruitland Formation and the warp and rise toward the surface, the pockets of coal, natural gas, oil, and coalbed methane contained within them are more readily accessible. Currently, large-scale development of the coalbed methane resources is occurring in southwest Archuleta County and the southern half of adjoining La Plata County. Development of typical coal, oil and gas reserves has also been common within the basin over the last century (USDI-BLM 1999; Cullicott *et al.* 2002).

The generalized geologic units in Archuleta County are shown in Figure 6, and are as follows, described from most recent to oldest:

- **Quaternary** units were shaped by the last ice age, in which glaciers gouged the rugged alpine terrain.
- **Tertiary** units were formed by volcanic action and uplifting.
- The **Cretaceous** period covered the area with shallow seas and left behind deposits of sedimentary rock.
- During the **Jurassic** period, fossil-rich sandstone and limestone were laid down, while the **Triassic** left behind bright red sedimentary rocks.
- Red, sandy sediments created by the uplifting of islands formed the Permian and Pennsylvanian units of the **Paleozoic** Era.

- Finally, units of the **Precambrian** Era are sedimentary layers that eventually became gneisses, schists, quartzites and granites (Foutz 1994).

These geologic structural units influence the distribution of wetland plant associations through their direct affect on soil development, groundwater movement, and fluvial processes. For example, numerous seeps and springs exist in the San Juan volcanic area, and are likely discharging from permeable bedrock derived from lava flows, tuffs, and ash flows. Steep terrain in mountainous regions results in narrow linear riparian areas while broad floodplain wetlands, associated with the alluvial groundwater system in the gravels of the San Juan River, Piedra River, Rio Blanco and Navajo River floodplains are the result of the San Juan uplift and subsequent erosion.

Hydrology

The San Juan River is one of two major tributaries to the Colorado River, and is the principal drainage for Archuleta County. Its headwaters originate near Wolf Creek Pass, and it bisects the County as it drains from the northeast to the southwest. Navajo Reservoir interrupts its flow at the border with New Mexico, along with the flow of one of its major tributary in Archuleta County, the Piedra River. Within the County, the two other major tributaries to the San Juan River are the Rio Blanco and the Navajo River, whose watersheds drain the east and south portions of the County (Figure 7). These river systems are all a part of the San Juan River watershed, one of two major tributaries to the Colorado River in the Upper Colorado River Basin. In Archuleta County, the San Juan River provides water for agriculture and recreation, and supplements Pagosa Springs's municipal water supply.

Historically, flows of the San Juan, Piedra, and other County rivers were high and turbid in the spring with a low and clear flow later in summer and throughout the winter. However, the historic flow of these rivers has been significantly altered due to water development projects for irrigation and municipal use. A major transbasin diversion project, the San Juan-Chama Project (completed in 1970), takes water from the Navajo River and Rio Blanco and their tributaries and diverts it through a series of tunnels into the Rio Grande Basin for use as domestic water, for industrial uses, to supplement irrigation supplies, and for use by municipalities (Albuquerque, Santa Fe, Taos, Los Alamos, and the Jicarilla Apache Reservation, among others) (USDI-BOR no date). Due to reservoirs, irrigation diversions, and other flow alterations, floodplains of rivers and streams are not inundated as frequently during spring runoff, and

Figure 7. Major Watersheds and Drainages of Archuleta County.

floodplain dynamics along these watercourses that are necessary for continued development of wetland habitat have been greatly altered. As a result, new wetlands are not being created within the floodplains and aquatic habitat has been reduced.

Aquifers in Archuleta County are primarily alluvial and occur along the main riverways, with additional aquifers trapped within sandstone layers and between confining shale layers laid down in the San Juan Basin during Cretaceous period inland seas. Alluvial aquifers generally provide domestic water, and water for irrigation and stock-watering. The San Juan and Piedra Rivers form a combined alluvial system, whereas other San Juan-tributary alluvial aquifers in the San Juan Basin (i.e. the Los Pinos, La Plata, and Mancos Rivers west of Archuleta County) are isolated along the main stems of their rivers in the lower valleys. Well depths vary greatly as does the thickness of alluvium throughout the alluvial aquifer systems. Withdrawal is small compared with bedrock aquifers and surface water use (Topper *et al.* 2003).

Non-alluvial aquifers provide additional groundwater in Archuleta County, and are associated with the four principal regional aquifers of the Colorado Plateau and smaller local aquifers (this discussion on groundwater is almost entirely based on USGS 1995: Groundwater Atlas of the United States – HA 730-C, unless otherwise referenced). Discharge from these aquifers is mainly associated with small seep and spring wetlands, but occasionally support larger slope wetlands. Groundwater discharge from all aquifers provides critical base flow to many small streams in Archuleta County and thus is vital to the health of many riparian areas.

Non-alluvial aquifers in the region are composed of permeable, moderately to well consolidated sedimentary rocks that range in age from Permian to Tertiary and are separated by impermeable confining units (See Table 7 for review of the geologic time scale). Groundwater generally flows from the San Juan uplift toward the major surface-water drainages in the County. The numerous water-yielding units have been grouped into the following four principal regional aquifers. These four aquifers underlie Archuleta County and are typically recharged at higher elevations. No principle aquifer occurs in the far eastern portion of Archuleta County, under the tectonic-origin San Juan Mountains, Chalk Mountains, and Continental Divide (USGS 1995).

1). Uinta-Animas aquifer – this aquifer is found in the southwestern corner of the County and is associated with the San Jose Formation (permeable, coarse arkosoic sandstone, mudstone), the Animas Formation and Nacimiento Formation (permeable conglomerate, medium to very coarse sandstone, impermeable shale, mudstone). In this County, it generally lies above the other aquifers as it is associated with youngest hydrogeologic unit. Discharge is to stream flow and cold springs in the alluvium of the river valleys in the San Juan Basin. In this corner of Archuleta County, groundwater generally flows toward the San Juan River. This aquifer provides important water resource via wells in the southwest part of the County (Topper *et al*. 2003).

2). Mesa Verde aquifer –The aquifer is found within rocks of the Mesa Verde Group (which locally consists of sandstone, shale, siltstone and coal of the Cliffhouse sandstone and Menefee formations, intertongued with the Mancos shale), which are older than those associated with the Uinta-Animas aquifer. The Mesa Verde aquifer is found in southwest Archuleta County, generally lying below the Uinta-Animas aquifer except in areas where the younger Animas formation (which generally lies above the Mesa Verde Group formation) has eroded away. It also occurs in the central valleys of the County such as the long northwest-southeast valley where Pagosa Springs sits. Discharge not only occurs via seeps and springs but also directly into streams and rivers and via wells. The Mancos Shale Formation serves as the confining unit between the Mesa Verde and the underlying Dakota-Glen Canyon aquifer.

3). Dakota-Glen Canyon aquifer – this aquifer contains four permeable zones referred to as the Dakota aquifer (associated with the Dakota Sandstone), Morrison aquifer (associated with sandstone portions of the Morrison Formation), Entrada aquifer (associated with Entrada sandstone), and Glen Canyon aquifer (associated with Glen Canyon sandstone or equivalent). The latter two aquifers associated with the system are absent in Archuleta County (Topper *et al.* 2003). This aquifer system underlies both the Uinta-Animas and Mesa Verde aquifers and due to its great depth gives little discharge in the region. It underlies the majority of Archuleta County, with the exception of the far eastern edge under the San Juan and Chalk Mountains. Groundwater flows toward discharge areas along the San Juan River and its tributaries.

4). Coconino-De Chelly aquifer – this aquifer is contained in rocks of Early Permian age, and underlies most of the southern part of the Colorado Plateau. In Archuleta County, the geologic formation associated with this aquifer is the Cutler Formation (sandstones and shales). The Cutler Formation yields small amounts of water only in fractures (Topper *et al*. 2003). In Archuleta County, this aquifer underlies the majority of the County at a great depth (typically below the other three aquifers). However, it only surfaces in a small portion of the northwestern corner of the County where the Piedra River has cut down into these ancient geologic units.

Soils

Soils of Archuleta County may be alluvial, glacially deposited, or weathered in place. Soils have typically formed from either sedimentary bedrocks such as shale or sandstone, or from volcanic (igneous) bedrock. Lower elevation soils in the central and southwest parts of the County are mostly derived from sedimentary bedrock and tend to be fairly deep, fine textured, and moderately well drained. Sandstone and shale bedrock outcrops are also common. Higher elevation mountain soils (northeast and east parts of the County) are most likely to be from igneous parentage, and are typically coarse textured, moderately deep, and well drained except in areas where groundwater discharge or slope wetlands occur. At high elevation sites, these areas often form organic soils (e.g., peat or muck) due to organic matter production, persistent soil saturation and thus anaerobic conditions, and cool year round temperatures. Igneous bedrock outcrops are common and are a dramatic feature of some of the San Juan peaks in the County.

Along drainages, both in the mountains and at lower elevations, wetland and riparian plant associations occur on alluvial soils. In lower elevations, alluvial soils along major drainages tend to be a composite of igneous and sedimentary parentage; the igneous-derived soils having been carried down from higher elevations and combining with lower elevation (sedimentary parentage) alluvial soils. Alluvial soils along the lower river valleys such as the San Juan River and Piedra River are highly variable in texture, ranging from very fine material to areas of sand, gravel, and cobble. Some oxbows and backchannels may have organic soil horizons but may not be classified as an organic soil. Soil development around many of the seeps and springs in Archuleta County is also variable, depending again on the parent materials, as well as on their geomorphic setting (e.g., steep hillsides, atop geologic bedrock, or gentle slopes). For more specific information about the soils in Archuleta County, see the "Soil Survey of Piedra Area, Colorado" (USDA-SCS 1981).

Ecological Systems *(Adapted from Rondeau 2001)*

Ecological systems are dynamic assemblages of plant and animal communities that occur together on the landscape, unified by similar ecological processes (e.g. climate as moderated by elevation and natural disturbance processes) and/or underlying abiotic environmental factors or gradients (e.g. bedrock geology and hydrology) (NatureServe 2005, Comer *et al.* 2003). In Archuleta County, the diversity of climate, geology, elevation, and soils leads to a wide range of ecological systems, spanning from alpine tundra at the highest elevations in the northeast to pinyon-juniper woodlands occupying the lowest elevations in the southwest.

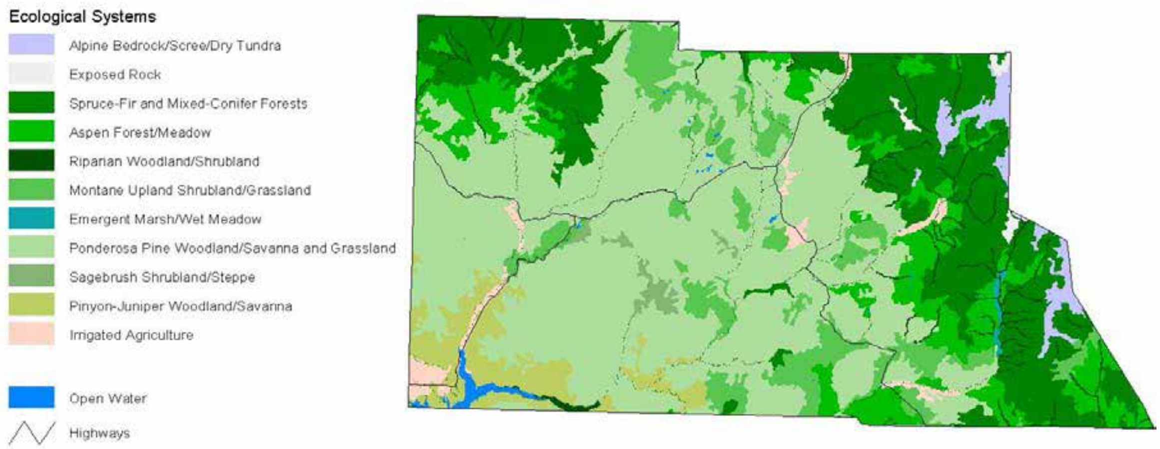


Figure 8. Ecological Systems of Archuleta County.

The biodiversity of ecological systems in Archuleta County can be classified into nine broad vegetation types, each containing one to several specific ecological systems (Figure 8). These types more or less correspond to elevation: from highest to lowest, 1) alpine bedrock/scree/dry tundra; 2) spruce-fir and mixed-conifer forests; 3) aspen forest/meadow; 4) riparian woodland/shrubland; 5) montane upland shrubland/grassland; 6) emergent marsh/wet meadow; 7) ponderosa pine woodland/savanna and grassland; 8) sagebrush shrubland/steppe; and 9) pinyon-juniper woodland/savanna. Within each of these zones, the addition of water (streams, rivers, or springs) creates additional vegetation types. Although distribution of vegetation in Archuleta County is mostly determined by elevation, other factors such as topography, soils, and local microclimates all contribute to the distribution patterns.

Alpine Bedrock / Scree / Dry Tundra

Alpine bedrock and scree, and alpine tundra ecological systems comprise approximately 2% of Archuleta County's alpine areas, occurring at only the highest elevations (10,800-13,300 feet/ 3300-4050 m). These systems are commonly comprised of a mosaic of herbaceous plant communities dominated by sedges, grasses, and forbs often intermixed with rock outcrops and talus or scree supporting nonvascular- (lichen) dominated communities. Dominant species include blackroot sedge (*Carex elynoides*), dry spike sedge (*Carex foenea*), bog sedge (*Kobresia myosuroides*), tufted hairgrass (*Deschampsia cespitosa*), sheep fescue (*Festuca brachyphylla*), Ross' avens (*Geum rossii*), and alpine clover (*Trifolium dasyphyllum*). Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, unstable substrates, and a short growing season.

Spruce-Fir and Mixed-Conifer Forests

Nearly 22% of Archuleta County is classified as either spruce–fir forests or mixed-conifer forests. Spruce-fir forests are typically dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) at higher elevations, grading into the mixed-conifer forest systems dominated by white fir (*Abies concolor),* blue spruce (*Picea pungens*), and Douglas-fir (*Pseudotsuga menziesii*) at lower elevations.

Spruce–fir dry-mesic forest and spruce-fir moist-mesic forests are widespread and occur in the subalpine and upper montane zones on all but the most xeric sites from cool, sheltered valleys at elevations as low as 8,200 feet (2500 m) to above 10,175 feet (3100 m). The relative dominance of the two canopy tree species and the understory composition vary substantially over a gradient from excessively moist to xeric sites (Peet 1981). The mesic spruce-fir type occurs on cool, sheltered, but well-drained sites above 8,850 feet (2700 m) and is one of the most widespread forest types in the subalpine zone. Open slopes above 9,850 feet (3000 m) are typically characterized by the dry-mesic spruce-fir system. Common understory species may include boxleaf myrtle (*Paxistima myrsinites*), whortleberries (*Vaccinium* spp.), Saskatoon serviceberry (*Amelanchier alnifolia*), common juniper (*Juniperus communis*) and red raspberry (*Rubus idaeus*). Herbaceous species include baneberry (*Actaea rubra*), false lily of the valley (*Maianthemum* spp.), thimbleberry (*Rubacer parviflorum*), showy alpine ragwort (*Ligularia amplectens*), and Porter's licorice root (*Ligusticum porteri*). Towards lower elevations, the spruce-fir types give way to montane mixed-conifer forest systems.

The mixed-conifer forest systems (dry-mesic and moist-mesic) occur on all slope aspects from 3,900 feet to 10,800 feet (1200 to 3300 m) elevation, and often intergrade with spruce-fir forests systems. Within the dry-mesic mixed conifer type, white fir is primarily the climax dominant at higher elevations and on cooler, moister sites such as northern and eastern exposures. Blue spruce is also found on cool, moist sites but often occurs in small patches within a larger matrix of other coniferous species. Ponderosa pine (*Pinus ponderosa*), and Douglas-fir tend to co-dominate at climax on warmer and drier sites such as south facing slopes and at lower elevations. On intermediate sites, white fir may co-dominate at climax with these other conifers (www.fs.fed.us/database/feis/). In moist-mesic mixed conifer forests, Douglas-fir and white fir are most common canopy dominants, but Engelmann spruce, blue spruce, or ponderosa pine may be present. Often this system will also include mixed conifer/quaking aspen (*Populus tremuloides*) stands. This moist-mesic mixed-conifer forest system is found on lower and middle slopes of ravines, along stream terraces, in moist, concave topographic positions and on north- and east-facing slopes. Understory components vary with the amount of soil moisture, but may include creeping barberry (*Mahonia repens*), kinnikinnick (*Arctostaphylos uva-ursi*), Rocky Mountain maple (*Acer glabrum)*, roundleaf snowberry (*Symphoricarpos rotundifolius*), twinflower honeysuckle (*Lonicera involucrata*), Woods' rose (*Rosa woodsii*), sweet cicely (*Osmorhiza depauperata*), Fendler's meadowrue (*Thalictrum fendleri*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Arizona fescue (*Festuca arizonica*), and fringed brome (*Bromus ciliatus*).

Aspen Forest/Meadow

Nearly 10% of Archuleta County is classified as quaking aspen (*Populus tremuloides*) forest or mesic meadow. The aspen forest system is found in the north and east portions of the County between 8,000-10,000 feet (2440-3050 m) in elevation. Aspen forest is a matrix community usually maintained by fires. It is composed of upland forests and woodlands dominated by aspen without a significant conifer component (>25% relative tree cover). The understory may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. Common associated species in the understory include roundleaf snowberry (*Symphoricarpos rotundifolius*), red raspberry (*Rubus idaeus*), Saskatoon serviceberry (*Amelanchier alnifolia*), bracken fern (*Pteridium aquilinum*), Fendler's meadowrue (*Thalictrum fendleri*), common cow parsnip (*Heracleum maximum*), bluejoint reedgrass (*Calamagrostis canadensis*), and fringed brome (*Bromus ciliatus*).

The mesic meadow system typically occurs above 6,600 feet (2000 m) on gentle to moderate-gradient slopes. Soils are often finely textured, and often snow deposition or windswept dry conditions limit the establishment of woody species. Soils are usually moist to saturated seasonally, but dry out later in the growing season. Vegetation is typically heavily dominated by forb species, with some graminoid species intermixed and may include Porter's licorice root (*Ligusticum porteri*), American vetch (*Vicia americana*), yarrow (*Achillea millefolium*), (*Rudbeckia laciniata* var. *ampla*), larkspur (*Delphinium* spp.), heartleaf bittercress (*Cardamine cordifolia*), tall fringed bluebells (*Mertensia ciliata*), large-leaved avens (*Geum macrophyllum*), tufted hairgrass (*Deschampsia cespitosa*), and bluejoint reedgrass (*Calamagrostis canadensis*).

Aspen is usually a seral tree in climax sub-alpine fir associations at the higher elevations. In such situations it may dominate the forest community for many decades following severe disturbance, such as fire or clear-cutting, but will gradually decline as conifer species such as subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) become reestablished. At lower elevations aspen can occur either as a temporarily dominant seral species in a variety of climax conifer associations, or it can achieve permanent dominance as the climax forest type. The environmental conditions related to aspen's role as a seral and as a climax species remain ill defined (Mueggler and Campbell 1986). In montane aspen forests, aspen comprise at least 50% of the tree canopy. It typically is less shade tolerant and shorter lived than most conifers of that zone. Thus, aspen stands that contain a substantial element of conifers are considered to be at a seral stage leading toward a conifer climax.

Riparian Woodland/Shrubland

Riparian woodland or shrubland ecological systems are linear systems confined to specific environments occurring on floodplains or terraces of rivers and streams, from steep narrow drainages to shallow broad valleys. In Archuleta County these systems occur from the lower montane zone into the subalpine zone. Although these combined riparian woodland/shrubland ecological systems occupy just over 2% of lands in Archuleta County they are scattered throughout the County, within a broad elevation range from approximately 6,000 to 11,000 feet (1825 to 3350m). These systems often occur as a mosaic of multiple communities that are either shrub- or tree dominated with a diverse shrub component. The variety of plant associations connected to these systems reflects elevation, stream gradient, floodplain width, and flooding events. When shrub-dominated, the primary cover may include thinleaf alder (*Alnus incana* ssp. *tenuifolia*), red-osier dogwood (*Cornus sericea*), water birch (*Betula occidentalis*), river hawthorn (*Crataegus rivularis*), silver buffaloberry (*Shepherdia argentea*), Bebb's, Booth's, Drummond's, Geyer's, Rocky Mountain, or planeleaf willows (*Salix bebbiana, S. boothii, S. drummondiana, S. geyeriana, S. monticola, S. planifolia*). When tree-dominated, the overstory may include narrowleaf cottonwood (*Populus angustifolia*), box elder (*Acer negundo*), Douglas-fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), quaking aspen (*Populus tremuloides*), or subalpine fir (*Abies lasiocarpa*) as the primary tree component. Generally the upland vegetation surrounding these riparian systems may include grasslands, upland shrublands, or conifer or aspen forests.

The primary ecological processes necessary to maintain these ecological systems are hydrology and more specifically surface flow, although ground water is important. Annual and episodic flooding is extremely important for maintaining a diversity of age classes of narrowleaf cottonwood as well as a mosaic of plant associations within any given floodplain (Richter *et al.* 1996). 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, such as mining or logging, may be important to the vertebrates and invertebrate species that use this system.

Montane Upland Shrubland/Grassland
The montane upland shrubland/grassland group is comprised of three systems: Gambel oak-mixed montane shrublands, lower montane-foothill shrublands, and montane–subalpine grasslands. These three ecological systems cover over 8% of Archuleta County lands and occur between approximately 5,000 and 9,500 feet (1525 and 2900 m) in elevation. They are most commonly found along canyon walls, dry foothills, lower mountain slopes, or on flat to rolling plains that are typically dry. The shrublands are often situated above pinyon-juniper woodlands or sagebrush shrublands, and may have scattered trees but are shrub dominated systems with a variety of shrubs including Gambel oak (*Quercus gambelii*), serviceberry (*Amelanchier* spp.), mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), skunkbush sumac (*Rhus trilobata*), or wax currant (*Ribes cereum*). The shrublands may occur as a mosaic of two or three plant associations often surrounded by grasslands or woodlands. The grassland system usually consists of a mosaic of two or three plant associations with one of the following dominant bunch grasses: oatgrasses (*Danthonia* spp.), fescues (*Festuca* spp.), slim-stem muhly (*Muhlenbergia filiculmis),* or bluebunch wheatgrass (*Pseudoroegneria spicata*). The sub-dominants include mountain muhly (*Muhlenbergia montana*), blue grama (*Bouteloua gracilis*), and Sandberg bluegrass (*Poa secunda*). Floristic composition varies with site characteristics and grazing history, and forbs tend to be more prominent at higher elevations and shrubs at lower elevations (Turner 1975).

Emergent Marsh/Wet Meadow
These two ecological systems comprise less than 1% of the lands in Archuleta County. Emergent marshes and wet meadows can be widely distributed in elevation and confined to specific environments defined primarily by hydrology. Physical disturbance during inundation (e.g., during flood events) may be significant for the structure and composition of both systems, but especially so for the wet meadow system. Emergent marshes are frequently or continually inundated, with water depths up to 6.5 feet (2 m). Water levels may be stable, or may fluctuate 3.2 feet (1 m) or more over the course of the growing season. Natural marshes may occur in depressions in the landscape (ponds, kettle ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes, also referred to as sloughs). Marshes have distinctive soils that are typically mineral soils but can also accumulate organic material. Soils have characteristics that result from long periods of anaerobic conditions (e.g., gleyed soils, high organic content, redoximorphic features). Marshes are characterized by herbaceous vegetation adapted to saturated soil conditions. Vegetation is typically emergent (rising out of the water) such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.), or submergent/floating such as pondweeds (*Potamogeton* spp.) and duckweeds (*Lemna* spp.). Most freshwater marshes are usually composed of mosaics of several plant associations and may be dominated by cattails, bulrushes, spikerushes (*Eleocharis* spp.), mannagrasses (*Glyceria* spp.), Rocky Mountain pond lily (*Nuphar lutea*), water smartweed (*Polygonum amphibium*), water crowfoot (*Batrachium sp.*), or bur-reeds (*Sparganium* spp.).

Water levels in wet meadow systems are often at or near the ground surface for much (or all) of the growing season, but may fluctuate considerably throughout the year. Surface inundation may occur, but typically does not last for long. Wet meadows are usually dominated by herbaceous graminoids, and occur on mineral soils that have typical hydric soil characteristics, including relatively high organic content and redoximorphic features. The surrounding landscape often contains other wetland systems, such as riparian shrublands, or a variety of upland systems from grasslands to forest. This system usually occurs as a mosaic of several plant associations, frequently dominated by bluejoint reedgrass (*Calamagrostis canadensis*), sedges (*Carex* spp.), spikerushes (*Eleocharis* spp.), or Baltic rush (*Juncus balticus* var. *montanus*).

Ponderosa Pine Woodland/Savanna and Grassland
In Archuleta County, this group is made up of the Ponderosa pine (*Pinus ponderosa*) woodland and savanna, as well as the foothill grassland ecological systems. These systems cover 50% of Archuleta County lands, and are primarily located in the foothills and montane zones from approximately 6,000 to 9,000 feet (1825 and 2750 m) on rolling plains or dry slopes with both north and south aspects. The northerly aspects may have a mixture of ponderosa pine and Douglas fir (*Pseudotsuga menziesii*), while the southerly aspects tend to be dominated by ponderosa pine savannas or open grasslands. A healthy ponderosa pine woodland or savanna often consists of open and park-like stands of trees dominated by ponderosa pine. The grassland component is fairly small in Archuleta County (0.4% of total land cover), with the ponderosa pine systems covering nearly half of the County. Understory vegetation in the ponderosa pine woodlands varies from shortgrass to tall shrubs like Gambel oak (*Quercus gambelii*) or grasses such as Arizona fescue (*Festuca arizonica*), and blue grama (*Bouteloua gracilis*). Savanna understories and open grasslands may be dominated by blue grama, mountain muhly (*Muhlenbergia montana*), western wheatgrass (*Pascopyrum smithii*), needle-and-thread grasses (*Hesperostipa* spp.), or Indian ricegrass (*Achnatherum hymenoides*).

Sagebrush Shrubland /Steppe
Sagebrush shrubland and steppe ecological systems occupy less than 1% of Archuleta County. These systems are usually found on flat to rolling hills between 7,000 and 10,000 feet (2150 to 3050 m) in elevation. Sagebrush shrubland differs from the sagebrush steppe in that the steppe is dominated by dwarf sagebrush rather than tall sagebrush. These dwarf shrublands are often found on poorly drained, low areated soils whereas the big sagebrush shrublands are usually on well drained and areated soils (Johnston 1997, Fosberg and Hironaka 1964 as cited in Johnston 1997). These two systems are characterized by a dense shrubland with a significant herbaceous understory. The dominant shrub species may include: mountain big sagebrush and black sagebrush (*Artemisia tridentata* ssp. *vaseyana, A. nova*), with occasional component shrubs, e.g., rabbitbrush (*Chrysothamnus* spp., *Ericameria nauseosa*), and antelope bitterbrush (*Purshia tridentata)*. Dominant herbaceous species may include: Arizona fescue (*Festuca arizonica*), Thurber fescue (*F. thurberi*), Great Basin wildrye (*Leymus cinereus*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needle and thread grass (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), elk sedge (*Carex geyeri*), and blue grama (*Bouteloua gracilis*).

Pinyon-Juniper Woodland/Savanna
Pinyon-juniper (*Pinus edulis-Juniperus* spp.) woodland and juniper woodland/savanna ecological systems occupy approximately 19% of Archuleta County lands, primarily in the southwestern portion of the County between 6,000 and 8,000 feet (1825 and 2440 m). Pinyon-juniper woodlands are typically dominated by a mix of pinyon and juniper, or pure or nearly pure stands of pinyon. Juniper woodlands and savannas are best described as having widely spaced mature (>150 years old) juniper trees and occasionally pinyon pine. Utah juniper or Rocky Mountain juniper (*Juniperus osteosperma, J. scopulorum*) are the dominant junipers. Both systems grow best just below the lower elevational range of ponderosa pine (*Pinus ponderosa*) and often intermingle with open grasslands and sagebrush (*Artemisia* spp.) shrublands. Pinyon woodlands often contain a small shrub component, with species such as sagebrush, Gambel oak (*Quercus gambelii*), antelope bitterbrush (*Purshia tridentata*), or mountain mahogany (*Cercocarpus montanus)*. Common herbaceous plants include: blue grama (*Bouteloua gracilis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Fendler’s bluegrass (*Poa fendleriana*), Arizona fescue (*Festuca arizonica*), and needle and thread grass (*Stipa comata*). Juniper woodlands and savannas have a similar shrub and herbaceous understory, but may also have succulent species present such as yucca or soapweed (*Yucca* spp.) or pricklypear cactus (*Opuntia* spp.).

Stands of pinyon exhibit considerable diversity in appearance and composition. Stands may consist of all ages or one age (Mehl 1992). Dominant trees are often 400 years old, and trees 800 to 1000 years old have been recorded (Mehl 1992). Some stands may have closed canopies with single or both tree species, with little or no understory, but many stands are open with widely scattered trees of one or both species with a wide variety of understory vegetation. The pinyon-juniper woodland is shade intolerant. It is the climax cover type remaining on the site until disturbed by fire. When disturbed by fire it will revert to grasses and eventually return to pinyon-juniper woodland (Mehl 1992).

Wetland and Riparian Vegetation

Wetland/riparian vegetation may be found within all of the zones discussed above. At the lowest elevations, along the major rivers, the dominant native vegetation is narrowleaf cottonwood (*Populus angustifolia*), with a subcanopy and understory supporting box-elder (*Acer negundo*), Rocky Mountain juniper (*Juniperus scopulorum*), thinleaf alder (*Alnus incana* ssp. *tenuifolia*), river hawthorn (*Crataegus rivularis*), silver buffalo berry (*Shepherdia argentea*), and several willow species (e.g., *Salix monticola*, *S. bebbiana*, *S. drummondiana*, *S. exigua*, *S. lucida* ssp. *lasiandra*, *S. ligulifolia*). It is common for the understory to contain hay grasses and native graminoids as well, such as fringes of Baltic rush (*Juncus balticus* var. *montanus*), field horsetail (*Equisetum arvense*) and scouring rush (*Equisetum laevigata*). At higher elevations, narrowleaf cottonwood is replaced by thinleaf alder, planeleaf willow (*S. planifolia*), Colorado blue spruce (*Picea pungens*), Engelmann spruce (*Picea engelmannii*), and quaking aspen (*Populus tremuloides*). Riparian forbs can make a lush thicket with tall growing plants such as cutleaf coneflower (*Rudbeckia laciniata* var. *ampla*), common cow parsnip (*Heracleum maximum*), Columbian monkshood (*Aconitum columbianum*), Porter's licorice root (*Ligusticum porteri*), and many others. Mesic sedges (e.g., *Carex utriculata, C. aquatilis*) can form dense stands along the banks of creeks and rivers, in depressional wetlands, and are often associated with beaver ponds.

Groundwater-supported middle elevation wetlands in Archuleta County occur in the fringes of stock reservoirs, or spring fed depressions. These areas may be dominated by broadleaf cattail (*Typha latifolia*), hardstem bulrush (*Schoenoplectus acutus* ssp. *acutus*) and various aquatic species including smartweeds (*Persicaria* spp.), burreeds (*Sparganium* spp.), water crowfoot (*Batrachium* sp.), and water plantain (*Alisma triviale*). Sedges (e.g., *Carex utriculata, C. atherodes, C. pellita; C. praegracilis*) and common spikerush (*Eleocharis palustris*) are common along the shorelines or in shallow water.

High elevation emergent wetlands typically occur on glaciated surfaces of volcanic materials. These alpine and subalpine wetlands are fed by snowmelt and precipitation. Dominant plants include tufted hairgrass (*Deschampsia cespitosa*), several sedges (*Carex canescens, C. vernacula, C. aquatilis, C. ebenea*) and tall cottongrass (*Eriophorum angustifolium*). Groundwater depressions and slope wetlands in the higher elevations of the subalpine or upper montane zones (typically above 9,000 feet/2750 m) often develop peat soils.

Middle elevation emergent wetlands are typically fed by surface water, groundwater, and overland sheetflow from neighboring hill slopes. Beaver activity has enhanced the emergent wetlands that are commonly occupied by beaked sedge (*Carex utriculata*), and submerged or floating aquatic species are often present in the more stable ponds. Emergent wetlands occur at lower elevations in patches, are greatly influenced by agriculture, residential and commercial development, and by irrigation water. Cattails and bulrush are the most common native plants observed.

Much of the riparian zone in the western part of the County has been invaded by non-native species, though compared to nearby counties the percent cover is still relatively low, providing a terrific opportunity for eradication of these species while their numbers are still manageable. Russian olive (*Elaeagnus angustifolia*) and saltcedar or tamarisk (*Tamarix ramosissima*) may occur around stock ponds, along irrigation ditches and ephemeral streams in the draws and canyons of the lower elevations, but are most frequently found along Stollsteimer Creek, the lower San Juan River and lower Piedra River, and along the shores of Navajo Reservoir where water levels fluctuate frequently. Eradication and monitoring are required to effectively manage for the extremely aggressive saltcedar, and moderately aggressive Russian olive. Other common invasive, non-native herbaceous species include Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), knapweeds (*Centaurea* spp.), sweet clover (*Melilotus officinalis; M. alba*), cheatgrass (*Bromus tectorum*) and smooth brome (*Bromus inermis*). Reed canarygrass (*Phalaris arundinacea*) is an aggressive native grass that has been introduced in lower elevation wetlands fed by irrigation ditches, reservoir tailwaters and backwater channels.

Disruption of the natural flood regime by dams, water diversion projects, and alteration of river channels as well as intensive grazing in riparian zones has severely impacted regeneration of cottonwoods, especially along the lower Piedra and San Juan Rivers. Large cottonwood trees are important for nesting and roosting of Bald Eagles, Great Blue Herons, and other birds. Protection of young cottonwoods, modification of grazing regimes, and planting new trees may be necessary to ensure replacement of older trees. Riparian areas along smaller streams in the canyons and mountains are also essential for wildlife. 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 *et al.* 1988). In Colorado, 27% of the breeding bird species depend on riparian habitats for their viability (Pague and Carter unpublished). Dense riparian vegetation provides a protected corridor for migration of deer and elk, as well as cover for smaller animals. Riparian areas generally have a greater diversity of plant species than surrounding uplands, and therefore provide forage, cover, and nesting sites for a wide variety of species. Along the smaller streams, grazing has altered much natural riparian vegetation. Fencing riparian habitat, rotational grazing, and other grazing management techniques may provide a successful strategy for riparian restoration.

Fauna

As with the ecological systems, the varied topography and climate in Archuleta County lead to a diversity of fauna. The junction of the Southern Rocky Mountain and the Colorado Plateau ecoregions supports a fauna representative of both the high alpine tundra and montane forests to mesas, plateaus and low-elevation canyons. This diverse mixture of geology and biology contributes to Archuleta County's ecological character. Transition zones like these tend to support higher levels of biological diversity than "non-transitional" areas (Armstrong 1972, Odum 1972, Brewer 1990).

No vertebrates or invertebrates are known to be endemic to the study area (Armstrong 1972, Ferris and Brown 1981, Woodling 1985, Kippenhan 1994, Andrews and Righter 1992, Hammerson 1999). The only globally rare or vulnerable insect species for Archuleta County is the Nokomis Fritillary (*Speyeria nokomis nokomis*) (CNHP 2005). Fish and their aquatic habitats have been highly impacted in Colorado due to water development, dam construction, and declines in water quality (Woodling 1985). Both the Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) and the Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) have been documented in breeding populations in several of the County's rivers, but populations of the Rio Grande chub (*Gila pandora*) and the roundtail chub (*Gila robusta*) are both scarce (CNHP 2005).

The final extirpations in the state of two predaceous mammals once native to Colorado are documented within fifteen miles of the Archuleta County borders. The last known wolf (*Canis lupus*) in Colorado was killed in the San Juan Mountains in 1943, just east of the eastern border of Archuleta County in Conejos County, near Platoro Reservoir (Gerhardt 2004). The last known grizzly bear (*Ursus arctos*) in the Southwest was killed in 1979, again just over the border in Conejos County, this time within the headwaters of the Navajo River (Brown 1985). It is not clear whether wolverine (*Gulo gulo*) still roam the South San Juan Wilderness, but reports of sightings still persist (Povilitis 2000). Canada Lynx (*Lynx canadensis*) has been re-introduced in the San Juan Mountains beginning in 1999 (CDNR-DOW 2006), and there are several documented accounts of their presence in Archuleta County. Another species reintroduced in the 1970's in Archuleta County is the river otter (*Lontra canadensis*). Among several other western Colorado drainages, it was released the Piedra River where its presence continues to be documented (CDNR-DOW 2006). Coyote (*Canis latrans*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*) are all well known in the area, as are large ungulate prey animals such as mule deer (*Odocoileus hemionus*) and elk (*Cervus elephus*), which summer in the montane and subalpine forests of the San Juan Mountains and winter in the lower elevations of the County in large herd numbers.

The mixture of bird species in Archuleta County is very diverse. Species typical of the pinyon-juniper zone such as Brewer's Sparrow (*Spizella breweri*) and Western Scrub Jay (*Aphelocoma californica)* are found in close proximity to species with ponderosa pine community affinities such as Lewis' Woodpecker (*Melanerpes lewis*) and Western and Mountain Bluebirds (*Sialia mexicana*, *S. currucoides*). Montane woodland species such as Steller's Jay (*Cyanocitta stelleri*), White-breasted Nuthatch (*Sitta carolinensis*), and Hermit Thrush (*Catharus guttatus*) are also common. Species that are associated with riparian and wetland areas such as Black Swift (*Cypseloides niger*), American Dipper (*Cinclus mexicanus*) and wood warblers such as Wilson's Warbler (*Wilsonia pusilla*) were seen or heard with varied frequency during the field study. A large variety of passerine species are known to breed in the study area. Common waterfowl include Canada Goose (*Branta canadensis*), Mallard (*Anas platyrhynchos*), and Blue-winged Teal (*Anas discors*). Shorebirds are less common, but Great Blue Heron (*Ardea herodias*) and Spotted Sandpiper (*Actitis maculara*) were regularly seen along shorelines and riverbanks during the study, and at least one heron rookery is known in the County. Several nesting locations of Peregrine Falcon (*Falco peregrinus*), a state species of special concern, are documented across the County (CNHP 2005). Many other raptors, including Northern Harrier (*Circus cyaneus*), Golden Eagle (*Aquila chrysaetos*), Bald Eagle (*Haliaeetus leucocephalus*) and a variety of hawks can also be seen roosting and soaring over many parts of the County.

Amphibians are naturally rare in much of the County due to the predominantly xeric upland conditions. However, tiger salamanders (*Ambystoma tigrinum*) can be found across the County in natural ponds and small lakes as well as in stockponds. Other amphibians documented in montane ponds and waterways in Archuleta County include Woodhouse's toad (*Bufo woodhousii*), western chorus frog (*Pseudacris triseriata)*, and northern leopard frog (*Rana pipiens*). Historic records of boreal toad (*Bufo boreas*) also occur in the County, but the species has not been recently documented. Reptiles such as painted turtle (*Chrysemys picta*), short-horned lizard (*Phrynosoma hernandesi*), southern plateau (or fence) lizard (*Sceloporus undulatus tristichus*), bullsnake (*Pituophis catenifer*), western terrestrial garter snake (*Thamnophis elegans*), and western rattlesnake (*Crotalus viridis*) are commonly encountered across the County (Hammerson 1999).

CONSERVATION ASSESSMENT

Potential Impacts to Biological Diversity in Archuleta County

General threats that may affect biodiversity on a large, landscape-level scale in Archuleta County are summarized below. We understand that the issues discussed below are often important parts of a healthy economy and contribute to the well being of our society. We mention these general "impacts to biodiversity" with the hope that good planning can minimize the impacts where critical habitat resides.

Hydrological Modifications

Hydrological alteration in the form of water impoundment in lakes, reservoirs, irrigation ditches and canals, as well as major diversion projects which take water out of the basin entirely, can affect aquatic dependent plants and animals (Chien 1985, Friedman *et al.* 1998). Annual flooding is a natural ecological process that can be severely altered by the construction of dams, reservoirs, major diversion projects and other water diversions such as local irrigation ditches. These water diversions and impoundments have altered the normal high peak flows that were once a part of the natural hydrological regimes of the rivers and their tributaries in Archuleta County. These periodic floods are necessary for continued viability of most riparian vegetation. For example, many plants, including cottonwood trees, reproduce primarily with flooding events (Rood and Mahoney 1993). As plant composition changes in response to alterations in the flooding regime, the composition of the aquatic and terrestrial fauna may also change.

In addition to impoundment, rivers have also been altered by stream bank stabilization projects (e.g., channelization) (Rosgen 1996), which often intend to limit or stop erosion that threatens private or public property. Most streams and rivers are dynamic and inherently move across the land. Stabilizing or channelizing stream banks forces the river to stay in one place and often leads to changes in riparian ecology and more serious destruction downstream. It is also well known that different plant communities require different geomorphologic settings. For example, point bars are required for some species of willows to regenerate, terraces are required for mature cottonwood/shrubland forests, and old oxbow reaches may eventually provide habitat for many wetland communities. By stabilizing a river, the creation of these geomorphic settings is often eliminated. Thus, the plant communities that require such fluvial processes are no longer able to regenerate or survive. In general, the cumulative effects from dams, reservoirs, and channelization on plant communities have caused a gradual shift from diverse multi-aged riparian woodlands to mature single-aged forest canopies.

Many wetlands not directly associated with fluvial processes (e.g., seeps and springs) have been altered by irrigation practices, water diversions, and groundwater withdrawals. However, the increase of irrigated agriculture in Archuleta County since European settlement has inadvertently created many new wetlands in areas where wetland never existed, and at the same time has destroyed many existing wetlands. For example, seepage from the miles of unlined canals and earthen ditches, and much of the water applied in irrigation contributes to groundwater recharge and surface water runoff. As a result, many areas have developed wetland characteristics where none existed prior to irrigation. Conversely, many historical wetlands including seeps and springs have been lost or altered due to water "development" projects, such as water diversions or impoundments (e.g., stock ponds). Thus, as the quality and extent of historical wetlands diminished, some of the habitat loss was offset by irrigation-induced wetlands. It is debatable whether the biodiversity significance o fan integrated network of river bottom wetlands, sinuous marshy stream, and extensive intact seep and spring wetlands can be equated to the dispersed pattern of irrigation –induced wetlands across an agricultural landscape. For example, the number of species supported by a manmade pond with minimal edge habitat is generally less than the number supported by an extensive intact seep and spring wetland or naturally occurring pond.

Development

Residential development is increasing in Archuleta County, especially near Pagosa Springs, Chama, and Arboles; along the Highway 160, Highway 84 and Highway 151 corridors; and throughout other rural areas of the County. Development creates a number of stresses, including habitat loss and fragmentation, introduction and proliferation of non-native species, fire suppression, and predation and disturbance from domestic animals (dogs and cats) (Oxley *et al*. 1974, Coleman and Temple 1995). Increasing human density in an area can lead to a change in the composition of wildlife populations (e.g., numbers of foxes and coyotes may increase, or number of bird species present may decrease), and may also alter movement patterns and behavior of wildlife. Loss of habitat to development is considered irreversible.

Roads

There is a complex network of roads in many parts of Archuleta County due primarily to agricultural uses, residential development, past timber harvests, and recreational uses. Expansion of the existing road network in some areas will detrimentally affect the biodiversity of the region. Roads are associated with a wide variety of impacts to natural communities, including invasion by non-native plant species, increased depredation and parasitism of bird nests, increased impacts of pets, fragmentation of habitats, erosion, pollution, and road mortality (Noss *et al*. 1997).

Roads function as conduits, barriers, habitats, sources, and sinks for some species and populations of species (Forman 1995). Road networks crossing landscapes can increase erosion and alter local hydrological regimes. Runoff from roads may impact local vegetation via contribution of petroleum products, heavy metals, and sediments. Road networks interrupt horizontal ecological flows, alter landscape spatial patterns, and therefore inhibit important interior species (Forman and Alexander 1998).

Effects on wildlife can be attributed to road avoidance and mortality due to vehicular collisions (roadkill). Traffic noise appears to be the most important variable in road avoidance, although visual disturbance, pollutants, and predators moving along a road are alternative hypotheses as to the cause of avoidance (Forman and Alexander 1998). Songbirds appear to be sensitive to remarkably low noise levels, even to noise levels similar to that of a library reading room (Reijnen *et al*. 1995).

Recreation

Recreation, once very local and perhaps even unnoticeable, is increasing and becoming a threat to natural ecosystems in Archuleta County. Different types of recreation (e.g., motorized versus non-motorized activities) typically have different effects on ecosystem processes. All-terrain vehicles can disrupt migration and breeding patterns, and fragment habitat for native resident species. This activity can also threaten rare plants found in forested and non-forested areas. ATVs have also been identified as a vector for the invasion of non-native plant species.

Non-motorized recreation, mostly hiking but also some horseback riding, mountain biking and rock climbing, presents a different set of issues (Cole and Knight 1990, Knight and Cole 1991; Miller *et al.* 1998, 2001). Wildlife behavior can be significantly altered by repeat visits of hikers, horseback riders, or bicyclists. Trail placement should consider the range of potential impacts on the ecosystem. Considerations include minimizing fragmentation by leaving large undisturbed areas of wildlife habitat where possible (CDNR 1998). Miller *et al.* (1998) found lower nest survival for ground-nesting birds adjacent to trails; they also found that ground-nesting birds were more likely to nest away from trails with a zone of influence approximating 250 feet (75 meters). Alpine areas, mountain lakes, and riparian zones are routes and destinations for many established trails. Thus, impacts to native vegetation (mainly trampling) in these areas can be high.

Livestock Grazing

Domestic livestock grazing has been a traditional livelihood in Archuleta County since the mid 1800s and has left a broad and sometimes subtle impact on the landscape. For some species, properly managed grazing can be a compatible activity. However, some range management practices can adversely affect the region's biological resources. Many riparian areas in Archuleta County are included in rangeland and grazing allotments. Especially at lower elevations in the County, livestock tend to congregate near wetland and riparian areas for shade, lush browse, and access to water. Long-term, incompatible livestock use of wetland and riparian areas can potentially erode stream banks, cause streams to downcut or spread out of an established channel causing additional erosion, lower the water table, alter channel morphology, impair plant regeneration, establish non-native species, shift community structure and composition, degrade water quality, and diminish general riparian and wetland functions (Windell *et al*. 1986). Depending on grazing practices and local environmental conditions, impacts can be minimal and largely reversible (slight shifts in species composition) to severe and essentially irreversible (extensive gullying and introduction of non-native forage species).

Mining

In response to Colorado's rapid growth rate, aggregate mining throughout the state has increased by over 30% since 1993 (Macalady 2000). Gravel mining is a small but noticeable industry in parts of Archuleta County, and its impacts are of concern for wetland and riparian areas. Floodplain gravel mines remove riparian vegetation and shallow, bottomland habitat and replace them with deepwater ponds. The removal of riparian vegetation coupled with the increase in non-native plant species has decreased essential habitat for numerous species, especially avian species (Macalady 2000). Alternatives exist to minimize impacts associated with gravel mining such as improved reclamation efforts, targeting terrace deposits, utilizing crushed stone and recycled materials such as asphalt (Macalady 2000).

Logging

Most logging operations require a network of roads. The impacts from roads can result in threats to biodiversity (see "Roads" for more detailed discussion). Other logging impacts include loss of wildlife habitat, habitat fragmentation, soil erosion, and lower water quality for aquatic species. The U.S. Forest Service monitors logging closely; nonetheless, problems can still occur (Husong and Alves 1998). The effects of logging on biodiversity have not been determined in Archuleta County.

Fragmentation and Edge Effects

Edges are simply the outer boundary of an ecosystem that abruptly grades into another type of habitat, such as the edge of a Gambel oak shrubland adjacent to a grassland (Forman and Godron 1986). Edges are often created by naturally occurring processes such as floods, fires, and wind. Edges can also be created by human activities such as roads, trails, timber harvesting, agricultural practices, and rangeland management. Human induced edges are often dominated by plant and animal species that are adapted to disturbance. As the landscape is increasingly fragmented by large-scale, rapid anthropogenic conversion, these edges become increasingly abundant in areas that may have had few "natural" edges. The overall reduction of large landscapes jeopardizes the existence of specialist species, may increase non-native species, and may limit the mobility of species that require large landscapes or a diversity of landscapes for their survival (e.g., large mammals or migratory waterbirds).

Non-native Species

Invasion of non-native and aggressive species, and their replacement of native species, is one of the biggest threats to Archuleta County's natural diversity (James 1993; D'Antonio and Vitousek 1992). Non-native plants or animals can have wide-ranging impacts. Non-native plants can increase dramatically under the right conditions and dominate a previously natural area (e.g., scraped roadsides). This can generate secondary effects on animals (particularly invertebrates) that depend on native plant species for forage, cover, or propagation. Effects of non-native fishes include competition that can lead to local extinctions of native fishes and hybridization that corrupts the genetic stock of the native fishes.

Although complete eradication of non-native aggressive species is not possible, some control efforts can pay off. Regarding non-native invasive plant species, one important guideline is that when a plant is removed, something will take its place, that is, "Ecological voids do not exist" (Young 1981). Simply killing aggressive non-native plant species, unless there is a seed source for desirable replacements, will result in more unwanted species, perhaps even more noxious than those removed. Seeding of desirable plant species is usually necessary. When seeding, it is important to consider seedbed characteristics including rock cover, and the potential of the soil to support the planted species. A first step is to assess the current vegetation, in relation to the potential of the site. For example, former attempts to control salt lover (*Halogeton glomeratus*) were given up because land managers were unable to come up with a desirable species to replace it, especially on saline or alkaline soils (Young 1981). One approach is to experiment on a small scale to determine the potential success of a weed control/seeding project, using native plant species. Ideally, seed should be harvested locally. A mixture of native grasses and forbs is desirable, so that each species may succeed in the microhabitat for which it is best suited. In general, lower elevations of the County are more affected by non-native and aggressive plant species than higher elevations, and level valley bottoms more than steep slopes. Most of the major river corridors, and many of their tributaries have been invaded by pasture grasses. Non-native species that are commonly found in or near Archuleta County wetlands include:

GRAMINOIDS
Redtop (*Agrostis gigantean*)
Cheatgrass (*Bromus tectorum*)
Smooth brome (*Bromus inermis*)
Orchard grass (*Dactylis glomerata*)
Reed canarygrass (*Phalaris arundinacea*)
Timothy (*Phleum pratense*)
Kentucky bluegrass (*Poa pratensis*)

SHRUBS/TREES
Saltcedar (*Tamarix ramosissima*)
Russian olive (*Elaeagnus angustifolia*)

FORBS
Black medic (*Medicago lupulina*)
Tumble mustard (*Sisymbrium* spp.)
White Dutch clover (*Trifolium repens*)
Red clover (*Trifolium pretense*)
Common mullein (*Verbascum thapsus*)
Rough cocklebur (*Xanthium strumarium*)
Burdock (*Arctium minus)*
Spotted knapweed (*Centaurea biebersteinii*)
Yellow and White sweet clover (M*elilotus officinalis, M. alba*))
Musk thistle (*Carduus nutans*)
Canada thistle (*Cirsium arvense*)
Field bindweed (*Convolvulus arvensis*)
Tansy-mustard (*Descurainia* spp.)
Oxeye daisy (*Leucanthemum vulgare*)
Yellow toadflax (*Linaria vulgaris*)
Mountain tarweed (*Madia glomerata*)
Common dandelion (*Taraxacum officinale*)

Natural Processes
A long drought in Archuleta County and throughout the region culminated in 2002, after several years of below average precipitation. Snowpack and spring runoff levels in 2005 were above average, but the lingering long-term effects of drought are many and varied. It is unknown how severe or limiting the stress from drought is on long-term wetland vegetation viability.

Beetle killed and damaged trees in the spruce-fir forests of Archuleta County are beginning to be more common. The problem is not yet widespread, but some neighboring regions are severely affected. Although no Potential Conservation Area sites profiled in this report contain severe beetle damaged tree stands, or are surrounded by forest with a large cover of beetle damage, Archuleta County forests are threatened by this devastating ecological process. Bark beetles target stressed, weakened or dying trees (Day 1996), and after years of drought conditions, conifer forests in Archuleta County could be a suitable target. Pine beetles and/or disease have already had a severe impact on the population of pinyon pine, an upland species found in the southwest portion of the County.

Recommended Conservation Strategies

Conservation Strategies can be classified as three major types:

1. Land protection accomplished through conservation easements, land exchanges, long term leases, purchase of mineral or grazing rights, acquisition, or government regulation;

2. Management of the land influenced so that significant resources are protected; and

3. Public education about the significant ecological values of the County to engender support for land use decisions that protect these values.

The first step in facilitating any of the conservation strategies suggested above is to identify the significant elements of biodiversity and their locations in the County. This report and the accompanying GIS data provide information necessary for this first step. The next step is to use this information to conserve these elements and the areas that support them. The PCA descriptions within this report provide protection and management suggestions for most areas identified during the inventory. However, some general recommendations for conservation of biological diversity in Archuleta County are given here.

1). Develop and implement a plan for protecting the Potential Conservation Areas profiled in this report, with most attention directed toward areas with a biodiversity rank of B1, B2 and B3. The PCAs in this report provide a basic framework for implementing a comprehensive conservation program. The B2 and B3 sites (there are no B1 sites documented in this report), because they have global biological significance, are in need of priority attention. Consider incentive-based programs such as purchasing development rights or outright purchase from willing owners of land for significant sites that are in need of protection. Support local organizations, such as land trusts, in purchasing or acquiring conservation easements for protection of biological diversity or open space. Explore opportunities to form partnerships to access state and federal funding for conservation projects, such as those offered through the Colorado Division of Wildlife or the Farm Bill. Continue to promote cooperation among local entities to preserve the County's biodiversity. Encourage County leadership to institutionalize consideration of significant biological resources in land use planning.

2). Use this report in the review of proposed activities in or near Potential Conservation Areas to determine whether or not activities adversely affect elements of biodiversity. All of the PCAs presented contain elements of biodiversity of state or global significance. Weighing the biodiversity represented by PCAs should allow planners and biologists to consider natural resource conservation when making land use decisions.

Certain land uses on or near a site may affect the element(s) present there. Range-restricted species may be especially vulnerable to habitat destruction, while wetland and riparian areas are particularly susceptible to impacts from off-site activities if the activities affect water quality or hydrologic regimes. In addition, cumulative impacts from many small changes can have effects as profound and far-reaching as one large change. As proposed land use changes are considered, they should be compared to the maps presented herein (also available in GIS format). If a proposed project has the potential to impact a site, planning personnel should contact persons, organizations, or agencies with the appropriate biological expertise for input in the planning process. The Colorado Natural Heritage Program routinely conducts site-specific environmental reviews and should be considered a valuable resource. Also, CNHP is continually updating biodiversity data throughout the state and can provide up-to-date information in the area of concern. To contact CNHP's Environmental Review Coordinator call (970) 491-7331. Other key partners, such as the Colorado Division of Wildlife, can be valuable resources as well, particularly in evaluating potential impacts to biological resources not tracked by CNHP (e.g., game species).

3). Recognize the importance of larger, contiguous natural communities. While the PCAs identified in this report contain known locations of significant elements of natural diversity, protection of large areas in each vegetation type, especially where these are connected, may ensure that we do not lose species that have not yet been located. Work to protect large blocks of land in each of the major vegetation types in the County, and avoid fragmenting large natural areas unnecessarily with roads, trails, etc. Although large migrating animals like deer and elk are not tracked by CNHP as rare species, they are part of our natural diversity, and their needs for winter range and access to protected corridors to food and water should be taken into consideration.

Fragmentation of the landscape also affects smaller animals and plants, opening more edge habitats and introducing exotic species. Encourage cluster developments that designate large common areas for preservation of natural communities, as an alternative to scattering residences over the landscape with a house on each 35-acre parcel. Work with developers early in the planning process to educate them about the benefits of retaining natural areas. Locate trails and roads to minimize impacts on native plants and animals. See Forman and Alexander (1998) for an excellent review of the literature on the ecological effects of roads. See *Planning Trails with Wildlife in Mind* published by the State Trails Program (CDNR 1998) for suggestions regarding planning trails with minimum impacts to wildlife.

4). Increase efforts to protect biodiversity by promoting cooperation and incentives among landowners, pertinent government agencies, and non-profit conservation organizations. Involve all stakeholders in land use planning. The long-term protection of natural diversity in Archuleta County will be facilitated by the cooperation of private landowners, businesses, government agencies, and non-government organizations. Efforts to provide stronger ties among federal, state, local, and private interests involved in the protection or management of natural lands will increase the chance of success. By developing incentives that encourage biodiversity considerations in land-use planning, the likelihood of conserving biodiversity should increase. Such incentives will make planning for conservation a higher priority for private and public entities.

5). Promote wise management of the biodiversity resources that exist within Potential Conservation Areas. Development of a site-specific conservation plan is a necessary component of the long-term protection of a PCA. Because some of the most serious impacts to Archuleta County's ecosystems are at a large scale (e.g., altered hydrology, residential encroachment, and non-native species invasion), considering each area in the context of its surroundings is critical. Several organizations and agencies are available for consultation in the development of conservation plans, including the Colorado Natural Heritage Program, the Colorado Division of Wildlife, the Natural Resources Conservation Service, The Nature Conservancy, and various academic institutions. With the current rate of population growth in Colorado, rare and imperiled species will likely decline if not given appropriate protection or management attention. Coordinate with managers of public parks or other public lands that support sensitive biological resources. Engage local citizens, groups, and organizations (e.g., schools, 4-H clubs, Colorado Native Plant Society) in assisting with management and monitoring projects on public lands. Make a concerted effort to involve individual landowners in conservation dialogue, as applicable.

6). Stay informed and involved in public land management decisions. Approximately 52 percent of Archuleta County is publicly owned. The U.S. Forest Service owns approximately 50 percent, and the Bureau of Land Management, the Bureau of Reclamation, and the State of Colorado collectively own less than 2 percent. Many of the PCAs in Archuleta County are on public land and may be protected from development, but not from incompatible uses. Even ownership is not always secure, since federal and state agencies are becoming more and more involved in land exchanges. Encourage protection for the most biologically significant sites on public lands by implementing compatible management activities designated in Forest Management Plans, Grazing Management Plans, etc.

7). Continue inventories and monitoring where necessary, including inventories for species that cannot be surveyed adequately in one field season and continue inventories on lands that CNHP could not access in 2005. Not all targeted inventory areas can be surveyed in one field season due to several factors, including lack of access, phenology of species, or time constraints. Because some species are ephemeral or migratory, completing an inventory in one field season is often difficult. Despite the best efforts during one field season, it is likely that some elements were not documented during the survey. Thus, it is recommended that this report and the data included within it serve as a guide for subsequent surveys of Archuleta County.

8). Continue to take a proactive approach to weed and exotic species control. Recognize that weeds affect both agriculture and native plant communities. Discourage the introduction and/or sale of non-native species that are known to significantly impact natural areas. These include, but are not limited to, exotic, invasive species such as tamarisk, Russian olive, yellow toadflax, purple loosestrife, and stocking of non-native fish species. Further, natural area managers, public agencies, and private landowners should be encouraged to remove these species from their properties. Enforce the use of weed-free forage on horse trails, campgrounds, and at trailheads. Encourage the use of native species for revegetation and landscaping efforts. Ideally, seed should be locally harvested. This includes any seeding done on County road right-of-ways. The Colorado Natural Areas Program has published a book entitled *Native Plant Revegetation Guide for Colorado* that describes appropriate species to be used for revegetation. This resource is available at http://parks.state.co.us/cnap/Revegetation_Guide/Reveg_index.html.

9). Encourage public education functions and publications. A significant early step in the process of conserving biodiversity is educating local citizens and other stakeholders on the value that such areas offer the public. As described in this report, Archuleta County is rich in animal and plant diversity. Conveying the value and function of these habitats and the species that inhabit them to the public can generate greater interest in conserving lands. Conducting forums or presentations that highlight the biodiversity of Archuleta County should increase awareness of the uniqueness of the habitats within the County. Similarly, providing educational pamphlets or newsletters that explain why these areas are so valuable can increase public interest and support for biodiversity conservation. Consider developing a community conservation website to provide information on natural resource, biological diversity, and conservation opportunities in Archuleta County. Enlist the assistance of local media in public education efforts.

10). Develop and implement comprehensive program to address loss of wetlands. In conjunction with the information contained in this report, information regarding the degree and trend of loss for all wetland types (i.e., emergent marshes, riparian shrublands and forests, seeps/springs, etc.) should be sought and utilized to design and implement a comprehensive approach to the management and protection of Archuleta County wetlands. Encourage and support statewide wetland protection efforts such as the Colorado Division of Wildlife's Wetlands Program. County governments are encouraged to support research efforts on wetlands to aid in their conservation. Countywide education on the importance of wetlands could be implemented through the County extension service or other local agencies. Encourage communication and cooperation with landowners regarding protection of wetlands in Archuleta County, and utilize the expertise and breadth of experience within the Southwest Wetland Focus Area Committee.

METHODS

The primary objective for the survey was to visit every wetland type at various geomorphic positions and elevations within Archuleta County. Site selection targeted wetlands occurring on private lands, and identification during the field season of the highest quality occurrences of each wetland type. CNHP defines wetland types using wetland and riparian plant associations, whereas most other classifications applied to wetlands in Colorado and across the nation discriminate wetlands based primarily on the physiognomy (physical structure) of the vegetation. Broad structural classes, however, do not recognize the relative rarity of a plant species or of plant associations found within a specific study area. Plant associations reflect the broad nature of wetlands in the study area (e.g., willow carr, sedge meadow, cottonwood riparian forest, etc.), while also mirroring the local nature of wetlands in the watershed.

Collect Available Information

CNHP databases were updated with information regarding the known locations of species and significant plant associations within Archuleta County. A variety of information sources were searched for this information. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado, and the Rocky Mountain Herbarium.

The Colorado Natural Heritage Program utilizes pertinent and available information for County wetland survey and assessment projects. These maps were provided to CNHP by the DOW and were used during this survey as additional tools for identification of wetland and riparian habitats.

Both general and specific literature sources were incorporated into CNHP databases as either locational information or as biological data pertaining to a species in general. Such information covers basic species and community biology including range, habitat, phenology (timing), food sources, and substrates. This information was entered into CNHP's Biodiversity Tracking and Conservation System (BIOTICS).

Identify rare or imperiled species and significant plant associations with potential to occur in Archuleta County

The list of plant associations thought to occur in Archuleta County was derived from the Colorado Statewide Wetland Classification and Characterization project (CSWCC) (Carsey *et al*. 2003b), which is based on the International Vegetation Classification (Anderson *et al.* 1998; Grossman *et al*. 1998), the accepted international standard for vegetation. The CSWCC utilized and integrated previously collected data from the Classification of Riparian Wetland Plant Associations of Colorado (Kittel *et al*. 1999), CNHP wetland surveys, and Dr. David Cooper, Colorado State University. The CSWCC incorporated all these data on riparian and other wetlands collected during the past 14 years as well as data from other researchers to avoid duplication of effort.

The information collected in the previous step was used to refine the potential element list and to refine our search areas. In general, species and plant associations that have been recorded from Archuleta County, or from adjacent counties, are included in this list. Species or plant associations that prefer habitats not included in this study area were removed from the list. The list includes those elements currently monitored by CNHP that were thought to potentially occur in Archuleta County and were therefore targeted in CNHP field inventories.

The amount of effort given to the inventory for each of these elements was prioritized according to the element's rank. Globally rare (G1-G3) elements were given highest priority; state rare (S1-S3) elements were secondary.

Identify Targeted Inventory Areas
Survey sites or Targeted Inventory Areas (TIAs) were chosen based on their likelihood of harboring rare or imperiled species or significant plant associations. Known locations were targeted, and additional potential areas were chosen using a variety of information sources, such as aerial photography. Precisely known element locations were always included so that they could be verified and updated. Many locations were not precisely known due to ambiguities in the original data, e.g., "headwaters of Cataract Creek." In such cases, survey sites for that element were chosen in likely areas in the general vicinity.

Areas with potentially high natural values were chosen using a variety of tools, including aerial photographs, geology maps, soils maps, DOW riparian maps for a portion of the County, and other vegetation surveys and maps. Aerial photography is perhaps the most useful tool in this step of the process. General habitat types can be discerned from the aerial photographs, and those chosen for survey sites were those that appeared to be in the most natural condition. In general, this means those sites that are the largest, least fragmented, and mostly free of visible disturbances such as roads, trails, fences, quarries, etc. Geology, soils, and vegetation maps assisted staff in understanding where potential wetlands and riparian systems might occur across the county.

Also critical in the process of identifying TIAs were consultations with the Colorado Division of Wildlife, the Southwest Wetland Focus Area Committee, the Southern Ute Indian Tribe, the Southwest Land Alliance, the US Forest Service-San Juan National Forest Pagosa and Columbine Ranger Districts, the Natural Resources Conservation Service-Pagosa District and from personal recommendations from knowledgeable local residents. Without the insight of these persons, the survey would not have been nearly as efficient and successful in covering such a variety of areas across this large county.

Numerous roadside surveys by the field scientists were also conducted to assist in identifying additional areas to assess. Roadside surveys are useful in resolving the natural condition of areas initially identified through aerial photos, maps, or recommendations. The condition of wetlands can be especially difficult to discern from aerial photographs, and a quick survey from the road can reveal such features as weed infestation or overgrazing which may rule out the need for any further research time at a site.

Priority in site visitation was given to wetland and riparian areas occurring on private land, including Southern Ute Indian Tribal lands. Some emphasis was placed on revisiting and updating the status of previously visited sites documented over 10 years ago, as well as exploring areas of the county not previously covered in earlier surveys.

Because of the overwhelming number of potential sites and limited resources, surveys for all elements were prioritized by the degree of imperilment. For example, all species with Natural Heritage ranks of G1-G3 were the primary target of our field inventory efforts. Although species with lower Natural Heritage ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented as they were encountered.

Contact Landowners

Attaining permission to conduct surveys on private property was essential to this project. Once survey sites were chosen, land ownership of these areas was determined using records at the Archuleta County assessor's office. Landowners were then contacted by telephone. If landowners could not be contacted, or if permission to access the property was denied, this was recorded and the site was not visited. **Under no circumstances were properties surveyed without landowner permission.**

Conduct Field Surveys and Gather Data

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

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

Amphibians: visual or with aquatic nets

Birds: visual or by song/call, evidence of breeding sought

Wetland plant associations: visual canopy cover estimates, collection by qualitative or quantitative composition, soil, hydrological, and function data

When necessary and permitted, voucher specimens of wetland and/or riparian plant species were collected and deposited in the Colorado State University herbarium. For the Archuleta County survey, bird, amphibian, reptile, insect and fish species information was utilized from past surveys conducted by CNHP and other agency personnel.

When a rare species or significant natural plant community was discovered, its precise location and known extent was recorded on a Garmin 12 Geographic Position System (GPS) instrument and on 1:24,000 scale topographic maps. Other data recorded at each occurrence included numbers observed, flowering/fruiting status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the quality (size, vigor, etc.) of the population or community, the condition or naturalness of the habitat, the long-term viability of the population or community, and the defensibility (ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, which is useful in refining conservation priorities. For more information about element occurrence ranking, refer to the Natural Heritage Network and Biological Diversity section within this report.

Site visits and assessments were conducted on the following two levels:

1). Roadside or adjacent land assessments. Many of the sites could be viewed at a distance from a public road or from adjacent public land. While on the ground the field scientist can see, even from a distance, many features not apparent on maps and aerial photos. The road assessments determined the extent of human and livestock impacts on the survey area, which included ditching, adventive plant species, plant species indicative of intensive livestock use, stream bank destabilization, major hydrologic alterations, excessive cover of non-native plant species, or new construction. Sites with one or more of these characteristics were generally excluded as potential conservation areas and no extensive data were gathered at these areas. If roadside assessments of private lands yielded the potential presence of an element occurrence, landowner contact was initiated, and if permission was given, an on-site assessment was performed.

2). On-site assessments. On-site assessment was the preferred method, as it is the only assessment technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common associations. On-site assessments are also the most resource intensive because of the effort required to contact landowners. In several cases where on-site assessments were desired, they could not be conducted because either field personnel were denied access to the property by the landowner, or CNHP was unable to contact the landowner during the time frame of this study.

During on-site assessments, the following information was collected for the PCAs in this report:

General Field Information

- A list of all plant associations in the wetland complex, including the amount of wetland area covered by that community. In almost all cases, plant associations were immediately placed within CNHP's Statewide Wetland Classification.
- Vegetation data for each major plant association in the wetland were collected using visual ocular estimates of species cover in a representative portion of the plant association
- A sketch of the site layout, with distribution of plant community types indicated (this was generally done on the 7.5-min. USGS topographic map, but occasionally for clarity a separate map was drawn on the site survey form).
- UTM coordinates from Garmin GPS 12 Personal Navigator.
- Elevation (from 7.5-min. USGS topographic maps and GPS).
- Current and historic land use (e.g., grazing, logging, recreational use) when apparent.
- Notes on geology and geomorphology.
- Reference photos of the site.
- Indicators of disturbance such as logging, grazing, flooding, etc.

Natural Heritage Information

- A list of elements present or expected at the site
- Element occurrence (EO) ranks or information that will lead to EO Rank
- Proposed conservation area boundaries

General Wetland Information

- Proposed HGM Class and Subclass
- Water source
- Hydroperiod
- General soils description (these are based on either a detailed description of a soil profile in the field (e.g., horizons, texture, color, cobble size, percent mottling) or from information from the county soil surveys.

Delineate Potential Conservation Area Boundaries

Finally, since the objective for this inventory is to prioritize specific areas for conservation efforts, potential conservation area boundaries were delineated. Such a boundary is an estimation of the minimum area needed to assure persistence of the element. 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 site or the element may call for alterations of the boundaries.

RESULTS

Results of the 2005 survey of Archuleta County riparian and wetland areas confirmed that there are many biologically significant areas that support wetland-dependent species and plant communities. Three animals, 8 rare or imperiled plants, and 40 significant wetland or riparian plant communities were documented within Potential Conservation Areas (PCAs) (Table 8). An additional 5 animals, 1 insect, and 4 plant communities are also documented in Archuleta County but are not included within a PCA (Table 9).

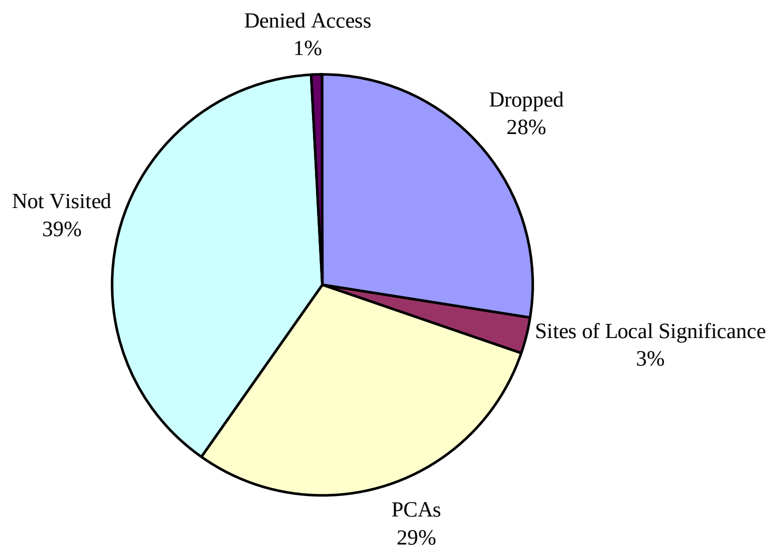


Figure 9. Summary of Targeted Inventory Areas (TIAs) for Archuleta County.

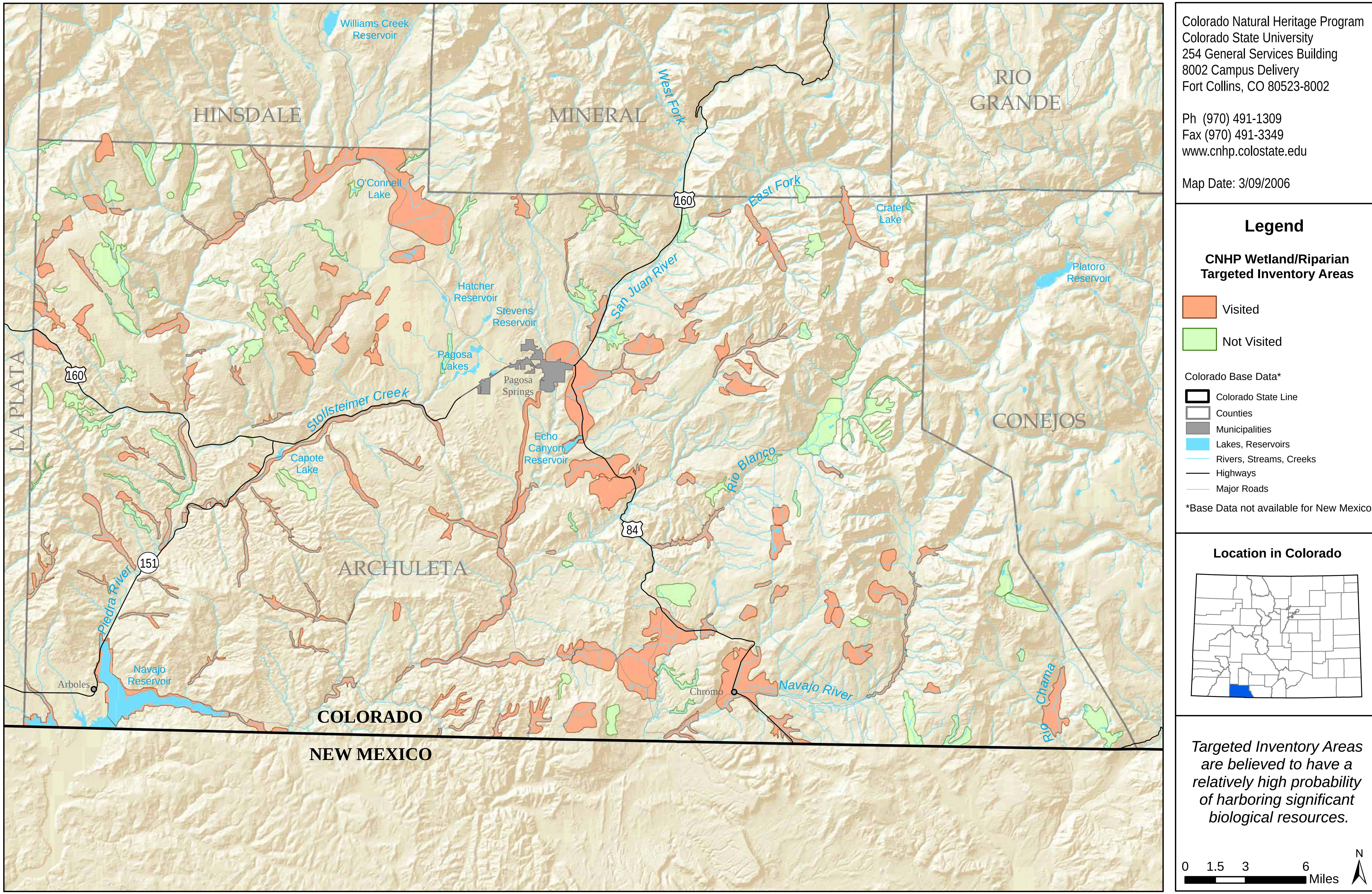
CNHP identified 214 wetland/riparian Targeted Inventory Areas (TIAs) within Archuleta County (Map 1), of which 128 (60%) were visited during the summer of 2005 (Figure 9). Of the TIAs visited, on-site inspection revealed that many (28%) were heavily impacted by roads, buildings, non-native species, agriculture, and/or grazing and were dropped from the surveys. For reasons, such as time limitation and the inability to contact landowners, 39% of the TIAs were not visited.

Of the visited TIAs, 50 (39%) were located on privately owned lands that include Southern Ute Indian Tribal lands. With the assistance of Archuleta County, Colorado Division of Wildlife, the Southern Ute Indian Tribe, Natural Resources Conservation Service, US Forest Service, Southwest Wetlands Focus Area, and the Southwest Land Alliance, CNHP was very successful in obtaining permission from landowners to conduct these surveys and were only denied access to 2 sites (1%).

Out of the total 214 TIAs, 29% are represented here within 36 Potential Conservation Areas (Map 2). Each PCA is ranked on a scale of 1 to 5 for Biodiversity Significance (Table 4). CNHP identified four B2 sites (Very High Significance), twenty-one B3 sites (High Significance), ten B4 sites (Moderate Significance), and one B5 site (General Significance) (Table 8). The B2 sites in Archuleta County reflect occurrences of B-ranked, or “good estimated viability” examples of species or communities considered globally imperiled under the definition of Natural Heritage

Imperilment Ranking (Table 1). A full explanation of Biodiversity Ranking can be found in the Natural Heritage Network Ranking System section of this report. One B2 site documented from the survey includes a globally imperiled (G2) mud sedge (*Carex limosa*) community and a newly discovered population of the state-rare (S1S2) marsh cinquefoil (*Comarum palustre*). In addition, several new populations of the state-rare (S1) retrorse sedge (*Carex retrorsa*) were documented across the county, contributing to four of the B3 sites.

Six sites (3%) visited during the survey are presented as Sites of Local Significance (SLS). These sites may not meet the criteria for inclusion into CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS), but contribute to the local biological diversity and character of the region, and warrant consideration when planning management activities. These sites range from a unique geothermally influenced alkaline wetland located in the midst of the downtown area of Pagosa Springs, to areas containing wetland habitats which may be globally common, but are not frequently found within this county.



Map 1. Wetland/Riparian Targeted Inventory Areas in Archuleta County

SIGNIFICANT ELEMENTS ASSOCIATED WITH WETLANDS AND RIPARIAN AREAS

Table 8 presents CNHP elements of biological significance known to occur in or associated with wetlands and riparian areas in the Potential Conservation Areas (PCAs) in this report. This is not a comprehensive list of all elements of biological significance known to occur in Archuleta County, but rather only includes those elements associated with wetlands and riparian areas, and deemed significant enough to be archived in CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS).

For a key to Federal and State Status Codes, please refer to the table of Federal and State Agency special designations for rare species, within the section of the report entitled "The Natural Heritage Network and Biological Diversity".

Elements with the highest global significance (G1-G3) are in **bold** type. Detailed descriptions of those elements listed in **bold** below can be found in the "Natural History Information" sections at the back of this document. PCAs listed in *italics* with an asterisk (*) are described further in the associated CNHP report, *Upper San Juan Basin Biological Assessment* (2003), and are not included in this report. PCAs listed in *italics* with two asterisks (**) are described further in the associated CNHP report, *Survey of Critical Wetland and Riparian Areas in La Plata County* (2004), and are not included in this report.

Table 8. Known elements of concern found within Archuleta County PCAs, by taxonomic group.

Scientific Name	Common Name	Global Rank	State Rank	Federal & State Status	Potential Conservation Area (PCA)
Animals					
Cypseloides niger	Black Swift	G4	S3B	FS	Quartz Creek at East Fork San Juan River
Oncorhynchus clarkii pleuriticus	Colorado River cutthroat trout	G4T3	S3	BLM, FS, SC	Navajo River at Banded Peak
Oncorhynchus clarkii virginalis	Rio Grande cutthroat trout	G4T3	S3	BLM, FS, SC	*Adams Fork of the Conejos River**
Plants					
Carex retrorsa	retrorse sedge	G5	S1		East Side Chalk Mountains; Opal Lake; Sparks Creek; Tributary to Rito Blanco; Turkey Creek at Snowball Creek; *Navajo Peak Trail**
Comarum palustre	marsh cinquefoil	G5	S1S2		Harris Lake

Scientific Name	Common Name	Global Rank	State Rank	Federal & State Status	Potential Conservation Area (PCA)
Cryptogramma stelleri	slender rock-brake	G5	S2	BLM	Quartz Creek at East Fork San Juan River; *East Fork San Juan River**
Draba smithii	**Smith whitlow-grass**	**G2**	**S2**	**FS**	*East Fork San Juan River**
Epipactis gigantea	**giant helleborine**	**G3G4**	**S2**	**FS**	**Piedra**
Equisetum variegatum	variegated scouring rush	G5	S1		*Kenney Flats**
Erigeron philadelphicus	Philadelphia fleabane	G5	S1		Piedra
Limnorchis ensifolia	canyon bog-orchid	G4G5T4?	S3		Piedra
Plant Communities					
Abies concolor-Picea pungens-Populus angustifolia / Acer glabrum	**white fir-blue spruce-narrowleaf cottonwood / Rocky Mountain maple forest**	**G2**	**S2**		**Navajo River at Banded Peak; Upper First Fork Piedra River**
Abies lasiocarpa / Alnus incana ssp. *tenuifolia*	subalpine fir-thinleaf alder forest	G5	S5		Upper Rito Blanco
Abies lasiocarpa / Ribes (montigenum, lacustre, inerme)	subalpine fir / (western prickly gooseberry, bristly black currant, white-stem gooseberry) forest	G5	S3		*Upper Mosca Creek**
Acer negundo / Cornus sericea	**box elder / red-osier dogwood forest**	**G3?**	**S2**		*Death Valley Creek**
Acer negundo-Populus angustifolia / Cornus sericea	**box elder-narrowleaf cottonwood / red-osier dogwood forest**	**G2**	**S2**		**Devil Creek at Middle Mountain; Ignacio Creek;** *Archuleta Creek**
Alnus incana* ssp. *tenuifolia/ Cornus sericea	**thinleaf alder / red-osier dogwood shrubland**	**G3G4**	**S3**		**Elk Creek at Piedra River; Indian Creek at Piedra River**
***Alnus incana* ssp. *tenuifolia/* mesic forbs**	**thinleaf alder / mesic forbs shrubland**	**G3**	**S3**		**Devil Creek at Middle Mountain; Harris Lake; Upper Coyote Creek**

Scientific Name	Common Name	Global Rank	State Rank	Federal & State Status	Potential Conservation Area (PCA)
Alnus incana **ssp.** ***tenuifolia/*** **Mesic graminoids**	**thinleaf alder / mesic graminoids shrubland**	**G3**	**S3**		**East Side Chalk Mountains**
Alnus incana **ssp.** ***tenuifolia-Salix (monticola, lucida, ligulifolia)***	**thinleaf alder-mixed willow shrubland**	**G3**	**S3**		**Quartz Creek at East Fork San Juan River; Rio Blanco at Deadman Canyon; Spring Creek Lakes; Upper Indian Creek**
Alnus incana **ssp.** ***tenuifolia -Salix drummondiana***	**thinleaf alder-Drummond's willow shrubland**	**G3**	**S3**		**Coal Creek Trailhead; Fourmile Creek at Quien Sabe; Opal Lake**
Betula occidentalis / Maianthemum stellatum	river Birch / mesic forbs shrubland	G4?	S2		Piedra
Caltha leptosepala	marsh marigold herbaceous vegetation	G4	S4		Buckles Lake
Cardamine cordifolia-Mertensia ciliata	heartleaf bittercress-tall fringed bluebells herbaceous vegetation	G4	S4		Quartz Creek at East Fork San Juan River
Carex aquatilis-Carex utriculata	water sedge-beaked sedge herbaceous vegetation	G4	S4		Buckles Lake
Carex atherodes	**awned sedge herbaceous vegetation**	**G3G5**	**S2?**		**Snow Spring PCA**
Carex limosa	**mud sedge herbaceous vegetation**	**G2**	**S1S2**		**Harris Lake**
Carex microptera	small-wing sedge herbaceous vegetation	G4	S2?		Spring Creek Lakes
Carex pellita	**woolly sedge herbaceous vegetation**	**G3**	**S3**		**Round Meadow Creek**
Carex utriculata	beaked sedge herbaceous vegetation	G5	S4		Quartz Creek at East Fork San Juan River
Carex vernacula	**native sedge herbaceous vegetation**	**GU**	**S1**		*Headwaters of Summit Creek**

Scientific Name	Common Name	Global Rank	State Rank	Federal & State Status	Potential Conservation Area (PCA)
Picea pungens / Alnus incana* ssp. *tenuifolia	**blue spruce / thinleaf alder woodland**	**G3**	**S3**		**Hunter Campground; Opal Lake; Sparks Creek;** *Weminuche Creek**
Populus angustifolia-Picea pungens / Alnus incana* ssp. *tenuifolia	**narrowleaf cottonwood-blue spruce / thinleaf alder woodland**	**G3**	**S3**		**Navajo River at Banded Peak; Quartz Creek at East Fork San Juan River;** *Sand Creek**
Populus angustifolia / Alnus incana* ssp. *tenuifolia	**narrowleaf cottonwood / thinleaf alder woodland**	**G3**	**S3**		**Navajo River at Banded Peak; Rio Chama;** *Archuleta Creek**
Populus angustifolia / Crataegus rivularis	**narrowleaf cottonwood / river hawthorn Woodland**	**G2?**	**S2**		**Devil Creek State Wildlife Area**
Populus angustifolia / Juniperus scopulorum	**narrowleaf cottonwood / Rocky Mountain juniper woodland**	**G2G3**	**S2S3**		**Ignacio Creek; Lower Piedra River; Round Meadow Creek; Sambrito Creek Headwaters; San Juan River at Carracas; San Juan River at Juanita;** *Spring Creek North***
Populus angustifolia / Rhus trilobata	**narrowleaf cottonwood / skunkbush woodland**	**G3**	**S3**		*Turkey Creek at Stollsteimer**
Populus angustifolia / Salix exigua	narrowleaf cottonwood / sandbar willow woodland	G4	S4		Lower Piedra River
Populus angustifolia / Salix irrorata	**narrowleaf cottonwood / bluestem willow woodland**	**G2**	**S2**		**Devil Creek at Middle Mountain; Middle Fourmile Creek**

Scientific Name	Common Name	Global Rank	State Rank	Federal & State Status	Potential Conservation Area (PCA)
Populus angustifolia / Salix ligulifolia-Shepherdia argentea	**narrowleaf cottonwood / strapleaf willow-silver buffaloberry woodland**	**G3**	**S3**		**Devil Creek State Wildlife Area; Lower Piedra River; San Juan River at Carracas; San Juan River at Juanita; San Juan River at Trujillo**
Populus angustifolia / Salix (monticola, drummondiana, lucida)	**narrowleaf cottonwood / mixed willows woodland**	**G3**	**S3**		**Upper Indian Creek;** *Sand Creek**
Populus tremuloides / Alnus incana* ssp. *tenuifolia	**quaking aspen / thinleaf alder Forest**	**G3**	**S3**		**Tributary to Little Navajo River**
Populus tremuloides / tall forbs	quaking aspen / tall forbs forest	G5	S5		*Coldwater Creek at Skunk Creek**
Pseudotsuga menziesii / Acer glabrum	Douglas-fir / Rocky Mountain maple forest	G4?	S1		Hunter Campground
Pseudotsuga menziesii / Cornus sericea	Douglas-fir / red-osier dogwood woodland	G4	S2		Elk Creek at Piedra River; Hurt Canyon
Salix bebbiana	**Bebb's willow shrubland**	**G3?**	**S2**		**Porcupine Creek Meadow; Spring Creek Lakes**
Salix drummondiana / mesic forbs	Drummond's willow / mesic forbs shrubland	G4	S4		*Hondo Creek**
Salix monticola / mesic forbs	mountain willow / mesic forbs shrubland	G4	S3		Porcupine Creek Meadow
***Salix monticola /* mesic graminoids**	**mountain willow / mesic graminoids shrubland**	**G3**	**S3**		**Buckles Lake; Rio Chama**
Salix planifolia / mesic forbs	Planeleaf willow / mesic forbs shrubland	G4	S4		Quartz Creek at East Fork San Juan River
Shepherdia argentea	**silver buffaloberry shrubland**	**G3G4**	**S1**		**Rio Blanco at Deadman Canyon; San Juan River at Carracas**

Additional Known Elements Associated with Wetlands and Riparian Areas
The following table (Table 9) presents additional CNHP elements of biological significance that are tracked in CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS), and that are known to occur in or associated with wetlands in Archuleta County. These elements are not included within any Potential Conservation Areas described in this report or the associated CNHP report, *Upper San Juan Basin Biological Assessment* (2003); however, these elements remain biodiversity targets for conservation due to their association with riparian and wetland habitats in Archuleta County.

Many of the elements are considered globally secure (G4 or G5) and therefore were considered lower priority for survey and PCA evaluation. Additionally, although the survey data for several of these species or natural associations is considered historical (>20 years old), these elements remain biodiversity targets for CNHP. Elements listed with a triple asterisk (***) are currently watch-listed species for CNHP. Watch-listed taxa are usually not actively inventoried by CNHP, although conservation concerns remain and data are passively accumulated and sometimes processed for possible future needs.

Table 9. Additional known elements of concern for Archuleta County, by taxonomic group.

Scientific Name	Common Name	Global Rank	State Rank	Federal & State Status
Animals				
Chrysemys picta	painted turtle	G5	S5	
Haliaeetus leucocephalus	Bald Eagle	G5	S1B S3N	LT, PDL, ST
Gila pandora	**Rio Grande chub**	**G3**	**S1?**	**BLM, FS, SC**
Gila robusta	**roundtail chub**	**G3**	**S2**	**PS, BLM FS, SC**
*Rana pipiens****	northern leopard frog	G5	S3	BLM, FS, SC
Insects				
Speyeria nokomis nokomis	**Nokomis fritillary**	**G3T1**	**S1**	**BLM, FS**
Plant Communities				
Abies lasiocarpa / Mertensia ciliata	subalpine fir / tall fringed bluebells forest	G5	S5	
Abies lasiocarpa / Salix drummondiana	subalpine fir / Drummond's willow forest	G5	S4	
Populus tremuloides / Cornus sericea	quaking aspen / red-osier dogwood forest	G4	S2S3	
Salix exigua / mesic graminoids	sandbar willow / mesic graminoids shrubland	G5	S5	

COLORADO DIVISION OF WILDLIFE RIPARIAN MAPS ANALYSIS

Over the years, CNHP has utilized the Division of Wildlife (DOW) riparian maps, when available (for a detailed description see section entitled, “Colorado Division of Wildlife Riparian Mapping Project”). These maps were used during this survey as additional tools for identification of wetland and riparian habitats located on federal lands. Five 7.5 minute USGS quadrangle coverages (topographic maps) are completed for Archuleta County and were used for reference during the project: Allison (371714), Carracas (3710713), Pagosa Junction (3710731), Pagosa Springs (3710731), and Trujillo (371711).

For each vegetation class (Table 10), a single label indicates that the class is dominant and comprises at least 75% or more of the vegetation. Other vegetation may be present but at less than the Minimum Mapping Unit (MMU) of 1/2 acre. Mixed communities consist of classes that are less than 75% cover with a lesser amount of one or more vegetation classes. The dominant type is annotated first with the lesser type following. For example, if a polygon is attributed as RT1/RS1, the vegetation in the area is less than 75% dominant of any particular class but is a mixed community of Aspen and Willow with Aspen dominant between the two classes. A forward slash (/) is used to separate the dominant/subdominant classes both on the hard copy and within the digital data (CDNR 2004).

Seven PCAs (one-B2, five B3, and one B4) and five plant communities (two globally imperiled (G2) and two globally vulnerable (G3)) were located on DOW riparian maps (Table 11) (Figures 10-16). The DOW Riparian Classification is at a coarser scale than CNHP’s Wetland Classification; overall the two classifications cross-reference accurately. For example, Woolly sedge (*Carex pellita*) Herbaceous Vegetation in the Round Meadow Creek PCA, corresponded to RH1—Riparian herbaceous cattails, sedges/rushes (with permanent standing water) and RH2—Riparian herbaceous sedges/rushes/mesic grasses (waterlogged or moist soils).

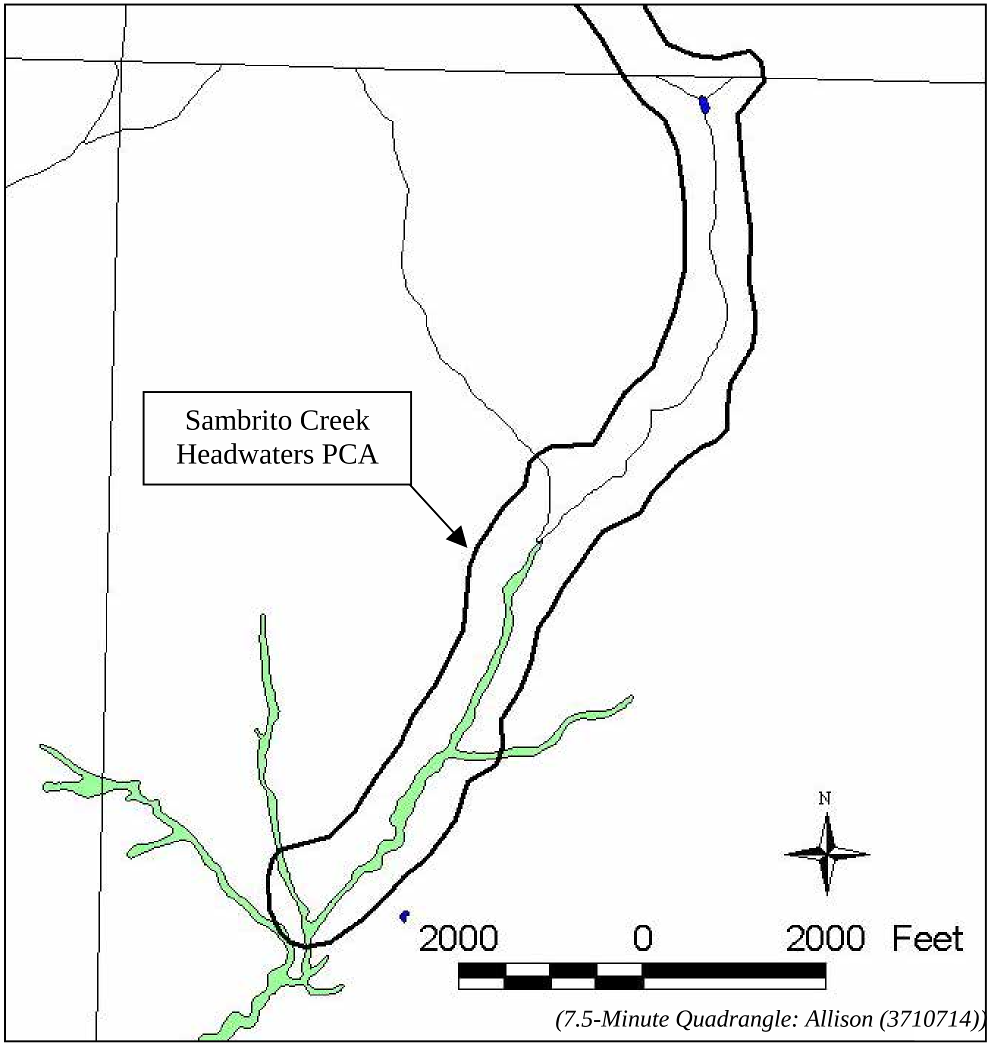
Table 10. DOW Riparian Mapping Classification.

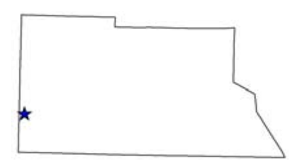
CATEGORY	MAP CODE
RIPARIAN DECIDUOUS TREES	
Riparian Deciduous Tree-General	RT
Riparian Deciduous Tree-Aspen	RT1
Riparian Deciduous Tree-Cottonwood	RT2
Riparian Deciduous Tree-Russian Olive	RT3
Riparian Deciduous Tree-Birch	RT4
Riparian Deciduous Tree-Box elder	RT5
Riparian Deciduous Tree-Green Ash	RT6
Riparian Deciduous Tree-Mulberry	RT7
RIPARIAN EVERGREEN TREES	
Riparian Evergreen Tree-General	RE
Riparian Evergreen Tree-Blue Spruce	RE1
Riparian Evergreen Tree-Engleman Spruce	RE2
Riparian Evergreen Tree-Douglas Fir	RE3
Riparian Evergreen Tree-Lodgepole Pine	RE4
Riparian Evergreen Tree-Spruce/Fir	RE5
Riparian Evergreen Tree-Ponderosa Pine	RE6
Riparian Evergreen Tree-Cedar/Juniper	RE7
Riparian Evergreen Tree-Pinon/Juniper	RE8
RIPARIAN SHRUBS	
Riparian Shrub-General	RS
Riparian Shrub-Willow	RS1
Riparian Shrub-Tamarisk	RS2
Riparian Shrub-Alpine Willow	RS3
Riparian Shrub-Gambel Oak	RS4
Riparian Shrub-Sagebrush	RS5
RIPARIAN HERBACEOUS	
Riparian Herbaceous-General	RH
Riparian Herbaceous-Cattails/Sedges/Rushes (with permanent standing water)	RH1
Riparian Herbaceous-Sedges/Rushes/Mesic Grasses (Waterlogged or Moist Soils)	RH2
OTHER RIPARIAN	
Unvegetated	NV
Sandbar	SB
NON-RIPARIAN	
Upland Tree	UT
Upland Shrub	US
Upland Grass	UG
WATER BODIES	
Open Water-Standing	OW1
Open Water-Riverine	OW2
Open Water-Canal	OW3

Table 11. CNHP PCAs located on DOW riparian maps for Archuleta County.

CNHP PCAs	B Rank[1]	CNHP Plant Community	Common Plant Community Name	Global/ State Rank[2]	DOW Riparian Classification[3]
Sambrito Creek Wetlands	B2	*Populus angustifolia – Juniperus scopulorum* Woodland	Narrowleaf cottonwood – Utah juniper Woodland	G2G3/S2S3	RE, RS, NV, UG
Ignacio Creek	B3	*Populus angustifolia -Juniperus scopulorum* Woodland; *Acer negundo – Populus angustifolia* / *Cornus sericea* Forest	Narrowleaf cottonwood – Utah juniper Woodland; Box elder – Narrowleaf cottonwood / Red-osier dogwood Forest	G2G3/S2S3; G2/S2	RE, NV, UG
Middle Fourmile Creek	B3	*Populus angustifolia* / *Salix irrorata* Woodland	Narrowleaf cottonwood / Bluestem willow Woodland	G2/S2	RE, UG, RS1
San Juan River at Juanita	B3	*Populus angustifolia* / *Salix ligulifolia – Shepherdia argentea* Woodland; *Populus angustifolia* / *Juniperus scopulorum* Woodland	Narrowleaf cottonwood / Strapleaf willow – Silver buffaloberry Woodland; Narrowleaf cottonwood / Utah juniper Woodland	G3/S3; G2G3/S2S3	RH2, RS, RT2, UG, OW
Round Meadow Creek	B3	*Carex pellita* Herbaceous Vegetation, *Populus angustifolia – Juniperus scopulorum* Woodland	Woolly sedge Herbaceous Vegetation; Narrowleaf cottonwood – Utah juniper Woodland	G3/S3; G2G3/S2S3	RH1, RT, RH2, RE, UG
San Juan River at Carracas	B3	*Populus angustifolia – Juniperus scopulorum* Woodland; *Shepherdia argentea* Shrubland	Narrowleaf cottonwood – Utah juniper Woodland; Silver buffaloberry Shrubland	G2G3/S2S3; G3G4/S1	RT2, RH2, RH1, UG, RS, OW, NV
San Juan River at Trujillo	B4	*Populus angustifolia* / *Salix ligulifolia – Shepherdia argentea* Woodland	Narrowleaf cottonwood / Strapleaf willow – Silver buffaloberry Woodland	G3/S3	RS, RT2, UG, NV

[1]*See Table 4 for an explanation of Natural Heritage Biological Diversity Ranks (B Ranks)*
[2]*See Table 1 for an explanation of Natural Heritage Imperilment Ranks (Global/State Ranks)*
[3]*See Table 10 for a key to the Riparian Classification Codes*





Location in County

Figure 10. DOW Riparian Map of Sambrito Creek Headwaters PCA (B2).

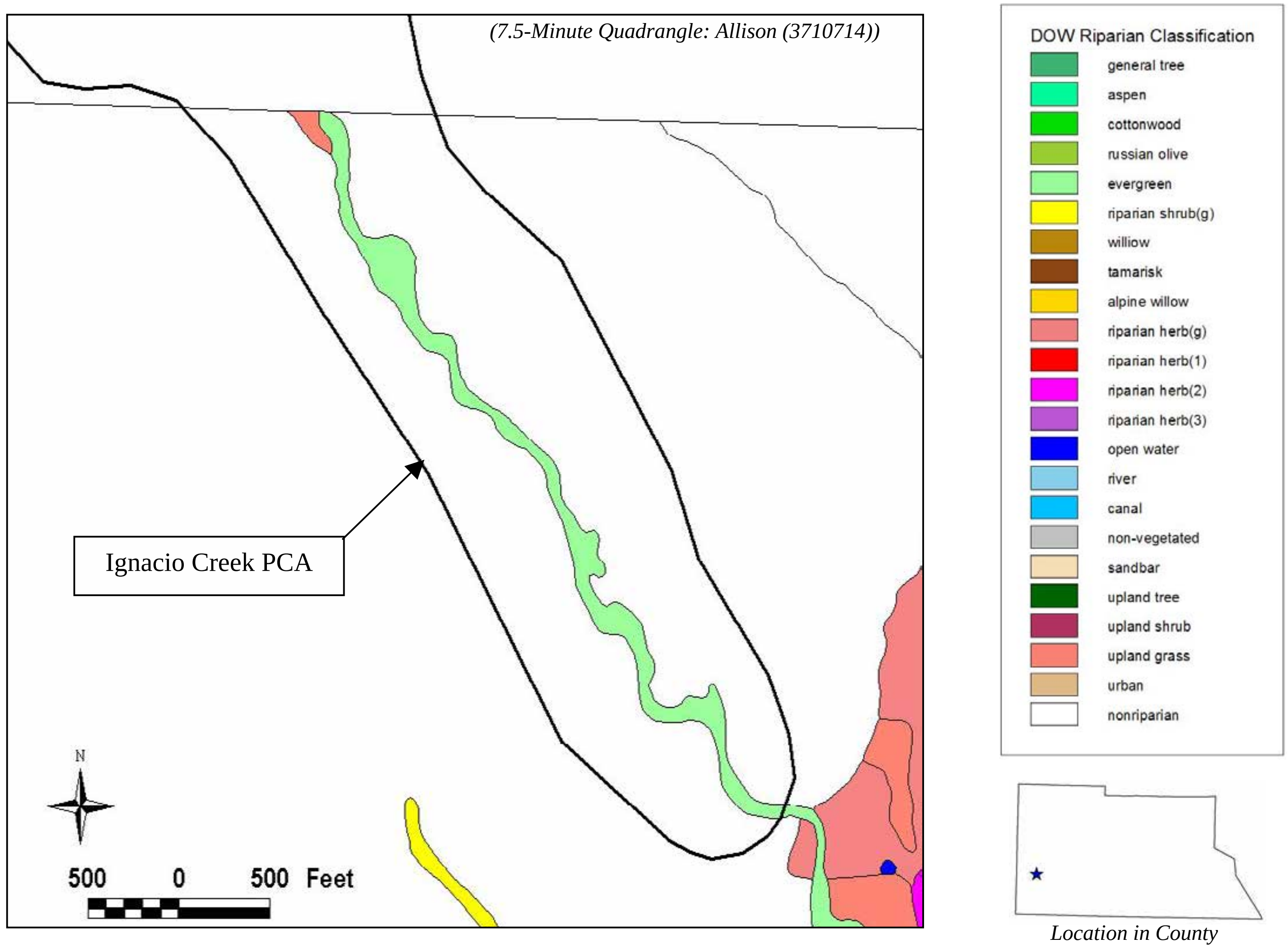


Figure 11. DOW Riparian Map of Ignacio Creek PCA (B3).

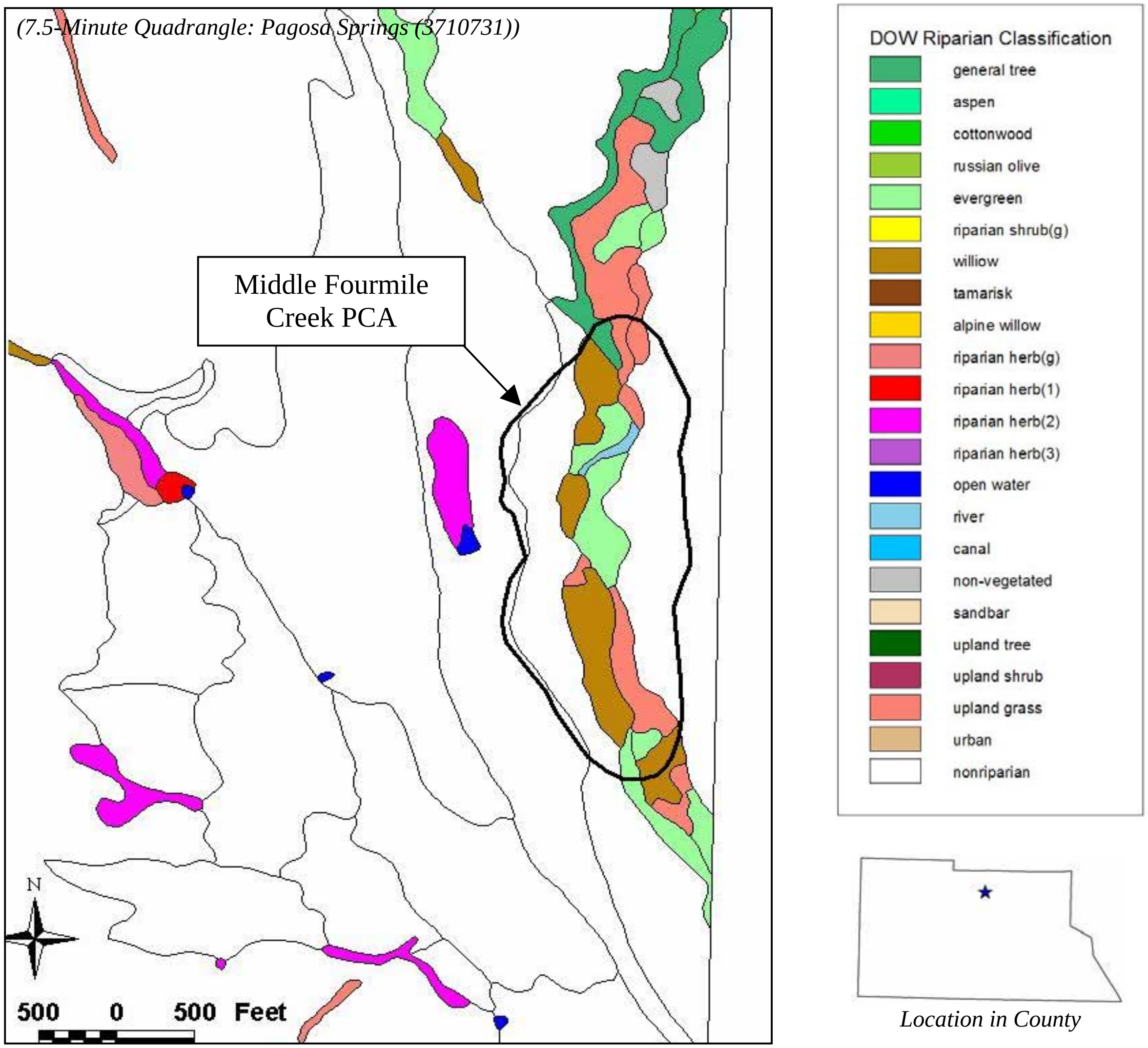
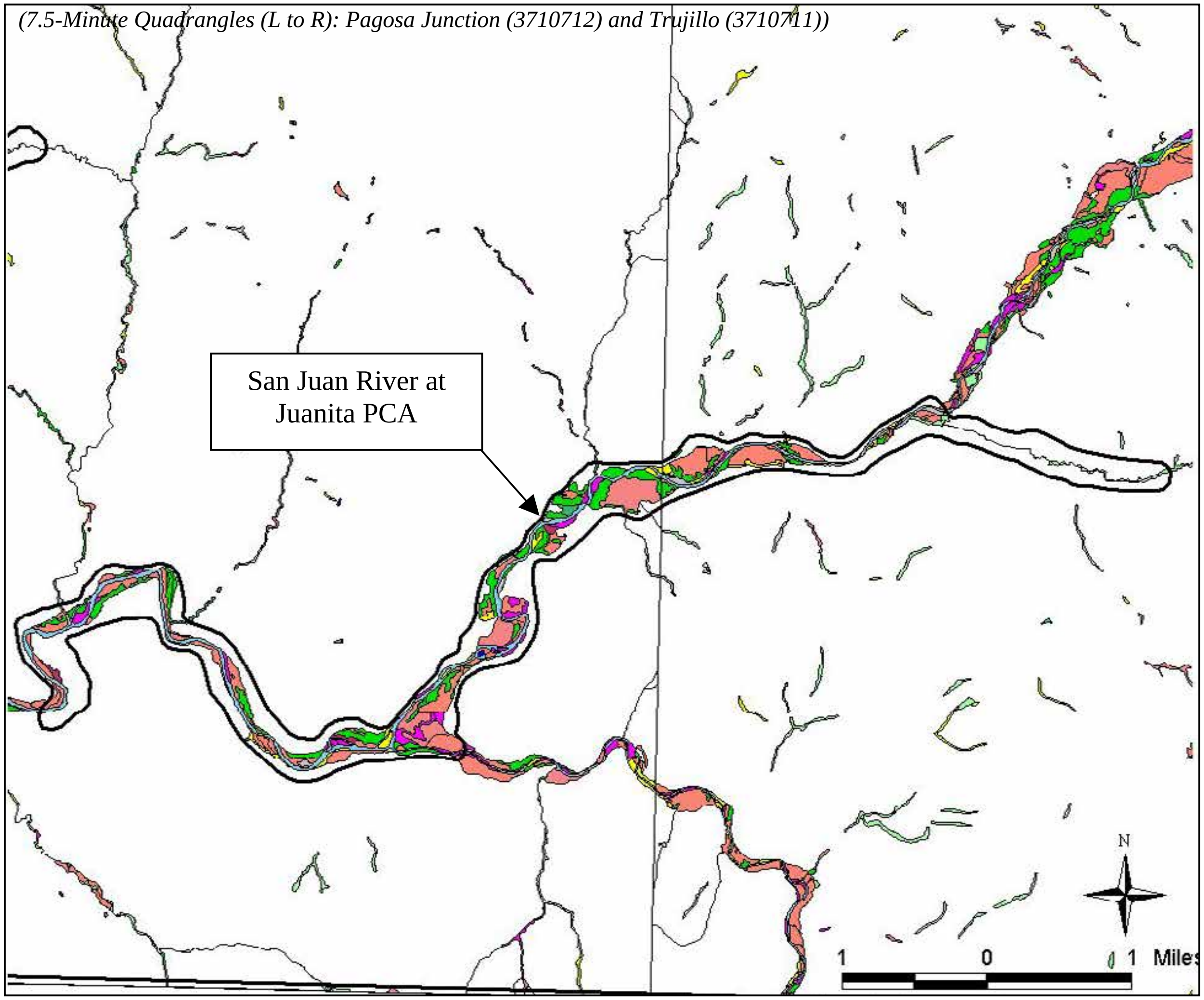
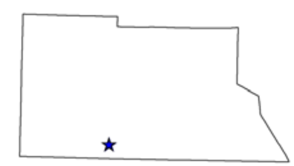


Figure 12. DOW Riparian Map Middle Fourmile Creek PCA (B3).



DOW Riparian Classification
general tree
aspen
cottonwood
russian olive
evergreen
riparian shrub(g)
williow
tamarisk
alpine willow
riparian herb(g)
riparian herb(1)
riparian herb(2)
riparian herb(3)
open water
river
canal
non-vegetated
sandbar
upland tree
upland shrub
upland grass
urban
nonriparian



Location in County

Figure 13. DOW Riparian Map of San Juan River at Juanita PCA (B3).

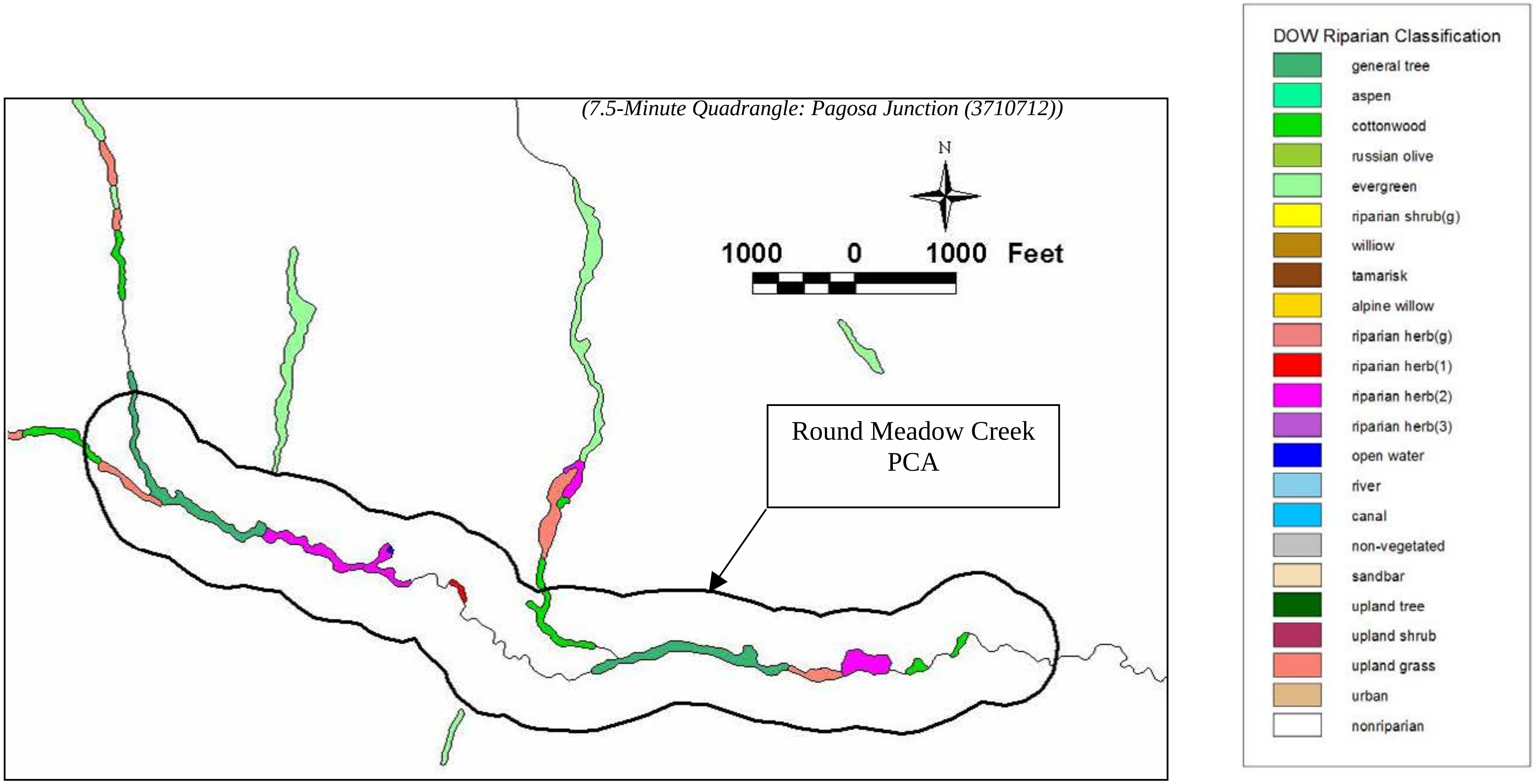
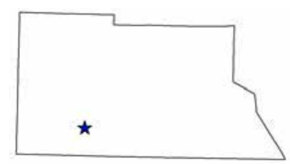


Figure 14. DOW Riparian Map of Round Meadow Creek PCA (B3).



Location in County

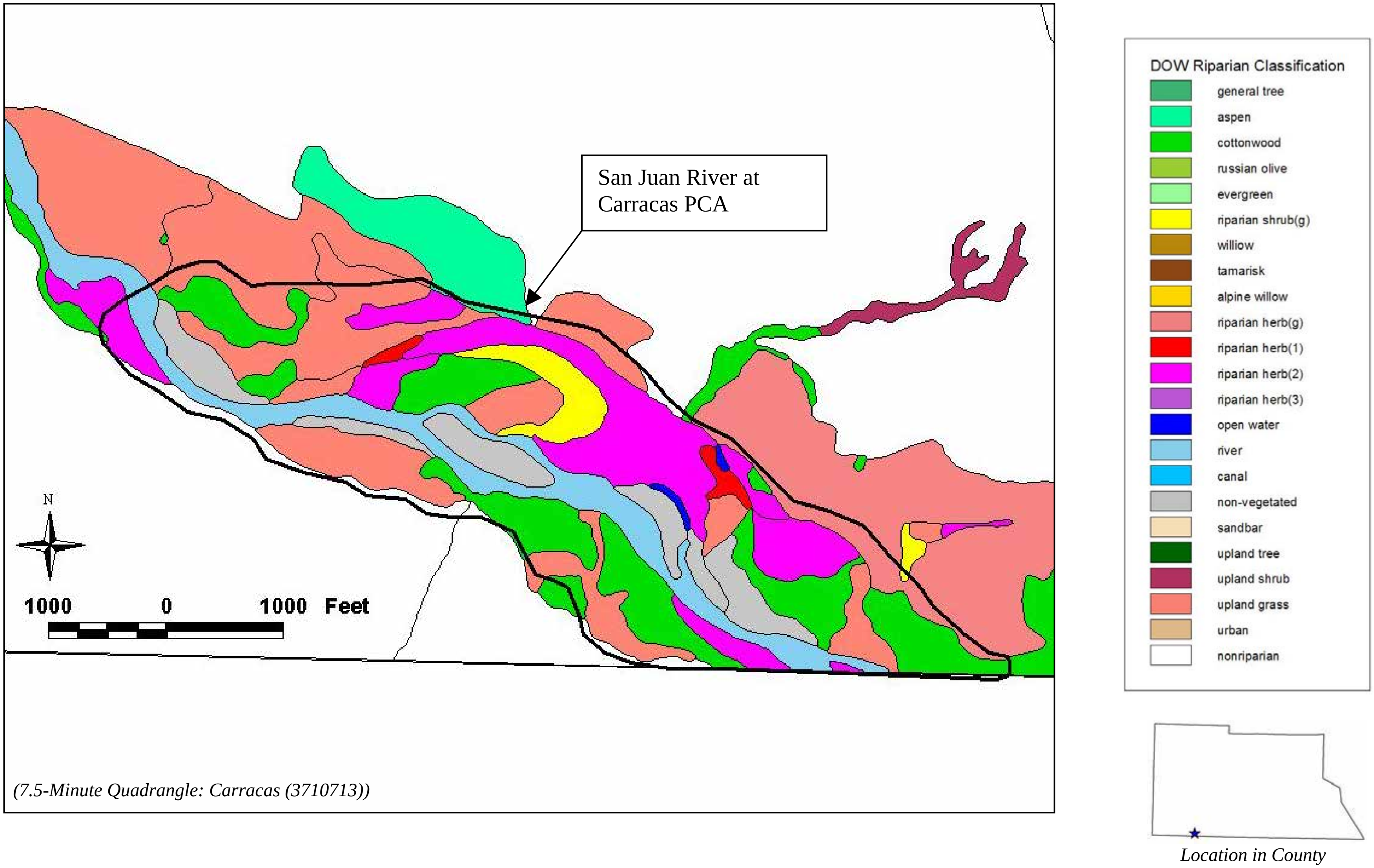


Figure 15. DOW Riparian Map of San Juan River at Carracas PCA (B3).

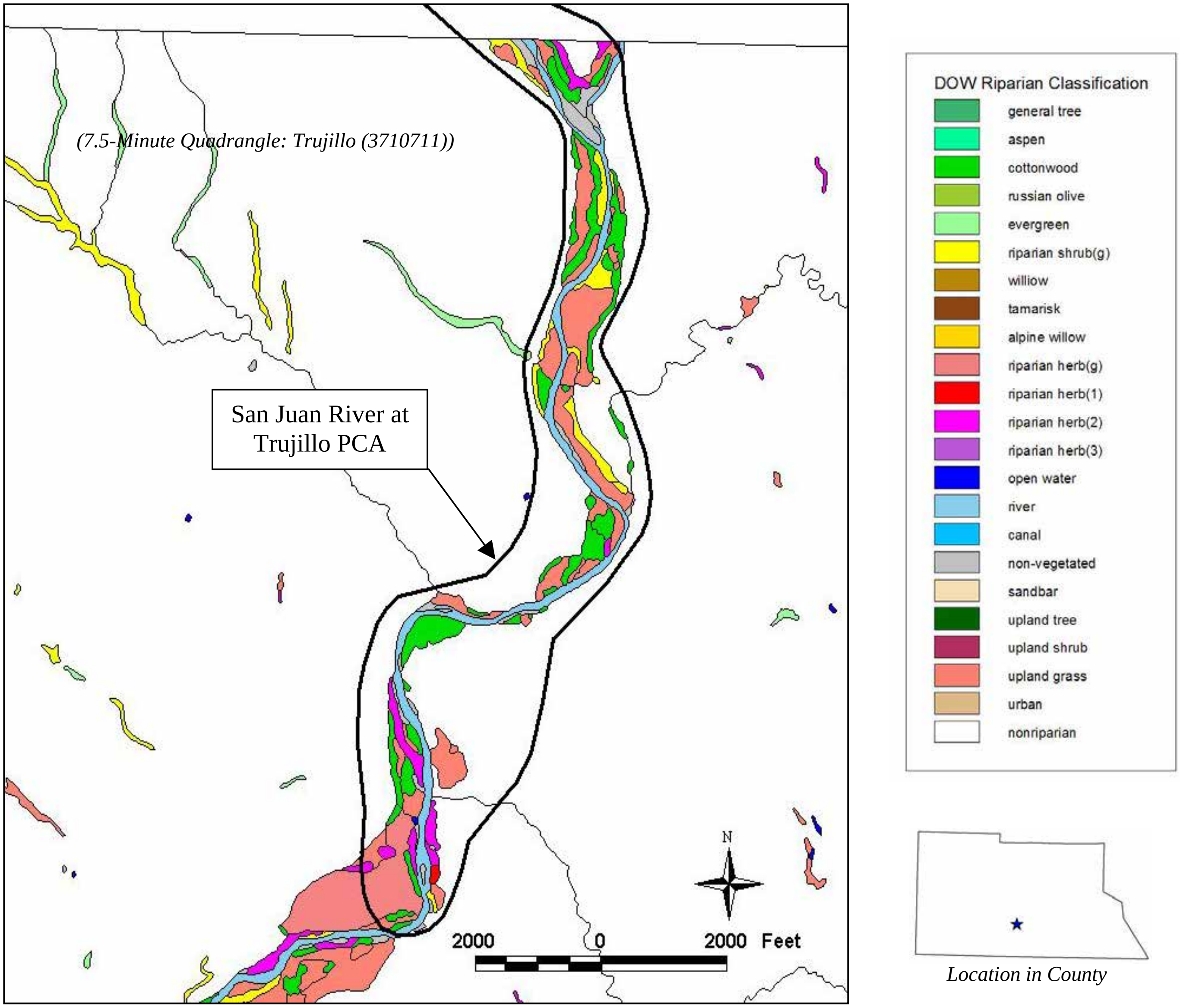


Figure 16. DOW Riparian Map of San Juan River at Trujillo PCA (B4).

SITES OF BIODIVERSITY SIGNIFICANCE

The thirty-six most important wetland sites in Archuleta County are profiled in this section as Potential Conservation Areas (PCAs) with biodiversity ranks (Table 12). These PCAs include the wetlands with the highest biodiversity significance, as well as the best examples of common wetland types present in the study area. Four are identified as being nearly irreplaceable biodiversity significance (B2), twenty-one of high biodiversity significance (B3), ten of moderate biodiversity significance (B4), and one of general biodiversity significance (B5). The highest ranking PCAs are the highest priorities for conservation action.

Following the PCAs are six Sites of Local Significance (SLS).

Each Potential Conservation Area (PCA) is described in a standard PCA profile report that reflects data fields in CNHP's Biodiversity Tracking and Conservation System (BIOTICS). The contents of the profile report are outlined and explained below:

PCA Profile Explanation Biodiversity Rank: B#
The overall significance of the PCA in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see *Natural Heritage Ranking System* section for more details.

Protection Urgency Rank: P#
A summary of major land ownership issues that may affect the long-term viability of the PCA and the element(s).

Management Urgency Rank: M#
A summary of major management issues that may affect the long-term viability of the PCA and the element(s).

USGS 7.5-minute Quadrangle name(s): A list of USGS 7.5 minute quadrangles which contain the boundary of the PCA; all quadrangles are from Colorado unless otherwise noted.

Size: Expressed in acres.

Elevation: Expressed in feet.

General Description: A brief narrative of the topography, hydrology, vegetation, and current use of the potential conservation area.

Key Environmental Factors: A description of key environmental factors that are known to have an influence on the PCA, such as seasonal flooding, wind, geology, soil type, etc.

Climate Description: Where climate has a significant influence on the elements within a PCA, a brief description of climate, weather patterns, seasonal and annual variations, temperature and precipitation patterns is included.

Land Use History: General comments concerning past land uses within the PCA which may affect the elements occurring within the boundary.

Cultural Features: Where pertinent, a brief description is given of any historic, cultural, or archeological features found within the PCA.

Biodiversity Significance Rank Comments: A synopsis of the rare species and significant plant communities that occur within the proposed conservation area. A table within the area profile lists each element occurrence found in the PCA, global and state ranks of these elements, the occurrence ranks and federal and state agency special designations. See Table 1 for explanations of ranks and Table 2 for legal designations.

Boundary Justification: Justification for the location of the proposed PCA boundary delineated in this report, which includes all known occurrences of natural heritage resources and, in some cases, adjacent lands required for their protection.

Protection Urgency Rank Comments: Brief comments to justify the rating assigned to the PCA.

General Protection Comments: Discussion of major land ownership issues that may affect the long-term viability of the PCA and the element(s).

Management Urgency Rank Comments: Brief comments to justify the rating assigned to the PCA.

Management Needs Comments: Discussion of major management issues that may affect the long-term viability of the PCA and the element(s).

Land Use Comments: Brief comments describing the current and/or past land use as it affects those elements contained in the PCA.

Natural Hazard Comments: If any potential natural hazards such as cliffs, caves, poisonous plants, etc. are prominent within the PCA and relevant to a land manager or steward, comments are included along with any precautions that may need to be taken.

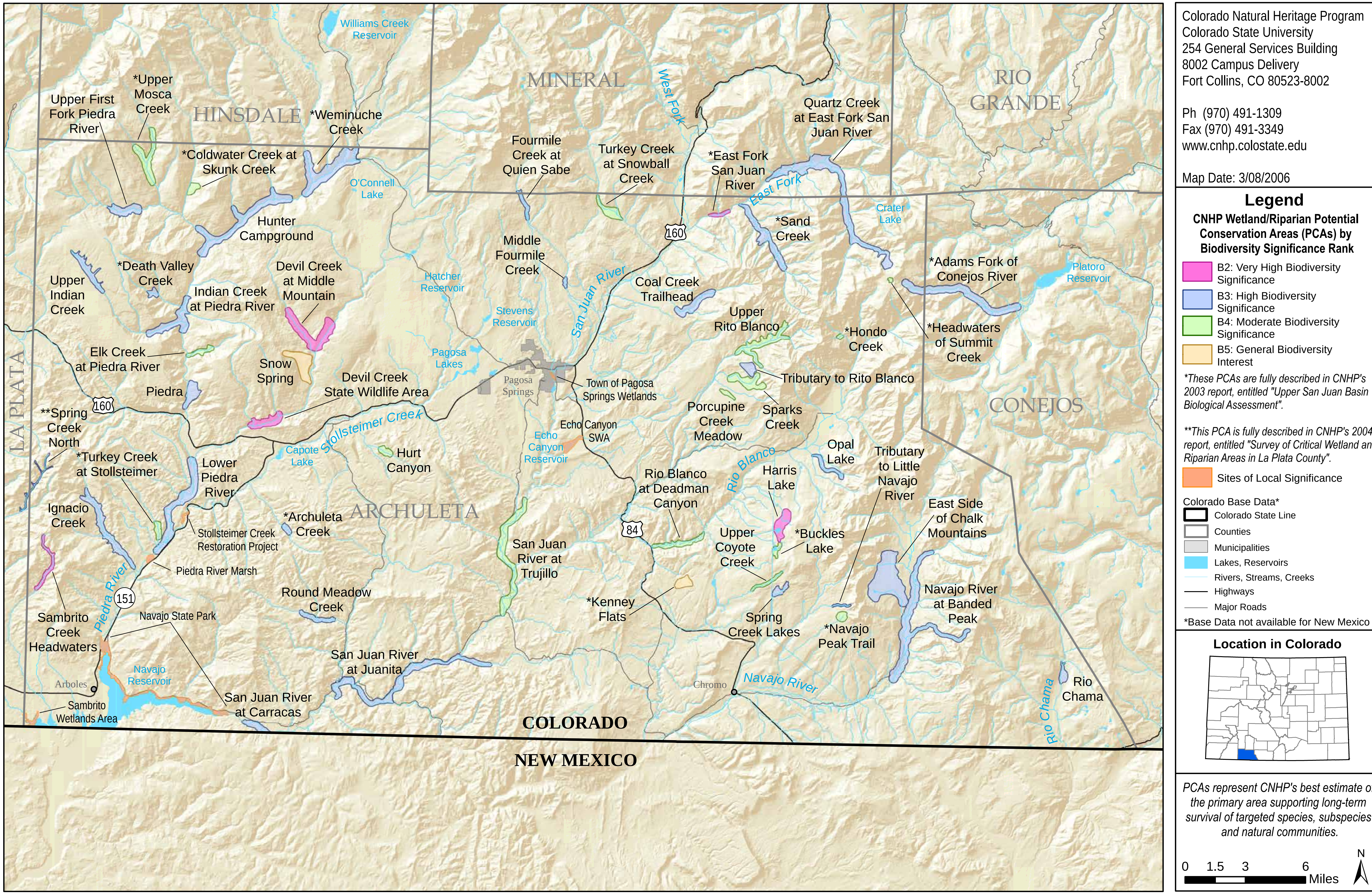
Exotic Species Comments: A description of potentially damaging exotic (i.e., alien) flora and/or fauna within the PCA, including information on location, abundance, and their potential effect on the viability of the targeted elements within the PCA.

Offsite Considerations: Where offsite land uses or other activities (e.g., farming, logging, grazing, dumping, watershed diversion, etc.) may have a significant influence on the elements within a PCA, a brief description of these is included.

Information Needs: A brief summary of any information that may still be needed in order to effectively manage the PCA and the elements within it.

Table 12. Potential Conservation Areas contained within Archuleta County, arranged by biodiversity rank (B-rank) and alphabetical order.

POTENTIAL CONSERVATION AREAS
B2
Devil Creek at Middle Mountain
Devil Creek State Wildlife Area
Harris Lake
Sambrito Creek Headwaters
B3
Coal Creek Trailhead
East Side of Chalk Mountains
Fourmile Creek at Quien Sabe
Hunter Campground
Ignacio Creek
Indian Creek at Piedra River
Lower Piedra River
Middle Fourmile Creek
Navajo River at Banded Peak
Opal Lake
Piedra
Quartz Creek at East Fork San Juan River
Rio Chama
Round Meadow Creek
San Juan River at Carracas
San Juan River at Juanita
Spring Creek Lakes
Tributary to Little Navajo River
Tributary to Rito Blanco
Upper First Fork Piedra River
Upper Indian Creek
B4
Buckles Lake
Elk Creek at Piedra River
Hurt Canyon
Porcupine Creek Meadow
Rio Blanco at Deadman Canyon
San Juan River at Trujillo
Sparks Creek
Turkey Creek at Snowball Creek
Upper Coyote Creek
Upper Rito Blanco
B5
Snow Spring



Map 2. Wetland/Riparian Potential Conservation Areas and Sites of Local Significance in Archuleta County

Devil Creek at Middle Mountain

Biodiversity Rank - B2: Very High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chris Mountain, Devil Mountain

Size: 1,154 acres (467 ha) **Elevation:** 7,320 - 8,440 ft. (2,231 - 2,573 m)

General Description: Devil Creek at Middle Mountain site is located in central Archuleta County, west of Pagosa Springs and north of Highway 160. It incorporates two somewhat climatically different drainages, the open, sunny Devil Creek and the cool and shady West Fork of Devil Creek. These creeks converge just south of the site boundary on a privately owned parcel and subsequently flow as Devil Creek to the southwest, nearly 10 miles to join with the Piedra River. This montane site is strongly defined by Devil Mountain, rising to 9,922 feet west of the site, and Chris Mountain (elev. 8,879 ft.), which lies to the east of the site. Middle Mountain (elev. 9,716 ft.) splits the site, occurring due north of the confluence of the two creeks. Three uncommon riparian communities are located within the site, which occurs mostly on USFS lands. The private land at the confluence of the two creeks has heavy horse use and a gravel mining operation. Exotic species occur on the uplands, especially near the south boundary adjacent to the private inholding; proceeding upstream the percent of exotic species cover drops rapidly. Access is limited to the site and its associated canyons since permission must be gained to cross the private property at the south boundary. Unmaintained trails occur along each of the creeks, and it is unknown whether the Forest Service plans to increase maintenance on these trails. Although the site is not a pristine area, its secluded location has left it in good ecological condition. On the west side of Middle Mountain, the West Fork of Devil Creek is a montane perennial stream flowing southeast through a cool, shady, moderately narrow canyon with steep side walls and a narrow floor. An infrequent riparian community, thinleaf alder (Alnus incana ssp. tenuifolia) /mesic forb riparian shrubland occurs along the immediate floodplain and creek banks. An overstory of blue spruce (Picea pungens) and narrowleaf cottonwood (Populus angustifolia) shades thinleaf alder and mixed willows (Salix spp.) along the creek. A mix of forbs and graminoids, such as bluejoint reedgrass (Calamagrostis canadensis), fowl mannagrass (Glyceria striata), cutleaf coneflower (Rudbeckia laciniata var. ampla), heartleaf bittercress (Cardamine cordifolia), common cowparsnip (Heracleum maximum), and Franciscan bluebells (Mertensia franciscana), provides a dense groundcover. On the terrace above the creek, a diverse, fairly dense and shady shrub understory occurs, containing a mix of Gambel oak (Quercus gambelii), Saskatoon serviceberry (Amelanchier alnifolia), twinflower honeysuckle (Lonicera involucrata var. involucrata), roundleaf snowberry (Symphoricarpos rotundifolius) and Woods' rose (Rosa woodsii). The surrounding forest is dominated by Douglas-fir (Pseudotsuga menziesii) and blue spruce. On the east side of Middle Mountain, Devil Creek is a moderately sloped montane tributary flowing southwest, occupying a somewhat broad, sunny canyon. The slopes of the canyon are steep, dropping over 600 feet from the canyon's rim to its floor. The upper slopes of the canyon and adjacent mountains have been logged, but good ponderosa pine (Pinus ponderosa ssp. scopulorum) and spruce-fir (Picea spp.-Abies spp.) forests occur within the canyon. Very large ponderosa pines still exist in the canyon bottom especially at the higher reaches of the community, and the upland understory in the upper canyon is a nice example of mostly native grasses and forbs. The riparian areas on Devil Creek are dominated by blue spruce, narrowleaf cottonwood, and boxelder (Acer negundo var. interius), with a dense shrub layer. Bluestem willow (Salix irrorata) dominates the stream channel and immediate floodplain throughout, mixed with sandbar willow (Salix exigua), thinleaf alder, and red-osier dogwood (Cornus sericea) higher on the streambanks. The understory is mostly native mesic forbs and mesic graminoids, generally with few exotic species. This sunny riparian area along Devil Creek is the site of two rare plant communities, the Boxelder-Narrowleaf Cottonwood/Red-osier Dogwood Riparian Forest, which occupies the benches, abandoned channels, and secondary floodplains. It occurs in mosaic with narrowleaf cottonwood/bluestem willow foothills riparian woodland, which dominates the immediate streambanks and cobble bars within the stream channel.

Key Environmental Factors: No known hydrological alterations occur upstream of either creek. The West Fork of Devil Creek is shaded and runs at various depths with pool/riffle complexes. The bed is mostly cobble and angular rock, 1" diameter and larger to 18" diameter. The banks show signs of natural erosion. Devil Creek has similar substrate and morphology. Large woody debris that has been transported by the creek remains downed in the channel, and there is evidence of channel migration, such as abandoned channels with riparian vegetation, and signs of flooding. A few areas of the channel are deeper, ponded, and slow moving, with abundant algae growth.

Biodiversity Significance Rank Comments (B2): The rank for this site is based on a good (B-ranked) occurrence of a boxelder-narrowleaf cottonwood/red-osier dogwood (Acer negundo-Populus angustifolia/Cornus sericea) riparian forest and a good (B-ranked) occurrence of narrowleaf cottonwood/bluestem willow (Populus angustifolia/Salix irrorata) foothills riparian woodland, both globally imperiled (G2/S2) communities. The boxelder-narrowleaf cottonwood/red-osier dogwood community type is a late-seral association that appears to be restricted to western Colorado and is not known from outside the state (NatureServe 2005). Most areas that may have supported past occurrences of this community type have been altered by agriculture and development. The narrowleaf cottonwood/bluestem willow community appears to be an early-seral community, occurring in the immediate floodplain of lower montane streams only in Colorado and New Mexico, and in limited distribution (NatureServe 2005). This site also supports a good (B-ranked) example of the globally vulnerable (G3/S3) thinleaf alder (Alnus incana)/mesic forb riparian shrubland. This plant association was once common and widespread, but is now declining. It is rarely found in good condition without non-native species in the undergrowth.

Natural Heritage element occurrences at the Devil Creek at Middle Mountain PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Acer negundo - Populus angustifolia / Cornus sericea Forest	Narrowleaf Cottonwood Riparian Forests	G2	S2				B	2005-07-05
Natural Communities	Populus angustifolia / Salix irrorata Woodland	Foothills Riparian Woodland	G2	S2				B	2005-07-05
Natural Communities	Alnus incana / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				B	2005-07-06

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The site boundary encompasses the element occurrences on Devil Creek and West Devil Creek, and includes a buffer of approximately 1,000 feet. This boundary protects the occurrence from direct disturbance, and is thought to protect the avian, macroinvertebrate and periphyton communities (Noel et al. 1986, Spackman and Hughes 1995) associated with the riparian communities. The boundary also incorporates an area that will allow natural hydrological processes such as groundwater discharge, seasonal flooding, natural levels of sediment deposition, and new channel formation to continue, thereby maintaining viable populations of the elements along each creek. It should be noted that the hydrological processes necessary to support the riparian communities are not fully contained by the site boundaries. Recharge of both Devil Creek and West Devil Creek from snowmelt and groundwater occurs at a scale larger than the site's size, and is important for long-term survival of the riparian community. Given that the riparian communities are dependent on natural hydrological processes, upstream activities such as water diversions and impoundments, improper livestock grazing, logging, and road development are detrimental to the hydrology of the riparian area. These activities may divert necessary surface and subsurface water, contribute excess sediment and nutrients to the creeks, and increase erosion within the watershed (Karr and Schlosser 1978). The boundary also covers extra area beyond the 1,000-foot buffer above the main stem of Devil Creek, where large old growth ponderosa pines on the steep east-facing hillside are still subject to the threat of logging. The entire site boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is almost entirely within the San Juan National Forest with a small portion of private land at the south boundary. The mixed ownership between USFS land and private property may dictate reevaluation of the protection rank if land use practices change in the future.

General Protection Comments: The site is almost entirely within the San Juan National Forest with a small portion of private land at the south boundary. Although this ownership status does not assure perpetual protection for the rare communities it is not expected that protection actions will be needed in the foreseeable future. However, any changes in ownership or land use practices may necessitate action. Currently livestock grazing occurs at the site and although it is not imminent, there is potential for development of the private property.

Management Urgency Rank Comments (M3): Current management seems to favor the persistence of the riparian associations in the site, but management actions may be needed in the future to maintain the current quality of the communities. Weed invasion, protection of the source hydrology, and public access (including foot traffic, horse use and OHV use) are the main management issues affecting this site.

Management Needs Comments: Recharge of Devil Creek and West Devil Creek from snowmelt and groundwater occurring at a scale larger than the size of the site is important for long-term survival of the riparian communities. Any changes to these hydrologic processes will compromise the viability of the communities, and it is important to stress that any project affecting surface or groundwater hydrology in the drainage has the potential to affect the hydrology maintaining the riparian communities. Restricting or disallowing potential logging projects within the immediate watershed would protect the occurrences by limiting direct and indirect impacts to the watershed. Exotic and invasive species also have the potential to become a serious problem within the otherwise mostly-native plant communities. Past and current human and horse activity (now mostly limited to usage by the private landowner at the south boundary) associated with trails along the two creeks has resulted in the introduction of exotic plant species especially at the south end of the site, and a monitoring program would aid in detecting expansion of the exotics and the introduction of new populations of non-native plants. Such information would assist in determining the timing and need for weed management actions necessary for maintaining the quality of the riparian communities. Lastly, trails shown on USFS maps are not currently maintained; however there is ongoing pressure from the public for the USFS to maintain the trails and to open these areas to motorized and non-motorized recreational use, which threatens to impact the communities. Currently the site does not receive much visitation either by foot, horseback or vehicle due to the current lack of trail maintenance as well as the necessity of crossing private land to access the downstream extent of either trail.

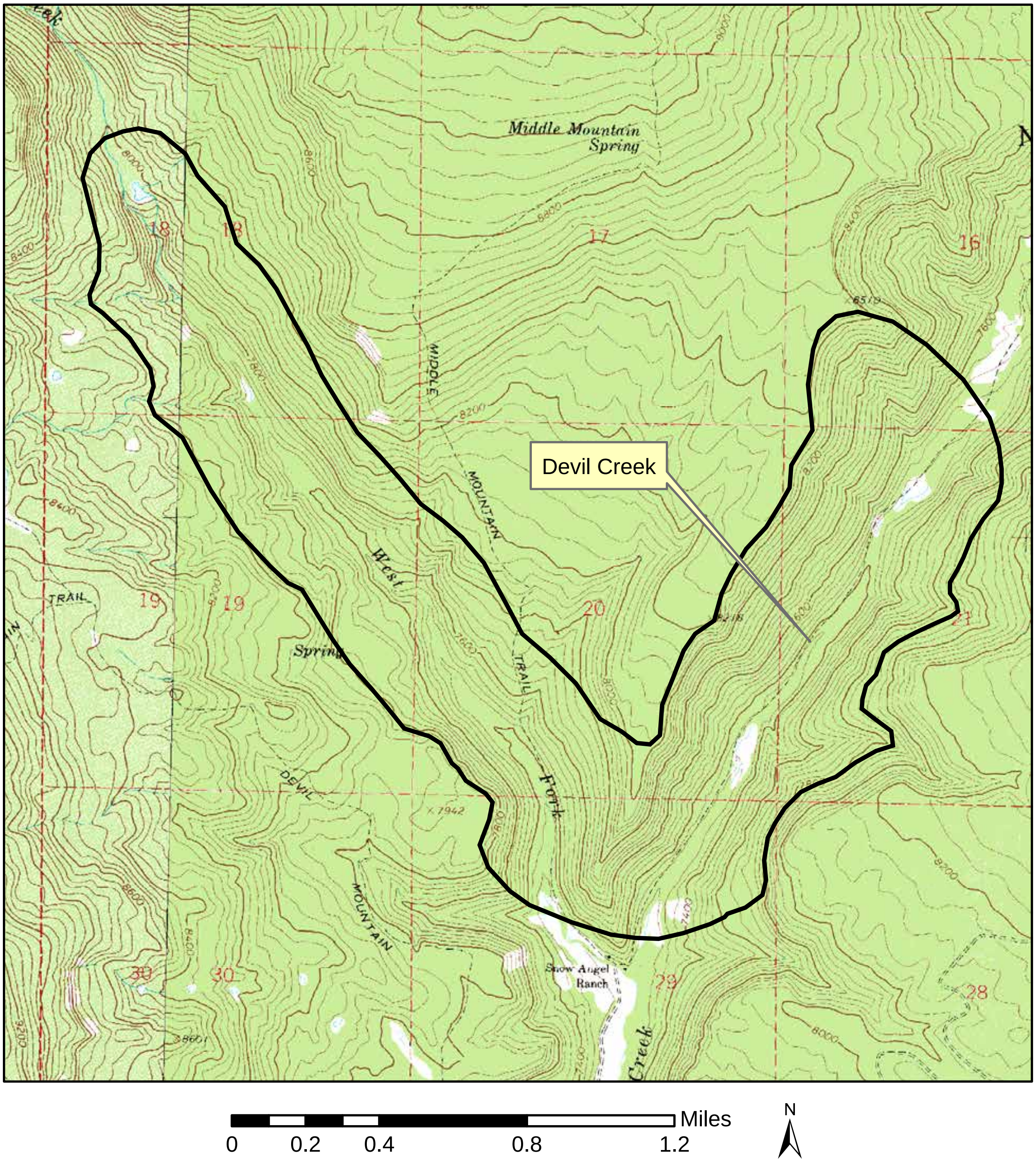
Because of the private ownership at the downstream end, the site is effectively protected from user access on its southern edge. It would further benefit the communities if the USFS would remove notation of these already non-maintained trails from all published USFS maps and install signage at key trail junctions noting the trails as closed, effectively limiting usage in the area and access from the northern portions of the site.

Land Use Comments: Land use is restricted to non-motorized recreational usage by hikers, horseback riders, and hunters, although the trails within the site are neither maintained nor accessible from the south end due to private property ownership.

Natural Hazard Comments: Western poison ivy (Toxicodendron rydbergii) is present and vigorous along the main stem of Devil Creek. It was not noted in the cooler, shadier habitats along the West Fork of Devil Creek.

Exotic Species Comments: Exotic species occur on the uplands, especially at the downstream extent of the two creeks adjacent to the private inholding. The dominant exotics found onsite include forbs such as thistles (Cirsium spp.), common dandelion (Taraxacum officinale), and oxeye daisy (Leucanthemum vulgare), and pasture grasses such as orchardgrass (Dactylis glomerata), Kentucky bluegrass (Poa pratensis), and cheatgrass (Bromus tectorum).

Off-Site Considerations: Hydrological processes originating outside of the planning boundary, including water quality, quantity, timing and flow must be managed to maintain site viability. Monitoring of cumulative watershed impacts may be necessary (see Preston and Dudley 1981, Coats and Miller 1981). Gravel mining currently occurs downstream of the element occurrences on the private property at the south end of the site (Snow Angel Ranch).



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

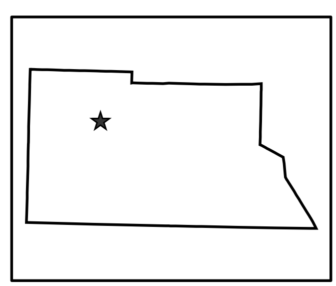
Legend

PCA Boundary

Chris Mountain, 37107-C2
Devil Mountain, 37107-C3

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 3. Devil Creek at Middle Mountain Potential Conservation Area, B2: Very High Biodiversity Significance

Devil Creek State Wildlife Area

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chimney Rock

Size: 496 acres (201 ha) **Elevation:** 6,700 - 7,200 ft. (2,042 - 2,195 m)

General Description: In the west-central portion of Archuleta County, north of Capote Lake and Highway 160 and between Haystack Mountain and Devil Mountain, Devil Creek flows westward through the Devil Creek State Wildlife Area. A snowmelt and spring-fed second-order stream in a lower montane, moderately broad river valley bottom, Devil Creek is a tributary to the Piedra River four miles downstream of the site. Along Devil Creek near the site, Haystack Mountain (7,900') rises sharply to the southeast and Devil Mountain (9,900') rises more gradually four and a half miles to the north. A broad riparian zone occurs along Devil Creek, occupying the terraces and benches. Dominated by an open-to-dense canopy of multi-aged narrowleaf cottonwood (Populus angustifolia), the riparian area has a diverse and sometimes dense understory of riparian shrubs dominated by silver buffaloberry (Shepherdia argentea) and river hawthorn (Crataegus rivularis); other riparian shrubs can reach a high density depending upon water availability. Ponderosa pine (Pinus ponderosa ssp. scopulorum) occurs sporadically within the riparian zone and on the upper terraces but never dominates the riparian area. One stand of non-native Russian olive (Elaeagnus angustifolia) was noted along Devil Creek. In the herbaceous layer, native species are mixed with non-natives including thistles (Cirsium sp.), smooth brome (Bromus inermis) and other hay grasses. Cheatgrass (Bromus tectorum) and jointed goatgrass (Aegilops cylindricum) have invaded hay meadows in the lower portion of the site adjacent to the riparian zone. Within the floodplain, backwater channels and sloughs are common and support a mix of more mesic and hydrophytic species, though none are considered dominant. The upstream reaches of Devil Creek exhibit fewer weeds and a higher density of native species, and the downstream reaches are more impacted, but not severely. On the terraces above the immediate floodplain there are large, downed cottonwoods as well as standing snags, enhancing the wildlife habitat. Adjacent upland forests are dominated by ponderosa pine and Gambel oak (Quercus gambelii). Deer, elk and turkey are common in the area, especially in the fall and winter, and many songbirds forage, roost, and possibly nest in the shrub understory and cottonwood canopy during warmer months. Peregrine Falcon from a nearby aerie may forage along Devil Creek within the site (CDNR 2005). The fishery is rated poor for rainbow and native trout according to the Colorado Division of Wildlife (CDNR 2005), since creek flows disappear in dry years, and because downstream culverts at the highway may limit fish migration. Power or utility lines cross through the site, and a limited-use two-track road parallels the creek on a high terrace north of the creek.

Key Environmental Factors: The geology along this reach of Devil Creek is mapped as MesaVerde Group, comprised of sandstone and shale. Adjacent hillsides to the north are mapped as Mancos Shale, and to the south as Pictured Cliffs sandstone and Lewis shale (Tweto 1979). Soils immediately along Devil Creek are mapped as Pescar sandy loam from mixed parentage, with Nunn loam (derived from sandstone and shale) on the terraces north of the creek. Surrounding upland hillsides are dominated by Carracas loam (also derived from sandstone and shale), with sandstone outcrops (USDA 1981). Natural fluvial processes appear to be intact within the creek, with signs of channel migration, deposition of large woody debris in the channel, cobble point bars and sediment deposition on the first floodplain, and drift lines caught in the understory and shrub layers. Natural levels of bank erosion are noted, such as cut banks on creek bends and deposition of gravel and cobble point bars. Sandbar willow (Salix exigua) and other species stabilize the banks in many areas, but naturally erosive soils contribute to the sediment load. Flood attenuation capability for this site is moderate due to its many old channels and immediate access to a large floodplain.

Biodiversity Significance Rank Comments (B2): The site supports good (B-ranked) occurrences of two riparian forest communities, the globally imperiled (G2?/S2) narrowleaf cottonwood/river hawthorn (Populus angustifolia/Crataegus rivularis) riparian forest and the globally vulnerable (G3/S3) narrowleaf cottonwood/strapleaf willow-silver buffaloberry (Populus angustifolia/Salix ligulifolia-Shepherdia argentea) riparian forest. The narrowleaf cottonwood/river hawthorn community typically occurs on higher ground within the floodplain, as well as near secondary backchannels. River hawthorn generally grows within the drier parts of a floodplain, and can be an indicator that the water table is dropping or that the area is no longer seasonally flooded (Carsey et al. 2003). As of 2005, this is the only documented occurrence of narrowleaf cottonwood/river hawthorn in Archuleta County. The narrowleaf cottonwood/strapleaf willow-silver buffaloberry community is extremely limited in western Colorado but is found in several locations in the county, and typically is located on the first terrace above the floodplain, usually with impacts from long-term cattle grazing.

Natural Heritage element occurrences at the Devil Creek State Wildlife Area PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia / Crataegus rivularis Woodland	Narrowleaf Cottonwood Riparian Forests	G2?	S2				B	2005-06-22
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				B	2005-06-22

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses the element occurrences and the immediate watershed to buffer hydrologic processes necessary to the viability of the elements. Natural fluvial disturbances such as seasonal flooding and sediment deposition are important to the maintenance of a dynamic, multi-aged cottonwood riparian system (TNC 1996; Hansen et al. 1995) and will help maintain viable populations of the elements along Devil Creek (Sanderson and Kettler 1996). Upstream hydrologic modifications such as water diversions, stock ponds or other impoundments, and improper livestock grazing in riparian areas may be detrimental to the hydrology of the riparian area. In addition, a 1,000 foot buffer from the riparian zone includes nearby trails, roads, and parking areas where surface runoff may contribute excess nutrients, sediment and weed invasion. It should be noted that all the hydrologic processes necessary to the elements are not fully contained by the site boundaries, and the boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed within the foreseeable future. The site is within the Devil Creek State Wildlife Area and the San Juan National Forest.

General Protection Comments: The site is mostly owned by the State of Colorado (Devil Creek State Wildlife Area), and where the site extends beyond the state's property boundaries, it lies fully within the San Juan National Forest.

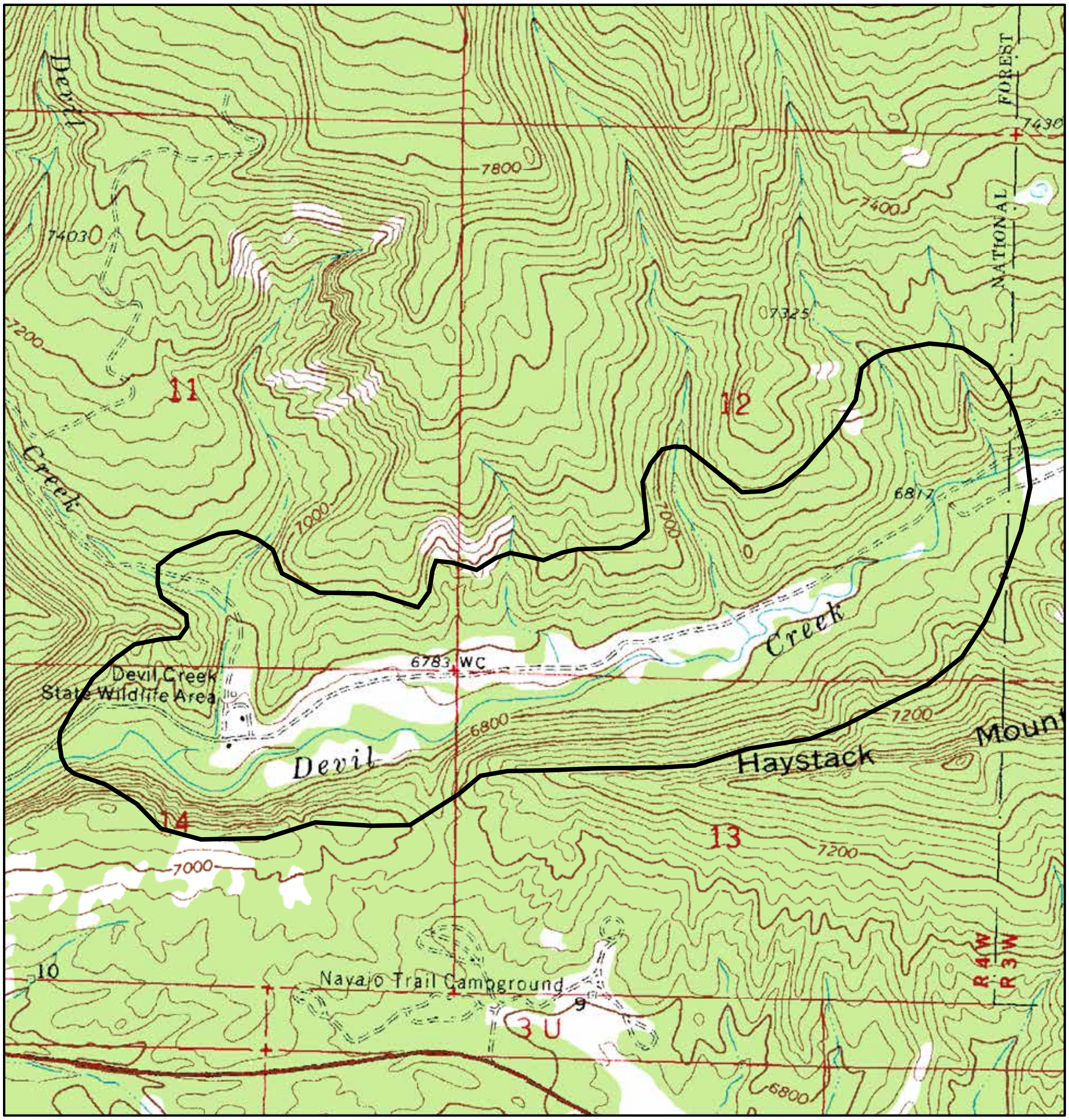
Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the site. Dispersal of noxious weeds and other exotic species may be a growing problem in the future with continued vehicular parking, hunting access, and horse use.

Management Needs Comments: Recreational uses such as hiking, fishing, hunting and horse use cause impacts including weed invasion and erosion. Impacts tend to be localized near trailheads and along trails and roads. Encouragement and enforcement of the use of certified weed seed free feed for horse users would benefit the ongoing viability and quality of the element occurrences by reducing the risk of introduction of exotic species. In addition, the riparian community would benefit from having a baseline weed survey completed, and thereafter an annual or biannual weed monitoring survey performed. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Land Use Comments: Steep topography to the south and southeast generally limits recreational use, but horses and foot travel are common on trails within the site, and both OHV and horse use are common on Forest Service lands on Devil Mountain to the north. The Division of Wildlife maintains irrigated hay meadows at the lower end of the site as food plots for wintering animals (CDNR 2005). A locked gate at the State Wildlife parking area controls access to a dirt road which parallels the creek on the north side of the creek, typically some distance from the riparian zone. This road may access a private cabin upstream, but its actual destination is unknown.

Exotic Species Comments: Weeds may be a growing problem in the future with continued hunting access and horse use, as evidenced by a few nodding plumeless thistle (Carduus nutans ssp. macrolepis) and significant cheatgrass (Bromus tectorum) invading a smooth brome (Bromus inermis) hay meadow adjacent to the creek.

Off-Site Considerations: As the creek leaves the boundaries of the State Wildlife Area at the west end of the site, its gradient increases and the valley narrows to a canyon for about a mile before the creek travels through culverts under the highway and the landscape opens out and flattens again. These culverts possibly prevent or at least limit fish passage upstream. A residence occurs at the junction of Highway 160 and FR 627. The resident there mentioned there may be a private cabin upstream of the site, but its location and relevance to the element occurrences are unknown.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

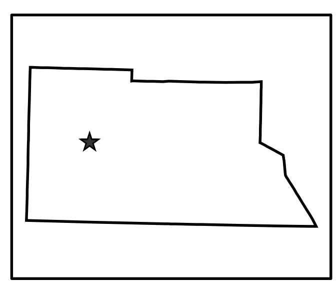
Legend

PCA Boundary

Chimney Rock, 37107-B3

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 4. Devil Creek State Wildlife Area Potential Conservation Area, B2: Very High Biodiversity Significance

Harris Lake

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Harris Lake

Size: 470 acres (190 ha) **Elevation:** 9,000 - 9,720 ft. (2,743 - 2,963 m)

General Description: Harris Lake is within the San Juan National Forest in the west-central part of Archuleta County, on the west slope of the Chalk Mountains and just west of the boundary of the South San Juan Wilderness. The site encompasses a small basin containing Harris Lake and adjacent slopes of the Chalk Mountains, which due to their landslide geology often have groundwater discharge and support many small ponds, lakes, drainages, wetlands and several fens. These water bodies subsequently support an extraordinarily rich and diverse mosaic of wetland and riparian habitats. It is important to note that both Harris Lake and Buckles Lake south of the site are manipulated (dammed), with headgates that provide control of water for irrigation diversions. Both lakes were enhanced many years ago and are well established and support extensive native wetland plant associations. Blanco Tunnel, a major US Bureau of Reclamation subterranean water diversion in the area built in the late 1960's as part of the San Juan-Chama Project to divert water from the San Juan River Basin across the Continental Divide and into the Rio Grande River Basin (USDI, no date), is mapped within 200 feet of the site, but no surficial impacts to the area were noted. The geomorphology of the Chalk Mountains area includes landslide deposits and generally slumpy, stepped topography. The western slopes of the Chalk Mountains typically have steep slopes, a dense, mature spruce-fir-aspen (Picea spp.-Abies spp.-Populus tremuloides) forest, and large rockslides and outcrops. Many small drainages flow from the mountains westward, eventually joining the Rio Blanco; these drainages frequently support thinleaf alder (Alnus incana ssp. tenuifolia)/mesic forb shrublands along with willow (Salix sp.) and mesic graminoid shrublands. Small ponds and wetlands across the site typically support beaked sedge (Carex utriculata) and water sedge (Carex aquatilis) dominated communities, frequently intermixed with other sedge species, swordleaf rush (Juncus ensifolius), northern green orchid (Platanthera hyperborea var. hyperborea), and Kentucky bluegrass (Poa pratensis). Often these wetlands are peat accumulating (peat less than 40 cm deep), and at least two of these wetlands are considered fens (where peat accumulation is greater than 40 cm in depth). One of the two fens consists of a floating mat of peat, which supports rare and infrequent wetland species including marsh cinquefoil (Comarum palustre), mud sedge (Carex limosa), silvery sedge (Carex canescens), inland sedge (Carex interior), lesser panicled sedge (Carex diandra), fewflower spikerush (Eleocharis quinqueflora), buckbean (Menyanthes trifoliata), and tall cottongrass (Eriophorum angustifolium). The Buckles Lake/Harris Lake trail is a very popular trail used by hikers/backpackers, horseback riders, fishermen and hunters, and therefore acts as a vector for impacts such as erosion, weed seed dispersal, and litter. ATV access is allowed from the trailhead to the headgates at Buckles Lake for irrigation maintenance, but other motorized vehicle use is prohibited. Exotic and invasive species such as Canada thistle (Cirsium arvense), common dandelion (Taraxacum officinale), and Kentucky bluegrass (Poa pratensis) are common and widespread, especially in upland areas and adjacent to trails and Harris and Buckles Lakes. However, many of the smaller riparian drainages and wetland and fen areas that are some distance from the trails are nearly weed-free. Because of the rugged (steep, rocky) terrain that occurs off-trail, neither cattle nor humans induce much impact on many of these difficult-to-reach areas, including the floating mat fen.

Key Environmental Factors: A large portion of the geology on the west slopes of the Chalk Mountains, including the area within the site, is mapped as Landslide Deposits (Tweto 1979), which includes areas of thick colluvial deposits. This geology seems to predispose the area to having a stepped or hummocky microtopography where the groundwater table often is intercepted, forming many small pocket lakes and ponds. Soils are mostly Castelleia loams - moderately deep and well-drained, but often limited by an underlying layer of impervious shale or sandstone. Pockets of Histic Cryaquepts occur frequently within the Castelleia matrix (USDA 1981), which appear to be directly related to locations of ponds, wetlands and fens.

Biodiversity Significance Rank Comments (B2): This site is drawn for a good (B-ranked) occurrence of the globally imperiled (G2/S1S2) and state critically imperiled mud sedge (Carex limosa) montane wetland community, and a good (B-ranked) occurrence of the globally secure (G5/S1S2) but state critically imperiled marsh cinquefoil (Comarum palustre). Both of these elements occur within a nearly pristine fen above 9,000 feet in elevation. As of 2005, the site contains the only known occurrences of these two elements within Archuleta County. Also occurring within the site is a fair (C-ranked) occurrence of the globally and state vulnerable (G3/S3) thinleaf alder (Alnus incana)/mesic forb riparian shrubland community.

Natural Heritage element occurrences at the Harris Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Carex limosa Herbaceous Vegetation	Montane Wetland	G2	S1S2				B	2005-07-13
Natural Communities	Alnus incana / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				C	2005-07-13
Vascular Plants	Comarum palustre	marsh cinquefoil	G5	S1S2				B	2005-07-13

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that includes the element occurrences, associated wetlands and fens, and the immediate watersheds supporting the element occurrences. Additional area is included that will buffer hydrologic processes, such as stream flows into Harris Lake, which are thought to secondarily contribute to the groundwater availability that supports the element occurrences. The boundary also provides a buffer from the Blanco Tunnel assuming maintenance work may someday be necessary along its length. It should be noted that all hydrologic processes necessary for wetland viability are not contained within the site boundaries.

Protection Urgency Rank Comments (P1): It is estimated that current land uses may reduce the viability of the elements within one year. There is an outstanding opportunity to mitigate or eliminate the threats if action is taken within one year. The site is owned and managed by the San Juan National Forest, Pagosa Ranger District, and occurs just outside of the South San Juan Wilderness boundary. No known protection plans are in place for the site; however, protection for the nearly pristine fen is critical to ensure its long-term existence.

General Protection Comments: A small, healthy, vigorous, native species-dominated fen and unassociated small riparian drainage, both with very few invasive or exotic species, are located within a relatively remote area of the San Juan National Forest. However, many years of accumulating grazing impacts on the immediate downstream edge of the fen threaten to drain the fen, and grazing impacts on the riparian system also threatens its nearly pristine condition. Special designation for this area or a modification of the allowable land uses in the area would ensure long-term viability for these element occurrences. The relative scarcity of the mud sedge community, and of marsh cinquefoil in this portion of the state may be grounds to pursue additional protection for the site and its associated hydrology.

Management Urgency Rank Comments (M1): The most observable threat identified is the heavy grazing, which threatens the wetland and riparian systems through contribution of excess nutrients, increased sedimentation, weed invasion, and potential draining of confined basins through erosion and soil compaction. At a minimum, an evaluation of grazing frequency, intensity, duration, and AUMs in the area may benefit the occurrence by determining appropriate grazing levels. However, it is important to note that due to existing cumulative impacts from grazing, any continued grazing in this area has the potential to have deleterious effects on the occurrences. Fortunately, human-caused impacts currently are a relatively small threat, since the element occurrences are located within a remote area of the site inaccessible to human or equine recreation without some concerted effort.

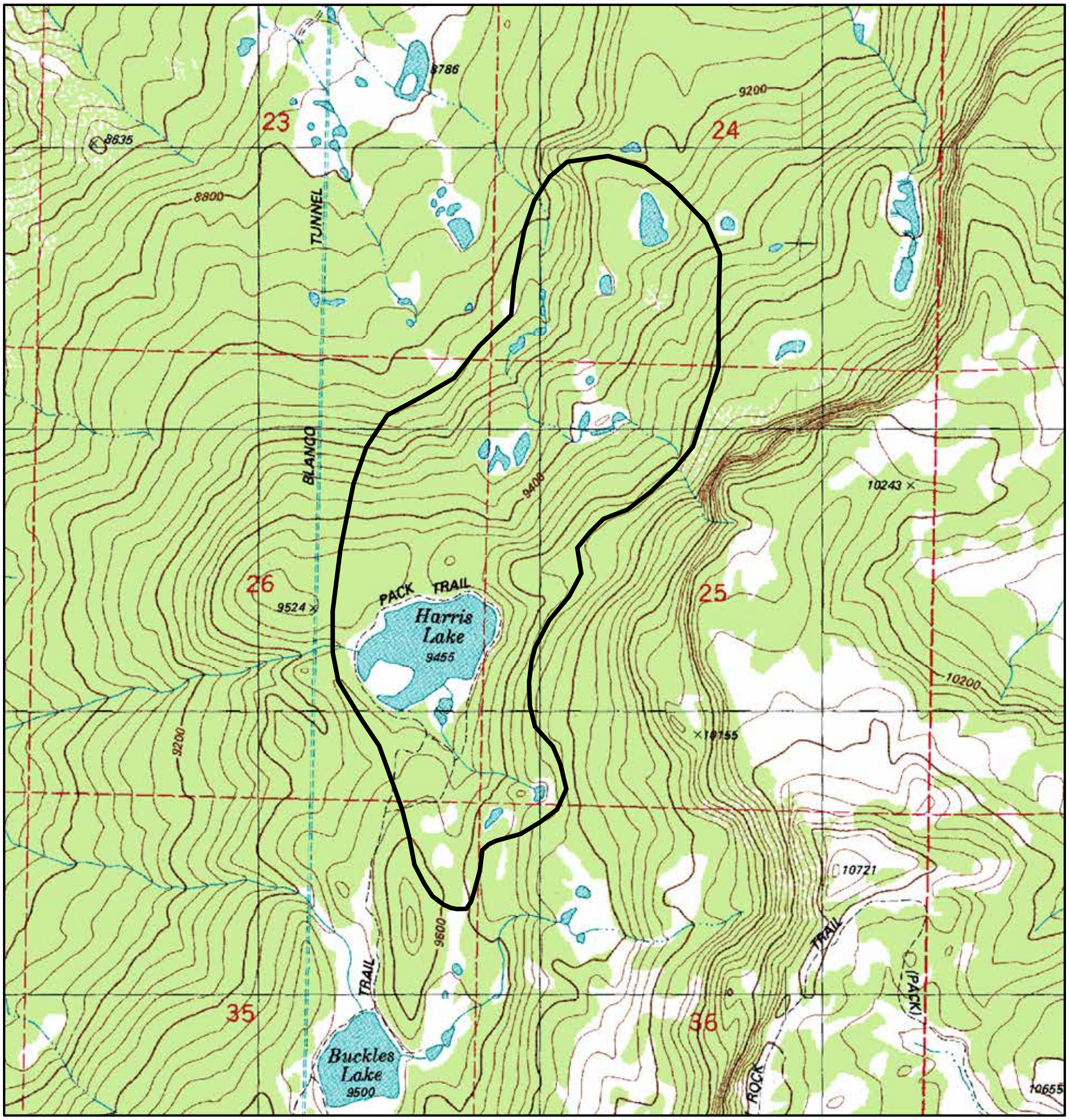
Management Needs Comments: Control of exotic species, especially Canada thistle, would be beneficial to all communities occurring within the site, including upland, riparian and wetland communities. However, the species is widespread and a significant eradication plan may be necessary. Cattle grazing is heavy, and protection of sensitive wetland and riparian communities and species from the ongoing, cumulative impacts of grazing is essential to ensuring their long term viability. Fencing and grazing restrictions would benefit those sites most threatened by grazing by protecting the existing hydrology and preventing introduction of weeds, sedimentation, and excessive nutrients into the riparian and wetland systems.

Land Use Comments: The current dominant land uses within the site are grazing and recreation. Harris Lake is a very popular day-hike destination as well as an overnight (backpacking or horsepacking) camping destination. The area is well used during hunting season, and both Buckles and Harris Lakes are popular fishing sites.

Exotic Species Comments: Common exotic species are found throughout the site, most notably Canada thistle (Cirsium arvense). Other common invasive or exotic species include dandelion (Taraxacum officinale), Kentucky bluegrass (Poa pratensis), common mullein (Verbascum thapsus), and common plantain (Plantago major). Weeds are more common along trails and readily accessible edges of Harris Lake, where the focus of recreational activities occurs, and in meadows and wetland areas that are easily accessible to cattle.

Off-Site Considerations: A large, single privately owned parcel occurs downslope of the site, within 1,000 feet of the boundary. From aerial photo interpretation, it appears that the parcel is not subdivided, and contains a large house and several barns and outbuildings, and grazing may occur on the property (USDA 2002).

Information Needs: Establishment of baseline monitoring will enable accurate monitoring of the ongoing grazing impacts to the fens and riparian areas. Additional ground surveys in the area may also uncover additional fen locations.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

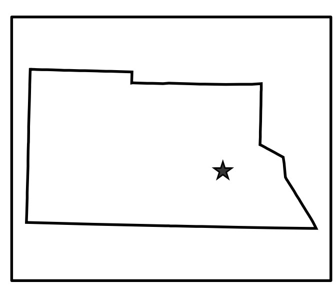
Legend

PCA Boundary

Harris Lake, 37106-B7

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 5. Harris Lake Potential Conservation Area, B2: Very High Biodiversity Significance

Sambrito Creek Headwaters

Biodiversity Rank - B2: Very High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Allison, Pargin Mountain

Size: 326 acres (132 ha) **Elevation:** 7,200 - 8,600 ft. (2,195 - 2,621 m)

General Description: Sambrito Creek is located in the southwest corner of Archuleta County, northwest of Piedra Peak. It flows generally southward to its confluence with Navajo Reservoir just north of the Colorado/New Mexico state line. The upper portion of Sambrito Creek is within a montane setting with an unimproved dirt road adjacent to it. The channel is moderately steep, straight to moderately sinuous, and cuts a deep ravine where the gradient increases. From its headwaters Sambrito Creek passes through open meadows and quaking aspen (Populus tremuloides) forests, and the local hydrology is slightly altered by small stock pond berms. Farther downstream the channel is dominated by narrowleaf cottonwood (Populus angustifolia) and Rocky Mountain juniper (Juniperus scopulorum). Stream flows appear to be low, and cottonwoods appear to be confined to the areas within the channel where water is available. The dry, lower reach of Sambrito Creek is dominated by ponderosa pine (Pinus ponderosa ssp. scopulorum), Douglas-fir (Pseudotsuga menziesii), and Rocky Mountain juniper. Over the full reach of the creek within the site, the riparian shrub understory displays a sparse to moderate canopy and is dominated by Gambel oak (Quercus gambelii) and roundleaf snowberry (Symphoricarpos rotundifolia). The herbaceous understory displays a mixture of upland, native and non-native species including Kentucky bluegrass (Poa pratensis), common dandelion (Taraxacum officinale), alpine false springparsley (Pseudocymopterus montanus), sweet cicely (Osmorhiza depauperata), common yarrow (Achillea millefolium var. occidentalis), longstalk clover (Trifolium longipes), moss and others. Ponderosa pine forests and Gambel oak shrublands dominate the uplands. Higher elevation uplands are comprised of spruce - fir (Picea pungens - Abies spp.) and quaking aspen forests. The riparian area and adjacent meadows at the upper extent of Sambrito Creek provide a lush and vigorous habitat within an otherwise arid region.

Key Environmental Factors: The surface geology is dominated by the San Jose Formation, comprised of siltstone, shale and sandstone (Tweto 1979). Soils within the riparian area are alluvium with angular cobble and gravel with silt deposits.

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) example of the globally imperiled to vulnerable (G2G3/S2S3) narrowleaf cottonwood-Rocky Mountain juniper (Populus angustifolia-Juniperus scopulorum) montane riparian forest plant association. This association typically occurs on drier sites of riparian systems, such as terraces, islands within wide rivers, and within rocky sandy bottoms of narrow straight channels (Carsey et al. 2003). The occurrence on Sambrito Creek is on the rocky bottom of a steep, ephemeral channel.

Natural Heritage element occurrences at the Sambrito Creek Headwaters PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				B	2005-06-17

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to include an area that encompasses supporting ecological processes necessary to the long-term viability of the element occurrence. The boundary also identifies a buffer including the road and rangelands where direct disturbance and impacts from road use and maintenance and grazing may contribute to excessive nutrients, sediment, and weed invasion. It should be noted that the boundary does not contain all hydrologic processes necessary to the element.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is owned by the Southern Ute Indian Tribe.

General Protection Comments: The site is entirely owned by the Southern Ute Indian Tribe. The San Juan National Forest boundary occurs just north of the site.

Management Urgency Rank Comments (M4): Current management is favoring the persistence of the plant association. Management actions may be needed in the future to maintain the current quality of the element occurrence. Roads in the area are utilized to access gas resource developments.

Management Needs Comments: The site is threatened by road development and road maintenance associated with gas well development. The stream passes through culverts where erosion is evidenced by steep banks with bare soils and backfill. Evaluating and monitoring effects of road use, road maintenance, and sediment loading into the channel may benefit the long-term viability of the element occurrence. There are few weeds except localized along the road adjacent to the riparian area. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species. The upstream extent of the site is domestically grazed where impacts appear moderate.

Land Use Comments: A major landuse threat in this area of the HD Mountains and the San Juan Basin is gas-well drilling, and the road networks and well-pad construction that go along with it. Gas well development is occurring downstream of the site. This portion of Archuleta County and nearby La Plata County is under heavy pressure for gas well development in 2005.

Exotic Species Comments: There are few weeds within the site. Weeds occurring in the area, such as common dandelion (Taraxacum officinale) and Kentucky bluegrass (Poa pratensis), are localized at the side of the road.

Off-Site Considerations: Gas well development is occurring downstream of the element occurrence, including multiple short roads and well pad sites.

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

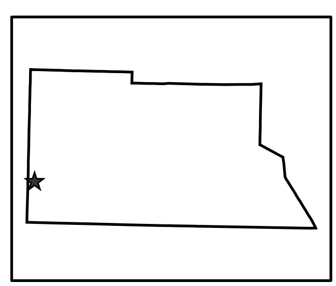
Legend

PCA Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 6. Sambrito Creek Headwaters Potential Conservation Area, B2: Very High Biodiversity Significance

Coal Creek Trailhead

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Blackhead Peak, Jackson Mountain

Size: 558 acres (226 ha) **Elevation:** 7,950 - 9,400 ft. (2,423 - 2,865 m)

General Description: Coal Creek is a small, moderately steep montane creek located in the northwest corner of Archuleta County, flowing generally northwest from a prominent, unnamed ridge in the South San Juan Wilderness to its confluence with the San Juan River north of Pagosa Springs. The creek flows through the site with low to moderate sinuosity, through a cool, narrow canyon bordered by steep hillsides. The area is owned by the U.S. Forest Service, with patchy private land on three sides of the site, and the South San Juan Wilderness beginning at the east edge of the site at the headwaters of Coal Creek. A dense, tangled cover of thinleaf alder (Alnus incana ssp. tenuifolia) and Drummond's willow (Salix drummondiana) lines the narrow floodplain, with occasional mature narrowleaf cottonwood (Populus angustifolia) dotting the community. The creek bed is approximately ten to twelve feet wide and is made up of multiple drop pool-riffle complexes, with overhanging riparian shrubs also including a high percentage of redosier dogwood (Cornus sericea) and Rocky Mountain maple (Acer glabrum). The understory has mesic graminoids and forbs such as mixed in about equal percentages, with a high percentage of litter and duff covering the ground. Typical herbaceous species include bluejoint grass (Calamagrostis canadensis), scouringrush horsetail (Equisetum hymale var. affine), common cowparsnip (Heracleum maximum), and Rocky Mountain hemlock parsley (Conioselinum scopulorum). The creek bed shows evidence of flooding with sediment deposition, small woody debris, and drift lines caught in shrub branches and on the banks of the creek. High creek flows appear to undercut the creek banks, but roots of creekside plants maintain the bank integrity. Wilson's Warbler and other songbirds flit through the dense shrub layer along the creek, and small trout fingerlings occur in the creek upstream of the trail crossing. Deer and elk use the area as well. The surrounding forest is mature and comprised of spruce (Picea sp.), white fir (Abies concolor), and Douglas-fir (Pseudotsuga menziesii), with a few quaking aspen (Populus tremuloides). The thinleaf alder and Drummond's willow in the riparian zone are dense and vigorous, and show abundant signs of regeneration. However, as is typical throughout Archuleta County in 2005, some alder plants are exhibiting branch dieback or leaf blight. In addition, the surrounding forest has approximately 5% spruce and fir death, documented in the form of dead standing trees. Downed wood and trees also occur all over the hillsides and within the creek corridor. The area is actively grazed, and typical weeds associated with grazing are present, including common plantain

(Plantago major), common dandelion (Taraxacum officinale) and Kentucky bluegrass (Poa pratensis). Steep hillsides adjacent to the creek show severe erosion in areas, possibly due to natural soil conditions or aggravated by cattle grazing.

Key Environmental Factors: The thinleaf alder-Drummond's willow community occurs within a cool, narrow canyon with steep, forested hillsides, and a channel with low to moderate sinuosity, all typical conditions for the community (Carsey et al 2003). The geology of the area is mapped as Animas formation in the upper half of the community, and Pictured Cliffs Sandstone and Lewis Shale in the lower half of the community (Tweto 1979). Soils in the local area typically are derived from interbedded sandstone and shale and are predominantly sandy loam or silt loams. The upper half-mile of the community occurs on Corta silt loam, a small portion of the middle section occurs on Castelleia loam, and the majority of the community at the lower end is on Pescar sandy loam. Pescar sandy loams in particular typically occur within the floodplains and terraces of drainages (USDA 1981). Soils sampled within the stream channel are alluvium with sandy deposits.

Land Use History: Review of a recent aerial photo indicates logging may have occurred in the past, upslope of the north banks of Coal Creek and within the site (USDA 2002).

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) Thinleaf Alder-Drummond's Willow (Alnus incana-Salix drummondiana) Montane Riparian Shrubland plant association. This plant community is an early- to mid-seral association that is typically confined to the immediate edges of steep, shady streams. Both species produce profuse amounts of seed, and readily colonize areas of bare sediment deposition including areas that have been recently scoured by floodwaters or seasonal runoff. Their inherent flexibility as seedlings allows them to persist through flood events. Drummond's willow may capitalize on the ability of thinleaf alder to fix atmospheric nitrogen and become more populous over time (Carsey et al. 2003).

Natural Heritage element occurrences at the Coal Creek Trailhead PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix drummondiana Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-09-06

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the riparian shrubland and forest along Coal Creek. It should be noted that the hydrological processes necessary to the riparian communities are not fully contained by the site boundaries. Given that the riparian communities are dependent on natural hydrological processes associated with Coal Creek and its tributaries, upstream activities such as logging, residential or other development, water diversions or impoundments, and improper livestock grazing are detrimental to the hydrology of the riparian area. The boundary also identifies a buffer around existing trails, trailheads and forest service roads where surface runoff may contribute nutrients and sediment, and where impacts may promote weed invasion. Lastly, the boundary includes an approximate 1,000 foot buffer to control sedimentation, protect the aquatic and plant communities from direct disturbance such as trampling (Karr and Schlosser 1978), and to allow additional native riparian plants to become established over time. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. Except for small portions of buffer areas within the west portion of the site, it is just inside the San Juan National Forest, and if forest ownership is maintained this area should be adequately protected.

General Protection Comments: Except for small portions of buffer areas within the west portion of the site, it is entirely contained within USFS land, and though this does not assure perpetual protection for the plant community, no protection actions are currently needed. The watershed is partially contained within the South San Juan Wilderness. However, any changes in use of the land or ownership within the site, or additional development within the adjacent privately owned parcels might necessitate action.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the viability of the plant community found within this site. Recreational use by hunters, horse packers, horseback riders, and hikers, and heavy cattle grazing may have deleterious effects on the plant community through introduction and spread of exotic species. Adjacent private parcels threaten the community with additional residential development and associated impacts.

Management Needs Comments: Cattle grazing and recreation (hunting, hiking, horse-packing) all currently occur within the immediate watershed. Current grazing practices in the immediate watershed have the potential to adversely affect this occurrence. Evaluation of the current management of the grazing allotment (duration, intensity and frequency) may assist in minimizing overgrazing, sediment and nutrient contributions to the stream, soil erosion and compaction, and the spread of weeds within the watershed. There is also the potential for non-native species to increase or invade with the high level of recreation uses such as hiking and horse use along the trail through the site. Encouragement and enforcement of the use of certified weed seed free feed for horse users would benefit the ongoing viability and quality of the element occurrences by reducing the risk of introduction or spread of exotic species. Additionally, inappropriate grazing in the upper watershed above the site or any activity in the upper drainage of the site has the potential to adversely affect the montane forest and the riparian community. Hydrological processes originating outside of the planning boundary-including water quality, quantity, timing and flow-must be managed to maintain site viability. A monitoring program would aid in detecting non-native plant introductions, hydrologic changes, and increased erosion, and may indicate when management actions are needed to maintain the quality of the montane riparian forest community.

Land Use Comments: Current land uses include cattle grazing, horse riding/packing, hunting, hiking, and wildlife habitat. Residential development is occurring downstream of the site.

Exotic Species Comments: Upslope of the riparian zone near the Forest Service road (FR 666) and trailhead, there is a high percentage of pasture species such as smooth brome (Bromus inermis), Kentucky bluegrass, timothy (Phleum pratense), and common dandelion. These continue down the slope, along the pack trail, which eventually crosses the creek, and then parallels the creek for the length of the site, creating a vector for weed distribution. A site survey in 1995 documented many exotic weed species along FR 666 and in adjacent areas, though it did not specify which species were present.

Off-Site Considerations: The west end of the site, though contained on USFS land, abuts two private parcels, both of which show residential development (USDA 2002). The east end of the site abuts the South San Juan Wilderness boundary. Old mining prospects are indicated on USGS 7.5 minute quadrangle maps occurring immediately south of the boundary, and large areas of private property downstream of the site are subject to residential development as Pagosa Springs and Archuleta County populations grow.

Information Needs: Some species within the riparian zone and on the adjacent upland slopes seem to be experiencing some type of disease possibly resulting in death, including spruce, Douglas-fir, currants (Ribes spp.), alder, and aspen. These plants show leaf wilt, leaf discoloration or "burns", and dead branches, and a notable percentage of the tree species are entirely dead, though still standing. Research could address why aspen, narrowleaf cottonwood, spruce, Douglas-fir, thinleaf alder, currants, and other forest species in the site are suffering from leaf wilt, branch dieback, or entire plant death.

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

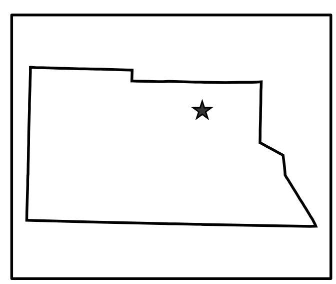
Legend

PCA Boundary

Blackhead Peak, 37106-C7
Jackson Mountain, 37106-C8

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 7. Coal Creek Trailhead Potential Conservation Area, B3: High Biodiversity Significance

East Side of Chalk Mountains

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chama Peak, Elephant Head Rock

Size: 1,965 acres (795 ha) **Elevation:** 8,080 - 9,520 ft. (2,463 - 2,902 m)

General Description: The Chalk Mountains are a small, north-south mountain range in the southeast corner of Archuleta County, bound on the north by Flattop Mountain (11,436') and on the south by Navajo Peak (11,323'). The Navajo River drains the east side of the Chalk Mountains, and the west side drains to the Rio Blanco and the Little Navajo River. All are tributaries to the San Juan River. The Chalk Mountains display an array of colored cliff faces as they rise dramatically from more gently sloping foothills. The toe and mid slopes east of the Chalk Mountains contain highly erosive surface geology resulting in hillslopes that are slumpy with hummocky soils. Many steep montane streams flow eastward from the mountains, and depressional wetlands have formed in the breaks of the slope and are fed by groundwater and/or surface water (streams) or sheet flow. Uplands are dominated by pine (Pinus ponderosa) or spruce-fir forests (Picea pungens-Abies concolor; Abies lasiocarpa), aspen groves (Populus tremuloides), and grasslands dominated by Thurber's fescue (Festuca thurberi) and pasture grasses. The depressional wetlands across the toe and mid slopes of the Chalk mountains support many scattered populations of retrorse sedge (Carex retrorsa), usually occurring with beaked sedge (Carex utriculata), American mannagrass (Glyceria grandis), bluejoint reedgrass (Calamagrostis canadensis) on the mudflats and within shallow water. Emergent vegetation includes common spikerush (Eleocharis palustris) and narrowleaf bur-reed (Sparganium emersum). There is typically little aquatic vegetation present and open water in the center of the pond. At the foot of some dramatic colored cliffs, a thinleaf alder (Alnus incana ssp. tenuifolia)/mesic graminoid community surrounds a large pond called Dolomite Lake, and follows the outlet drainage eastward down the hillside to larger Grayhackle Lake, where it surrounds the latter lake as a fringe. The plant association is characterized by a dense canopy cover of alder and a dense canopy cover of mesic graminoids, dominated by beaked sedge (Carex utriculata), American mannagrass, common spikerush, and bluejoint reedgrass.

Key Environmental Factors: Field ecologists in 2005 found that in Archuleta County, retrorse sedge often occupies clayey soils on muddy shorelines, and sometimes within shallow standing water, of depressional wetlands roughly between 8,000 and 9,500 feet elevation. It is also often found on slightly higher ground along perennially wet areas, especially preferring banks along small channels, small to mid-size depressional wetlands, open mudflats at pond edges, and surface-drying mud. Retrorse sedge is nearly always found with beaked sedge, but seems to occupy slightly higher ground or the mudflat niche that beaked sedge doesn't colonize as aggressively. The surface geology is comprised of Quaternary aged landslide deposits that are locally comprised of talus, rock glacier, and thick colluvial deposits (Tweto 1979), which often form hummocky soils and have poorly developed drainage patterns (USDA 1981). Dominant soil types include Castelleia loams, which are moderately deep and well drained, but often limited by an underlying layer of impervious shale or sandstone. Large pockets of Hunchback clay loams, which are deep, poorly drained and occurring on fans and toe slopes, appear to be directly related to locations of ponds mapped on the USGS 7.5 minute topographic quadrangle. The third dominant soil type in the area is Corta silt loam, a deep and well drained soil with low permeability, again limited by an underlying layer of impervious shale or sandstone (USDA 1981). Soil samples taken at the various retrorse sedge occurrences sometimes have a surface layer of muck, but then nearly all samples generally display a deep layer of silty-clay soils saturated to the surface, with mottling indicating fluctuating water levels. Specific soil samples taken within the alder/mesic graminoid community display a shallow surface horizon of loamy sand with mottling and a high percentage of roots. The next horizon was deeper with a loamy sand texture with a very dark color. Water collected at 30 cm depth in the soil pit.

Land Use History: The site is located in an area of Archuleta County that was part of the original Tierra Amarilla Mexican Land Grant. Fifty-thousand acres of this land grant at the northern extent of the Navajo River are now divided into 3 private ranches: Banded Peak Ranch, Catspaw Ranch, and Navajo Headwaters Ranch.

Biodiversity Significance Rank Comments (B3): The site supports a good occurrence (B-ranked) of the globally vulnerable (G3/S3) thinleaf alder (Alnus incana)/mesic graminoids montane riparian shrubland. This is the only documented occurrence of this association in Archuleta County as of 2005. Often this association is found with a high percentage of non-native grasses in the graminoid understory (Carsey et al. 2003), but this occurrence is relatively undisturbed and supports mostly native graminoid species with the exception of the ubiquitous Kentucky bluegrass (Poa pratensis). The site also supports two good (B-ranked) populations of the globally secure (G5) but state critically imperiled (S1) retrorse sedge (Carex retrorsa). Retrorse sedge has a broad distribution throughout the north half of North America, but, as of 2005, is known only in Colorado from several locations in Archuleta County. This site contains a large concentration of subpopulations.

Natural Heritage element occurrences at the East Side of Chalk Mountains PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana / Mesic Graminoids Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-08-24
Vascular Plants	Carex retrorsa	retrorse sedge	G5	S1				B	2005-08-24
Vascular Plants	Carex retrorsa	retrorse sedge	G5	S1				B	2005-09-01

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary was drawn to encompass all known retrorse sedge occurrences as well as the alder/mesic graminoid occurrence, along with additional areas that offer similar geology, soils, drainages, and groundwater discharges suitable for supporting additional populations or allowing populations to expand. The boundaries were additionally determined by the edge of loam/silt-loam/clay loam soil types (USDA 1981) which support the populations, and landslide deposit surficial geology (Tweto 1979), which is essential in creating the hummocky soils intercepted by groundwater that support the small ponds and the retrorse sedge populations. Natural fluvial processes such as seasonal flooding, sediment deposition, and beaver activity will help maintain viable population of the alder/mesic graminoid component along the montane drainages (Sanderson and Kettler 1996, Carsey et al. 2003).

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The private land where the site is located has conservation minded landowners and is managed with good conservation practices. The land is also mostly surrounded by USFS land and Wilderness.

General Protection Comments: The private land consists of three separate ranches, all of which are actively managed with conservation minded practices. Riparian restoration is taking place on the Navajo River, and conservation easements already exist on portions of the ranches; additional easements were under negotiation in 2005. The private ranches are surrounded on three sides by USFS land or Wilderness. The southern boundary abuts smaller parcels of private property.

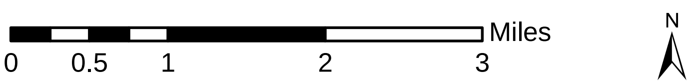
Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences within the site. Weed invasion is the main threat.

Management Needs Comments: The area is well managed, though it has been historically grazed by cattle (10 years ago). Cattle were removed 10 years ago, and the area now serves as wildlife forage with small areas of forestry delimited by the owners. The area surrounding the various ponds and riparian drainages displays stands of Canada thistle, though not omnipresent, and various other upland weedy species. Although it is recommended to treat the thistle, it is not recommended to spray in the immediate vicinity of the ponds as herbicides may be harmful to amphibians, such as certain types of frog tadpoles (Relyea 2005). Frogs and larval salamanders were observed at several ponds in the area.

Land Use Comments: The area is primarily for wildlife use. The site crosses three private ranches that grazed cattle historically; however there have been no cattle on the property for approximately 10 years. Small areas of forestry delimited by the owners occur within the site. A very large (minimum 4,000 head) elk herd migrates through this area each year and often over-winters on the ranches, which accounts for any heavy grazing or browsing that might be observed.

Exotic Species Comments: Canada thistle and musk thistle (Cirsium arvense and Carduus nutans) occur on the uplands surrounding many of the small ponds and riparian drainages. Musk thistle is considered a noxious weed in the county (State of Colorado, no date). Pasture grasses such as smooth brome, Kentucky bluegrass, timothy, and redtop (Bromus inermis, Poa pratensis, Phleum pratense, and Agrostis gigantea) are common on the surrounding uplands as well. Weeds occurring within several of the pond areas include devil's beggar-tick (Bidens frondosa), Canada thistle, common dandelion (Taraxacum officinale), and Mexican dock (Rumex triangulivalvis).

Information Needs: The current owners are very conservation minded, and the ranch managers are very interested in learning as much about the natural elements on the property as possible. Excellent opportunities exist here for future surveys and/or inventories by CNHP staff, and maintaining the established, positive environment of information exchange with the ranch owners/managers would be encouraged in order to ensure future access the ranches and their resources.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

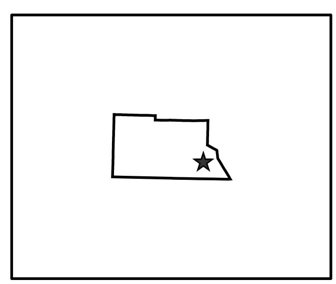
Legend

PCA Boundary

Antonito, 37106-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 8. East Side of Chalk Mountains Potential Conservation Area, B3: High Biodiversity Significance

Fourmile Creek at Quien Sabe

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Pagosa Peak, Pagosa Springs

Size: 206 acres (83 ha) **Elevation:** 7,980 - 8,720 ft. (2,432 - 2,658 m)

General Description: At the north-central edge of Archuleta County, Fourmile Creek drops between Quien Sabe Mountain and Cade Mountain through a narrow V-shaped valley at a moderate gradient with little sinuosity. The floodplain is narrow due to steep hillsides on either side, but the creek is meandering and migrating laterally when it can. The creek overbanks and deposits fine sandy-silty sediment on the floodplain and in secondary channels, but the floodplain consists mostly of boulders and cobble. High flows create drift lines, and carry large woody debris and other litter, depositing it in the creek bed and on the floodplain. The creek has a drop pool-short riffle structure along the length of the community, though the grade becomes gentler at the downstream end of the occurrence. The creek bed is lined by a consistent thinleaf alder-Drummond's willow (Alnus incana ssp. tenuifolia-Salix drummondiana) shrub component, with scattered mountain willow (Salix monticola) and narrowleaf cottonwood (Populus angustifolia). The riparian shrubs and trees grow close to the creek bed, and dense native mesic forbs and graminoids make up the herbaceous understory, dominated by cutleaf coneflower (Rudbeckia laciniata var. ampla), Fendler's cowbane (Oxypolis fendleri), and fowl bluegrass (Poa palustris). The alder has some branch dieback as noted elsewhere across the county in 2005; otherwise the stands of alder and Drummond's willow are vigorous and dense. No emergent vegetation was noted on the creek edges or within the riparian zone, likely due to lack of soil development. Narrowleaf cottonwoods increase at the downstream end of the site, as does red-osier dogwood (Cornus sericea), and the riparian community shifts toward a narrowleaf cottonwood-blue spruce (Picea pungens)/alder community, but the alder-Drummond's willow component is still present. The hillsides are forested with a dense and mature subalpine fir-Engelmann spruce-blue spruce-quaking aspen (Abies lasiocarpa-Picea engelmannii-Picea pungens-Populus tremuloides) forest complex, with an understory of mesic herbaceous plant material, especially on the west hillside where a leaky irrigation ditch supplies groundwater to the seepy hillside. Wildlife use is common; caddisfly larvae were found under rocks in the creek, and fingerling fish were seen in the creek. Deer tracks were seen in the sediment next to the creek, an Abert squirrel (Sciurus aberti) was seen, and Northern Flickers (Colaptes auratus), American Crows (Corvus brachyrhychos), chickadees (Poecile spp.), and Red-breasted Nuthatches (Sitta canadensis) were heard. Cattle grazing occurs in the area and causes erosion in seepy hillside locations. Cattle trails were noted above the creek and down to the creek in a few places, but the riparian area exhibits few direct impacts other than infrequent cattle visitation. Irrigation diversions occur upstream, within, and downstream of the community.

Key Environmental Factors: The geology of the upper third of the site is mapped as Landslide Deposits, and the lower two-thirds is mapped as Pictured Cliffs Sandstone and Lewis Shale (Tweto 1979). Soil within the upper two-thirds of the site is mapped as Pagosa Loam, formed in glacial till overlying shale. The lower third is mapped as Muggins Loam, derived from glacial till deposited as moraines (USDA 1981). Soils in the creek bed are alluvial, with large, granitic rounded cobbles (3"-18" diameter, on average) and boulders. Sandy-silty deposition occurs on banks and on cobble point bars.

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) thinleaf alder-Drummond's willow (Alnus incana-Salix drummondiana) montane riparian shrubland plant association. This plant community is an early- to mid-seral association that is typically confined to the immediate edges of steep, shady streams. Both species produce profuse amounts of seed, and readily colonize areas of bare sediment deposition including areas that have been recently scoured by floodwaters or seasonal runoff. Their inherent flexibility as seedlings allows them to persist through flood events. Drummond's willow may capitalize on the ability of thinleaf alder to fix atmospheric nitrogen and become more populous over time (Carsey et al. 2003).

Natural Heritage element occurrences at the Fourmile Creek at Quien Sabe PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix drummondiana Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-08-08

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain a viable population of the riparian shrubland along Fourmile Creek. It should be noted that the hydrological processes necessary to the riparian community are not fully contained by the site boundaries. Given that the riparian community is dependent on natural hydrological processes associated with Fourmile Creek and its tributaries, upstream activities such as logging, residential or other development, water diversions or impoundments, and improper livestock grazing are detrimental to the hydrology of the riparian area. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The entire site is within the San Juan National Forest.

General Protection Comments: The area is owned and managed by the Pagosa Ranger District of the San Juan National Forest.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrence. Grazing impacts and weed invasion are the main threats to the community.

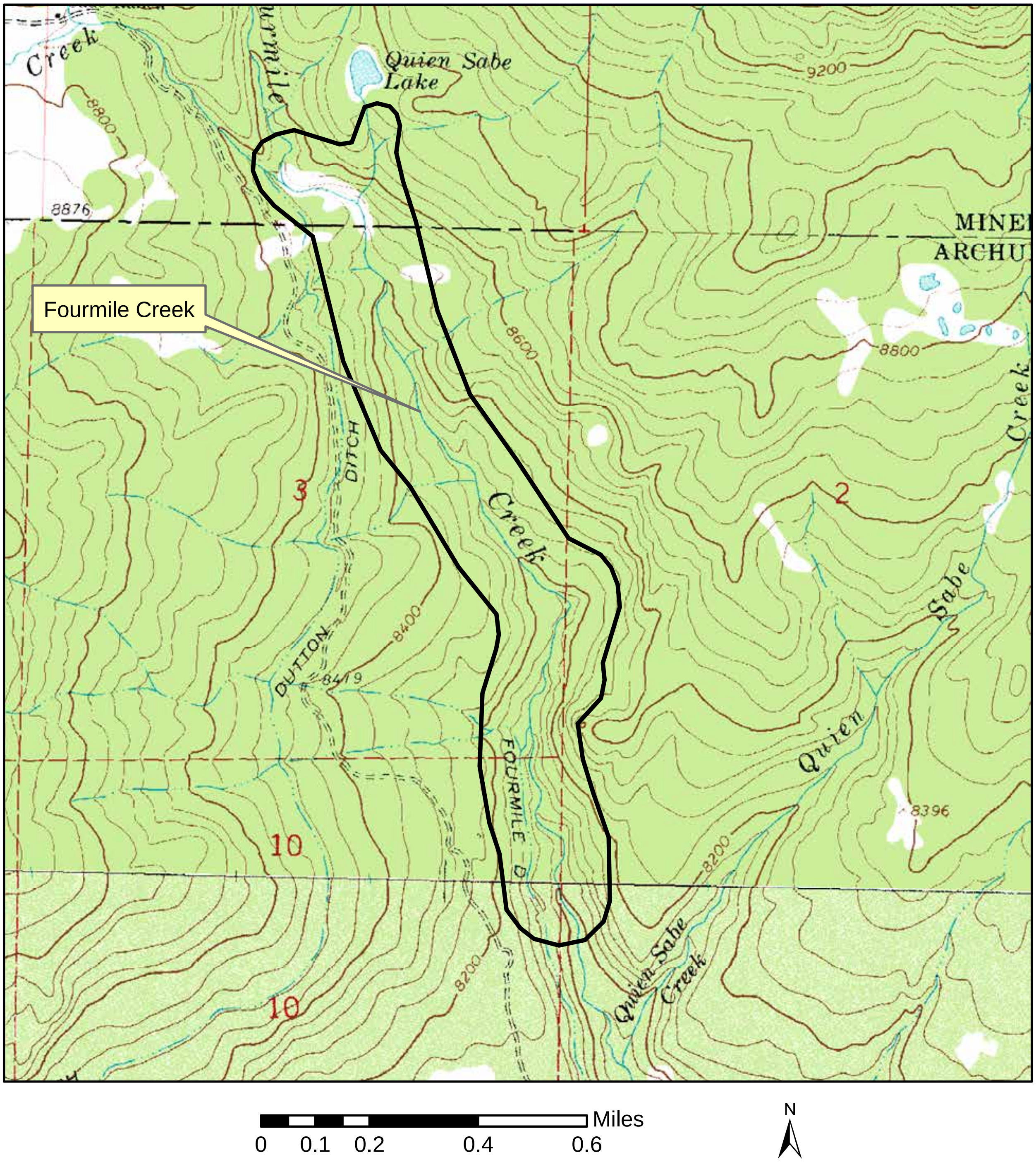
Management Needs Comments: The riparian community would benefit from a monitoring program to determine the effects on the riparian zone of the 2005 construction project, which put Dutton Ditch (uphill to the west, above the Forest Road) into a pipe. The leaky ditch provided hydrology to the mesic hillside above the creek prior to piping. It is expected that there may be significant vegetative and/or erosional changes after this seepy hydrology is removed. Also, monitoring the effects of cattle on the slumping hillside would also benefit the community, as some areas are beginning to erode fairly severely and contribute additional sediment to the creek channel.

Land Use Comments: Current land uses include cattle grazing, irrigation diversions, and possibly hunting. The hillsides are too steep for much hiking and definitely prohibitive for OHV use.

Natural Hazard Comments: Much of the terrain within the site is quite steep.

Exotic Species Comments: The herbaceous understory within the riparian community is mostly native, with dandelions (Taraxacum officinale), timothy (Phleum pratense) and Kentucky bluegrass (Poa pratensis).

Off-Site Considerations: The site is wholly within USFS lands, but a large private parcel occurs upstream on a tributary to Fourmile Creek, and downstream (after the creek leaves forest land) it travels through many private, agricultural parcels. Dutton Ditch diverts some of the Fourmile Creek flow at the upstream end of the site. The ditch runs parallel to and uphill of the occurrence by 0.25-0.3 mile and is being put into a pipe in 2005, which will alter some of the hydrology in the area since the piping is to offset water loss from the leaky ditch. Temporary sediment impacts during and after construction and long-term hydrologic impacts will be likely, since the leaking ditch supplemented the hydrology of the area from uphill. Approximately 1/2 to 2/3 of the flow of Fourmile Creek is diverted into Fourmile Ditch at the lower end of the site, and other similar diversions occur downstream. Forest Road 645 occurs uphill of Fourmile Creek, by about 0.25-0.3 mile.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

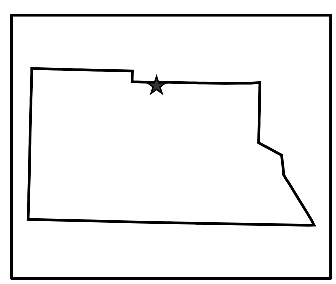
Legend

PCA Boundary

Pagosa Springs, 37107-C1
Pagosa Peak, 37107-D1

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 9. Fourmile Creek at Quien Sabe Potential Conservation Area, B3: High Biodiversity Significance

Hunter Campground

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Bear Mountain, Devil Mountain

Size: 1,747 acres (707 ha) **Elevation:** 7,020 - 7,920 ft. (2,140 - 2,414 m)

General Description: The Hunter Campground site is situated in the north-central part of Archuleta County along a relatively straight reach of the Piedra River, just below Second Box Canyon in a narrow, deep, shaded valley with side slopes dropping over 500 feet from steep ridges. The riparian forest along the Piedra River within the site consists of blue spruce (Picea pungens) and Douglas-fir (Pseudotsuga menziesii) with scattered narrowleaf cottonwood (Populus angustifolia). The understory cover of shrubs is clearly dominated by thinleaf alder (Alnus incana ssp. tenuifolia), but also includes narrowleaf willow (Salix exigua), Woods' rose (Rosa woodsii), red-osier dogwood (Cornus sericea) and chokecherry (Prunus virginiana). The dominant community along the river is blue spruce/thinleaf alder montane riparian forest. Common forbs and graminoids in the understory include indianhemp (Apocynum sibiricum), smooth horsetail (Equisetum laevigatum), and field horsetail (Equisetum arvense). The riverbed contains large boulders as well as transported alluvium, which forms islands and cobble bars that are scoured annually by seasonal flooding and are typically dominated by coyote willow with a high percentage of unvegetated surface. Some areas along the Piedra River and within the site have no riparian vegetation due to the sheer rock walls with no bank or floodplain. Near the south boundary is Piedra Hunter Campground, a semi-primitive and very popular camping area. First Fork Trailhead is located at the Campground, where a large bridge crosses the river. This bridge has been closed to motorized vehicles and bicycles since the congressional designation of the Piedra Area in 1993 (US Public Law 103-77 1993), which prohibits motorized and mechanized travel within the 62,500 acre Piedra Area. From the trailhead, the Piedra River Trail runs both upstream and downstream along the Piedra River, and as a result, the area experiences heavy recreational use from hikers and horse riders. The Piedra River Trail passes through the Hunter Campground site and crosses several tributaries feeding the Piedra River, including Davis Creek, a relatively short, four-mile long creek that starts in mountain meadows and drops some 2,000 feet in those four miles. Large boulders are strewn along the banks of the ephemeral spring stream, which is usually dry by mid-summer. Blue spruce and Douglas-fir are the dominant trees in the overstory along Davis Creek, and there is a dense cover of shrubs including thinleaf alder, Rocky Mountain maple (Acer glabrum) and red-osier dogwood in the understory. The Douglas-fir/Rocky Mountain maple lower montane forest community is dominant on this portion of Davis Creek.

Ground cover includes a thin cover of grasses such as fowl bluegrass (Poa palustris) and fringed brome (Bromus ciliatus), and a higher-percent cover of forbs, such as cutleaf coneflower (Rudbeckia laciniata var. ampla), Porter's licorice-root (Ligusticum porteri) and Franciscan bluebells (Mertensia franciscana).

Key Environmental Factors: This reach of the Piedra River and its tributary streams at their confluence with the river are within the Rico/Hermosa Formation, which is comprised of arkosic sandstone, conglomerate, shale and limestone (Tweto 1979). Soils within the riparian zone are alluvial, including large cobble and boulders with gravelly or sandy deposits. The soils on terraces vary, but are typically more developed.

Biodiversity Significance Rank Comments (B3): The site supports an occurrence of the globally vulnerable (G3/S3) blue spruce/thinleaf alder (Picea pungens/Alnus incana) montane riparian forest plant association in good (B-ranked) condition. The blue spruce/thinleaf alder riparian plant association is somewhat widespread on the western slope of Colorado, and may also occur in Wyoming and New Mexico. In Colorado, it has been found in the Routt National Forest, south to the Rio Grande and San Juan National Forests. This association occurs along narrow to moderately wide floodplains and stream benches in narrow canyons subject to cold air drainage and limited sunlight, typically in small patches and scattered locations. Recent inventory efforts by the Colorado Natural Heritage Program have found this association to be more common in Colorado than previously thought. While livestock grazing has negatively impacted many stands, and dams or hydrologic alterations are threats, the association does not appear to be rare or severely threatened. The site also supports a state rare (G4?/S1) Douglas-fir/Rocky Mountain maple (Pseudotsuga menziesii/Acer glabrum) lower montane forest plant association in good (B-ranked) condition. As of 2005, this community occurrence represents the best-known occurrence in Archuleta County.

Natural Heritage element occurrences at the Hunter Campground PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				B	2005-08-29
Natural Communities	Pseudotsuga menziesii / Acer glabrum Forest	Lower Montane Forests	G4?	S1				B	2005-08-29

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses the occurrences and an approximate 1,000 foot buffer. Eliminating disturbances within this 1,000 foot buffer would aid in reducing impacts from sedimentation (Karr and Schlosser 1978), and assist in maintaining the integrity of the occurrences and its associated avian, macroinvertebrate and periphyton communities (Noel et al. 1986, Spackman and Hughes 1995). The boundaries also incorporate an area that will allow natural hydrologic processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the plant community along Davis Creek and the Piedra River. It should be noted that the natural hydrological processes necessary to maintain and support the montane riparian forest occurrences are not fully contained by the site boundaries. Given that the communities are dependent on natural hydrologic processes associated with Davis Creek and the Piedra River, upstream activities such as water diversions, impoundments, and improper livestock grazing are detrimental to maintaining the supporting hydrology of the riparian areas. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P5): Land protection is complete and no additional protection actions are needed. The entire site is within the San Juan National Forest, and the majority of the site is within the congressionally designated Piedra Area, which is directed to be managed for its wilderness characteristics and for its potential future designation as wilderness (US Public Law 103-77 1993).

General Protection Comments: Hunter Campground site is within the San Juan National Forest, Pagosa Ranger District. The majority of the site is also within the USFS Special Management Area Unit named the "Piedra Area", a congressionally designated Area to be managed for its presently existing wilderness character, and its potential for inclusion in the National Wilderness Preservation System (US Public Law 103-77 1993). The Area is managed similarly to Wilderness such that livestock grazing is permitted, but motorized vehicles and bicycles are not allowed. It is different than Wilderness in that chainsaw use is permitted.

Management Urgency Rank Comments (M3): Management actions may be needed within 5 years to maintain the current quality of the element occurrences. Inappropriate grazing in the upper watershed above the site could impair hydrologic functioning needed for continued viability of the elements by disturbing surface flow volumes, eroding stream banks, and increasing sedimentation. High recreation use at the Hunter Campground/First Fork trailhead creates a potential for non-native species to increase at the trailhead and along the trails. A monitoring program would aid in detecting overgrazing, erosion, and non-native plant introductions, and in indicating when and what type of management actions are needed to maintain the quality of the montane riparian forest communities within the site.

Management Needs Comments: New management actions may be needed within 5 years to maintain the current quality of the montane riparian element occurrences. The area is easily accessed from the top of First Fork Road at Hunter Campground, and recreational use of the trail along the Piedra River is intense. There is a potential for non-native species to increase or invade with the high level of recreation uses such as hiking and horseback riding. Additionally, any activity in the upper drainage of the site has the potential to adversely affect the montane forest and the riparian communities. Inappropriate grazing in the upper watershed above the site could impair hydrologic functioning needed for continued viability of the montane forest. Hydrological processes originating outside of the planning boundary, including water quality, quantity, timing and flow, must be managed to maintain site viability. A monitoring program would aid in detecting non-native plant introductions, hydrologic changes, and increased erosion, and may indicate when management actions are needed to maintain the quality of the montane riparian forest communities.

Natural Hazard Comments: Plenty of western poison ivy (Toxicodendron rydbergii) occurs along the trails and hillsides all along both sides of the Piedra River.

Exotic Species Comments: Exotic and invasive flora currently do not pose a large problem; however, the high level of recreational use (including horseback riding and packing) threatens to introduce exotic species at the dispersed camping areas, along the trails system, and at the trailhead at Hunter Campground/First Fork. Encouragement and enforcement of the use of certified weed seed free feed for horse users would benefit the ongoing viability and quality of the element occurrences by reducing the risk of introduction of exotic species.

Off-Site Considerations: Hydrological processes originating outside of the planning boundary, including water quality, quantity, timing and flow must be managed to maintain site viability.

Information Needs: Baseline monitoring for the presence of exotic or invasive species would benefit the long-term viability of the element occurrences by providing a gauge with which to determine the progressive spread of exotic species within the site.

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

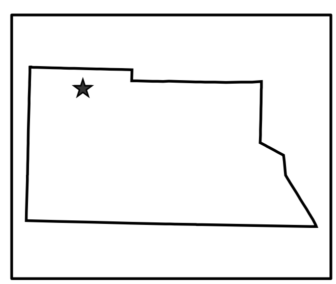
Legend

PCA Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 10. Hunter Campground Potential Conservation Area, B3: High Biodiversity Significance

Ignacio Creek

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity
Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Allison, Pargin Mountain

Size: 983 acres (398 ha) **Elevation:** 6,100 - 7,400 ft. (1,859 - 2,256 m)

General Description: Ignacio Creek is located in the southwest portion of Archuleta County, west and south of Pargin Mountain and north of Navajo Reservoir. It is a lower montane intermittent stream that flows southward first through a moderately narrow valley that then opens into a moderately broad valley upstream of its confluence with the Piedra River. Ignacio Creek flows in a moderately sinuous stream channel, punctuated by boulders, pools, cascades, scoured banks, and point bar deposition. There are abandoned channels and signs of flooding events (debris and scouring). Riparian vegetation occurs along the narrow channel and the immediate floodplain. The upstream extent of the creek is dominated by a mature and healthy boxelder-narrowleaf cottonwood/red-osier dogwood (Acer negundo var. interius-Populus angustifolia/Cornus sericea) community, with Douglas-fir (Pseudotsuga menziesii) in the overstory, and a diverse shrub component displaying a sparse to dense canopy cover. The riparian shrubs such as red-osier dogwood, sandbar willow (Salix exigua), and park willow (Salix monticola) are most abundant where the riparian zone expands to incorporate low terraces and benches. The herbaceous understory is sparse to moderately dense and is a mixture of mostly native forbs with few non-native species. The adjacent uplands along this higher stretch of Ignacio Creek contain spruce-fir forests (Picea pungens, Pseudotsuga menziesii-Abies sp.) on north-facing slopes and ponderosa pine (Pinus ponderosa ssp. scopulorum) forests with Gambel oak (Quercus gambelii) shrublands on south-facing slopes. In its lower reach, the riparian area is dominated by a narrowleaf cottonwood-Rocky Mountain juniper (Juniperus scopulorum) community, providing a more open canopy cover than upstream. Cottonwoods are generally mature or decadent, but are regenerating on cobble bars within the creek floodplain. The shrub layer is less diverse and also more sporadic, dominated by sandbar willow, Woods' rose (Rosa woodsii), and western white clematis (Clematis ligusticifolia). The terraces above the floodplain are dominated by native and non-native herbaceous species and an abundance of cheatgrass (Bromus tectorum), especially in pastures adjacent to the riparian area. A hydrophytic herbaceous layer containing clustered field sedge (Carex praegracilis) and field horsetail (Equisetum arvense) occurs in fringes along the stream channel and banks, but is not contiguous. Adjacent uplands are dominated by ponderosa pine forests with sagebrush-rabbitbrush (Artemisia spp.-Chrysothamnus spp.) flats and Gambel oak shrublands. There is wildlife sign throughout the site, such as wildlife trails, deer and elk scat, coyote scat, and bear scat and tracks. Songbirds and birds of prey also use the riparian habitat for forage, cover, and roosting. A dirt road parallels the creek halfway up the site to where it ends at an oil or gas wellhead. Above the well pad, an ill-defined trail follows the creek, but is seldom used.

Land Use History: Ignacio Creek was proposed as a USFS Research Natural Area at one time.

Biodiversity Significance Rank Comments (B3): This site supports a fair (C-ranked) example of the globally imperiled (G2/S2) boxelder-narrowleaf cottonwood/red-osier dogwood (Acer negundo-Populus angustifolia/Cornus sericea) riparian forest plant community. This community type is a late-seral association that appears to be restricted to western Colorado and is not known from outside the state (NatureServe 2005). Typically, mature to decadent cottonwoods occur in the overstory above stands of box elder, with a dense and diverse shrub layer. This riparian plant community can slowly convert to an upland association over time (Carsey et al. 2003). Many areas that may have supported occurrences of this community type in the past have been altered by agriculture and development. The site also supports a fair (C-ranked) example of the globally vulnerable (G2G3/S2S3) narrowleaf cottonwood-Rocky Mountain juniper (Populus angustifolia-Juniperus scopulorum) montane riparian forest, a plant community typified by an open cottonwood and juniper canopy and a sparse shrub layer and herbaceous understory, occurring along lower foothill elevation streams. This community type is rarely found without grazing or other agricultural impacts.

Natural Heritage element occurrences at the Ignacio Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Acer negundo - Populus angustifolia / Cornus sericea Forest	Narrowleaf Cottonwood Riparian Forests	G2	S2				C	2005-06-14
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-06-14

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary was drawn to include the known extent of the two riparian plant associations, plus additional area large enough to buffer the riparian zone and its direct watershed. The boundary also provides a small buffer from the road where surface runoff may contribute excess nutrients and sediment, and may act as a vector for weed distribution and subsequent invasion. It should be noted that all the hydrologic processes necessary to the elements and the watersheds that contribute to the reach of stream within the site are not fully contained by the boundary.

Protection Urgency Rank Comments (P1): Current oil and gas development pressure, if approved under a pending USFS EIS, would induce stresses that may reduce the viability of the elements within 1 year. The site is under USFS, Southern Ute Indian Tribe (SUIT), and private ownership, and the Ignacio Creek drainage is under heavy pressure to be developed with gas and oil wells and associated access roads under the USFS' Northern San Juan Basin Coal Bed Methane Project. Lands within the site under SUIT and private ownership are also expected to have similar development pressure.

General Protection Comments: Ignacio Creek is considered to be one of the most pristine lower foothill riparian environments in the entire San Juan National Forest, and has been evaluated in the past as a potential Research Natural Area within the San Juan National Forest (Save the HD Mountains 2005). However, since its evaluation, proposed gas drilling in the area (under the San Juan National Forest's Northern San Juan Basin Coal Bed Methane Project proposal) threatens the roadless integrity of the site, the near-pristine quality, and the viability of riparian communities. Specifically, areas on USFS land immediately adjacent to Ignacio Creek from the approximate midpoint of the site to well above the northernmost boundary of the site are currently under proposal for new wells, directional drilling pads and wells, and access roads (USDA Forest Service 2005, Cullicott et al. 2002). It is unknown what, if any, protection plan is being considered for either SUIT or private lands within the site. Drilling on USFS land may cause direct impacts to riparian area and species dependent on habitat due to a number of potential actions, including but not limited to disturbances associated with surface well pad locations and drilling activities, cross-contamination of groundwater during drilling and pumping, discharge of secondary materials (in the form of gas, liquid and solids) during pumping, pipeline installation and maintenance, road surface area creation and maintenance and subsequent sediment and erosion issues, culvert installation, vehicular use, and increased accessibility to areas of Ignacio Creek previously difficult to access (Cullicott et al. 2002). Currently, the entire stream channel exists with unfragmented continuity to near its confluence with the Piedra River, where Ignacio Creek crosses Fosset Gulch Road through a culvert.

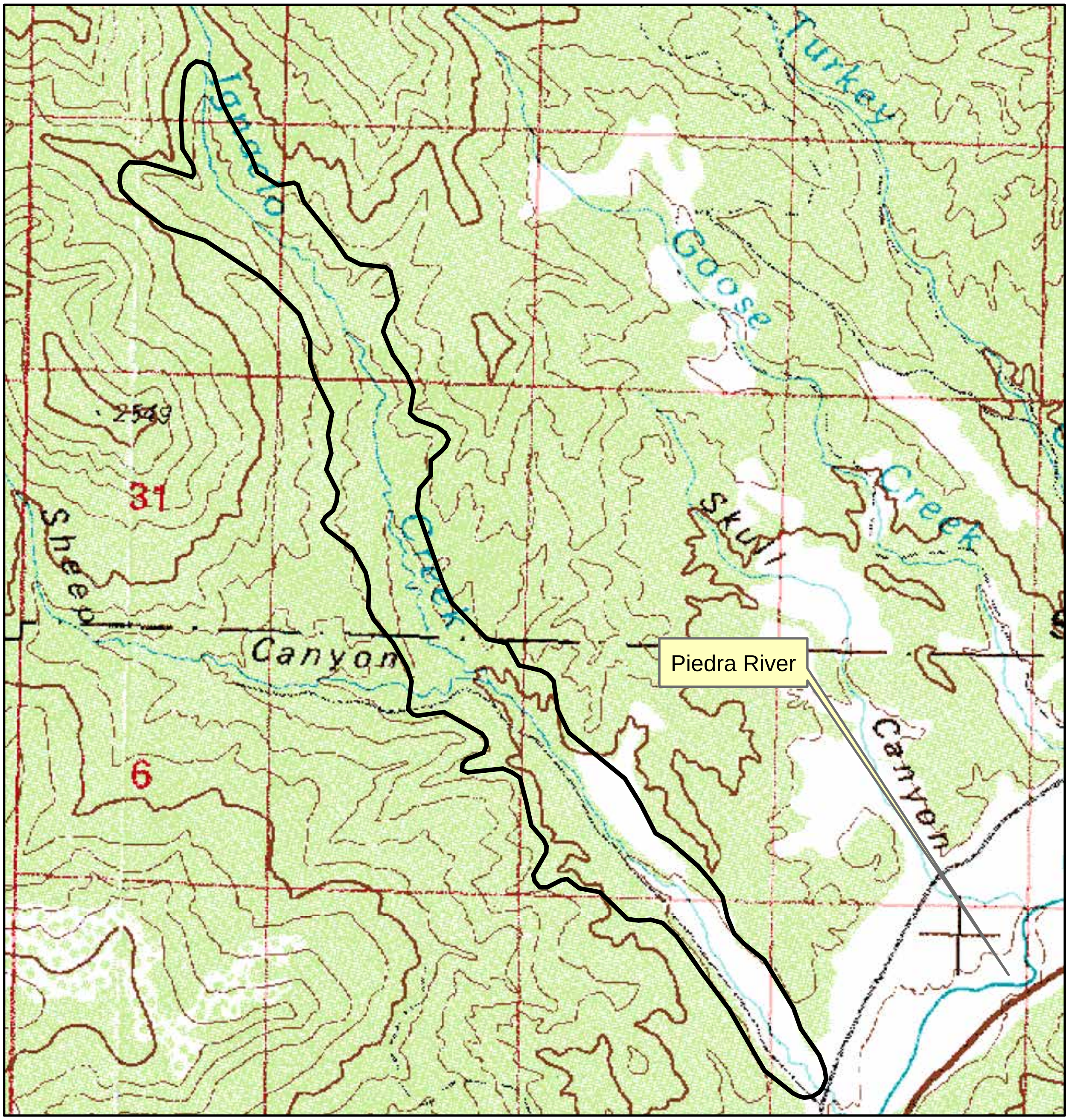
Management Urgency Rank Comments (M2): Management actions may be required within one to five years or the element occurrences may be lost or irreparably degraded. Potential oil and gas development and its associated infrastructure, weed control, and proper grazing regimes are the main concerns for this site.

Management Needs Comments: Monitor weed invasion and provide weed control for more invasive species such as thistles (Cirsium spp., Carduus spp.). The riparian community would benefit from having a baseline weed survey completed, and thereafter an annual or biannual weed monitoring survey performed. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species. In addition, an evaluation of any grazing practices that may occur within the riparian zone and on adjacent terraces may benefit the long-term viability of the community.

Land Use Comments: An oil/gas wellhead currently exists at the Forest Service boundary, approximately at the midpoint of the site. It is currently not in use, but is likely to be developed in the near future. The Forest Service maintains a locked gate at this boundary, and the road ends at the oil/gas wellhead. A faint trail occurs upstream of the wellhead, but it is not heavily traveled. It can be expected that hunters use the area during the fall. The lower half of the site may be used for grazing, though no signs of current grazing were noted in 2005.

Natural Hazard Comments: Western poison ivy (Toxicodendron rydbergii) occurs along Ignacio Creek, and bear sign is common.

Exotic Species Comments: Cheatgrass (Bromus tectorum), yellow sweetclover (Melilotus officinalis), field bindweed (Convolvulus arvensis) and other common weeds are prevalent in the lower reaches of Ignacio Creek, but above where the existing dirt road ends at an oil/gas wellhead, cheatgrass and other weeds rapidly diminish along the riparian zone. The most frequent weeds in the upper portion of the site include Kentucky bluegrass (Poa pratensis), and common dandelion (Taraxacum officinale).



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

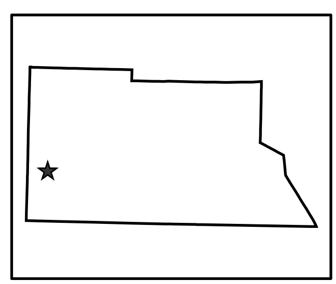
Legend

PCA Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 11. Ignacio Creek Potential Conservation Area, B3: High Biodiversity Significance

Indian Creek at Piedra River

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P5: No Action to be Taken on this Site
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Baldy Mountain, Devil Mountain

Size: 833 acres (337 ha) **Elevation:** 6,750 - 7,400 ft. (2,057 - 2,256 m)

General Description: The Indian Creek at Piedra River site is situated in the northwest part of Archuleta County along a moderately sinuous reach of the Piedra River, below First Box Canyon and at the confluence of the river and Indian Creek. The site is mostly within the San Juan National Forest and the congressionally designated, managed-as-wilderness Piedra Area, but also extends south into a privately owned parcel. The Piedra River here is in a narrow, deep, shaded valley with side slopes dropping over 600 feet from steep ridges. Some areas along the Piedra River have no riparian vegetation due to the sheer rock walls with no bank or floodplain. Where a floodplain has room to form, it is dominated by either a dense cover of blue spruce (Picea pungens) and thinleaf alder (Alnus incana ssp. tenuifolia), or by mixed riparian shrubs including red-osier dogwood (Cornus sericea). The riverbed contains large boulders as well as transported alluvium, which forms islands and cobble bars that are scoured annually by seasonal flooding and are typically dominated by sandbar willow (Salix exigua) with a high percentage of unvegetated surface, or a mixture of native and weedy species. There are scattered narrowleaf cottonwood (Populus angustifolia) and boxelder (Acer negundo var. interius) along the banks of the river. Indian Creek is a tributary to the Piedra River and is a relatively long creek that is fed by springs and runoff, and starts in mountain meadows below Baldy Mountain and flows within a steep, cool V-shaped valley to its confluence with the Piedra River. There are several seeps and springs discharging from adjacent hill slopes, draining into Indian Creek and the Piedra River. Large boulders are strewn along the banks of Indian Creek, and the channel is comprised mostly of angular cobble and gravel, with coarse sands deposited in pockets. The vegetation along Indian Creek is characterized by a sparse overstory canopy of mixed conifers, a dense and vigorous shrub component and a sparse herbaceous layer. The shrub layer is dominated by thinleaf alder and red-osier dogwood. Associated shrubs in moderate canopy cover include bluestem willow (Salix irrorata), strapleaf willow (Salix ligulifolia), Rocky Mountain maple (Acer glabrum) and sandbar willow (mostly occurring at the confluence with the Piedra River). There are scattered mature boxelder and narrowleaf cottonwood throughout Indian Creek. Forbs occurring in the understory include (Actaea rubra ssp. arguta), limestone swamp bedstraw (Galium brevipes) and cutleaf coneflower (Rudbeckia laciniata var. ampla). Upland forests surrounding both Indian Creek and the Piedra River are dominated by ponderosa pine (Pinus ponderosa ssp. scopulorum) and spruce-fir-Douglas-fir (Picea spp.-Abies concolor-Pseudotsuga menziesii) forests. The multiple locations of cold and hot springs, contiguous riparian vegetation, and variety of healthy upland plant communities provide a diverse habitat for wildlife, such as deer, elk, coyote, and bear, and various song birds, birds of prey, small mammals and fish can readily be seen. Within Indian Creek itself, trout fingerlings hatch and grow in pools along the lower reaches. The general area is a popular destination for recreation including hiking, fishing, rafting, hot spring soaking, hunting and horse use. Impacts such as weed invasion and erosion tend to be localized near campgrounds, dispersed campsites, trailheads, and trails. There is an irrigation diversion along the Piedra River within the site that apparently services the private land downstream, but doesn't appear active. Near the east boundary is Sheep Creek Trailhead, where a popular trail travels down a steep hillside and to a disabled footbridge closed by the USFS. Across the river, a trail runs upstream along the river and up Indian Creek, but due to the inaccessible bridge, it does not get a high amount of usage.

Key Environmental Factors: This reach of the Piedra is in a very deep and narrow canyon with steep, rocky canyon walls in places, and steep, forested slopes in others. Here, the Piedra River and its tributary streams at their confluence with the river are within the Rico/Hermosa Formation, which is comprised of arkosic sandstone, conglomerate, shale and limestone (Tweto 1979). Soils along the Piedra River and Indian Creek are mapped as a mix of Chris gravelly loam and Chris stony loam on steep (25%-65%) slopes, typically formed from sandstone-derived alluvium, as well as Carracas loam on steep (25%-65%) slopes, which is typically formed from shale and sandstone parent materials (USDA 1981). Soils within the riparian zone are alluvial, including large boulders and cobble with gravelly or sandy deposits. The soils on terraces vary, but are typically more developed.

Biodiversity Significance Rank Comments (B3): The site supports a good (B-ranked) occurrence of thinleaf alder-red-osier dogwood (Alnus incana-Cornus sericea) riparian shrubland that is globally vulnerable (G3G4/S3). This riparian plant association is widely spread throughout the western U.S., and in Colorado it is an uncommon association restricted to small tributaries and narrow, constricted reaches of larger rivers. It is a long-lived early-seral stage community that requires a high early season water table and can withstand seasonal flooding (Carsey et al. 2003).

Natural Heritage element occurrences at the Indian Creek at Piedra River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana / Cornus sericea Shrubland	Thinleaf Alder - Red - osier Dogwood Riparian Shrubland	G3G4	S3				B	2005-09-15

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses the occurrence and an approximate 1,000 foot buffer. Eliminating disturbances within this buffer would aid in reducing impacts from sedimentation (Karr and Schlosser 1978), and assist in maintaining the integrity of the occurrence and its associated avian, macroinvertebrate and periphyton communities (Noel et al. 1986, Spackman and Hughes 1995). The boundary also identifies a buffer including trails and an irrigation ditch where direct disturbance and impacts from recreation or ditch use may contribute to excessive nutrients, sediment, and weed invasion. The boundary incorporates an area that will allow natural hydrologic processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the plant community along Indian Creek and the Piedra River. It should be noted that the natural hydrological processes necessary to maintain and support the montane riparian shrubland occurrence are not fully contained by the site boundary. Given that the communities are dependent on natural hydrologic processes associated with Indian Creek and the Piedra River, upstream activities such as water diversions, impoundments, and improper livestock grazing are detrimental to maintaining the supporting hydrology of the riparian areas. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P5): Land protection is complete and no protection actions are needed. The site is mostly within the San Juan National Forest, with the southern finger of the site occurring on privately owned land, which has a conservation easement. The majority of the site is also within the congressionally designated Piedra Area, which is directed to be managed for its wilderness characteristics and for its potential future designation as wilderness (US Public Law 103-77 1993).

General Protection Comments: Indian Creek at Piedra River site is mostly within the San Juan National Forest, Pagosa Ranger District, with the southern finger occurring on privately owned land, which has a conservation easement. The majority of the site is also within the USFS Special Management Area Unit named the "Piedra Area", a congressionally designated Area to be managed for its presently existing wilderness character, and its potential for inclusion in the National

Wilderness Preservation System (US Public Law 103-77 1993). The Area is managed similarly to Wilderness such that livestock grazing is permitted, but motorized vehicles and bicycles are not allowed. It is different than Wilderness in that chainsaw use is permitted.

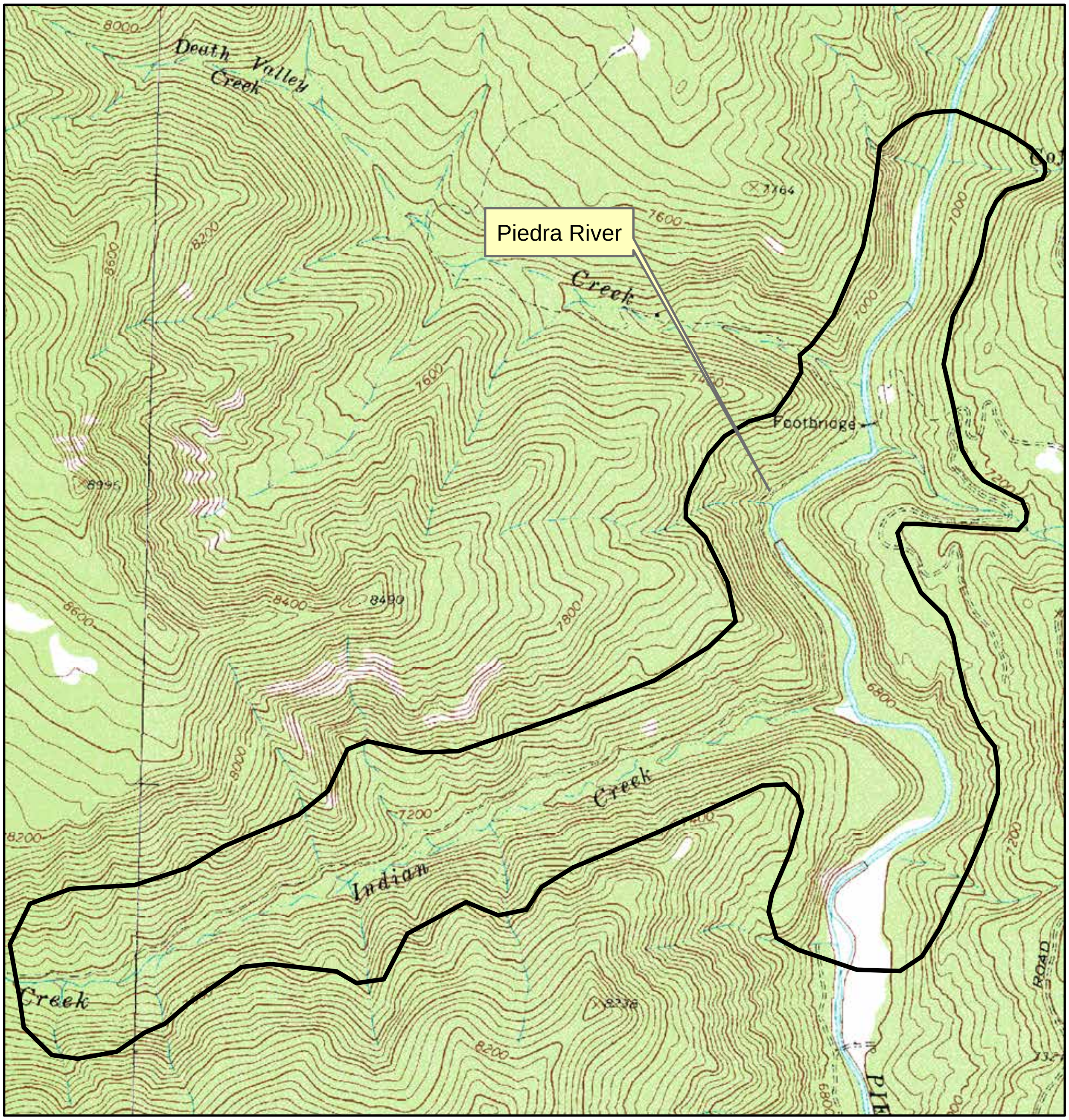
Management Urgency Rank Comments (M4): Current management is favoring the persistence of the plant association. Management actions addressing invasion of non-native species along trails and high-use areas may be needed in the future to maintain the current quality of the element occurrence.

Management Needs Comments: Recreational uses such as hiking, fishing, rafting, hunting and horse use cause impacts including weed invasion and erosion. Impacts tend to be localized near trailheads, campgrounds and along trails. Within the site, the only local footbridge across the Piedra River is currently in disrepair and closed to use, and this may offer intrinsic protection for Indian Creek from recreational impacts, as the trail on the west shore of the river is not frequently used. However, the riparian community would benefit from having a baseline weed survey completed, and thereafter an annual or biannual weed monitoring survey performed. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Natural Hazard Comments: Plenty of western poison ivy (Toxicodendron rydbergii) occurs along the trails and hillsides all along both sides of the Piedra River. The only footbridge across the river in this area is disabled and has been closed by the USFS; fording the river is the only option for accessing the west shore within the site, and even at low flow the river can be knee- or thigh-deep and fast moving.

Exotic Species Comments: Exotic and invasive flora currently do not pose a large problem; however, the high level of recreational use (including horseback riding and packing) along the Piedra River threatens to introduce exotic species at the dispersed camping areas and along the trails system, including the trail along Indian Creek. Encouragement and enforcement of the use of certified weed seed free feed for horse users would benefit the ongoing viability and quality of the element occurrence by reducing the risk of introduction of exotic species.

Off-Site Considerations: A natural hot spring immediately upriver draws a lot of foot traffic along an unmarked trail that passes through the site. A dispersed camping area along the Piedra River adjacent to the hot spring also sees heavy use. Both the trail and the camping area are vectors for the spread of invasive species, and contribute to erosion and soil compaction.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

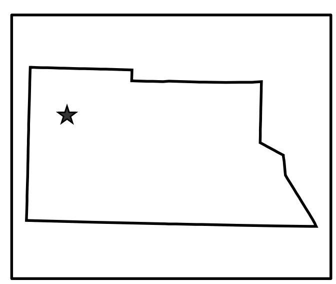
Legend

PCA Boundary

Devil Mountain, 37107-C3
Baldy Mountain, 37107-C4

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 12. Indian Creek at Piedra River Potential Conservation Area, B3: High Biodiversity Significance

Lower Piedra River

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chimney Rock

Size: 1,442 acres (584 ha) **Elevation:** 6,240 - 6,800 ft. (1,902 - 2,073 m)

General Description: The Piedra River flows north to south through canyon, mesa and foothill topography in the west-central part of Archuleta County, before entering Navajo Reservoir at the state line to the south. The river passes through U.S. Forest Service lands, Southern Ute tribal lands, and privately owned properties. The Piedra River meanders well within its broad floodplain, and carries a high bedload of cobble and gravel, depositing these materials on many large islands and point bars. The floodplain along the Piedra River typically supports large narrowleaf cottonwood (Populus angustifolia) galleries with a riparian shrub layer dominated by a mix of willow species (Salix spp.), and patches of silver buffaloberry (Shepherdia argentea). At the upper end of the site, two miles south of where Highway 160 crosses the Piedra River, the foothills of the HD Mountains on the west bank and the ridge of Chimney Rock on the east bank begin to pinch the floodplain of the river before drawing away downstream and widening the floodplain again. Within this pinched floodplain area, a moderately dense gallery of narrowleaf cottonwood occurs with an understory of riparian shrubs. At the immediate river's edge within the bankfull channel and on cobble bars and islands, the vegetation is dominated by pioneering sandbar willow (Salix exigua), narrowleaf cottonwood saplings, and silver buffaloberry. The first terrace above the river is dominated by sandbar willow, mountain willow (Salix monticola), and silver buffaloberry, with an overstory of mature narrowleaf cottonwood and scattered boxelder (Acer negundo var. interius) and Rocky Mountain juniper (Juniperus scopulorum). Cottonwood saplings are present throughout the first terrace, though never in dense patches. This pattern is typical and continues down the length of the Piedra River. Some areas support a dominating cottonwood-juniper overstory, some areas have high concentrations of cottonwood with a silver buffaloberry shrub layer, and other areas are mostly cottonwood with sandbar willow. Other typical species often occurring on the first terrace with cottonwood and silver buffaloberry include river hawthorn (Crataegus rivularis), Woods' rose, (Rosa woodsii), skunkbush sumac (Rhus trilobata), Colorado barberry (Berberis fendleri), and scattered ponderosa pine (Pinus ponderosa). The herbaceous understory is nearly always dominated by hay grasses such as cheatgrass, smooth brome, and Kentucky bluegrass (Bromus tectorum, Bromus inermis, and Poa pratensis) with weedy forbs like thistles (Cirsium sp. and Carduus sp.), oxeye daisy (Leucanthemum vulgare) and yellow sweetclover (Melilotus officinalis). The native vine western white clematis (Clematis ligusticifolia) is often found trailing and climbing densely through the buffaloberry, willows, and hawthorns along the bankfull level of the floodplain. The uplands on the valley floor above the first terrace are often open, weedy meadows or irrigated pastures or hay meadows. Adjacent hillsides have sandstone and shale outcrops, and are dominated by Rocky Mountain juniper, Utah juniper (Juniperus utahensis), skunkbush sumac, mountain mahogany (Cercocarpus spp.), and ponderosa pine.

Key Environmental Factors: The upper end of the site is mapped as Pictured Cliffs Sandstone and Lewis Shale formation. The Piedra River then passes through a section of Kirtland Shale and Fruitland formation (shale, sandstone and major coal beds), and then a short section of Animas formation (sandstone, shale and conglomerate with abundant volcanic materials). The entire lower half of the site is mapped as Modern Alluvium deposits (Tweto 1979). Soils all along the river and within the community are mapped as Riverwash, comprised of sand, gravel and cobble, usually mixed. The higher soils on the terraces are mapped as Pescar Sandy loams, derived from alluvium of mixed parentage (USDA 1981). Soils tested within the site are typically alluvial, with cobbles and sand deposits in the immediate floodplain, and cobble and finer sediments such as silty loam soils on the terraces just above the floodplain.

Cultural Features: Chimney Rock Archeological Area abuts the site to the east, and it is possible other historic Native American sites or artifacts may occur within the site. The Stollsteimer family, who settled the area in the late 1800's, built a small adobe Catholic chapel near the confluence of the Piedra River and Stollsteimer creek, which still stands.

Biodiversity Significance Rank Comments (B3): The site supports a fair (C-ranked) occurrence of the globally imperiled to vulnerable (G2G3/S2S3) narrowleaf cottonwood-Rocky Mountain juniper (Populus angustifolia-Juniperus scopulorum) montane riparian forest. The site also supports two fair (C-ranked) occurrences of the globally vulnerable (G3/S3) narrowleaf cottonwood/strapleaf willow-silver buffaloberry (Populus angustifolia/Salix ligulifolia-Shepherdia argentea) riparian forest. This occurrence is common on the terraces of alluvial floodplains in broad, low-elevation river valleys, and is found within Colorado in western and southwestern counties. Several known occurrences are within Archuleta County along the Piedra River and the San Juan River. A fair (C-ranked) occurrence of the globally apparently secure (G4/S4) narrowleaf cottonwood/sandbar willow (Populus angustifolia/Salix exigua) riparian forest is also supported at this site.

Natural Heritage element occurrences at the Lower Piedra River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-06-15
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				C	2005-06-15
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				C	2005-09-07
Natural Communities	Populus angustifolia / Salix exigua Woodland	Narrowleaf Cottonwood Riparian Forests	G4	S4				C	2005-06-15

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, channel migration, and sediment deposition to continue, and to maintain viable populations of the riparian communities along the lower Piedra River. The broad floodplain and the steep slopes adjacent to the occurrence that would most likely impact the riparian zone if altered are also included. The boundary also reflects an approximate 1,000 foot buffer, which includes nearby roads and hay meadows where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. It should be noted that all the hydrological processes necessary to support the riparian communities are not fully contained by the site boundaries. Given that the riparian communities are dependent on natural hydrological processes associated with the Piedra River, upstream activities such as water diversions and impoundments, improper livestock grazing, and development are detrimental to the hydrology of the riparian area. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P3): Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses including potential residential development and continuing agricultural uses may reduce the viability of the element occurrences if protection action is not taken.

General Protection Comments: Ownership is split between the USFS, the Southern Ute Indian Tribe (SUIT), and several private landowners. Conservation easement education for the private landowners and the SUIT would be an excellent step toward protection for the areas containing element occurrences. Conservation easements placed on private lands may conserve the natural values of the site as well as providing tax credits and other financial benefits to the landowner. Riparian ecology education may also benefit landowners and land managers, especially those landowners who currently graze livestock within the riparian zone.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences. Impacts from improper grazing and weed invasion are the main threats that could be minimized with new management practices.

Management Needs Comments: The most urgent management need is gaining control of the state-prioritized noxious weed woody species of saltcedar and Russian olive while the populations are still small. At a minimum, the initiation of a monitoring program to track the spread of aggressively invasive, noxious weeds such as saltcedar, Russian olive, Canada thistle and musk thistle would benefit these riparian communities. Control of Canada thistle, musk thistle and other invasive herbaceous weeds is a slightly lower priority than controlling the saltcedar and Russian olive, but would also benefit the long-term viability of the communities. Canada thistle and Musk thistle are both Colorado-prioritized and Archuleta County-listed noxious weed species (State of Colorado, no date). Removing grazing from the riparian area will also protect the regenerating narrowleaf cottonwood, silver buffaloberry and willow species, though some private property owners have indicated that they do not wish to make this management change. In lieu of removing grazing, improved grazing management (duration, rotation) may assist landowners in gaining control over some of the herbaceous weeds. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may also provide some assistance with control and eradication of non-native species.

Land Use Comments: Cattle, horse, and sheep/goat grazing is the most common land use. Fishing access points occur along the SUIT lands. Adjacent upland terraces are commonly irrigated for hay meadows or irrigated pasture, and scattered residences occur. Fosset Gulch Road, a maintained gravel road, parallels the Piedra River along the length of the site, and a portion of Highway 151 runs through the southern portion of the site. River rafting trips float through this stretch of river, but typically do not disembark within the riparian zone during their trips.

Natural Hazard Comments: Western poison ivy (Toxicodendron rydbergii) is scattered throughout.

Exotic Species Comments: Several specimens of saltcedar (Tamarix ramosissima) and one Russian olive (Elaeagnus angustifolia) were located in the southernmost part of the site, and taking immediate steps to eradicate the saltcedar is essential to prevent further spread of this very invasive, quickly spreading species. Unfortunately, larger populations of both saltcedar and Russian olive species are known to occur downstream at Navajo Reservoir, but eradication would benefit the community occurrences and prevent further spread. The herbaceous layer within the riparian zone along most of the Lower Piedra River consists of mostly weedy species, which is a common finding in low elevation riparian zones that have experienced heavy grazing over many years (Carsey et al. 2003). Weeds commonly found include but are not limited to: cheatgrass (Bromus tectorum), Canada thistle (Cirsium arvense), musk thistle (Carduus nutans), prickly lettuce (Lactuca serriola), black medic (Medicago lupulina), yellow sweetclover (Melilotus officinalis), oxeye daisy (Leucanthemum vulgare), common dandelion (Taraxacum officinale), rough cocklebur (Xanthium strumarium), Russian thistle (Salsola sp.), tansy-mustard (Descurainia sp.), tumble mustard (Sisymbrium sp.) and redstem stork's bill (Erodium cicutarium). Other species occurring on the terraces but not necessarily within the communities include alfalfa (Medicago sativa), field bindweed (Convolvulus arvensis), and white clover (Trifolium repens).

Information Needs: This area could be an excellent restoration project focusing on maintenance of native riparian shrub cover and eradication of noxious weeds and non-native grasses.

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/12/2006

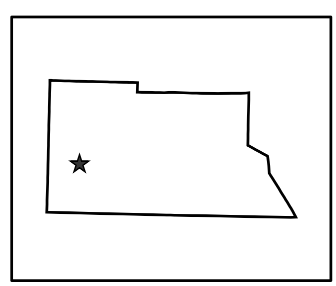
Legend

PCA Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 13. Lower Piedra River Potential Conservation Area, B3: High Biodiversity Significance

Middle Fourmile Creek

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P5: No Action to be Taken on this Site
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Pagosa Springs

Size: 66 acres (27 ha) **Elevation:** 7,420 - 7,480 ft. (2,262 - 2,280 m)

General Description: The middle section of Fourmile Creek is located in north-central Archuleta County southwest of Jackson Mountain and due north of downtown Pagosa Springs, and flows generally southeast through a narrow canyon with gently sloping, 200 foot high hillsides and a broad floodplain. The hillsides support dense coniferous forests of blue spruce, Engelmann spruce, Douglas-fir, and ponderosa pine (Picea pungens, Picea engelmannii, Pseudotsuga menziesii and Pinus ponderosa). Fourmile Creek has a moderate gradient just upstream of the site boundary, but flattens as the valley broadens. The creek is broad and somewhat shallow with small banks, and the channel has very good access to its floodplain. The creek is sinuous within the floodplain, and is exhibiting signs of fluvial and flooding processes including overbanking, sediment deposition, secondary channels, and debris transport. The creek bed is cobble, and over slightly higher gradients sandy deposits begin to support dense riparian shrubs such as bluestem willow, strapleaf willow and sandbar willow (Salix irrorata, Salix ligulifolia and Salix exigua), thinleaf alder (Alnus incana ssp. tenuifolia), and a dense herbaceous layer including cutleaf coneflower (Rudbeckia laciniata var. ampla) and white checker-mallow (Sidalcea candida). The creek is undercutting the sandy banks in some areas, and the roots of the willow species and streamside grasses such as Wheeler bluegrass, Kentucky bluegrass, and redtop (Poa nervosa, P. pratensis, and Agrostis gigantea) are barely holding the banks intact. Narrowleaf cottonwood (Populus angustifolia) mature trees and regenerating poles and saplings dominate the tree layer especially on the first terrace, and mid-aged and young blue spruce trees are also colonizing the terrace. Several exotic species inhabit the herbaceous layer on these broad terraces, including Canada thistle (Cirsium arvense), musk thistle (Carduus nutans), and oxeye daisy (Leucanthemum vulgare) as well as non-native pasture grasses. Deer, elk and black bear are known to utilize the riparian zone. Unidentified fish were seen in the creek, and various birds were heard or seen including White-breasted Nuthatch (Sitta carolinensis), Red-tailed Hawk (Buteo jamaicensis), American Crow (Corvus brachyrhynchos), American Robin (Turdus migratorius), and possibly an Olive-sided Flycatcher (Contopus cooperi) whose song was only heard once, and was not repeated for verification. Fourmile Creek has several major irrigation diversions above and below the site boundary. No recent logging was noted in the area, but a part-time residence with outbuildings occurs within the forest at the uppermost edge of the site, and environmental education tours are led through the community, crossing the creek in several places. A faint ranch road also crosses the community and the creek, and is still used infrequently for accessing parts of the ranch.

Key Environmental Factors: The geology of the area is mapped as Mesaverde Group, Undivided, consisting of sandstone and shale (Tweto 1979). Soils are mapped as Nunn loams, deep, well-drained soils derived from shale and sandstone, and found on floodplains and alluvial fans (USDA 1981). Soils on site are alluvial, consisting of rounded cobble with sandy deposits.

Biodiversity Significance Rank Comments (B3): The site supports a fair (C-ranked) occurrence of the globally imperiled (G2/S2) narrowleaf cottonwood/bluestem willow (Populus angustifolia/Salix irrorata) foothills riparian woodland. This community is an early-seral type, occurring on point bars and islands within the bankfull level of meandering streams. The presence of bluestem willow and sandbar willow (Salix exigua) are indicators of frequent flood events and regular sediment deposition (Carsey et al. 2003). As of 2005, this is one of only two documented occurrences of this community type in Archuleta County.

Natural Heritage element occurrences at the Middle Fourmile Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia / Salix irrorata Woodland	Foothills Riparian Woodland	G2	S2				C	2005-08-09

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary was drawn to incorporate the element occurrence, the immediate watershed supporting the occurrence, and an area that will allow natural hydrological processes such as seasonal flooding and sediment deposition to maintain the riparian woodland along Fourmile Creek. Buffers to the east and west include two irrigation ditches and the maintenance trails that occur alongside those ditches, where surface runoff from maintenance activities may contribute excess nutrients and sediment (Karr and Schlosser 1978), and may promote weed invasion. It should be noted that the hydrological processes necessary to the riparian community are not fully contained by the site boundaries. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P5): Land protection is complete and no protection actions are needed. The majority of the site is privately owned and is protected by a conservation easement, and the remaining area along the extreme east edge of the site is owned and managed by the San Juan National Forest.

General Protection Comments: This portion of the privately owned Fourmile Ranch is under a conservation easement held by the Southwest Land Alliance in Pagosa Springs. The remaining portion of the site is owned and managed by the San Juan National Forest.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrence. Weed invasion and hydrologic manipulations are the main threats to the community.

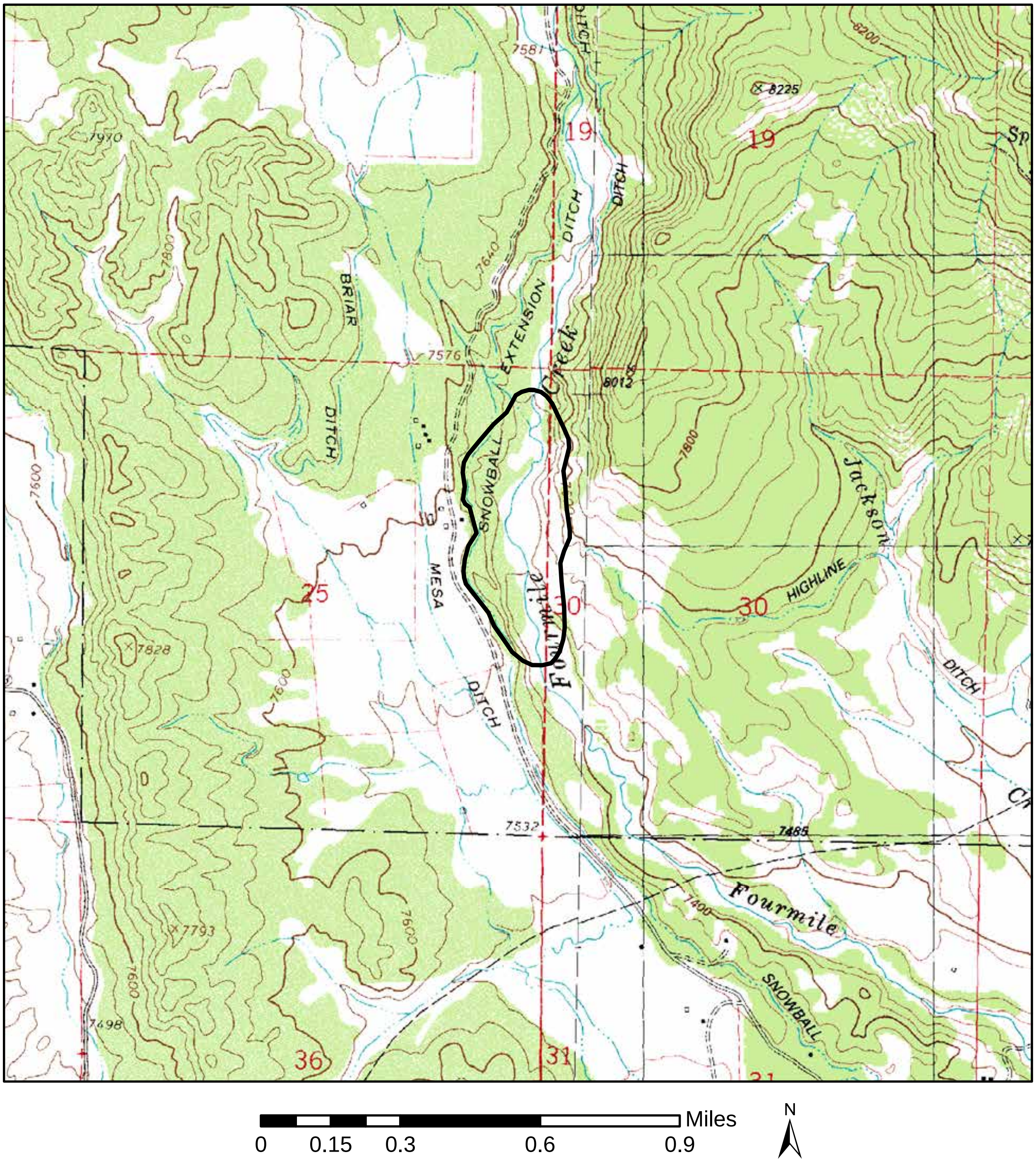
Management Needs Comments: Irrigation diversions above the site manipulate the flows within the creek, but the feasibility of gaining more control over flows is recognized as not practical. However, a monitoring program to document ongoing grazing impacts and increases in exotic species populations within the community such as oxeye daisy, Canada thistle, and musk thistle would provide a baseline condition from which to make management decisions. In addition to a monitoring program, control of these weedy species would benefit the community's long-term viability and quality.

Land Use Comments: A residence with outbuildings occurs at the very upper edge of the site, though the house is not inhabited year round. Irrigation diversions occur above and below the site, and environmental education trails and an old ranch road crisscross the community and the creek. Grazing also occurs in the area, and residential and agricultural activities occur adjacent to the site to the west. Wildlife usage is expected to be high.

Exotic Species Comments: Exotic species occur frequently in the understory, including the weedy forbs Canada thistle (Cirsium arvense), musk thistle (Carduus nutans), oxeye daisy (Leucanthemum vulgare), common dandelion (Taraxacum officinale), and white clover (Trifolium repens), and pasture grasses such as Kentucky bluegrass (Poa pratensis), redtop (Agrostis gigantea), foxtail barley (Hordeum jubatum), and timothy (Phleum pratense).

Off-Site Considerations: Within 700 feet of the creek channel but 150 feet in elevation above the creek, atop the west slope of the creek valley, cultivated hay pastures, residential and agricultural buildings, and roads occur on Fourmile Ranch. Upstream, Forest Service property surrounds the ranch, and downstream the land is divided into large, privately owned parcels. Forest Road 646 crosses the creek 0.80 of a mile upstream of the site. This road crossing washed out during high spring flows in 2005, and subsequently contributed large amounts of sediment to the stream. One of the main tributaries to Fourmile Creek is Snowball Creek, which is actually a diversion from Turkey Creek 4.5 miles northeast of the site. This, along with many irrigation diversions above and below the site represent that the flows in Fourmile Creek are highly manipulated.

Information Needs: The regular environmental education programs provide an excellent opportunity to do basic documentation on species composition, weed lists, and the ongoing health and vigor of thinleaf alder, which is showing evidence of branch dieback here, as it is across the county in 2005.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

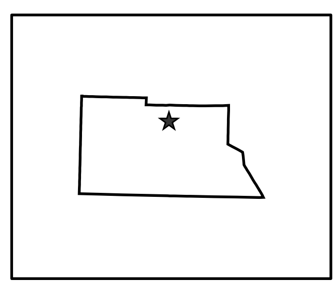
Legend

PCA Boundary

Pagosa Springs, 37107-C1

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 14. Middle Fourmile Creek Potential Conservation Area, B3: High Biodiversity Significance

Navajo River at Banded Peak

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chama Peak, Elephant Head Rock

Size: 2,338 acres (946 ha) **Elevation:** 7,800 - 11,200 ft. (2,377 - 3,414 m)

General Description: The Navajo River is a sinuous river in extreme southeast Archuleta County, originating at the Continental Divide and flowing within a broad, U-shaped valley between two high mountain ranges. The Chalk Mountains and Navajo Peak rise immediately to the west of the river, and to the east, the slopes rise dramatically to the Continental Divide, Banded Peak, and Chama Peak, all above 12,000' elevation. Dramatic, exposed rock cliffs of varying colors occur high on the slopes on both sides of the valley, and the mountain slopes are blanketed with spruce-fir (Picea spp.-Abies spp., Pseudotsuga menziesii) and aspen (Populus tremuloides) forests, with ponderosa pine (Pinus ponderosa), Gambel oak (Quercus gambelii) and infrequent Mexican white pine (Pinus strobiformis) occurring at lower elevations. The Navajo River and its tributaries carry a high bedload of cobble, gravel and sand, depositing it wherever the stream gradient flattens. On the valley floor, for a nearly six-river-mile stretch of the Navajo River, mature, vigorous and healthy narrowleaf cottonwood (Populus angustifolia) and blue spruce (Picea pungens) with a thinleaf alder (Alnus incana ssp. tenuifolia) understory occur on the floodplain and first terrace. Cottonwood, alder, Pacific willow and sandbar willow (Salix lucida ssp. lasiandra and S. exigua) are regenerating on the floodplain, but the first terrace supports the majority of the cottonwood, as well as the blue spruce and a few ponderosa pine. The understory on the floodplain and terrace contains mostly native shrubs, mesic forbs, and graminoids with some weedy forbs and pasture grasses. On the terraces above the riparian community, a mix of blue spruce, ponderosa pine and aspen are interspersed with large, grassy meadows. At the upstream end of the site, the East Fork of the Navajo River descends southwest from the Continental Divide below Fets Peak (12,127') and Gramps Peak (12,792') and eventually joins the main stem of the Navajo River. Several mapped and unmapped waterfalls occur along its run. Just above where the river enters the broad floor of the Navajo River valley, a small but fairly pristine white fir (Abies concolor)-blue spruce-narrowleaf cottonwood/Rocky Mountain maple (Acer glabrum) community occurs within a narrow canyon with steep rock walls. Mature and regenerating cottonwood, blue spruce, Douglas-fir (Pseudotsuga menziesii), and white fir dominate the canopy and shade the understory in the narrow, deep canyon. The understory shrub layer at the riverbank consists of thinleaf alder and red-osier dogwood (Cornus sericea), with sporadic willows (Salix spp.), and Rocky Mountain maple is scattered throughout the community. The herbaceous understory is quite sparse in this shady canyon, but common species are false lily-of-the-valley (Maianthemum spp.), few-flower meadow-rue (Thalictrum sparsiflorum), fringed brome (Bromus ciliatus) and bluejoint reedgrass (Calamagrostis canadensis). Downstream on the Navajo River, below the midpoint of the site, Headache Creek descends to the west from the Continental Divide, passing through alpine meadows, mixed Engelmann spruce-subalpine fir forests and aspen stands, and near its confluence with the Navajo River it passes through Douglas-fir and ponderosa pine forests with a Gambel oak understory. This creek supports a 90% genetically pure, viable, and reproducing population of Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus). Restoration activities are currently taking place on Headache Creek to create barriers to non-native trout species that could potentially interbreed with the cutthroat trout population.

Land Use History: Headache Creek joins with the Navajo River at the site of Gramps Oil Field. This oil field has produced over 5 million barrels of oil since 1935 (USDA 2004), but was decommissioned and closed in recent years; the closure included Phase I, II and III environmental assessments, well plugging, removal of equipment, and decompaction and restoration of roads and facility sites (Trident Environmental, no date). Additionally, the site is located in an area of Archuleta County that was part of the original Tierra Amarilla Mexican Land Grant. Fifty-thousand acres of this land grant at the northern extent of the Navajo River are now divided into 3 private ranches: Banded Peak Ranch, Catspaw Ranch, and Navajo Headwaters Ranch.

Biodiversity Significance Rank Comments (B3): The site supports several unique riparian communities as well as a rare fish subspecies. A fair (C-ranked) occurrence of the globally imperiled (G2/S2) white fir-(Blue spruce)-narrowleaf cottonwood/Rocky Mountain maple (Abies concolor-(Picea pungens)-Populus angustifolia/Acer glabrum) montane riparian forest is located within the site. This plant association is a mid- to late-seral community occurring on active floodplains of montane valleys, often within narrow shady canyons (Carsey et al. 2003). Large occurrences of two other montane riparian forests occur in a mosaic: a good (B-ranked) occurrence of narrowleaf cottonwood/thinleaf alder (Populus angustifolia/Alnus incana), a globally vulnerable (G3/S3) community and a good (B-ranked) occurrence of narrowleaf cottonwood-blue spruce/thinleaf alder (Populus angustifolia-Picea pungens/Alnus incana), another globally vulnerable (G3/S3) community. The site also supports a good (B-ranked) occurrence of Colorado River Cutthroat Trout (Oncorhynchus clarkii pleuriticus), a globally vulnerable (G4T3/S3) subspecies. This population is considered 90% genetically pure, showing minimal hybridization with other introduced (non-native) trout species. Currently, projects are being implemented by the private property owners in conjunction with the Colorado Division of Wildlife to install barriers to prevent further hybridization (Allison 2005).

Natural Heritage element occurrences at the Navajo River at Banded Peak PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Fish	Oncorhynchus clarkii pleuriticus	Colorado River Cutthroat Trout	G4T3	S3		SC	USFS	B	2003-02-27
Natural Communities	Abies concolor - Picea pungens - Populus angustifolia / Acer glabrum Forest	Montane Riparian Forests	G2	S2				C	2005-09-01
Natural Communities	Populus angustifolia - Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				B	2005-08-23
Natural Communities	Populus angustifolia / Alnus incana Woodland	Montane Riparian Forest	G3	S3				B	2005-08-25

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the riparian woodlands along the East Fork of the Navajo River and the main stem of the Navajo River. Additionally, since the cutthroat trout population depends exclusively on the local hydrology for their life needs, the extent of the watershed was included from the headwaters of Headache Creek to its confluence with the Navajo River. Thus, the floodplain and immediate watershed, which are necessary to support natural hydrological processes, are included to ensure the long-term maintenance of the riparian ecosystems and the fish population. Activities within the boundary have the potential to impact the local hydrology and dependent ecology. The boundary also includes an approximate 500 foot buffer on the tributaries, and a 1,000 foot buffer on the main stem of the Navajo River, which includes nearby ranch roads, old development sites, hay meadows, and primitive campgrounds where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. These upland buffers are also provided to limit direct disturbance and local hydrologic alteration. It should be noted that the hydrological processes necessary to the riparian communities are not fully contained by the site boundary. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The private land where the site is located has conservation minded landowners and is managed with good conservation practices. The land is also mostly surrounded by USFS land and Wilderness.

General Protection Comments: The private land where the site is located consists of two separate ranches, both of which are actively managed with conservation minded practices. Riparian restoration is taking place on the Navajo River and Headache Creek, and conservation easements already exist on portions of the ranches. Additional easements were under negotiation in 2005. The private ranches are surrounded on two sides by USFS land or Wilderness. The northern boundary is another private ranch (Navajo Headwaters Ranch) owned jointly by the owners of the other two ranches, and the southern boundary abuts smaller parcels of private property.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences. Weed invasion is the main threat to the plant communities and hybridization with non-native species is the main threat to the fish population.

Management Needs Comments: The area is well managed, though it has been historically grazed by cattle (10 years ago). Cattle were removed 10 years ago, and only a few horses are kept on the ranches. The area now serves as wildlife forage with small areas of forestry delimited by the owners. The area surrounding the various riparian drainages displays stands of thistles, though not omnipresent, and various other upland weedy species. Focus weed management on control of invasive Canada thistle and musk thistle within the riparian areas and elsewhere on the ranch. The area near Gramps Oil Field would benefit from removal of trash and other debris, and further decompaction and reclamation of unused roads.

Land Use Comments: The area is primarily for wildlife use. The site crosses two private ranches that grazed cattle historically; however there have been no cattle on the property for approximately 10 years. Small areas of forestry delimited by the owner(s) occur within the site. A very large (minimum 4,000 head) elk herd migrates through this area each year and often over-winters on the ranches, which accounts for any heavy grazing or browsing that might be observed. Ranch roads with several small bridge crossings, and several irrigation diversions occur within the site. These diversions serve to irrigate adjacent meadows, supplying feed and hay for the ranch and forage for migrating elk and deer. On the East Fork, a large shed exists with cars parked within and various equipment and tools nearby. Another large shed, other outbuildings, and several old holding ponds occur at the site of the old Gramps oil field, which has been closed and decommissioned. A river gauge is installed on the Navajo River just upstream of its confluence with Headache Creek. At the downstream end of the site, a small portion of USFS land and BLM land occur along the Navajo River. A primitive campground is located on the USFS land.

Exotic Species Comments: Few if any weeds occur in the understory along the riparian community on the East Fork of the Navajo River. However, weedy species increase as the tributary enters the broad valley meadows, which were once grazed, and joins with the main stem of the Navajo River. The understory on the floodplain and terrace of the Navajo River often contains Canada thistle (Cirsium arvense), common dandelion (Taraxacum officinale), and hay grasses such as timothy, smooth brome, and Kentucky bluegrass (Phleum pratense, Bromus inermis and Poa pratensis), but also supports native shrubs, mesic forbs, and graminoids. Headache Creek was not botanically surveyed, and no weed information is available at this time; however, the Colorado Division of Wildlife, in association with the property owners and ranch manager of the Banded Peak Ranch, are actively working on projects to prevent invasion of exotic trout species into the Headache Creek drainage which threaten the existing population of Colorado River cutthroat trout.

Information Needs: The current owners are very conservation minded, and the ranch managers are very interested in learning as much about the natural elements on the property as possible. Excellent opportunities exist here for future surveys and/or inventories by CNHP staff, and maintaining the established, positive environment of information exchange with the ranch owners/managers would be encouraged in order to ensure future access the ranches and their resources.

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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

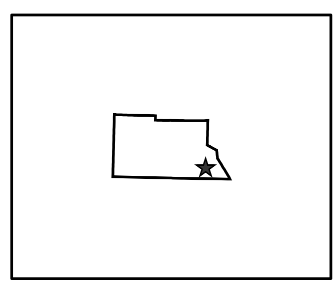
Legend

PCA Boundary

Antonito, 37106-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 15. Navajo River at Banded Peak Potential Conservation Area, B3: High Biodiversity Significance

Opal Lake

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Elephant Head Rock, Harris Lake

Size: 263 acres (106 ha) **Elevation:** 8,080 - 9,300 ft. (2,463 - 2,835 m)

General Description: Opal Lake site is located in the east central part of Archuleta County, in a montane basin below Flat Top Mountain in the wonderfully erosive Chalk Mountain range. These mountains are forested in aspen (Populus tremuloides), blue spruce (Picea pungens) and fir (Abies spp. and Pseudotsuga menziesii), surrounding Opal Lake and White Creek. Opal Lake is approximately three acres, with a wide fringe of graminoids on the north and east edge supporting an occurrence of retrorse sedge (Carex retrorsa), and a dense riparian shrubland located above the hydrophytic fringe. Slopes on the other three sides of the lake drop sharply from the surrounding forests into the lake, supporting only a sporadic, thin fringe of graminoids. The lake is opaque whitish-gray in good weather, and turbid (muddy) during the summer monsoons. At least two small spring-fed creeks on the south edge feed the lake, both supplying white-tinged water to the lake. Two beaver live at the lake, and a new lodge sits at the southeast corner. A small dam controls the lake outflow at the northwest corner, where White Creek drains the lake, and near this outlet there is a dense, and healthy thinleaf alder-Drummond's willow (Alnus incana ssp. tenuifolia-Salix drummondiana) montane riparian shrubland. Additional shrub species including park willow (Salix monticola) and diamondleaf willow (Salix planifolia) combine to provide a 58% shrub canopy cover within this riparian area. The herbaceous understory is dominated by beaked sedge (Carex utriculata), with other native mesic graminoids and forbs such as largeleaf avens (Geum macrophyllum), northern green orchid (Platanthera hyperborea var. hyperborea), and common cowparsnip (Heracleum maximum). Below this riparian shrubland, White Creek flows down a valley with moderate to slightly steep slopes that are densely forested with conifers and aspen (Populus tremuloides). The creek appears to periodically flood and many overflow channels are present. Riparian shrubs including alder, Drummond's willow, and red-osier dogwood (Cornus sericea) as well as hydrophytic graminoids are found in the flood plain terrace and overflow channels. A rare blue spruce/thinleaf alder montane riparian forest occurs here with aspen and subalpine fir (Abies lasiocarpa var. lasiocarpa) also present in the overstory. The herbaceous understory includes Richardson's geranium (Geranium richardsonii), Fendler's cowbane (Oxypolis fendleri), and cutleaf coneflower (Rudbeckia laciniata var. ampla). A trail follows and crosses White Creek only at its upper end near the lake, but the lake is a popular destination for hikers and trails criss-cross the area and encircle the lake. A popular campsite at the west edge of the lake sits just off the trail and within 350 feet of the lakeshore.

Key Environmental Factors: Soils around Opal Lake are described as Typic Ustorthents on the north shore, derived from andesite and quartz latite and found on fans and toe slopes, and Castelleia loam on the south shore, with similar parentage. Along White Creek, from Opal Lake to below the Forest Road, the soils shift from Skyway loams just downstream of the lake to mostly Castelleia loams the remainder of the length of the site. Both soil types are deep and well drained, and derived again from andesite and quartz latite parentage (USDA 1981). Specifically, soils at Opal Lake vary along the lake's graminoid fringe as to their geomorphic position. At the top of the north forest slope, a shallow, clayey A horizon (10 cm) lies over sand and gravels. At the edge of a rivulet within the graminoids, a shallow, mottled sandy loam (10 cm) lies over gravels. At the lake's edge within the graminoids and near some willow and alder shrubs, the soil is better developed. The top 10 cm is rooty, organic matter in mottled gray clay; the next 15 cm contains mottled sandy loam in mosaic with sand/clay. These textures are not mixed, but lie next to each other. The entire horizon is 40% mottled. Below this, the next 10 cm contains clay with some gravel and sand. The soils at this location are saturated to the surface and collect water at 20 cm deep. It should be noted that field ecologists in 2005 found that retrorse sedge (Carex retrorsa) appears to occupy clayey soils on muddy shorelines or creek banks, and sometimes within shallow standing water roughly between 8,000 and 9,500 feet elevation. It is nearly always associated with beaked sedge (Carex utriculata). Along White Creek, soils are typically alluvial, and the streambed consists of rounded and angular cobble, averaging 1"- 8" in diameter. Sediment deposition within the floodplain is silty clay loam, and on the first terrace, soils show a shallow clayey mineral horizon (10 cm) over sand and gravel.

Biodiversity Significance Rank Comments (B3): The Opal Lake site supports a good (B-ranked) example of the globally vulnerable (G3/S3) thinleaf alder-Drummond willow (Alnus incana/Salix drummondiana) montane riparian shrubland. As of 2005, this plant association has only been documented from Colorado and is limited in distribution, but widespread in Colorado. It is highly threatened by improper livestock grazing and stream impoundments. This association is generally found along steep-gradient streams with stable, shaded stream banks. The site also includes a fair (C-ranked) example of blue spruce/thinleaf alder (Picea pungens/Alnus incana) montane riparian forest, a community that is also globally vulnerable (G3/S3). This woodland occurs in deep, shaded canyons and narrow valleys along relatively straight stream reaches. It generally forms small patches, but can be continuous for several river miles. As of 2005, fewer than 100 stands exist in Colorado, and very few of these are in pristine condition. This association is threatened by development, road building and maintenance, heavy recreational use, improper livestock grazing, and stream flow alterations. An unranked occurrence of retrorse sedge (Carex retrorsa), a plant that is extremely rare (S1) in Colorado, although not threatened globally (G5) was documented at the site in 2001 but was not located in 2005. Site conditions have not changed dramatically so it is expected that the population still exists. Retrorse sedge has a broad distribution throughout the north half of North America, but, as of 2005, is known only in Colorado from several locations in Archuleta County.

Natural Heritage element occurrences at the Opal Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix drummondiana Shrubland	Montane Riparian Shrubland	G3	S3				B	2005-08-15
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				C	2005-08-15
Vascular Plants	Carex retrorsa	retrorse sedge	G5	S1				E	2001-08-31

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundaries were drawn to include the wetlands around Opal Lake and to incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the plant communities along White Creek. It should be noted that the hydrological processes necessary to the elements are not fully contained by the site boundaries. This boundary indicates the minimum area that should be considered for any conservation management plan. The boundary also includes a buffer of approximately 1,000 feet. Eliminating disturbance within this 1,000 foot buffer would aid in reducing impacts from sedimentation (Karr and Schlosser 1978), and assist in maintaining the integrity of the occurrences and its associated avian, macroinvertebrate and periphyton communities (Noel et al. 1986, Spackman and Hughes 1995).

Protection Urgency Rank Comments (P4): The site falls entirely within the San Juan National Forest, and the east end of the site is within the South San Juan Wilderness. No special protection is in place, and should not be required if present management and level of public use continue.

General Protection Comments: The site is entirely within the San Juan National Forest, and the east edge of the site is within the South San Juan Wilderness. Although this does not assure perpetual protection for the rare communities, it is not expected that protection actions will be needed in the foreseeable future. However, any changes in use of the land or ownership may necessitate action.

Management Urgency Rank Comments (M3): Current management seems to favor the persistence of the plants and plant communities in the site, but management actions may be needed in the future to maintain the current quality of the communities. Monitoring the grazing and recreation impacts on the area, such as dispersed camping, fishing, trail use, and development of new fishing trails, and altering management to minimize impacts would benefit the natural communities. Management of weeds and other potential invasive species that can be transported by hikers and horses may also be needed to maintain the current quality of the communities.

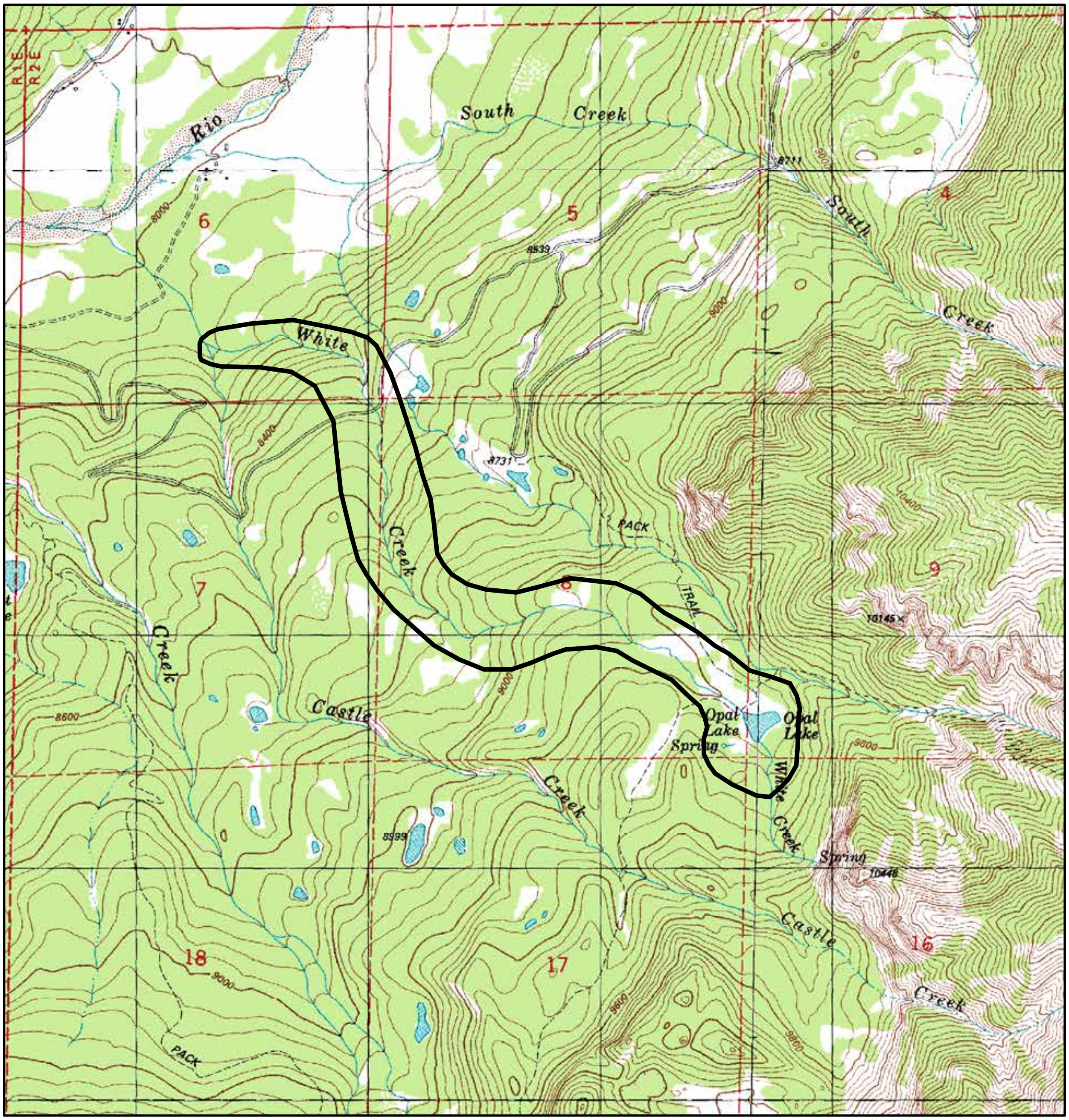
Management Needs Comments: The area is a popular destination for day hikers. Vegetation around the lake could be impacted if visitation is increased. Management of exotic plant species and other potential invasive species that can be transported by hikers and horses may be needed in the future. Encourage and enforce use of weed-seed-free feed for horses or livestock used for trail riding, packing and outfitting in this area.

Land Use Comments: Grazing and recreational use (such as hiking, hunting, horseback riding, fishing, and dispersed camping) have the greatest impacts on the site.

Exotic Species Comments: Prominent exotic plant species observed at Opal Lake and the upper extent of White Creek were Canada thistle (Cirsium arvense) and timothy (Phleum pratense). In the lower extent of White Creek, only common dandelion (Taraxacum officinale) was noted as a prominent exotic species, but weeds may easily spread if introduced where the creek crosses FR 660.

Off-Site Considerations: Hydrological processes originating outside of the planning boundary, including water quality, quantity, timing and flow are critical for maintaining the quality of the riparian and wetland communities.

Information Needs: The occurrence of retrorse sedge (Carex retrorsa) documented in 2001 was not relocated during the 2005 survey. Beaked sedge (Carex utriculata) was abundant at location described, but no retrorse sedge heads were identified; however it is possible that the seed heads were too immature or had dropped by the time of visit. No hydrologic or other alterations have occurred at the site since 2001, and soil and hydrology conditions are very similar to those occurring at other locations of retrorse sedge in Archuleta County. The associated species at the site also match what occurs at other sites; therefore, it is not unreasonable to assume the population still exists at this location. A small drainage coming into Opal Lake on the south shore supports a small sedge stand just upstream of the lake, and possibly has a small retrorse sedge population mixed with beaked sedge (specimens were not definitely identified, but photos were taken). Additional field work is necessary to verify the occurrence.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

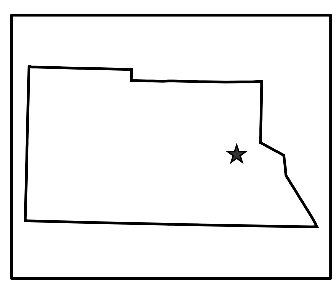
Legend

PCA Boundary

Elephant Head Rock, 37106-B6
Harris Lake, 37106-B7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 16. Opal Lake Potential Conservation Area, B3: High Biodiversity Significance

Piedra

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chimney Rock, Devil Mountain

Size: 416 acres (168 ha) **Elevation:** 6,400 - 7,800 ft. (1,951 - 2,377 m)

General Description: The Piedra River canyon occurs in the west-central part of Archuleta County, below Mule Mountain to the east and a prominent, unnamed mesa which rises from the west side of the Piedra River. The Piedra site is located on USFS lands across both sides of the Piedra River, just upstream of where Highway 160 crosses the Piedra River. Ponderosa pine (Pinus ponderosa) and Douglas-fir (Pseudotsuga menziesii) with an understory of Gambel oak (Quercus gambelii) dominate the steeply sloping, forested hillsides, which drop to the river's edge and meet a narrowleaf cottonwood (Populus angustifolia) dominated community along the river. A forest road travels north, adjacent to and above the Piedra River on the east bank. On a moderately steep slope above and on the east side of the forest road, a densely vegetated draw draining to the Piedra River hides a seepy hillside. A water birch/mesic forb (Betula occidentalis/Maianthemum stellatum) community, rarely documented in this part of the state, dominates the main, wettest part of the seep. The slightly higher north edge of the seep supports stream orchid (Epipactis gigantea) and canyon bog orchid (Limnorchis ensifolia) and other mesic forb species, such as Philadelphia fleabane (Erigeron philadelphicus), scouringrush horsetail (Equisetum hymale var. affine), and violets (Viola spp.). The seep extends from the forest road at its base, up the hill approximately 350 feet to a small bench, where the groundwater ceases its surface discharge. This small wetland area has a power line running through it and a road adjacent on its downhill edge. Across the river on the west side, the endemic Aztec milkvetch (Astragalus proximus) was found on a steep west-facing slope within a ponderosa pine and Gambel oak forest, south of the Lower Piedra campground and uphill of a steep road cut.

Key Environmental Factors: The Piedra River canyon, from where it crosses the Archuleta/Hinsdale County Line at its northern extreme to Highway 160 at its south terminus, commonly has groundwater discharge in the form of cold and hot springs, and infrequent seeps. Within the site, the geology of the specific area surrounding the seep is mapped as Mancos Shale (Tweto 1979), and soils are mapped as Chris stony loam, formed in residuum and alluvium derived from sandstone (USDA 1981). A soil pit within the main part of the seep shows the soils are saturated to the surface, with mosses and some detritus on the top, 1 cm of O horizon below, then 6.5 cm of sand with gravel, transitioning to mottled and gleyed sandy clay loams with rocks and pebbles approximately 5 mm to 30 mm in diameter. Water collects at 34 cm within 10 minutes. Surface water is not always present, but the gleying indicates that groundwater is consistent. The geology of the specific area surrounding the Aztec milkvetch occurrence across the Piedra River, is mapped as Modern Alluvium (Tweto 1979), but occurs just down slope of an area of Mesa Verde group sandstone and shale. Soils in this area are generally mapped as Sandstone Outcrops or Carracas loams derived from sandstone and shale on the slopes above the river (USDA 1981).

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of a state imperiled (G4?/S2) riparian plant association, water birch/mesic forb (Betula occidentalis/Maianthemum stellatum) foothills riparian shrubland. This association usually occurs along stream channels, but can also occur on hillside seeps, forming a consistent canopy sheltering numerous species of wetland-associated forbs. As of 2005, this occurrence is the only documented location of this association in Archuleta County. The site is also home to a good (B-ranked) occurrence of the globally vulnerable (G3G4/S2) stream orchid (Epipactis gigantea), and two state rare species, the canyon bog orchid (Limnorchis ensifolia) and the endemic Aztec milkvetch (Astragalus proximus). Also occurring on the hillside seep is the globally secure (G5) but state imperiled (S1) Philadelphia fleabane (Erigeron philadelphicus).

Natural Heritage element occurrences at the Piedra PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Betula occidentalis / Maianthemum stellatum Shrubland	Foothills Riparian Shrubland	G4?	S2				B	2005-05-21
Vascular Plants	Epipactis gigantea	helleborine	G3G4	S2			USFS	B	2005-06-21
Vascular Plants	Astragalus proximus	Aztec milkvetch	G4	S2			USFS	B	2005-06-10
Vascular Plants	Limnorchis ensifolia	Canyon bog - orchid	G4G5T4 ?	S3				B	2005-06-21
Vascular Plants	Erigeron philadelphicus	Philadelphia fleabane	G5	S1				C	2001-07-11

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The Piedra site includes the rare plant and community occurrences and a small buffer of surrounding suitable habitat. The buffer is designed to protect the occurrences from direct disturbance such as trampling and to allow additional individuals to become established over time. The boundary was enlarged in 2002 to include a new occurrence of Astragalus proximus.

Protection Urgency Rank Comments (P4): The site is entirely within the San Juan National Forest, and should need no further protection beyond that provided by the sensitive species status of Aztec milkvetch and stream orchid.

General Protection Comments: The seep location is not readily apparent to the general public from the popular and frequently traveled First Fork Road (FR 622), and large and vigorous western poison ivy plants along the road ditch discourage entry into the site from the road. First Fork Road occurs immediately at the base of the seep, and diverts the water through a culvert and prevents the population from continuing down slope. The population of Aztec milkvetch across the Piedra River from the seep is also not readily accessible, as it is located above a steep road cut on a steep hillside.

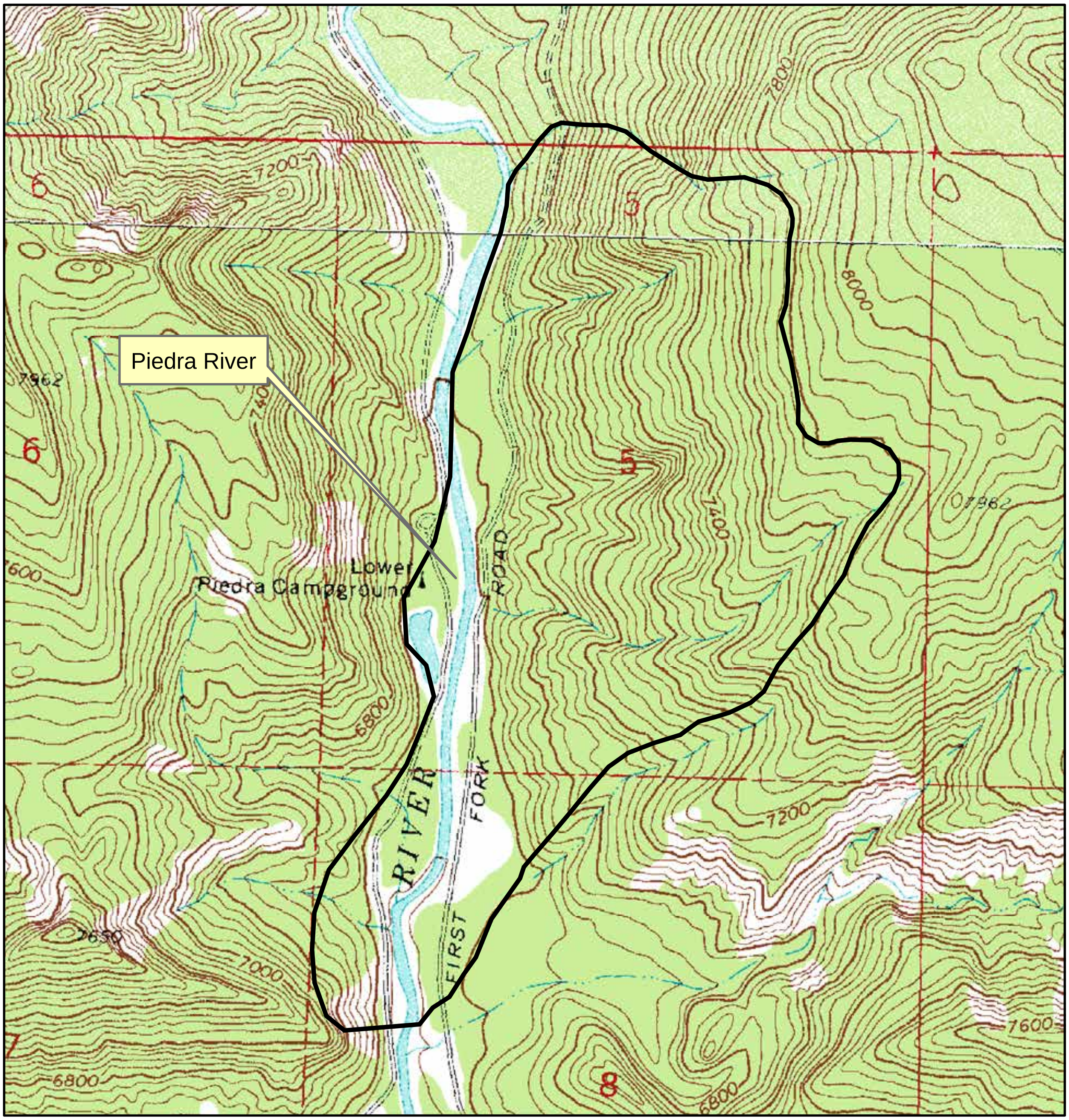
Management Urgency Rank Comments (M3): New management actions may be needed within five years to maintain the current quality of the rare plant populations. The seep area is vulnerable to maintenance of the powerline that passes through it, and is also dependent on continuation of the present hydrology. Coordination between power company personnel and the Forest Service when maintenance activities are planned would help prevent damage to the rare plants. The seep hydrology is an important consideration when activities such as logging are initiated by the National Forest in the area.

Management Needs Comments: The seep area is vulnerable to maintenance of the power line that passes through it, and is also dependent on continuation of the present hydrology. The seep hydrology should be considered before any activities such as logging are initiated by the National Forest in this area.

Natural Hazard Comments: Vigorous western poison ivy (Toxicodendron rydbergii) defends the seep site on all sides, and is also commonly found along west-facing slopes near the Piedra River, similar to the Aztec milkvetch site.

Exotic Species Comments: At the seep site, common dandelion (Taraxacum officinale) occurs within and near the wetland but is not dominating; otherwise the saturated habitat area is comprised of mostly native species. Status of exotic species at the Aztec milkvetch site is not known.

Information Needs: A survey for the historical occurrence of Grace's Warbler (Dendroica graciae) would be beneficial. Many songbirds were heard in the vicinity of the seep during 2005 but not identified.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

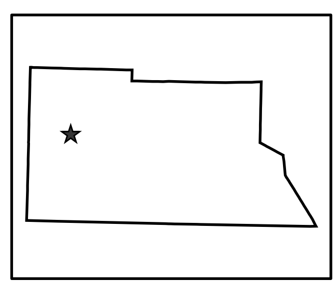
Legend

PCA Boundary

Chimney Rock, 37107-B3
Devil Mountain, 37107-C3

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 17. Piedra Potential Conservation Area, B3: High Biodiversity Significance

Quartz Creek at East Fork San Juan River

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Blackhead Peak, Elwood Pass, Summit Peak, Wolf Creek Pass

Size: 2,322 acres (940 ha) **Elevation:** 8,020 - 11,640 ft. (2,445 - 3,548 m)

General Description: In the extreme northeast corner of Archuleta County, the Continental Divide rises to elevations averaging 12,500 feet along ridgelines, and up to a high point in this county corner of 13,300 feet, at Summit Peak. Draining to the northwest just below Summit Peak in the South San Juan Wilderness are several intermittent streams and rivulets that converge at the base of a large, semi-circular subalpine and alpine basin to form the East Fork of Quartz Creek. Flowing northwest, the East Fork joins Quartz Creek one mile downstream, crosses the Wilderness boundary into the San Juan National Forest, and joins the East Fork of the San Juan River approximately 7 miles downstream. The East Fork of the San Juan River then turns ninety degrees to Quartz Creek and drains to the southwest through a broad, U-shaped, glaciated valley with a wide floodplain. The watersheds of East Fork of Quartz Creek, Quartz Creek, and the East Fork of the San Juan River support a variety of unique riparian and wetland communities, one rare breeding bird population, and at least one rare plant species along their lengths. At the upper end of the site, in the snowmelt basin just below Summit Peak, steep alpine talus and meadows fed by snowmelt support lush stands of subalpine mesic forbs, dominated by a heartleaf bittercress-tall fringed bluebells (Cardamine cordifolia-Mertensia ciliata) community. The meadows are productive and pristine with little degradation. Quartz Creek Trail, used by horse riders and hikers, crosses above this riparian area, which has lead to some erosion of the hillside above the meadows. Cattle also graze in the area. As the tributary streams and Quartz Creek Trail continue downslope and enter treeline in the subalpine and montane zones, dense forests begin on the steep hillsides and are comprised of mature Engelmann spruce, Douglas-fir, and subalpine fir (Picea engelmannii, Pseudotsuga menziesii, and Abies lasiocarpa) forests with pockets of mature quaking aspen (Populus tremuloides). Within this forest, the trail crosses a very steep, open-tree-canopy rockfall chute or avalanche path where a perennial rivulet drops from a large rock face down to the East Fork of Quartz Creek. The drainage is heavily vegetated and is dominated by a planeleaf willow (Salix planifolia)/mesic forb community. Additional shrubs in the community include short-fruit willow, Wolf's currant and gooseberry currant (Salix brachycarpa, Ribes wolfii and R. montigenum). The dense herbaceous understory is dominated by arrowleaf ragwort and tall fringed bluebells, as well as fewflower meadow-rue, Reeves' bladderfern (Thalictrum sparsiflorum, Cystopteris reevesiana) and mosses. Continuing downstream, Quartz Creek Trail crosses the East Fork of Quartz Creek, and just downstream of the crossing a small area of rock cliffs occurs near a waterfall carrying the creek down the moderately steep ravine. Steller's cliff brake (Cryptogramma stelleri) was found growing in horizontal crevices in the rock, with mosses and mat saxifrage (Cilaria austromontana), kept moist by spray from the falls, or in one place by a seep in an alcove. The surrounding forest is Engelmann spruce and subalpine fir with an understory of whortleberry (Vaccinium spp.). Immediately downstream of this rock face, the dominant riparian community of narrowleaf cottonwood-blue spruce/thinleaf alder (Populus angustifolia-Picea pungens/Alnus incana) begins along the East Fork of Quartz Creek, and continues past the confluence with the main stem of Quartz Creek, a montane, sinuous, dynamic creek carrying a high load of cobble, sand and silt. The broad floodplain has numerous wide cobble and sand point bars, which along with the creek banks, are populated by high numbers of regenerating cottonwood, alder, and Drummond's willow (Salix drummondiana). Blue spruce encroaches into the riparian zone from the surrounding forests. The understory is comprised of a sparse canopy of mesic shrubs such as white-stem gooseberry (Ribes inerme) and shrubby cinquefoil (Dasiphora floribunda), except at the banks of the creek where the alder and willow cover is vigorous. The herbaceous understory is comprised mostly of native mesic forbs and graminoids such as mountain parsley, common cowparsnip, and bluejoint reedgrass (Pseudocymopterus montanus, Heracleum maximum, and Calamagrostis canadensis), with a low cover of exotic herbaceous species. At the lower end, the creek gradient steepens and enters a narrow canyon with steep, shale slopes before opening up into a one-half-mile wide valley where Quartz Creek joins the East Fork of the San Juan River. The valley narrows again some five miles downstream at the west end of the site. Through this broad valley the river is low gradient, shallow, and braided, with a cobble bottom. The riparian vegetation is composed of a mosaic of three vegetation types, including a continuation of the narrowleaf cottonwood-blue spruce/thinleaf alder community from Quartz Creek in the upper portion of the valley, a thinleaf alder-mixed willow shrublands (Alnus incana-mixed Salix species) and wet meadows of beaked sedge (Carex utriculata) in the lower half of the valley. Beavers (Castor canadensis) are found on the secondary channels and help to maintain the wetlands. Grassy-forb meadows, often weedy, dominate the terraces within the valley floor and the toe slopes of the valley hillsides. North-facing hillsides support old growth Douglas-fir forest with a moist forb dominated understory. Small natural ponds and wetlands within the forest provide excellent habitat for mule deer (Odocoileus hemionus), elk (Cervus elaphus), and possibly frogs and other amphibians. The south-facing slopes are dominated by aspen (Populus tremuloides), ponderosa pine (Pinus ponderosa), or Gambel oak (Quercus gambelii). Cattle grazing has been the dominant use of this site, although grazing is being eliminated by the current land manager within the valley. There are no ditches, dams, man-made ponds, or irrigated hay meadows at this site, an unusual event given the elevation and geomorphology of the river. North of the river at the west end, Waterfall Creek drops down a steep cliff face, creating Silver Falls, a popular hiking destination. These steep cliff faces along the waterfall provide good nesting habitat for a small population of Black Swifts. Through the majority of the site, a popular Forest Road parallels the river and Quartz Creek to the Quartz Creek Trailhead. Both the trail and the road are almost always 50 to 500 feet from the river or the creek. The road crosses the river a mile downstream of the site boundary, and both the road and the trail cross Quartz Creek.

Key Environmental Factors: Starting at the upper (east) end of the site, the geology of the upper snowmelt basin is mapped as Ash-Flow Tuff of Main Volcanic Sequence (Tertiary-Oligocene; Age in San Juan Mountains, 26-30 million years old) transitioning to Pre-Ash-Flow Andesitic Lavas, Breccias, Tuffs, and Conglomerates (Tertiary-Oligocene; General Age 30-35 million years old) along the East Fork of Quartz Creek as it flows through subalpine and upper montane ecosystems and steep and narrow canyons. As the East Fork of Quartz Creek joins the main stem, the valley broadens into Quartz Meadow, the gradient flattens, and the soil type shifts to Pictured Cliffs Sandstone and Lewis Shale (Late Cretaceous). One mile above the confluence of Quartz Creek with the East Fork of the San Juan River, the surface geology transitions briefly to Animas Formation (Late Cretaceous; Arkosic sandstone, shale, and conglomerate) in a steep, narrow canyon. Then near the confluence, the valley of the East Fork of the San Juan River broadens and flattens, and the surface geology becomes recently deposited (Pleistocene-aged) Gravels and Alluviums (Pinedale and Bull Lake Age). Outside the boundary the surrounding mountains and contributing watersheds are dominated by Pre-Ash-Flow Andesitic Lavas, Breccias, Tuffs, and Conglomerates (Tweto 1979). Regarding soil types, again starting at the upper end of the site, the soils in the snowmelt basin are mapped as Igneous outcrop-Cryorthents complex, with barren exposures of andesite and quartz latite bedrock (USDA 1981). Soil sampling within the heartleaf bittercress-tall fringed bluebells community determined that soils are shallow silt loam with roots; mostly, the substrate is rocky with angular and rounded cobble, gravel and sand deposits. Lower in the site at the planeleaf willow occurrence, soils are mapped as Igneous outcrop; with steep, barren exposures of andesite and quartz latite bedrock, and areas of granite and metamorphic rock (USDA 1981). Samples taken here showed that the soils are rocky with boulders, angular cobble/talus, and gravel deposits. Areas closer to the forest edge with better soil development have a thin, loamy upper horizon. Along Quartz Creek within the broad valley of Quartz Meadow, the soils are mapped as Pescar sandy loam, derived from alluvium of various sources, and Igneous outcrop-Cryorthents complex, barren exposures of andesite and quartz latite bedrock. Pockets of Grenadier Loam and Adel Loam occur within the larger matrix. Soil samples taken along the riparian community on Quartz Creek are alluvial and consist of large and small cobble with large sand deposits on point bars and creek banks. After exiting Quartz Meadow, the creek drops through a steep, narrow valley lined by shale Badlands, consisting of barren, exposed shale, then enters the upper end of the broad, flat East Fork of the San Juan

River valley. As the creek gradient drops and it joins with the East Fork, they both drop their bedloads of sand, gravel and cobble, classified as Riverwash. As the East Fork of the San Juan River travels through this lowest 1/3 of the site, the main, braided riverbed remains Riverwash, with soils slightly higher in the floodplain mapped as Pescar sandy loam, with pockets of Hunchback clay loams and Histic Cryaquepts in marshy areas. The surrounding contributing watershed is made up of a patchwork of Adel loam, Grenadier loam, and Sambrito loam, all derived from a mixed source of alluvium and colluvium or from andesite and quartz latite. The steep hill toe slopes along the valley bottom are Typic Ustorthents, again mainly derived from andesite and quartz latite, with areas of bedrock outcrops (Igneous Outcrop-Cryorthents complex) such as near Silver Falls (USDA 1981).

Biodiversity Significance Rank Comments (B3): This site supports seven elements tracked by CNHP. Driving the biodiversity rank, a good (B-ranked), 8.5-mile-long example of the globally vulnerable (G3/S3) narrowleaf cottonwood-blue spruce/thinleaf alder (Populus angustifolia-Picea pungens/Alnus incana) montane riparian forest occurs along Quartz Creek and the East Fork of the San Juan River. This mid-seral community is reliant on continued fluvial activity and bank overflow to perpetuate the cottonwood component, and is typically dense and diverse in the shrub and herbaceous layer (Carsey et al. 2003). The site also contains an excellent (A-ranked) occurrence of a plant community that is apparently secure (G4/S4) on a global scale. As of 2005, this is the best-known occurrence of the heartleaf bittercress-tall fringed bluebells (Cardamine cordifolia-Mertensia ciliata) alpine wetland type in Archuleta County. Near a popular waterfall north of the river, a good (B-ranked) nesting population of the globally apparently secure (G4) but state-vulnerable breeding population (S3B) of Black Swift (Cypseloides niger) occurs. This site also contains a good (B-ranked) occurrence of planeleaf willow (Salix planifolia)/mesic forbs shrubland, a globally apparently secure (G4/S4) community occurring in montane and subalpine swales with persistent saturation from snowmelt (Carsey et al. 2003). This is the only documented occurrence of this community in the county as of 2005, but because it is a common community type, there are likely other undocumented examples. Near the midpoint of the site, a good (B-ranked) occurrence of slender rock-brake exists. This fern is rare in Colorado (S2), although globally secure (G5). This species of fern has a broad distribution throughout the north half of North America, but, as of 2005, is known from only 19 locations in Colorado. Lastly, a good (B-ranked) occurrence of the globally secure (G5/S4) beaked sedge (Carex utriculata) herbaceous vegetation community occurs along the East Fork of the San Juan River in saturated floodplain soils.

Natural Heritage element occurrences at the Quartz Creek at East Fork San Juan River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Cypseloides niger	Black Swift	G4	S3B			USFS	B	1997-08-28
Natural Communities	Alnus incana - Salix (monticola, lucida, ligulifolia) Shrubland	Thinleaf Alder - Mixed Willow Species	G3	S3				C	1998-08-11
Natural Communities	Populus angustifolia - Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				B	2005-07-21
Natural Communities	Cardamine cordifolia - Mertensia ciliata Herbaceous Vegetation	Alpine Wetlands	G4	S4				A	2005-08-31
Natural Communities	Salix planifolia / Mesic Forbs Shrubland [Provisional]	Planeleaf Willow / Mesic Forbs	G4	S4				B	2005-08-31
Natural Communities	Carex utriculata Herbaceous Vegetation	Beaked Sedge Montane Wet Meadows	G5	S4				B	1998-08-11
Vascular Plants	Cryptogramma stelleri	slender rock - brake	G5	S2			BLM	B	2001-07-27

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: Surface water and ground water were two primary ecological processes considered when designing the site boundary. Both are critical to the alpine wetland in its upper extremity, as well as the rare plant occurrence, the rare bird occurrence, and five riparian or wetland communities occurring in the lower part of the site. The boundary begins by capturing the snowmelt basin and its drainage that is so important to maintaining the viability of the alpine wetland. The boundary then incorporates the immediate watershed of the large narrowleaf cottonwood riparian community on Quartz Creek and East Fork San Juan River, the immediate watershed for the alder-willow community and the beaked sedge community on the East Fork San Juan River, the avalanche path supporting the planeleaf willow community, the cliffs where groundwater seepage and waterfall spray supports the slender rock-brake, and at a separate location, the waterfall and cliffs that provide nesting habitat for the Black Swift. Although the continuation of the current hydrology is essential to the long-term survival of the rock-brake and the persistence of the Black Swift breeding population, the larger watershed for each of those sites was not included in the boundary. Overall, the boundary generally reflects a 500 foot buffer that will aid in preventing direct disturbance of the riparian and wetland communities and rare species, and encompasses trails, roads, and dispersed campsites where surface runoff may contribute nutrients and sediment, and where impacts may promote weed invasion. It should be noted that not all the hydrologic processes necessary to all the element occurrences are contained within the boundary. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P2): Protection actions may be needed within 5 years. Although the upper 1/3 of the site is within the South San Juan Wilderness and the middle 1/3 is within the San Juan National Forest, several of the elements targeted for conservation occur on a large parcel of private land that is completely surrounded by the San Juan National Forest. Although past proposals for a ski area and luxury resort development on this private land have been abandoned, this does not preclude the landowners from proposing or proceeding with other development at this site. A conservation easement on this private land is warranted to protect not only the element occurrences but the visual values as well. Changes in use or ownership of any of these private or forest lands may necessitate further protection actions.

General Protection Comments: Protection actions may be needed within 5 years. Although the upper 1/3 of the site is within the South San Juan Wilderness and the middle 1/3 is within the San Juan National Forest, several of the elements targeted for conservation occur on the lower 1/3 on a large parcel of private land that is completely surrounded by the San Juan National Forest. It is estimated that stresses within this private parcel may reduce the viability of the elements within five years. Although separate proposed plans for a ski area and a luxury resort development (with 18-hole golf course) have been abandoned, the property still has the potential to be developed. Over 2,800 acres is a privately owned ranch that is also an inholding in the San Juan National Forest. A conservation easement on this private land is warranted to protect not only the element occurrences but the visual values as well. As for the upper 2/3 of the site and the associated element occurrences, this portion is relatively well protected, and the upper 1/3 of the site can be accessed only by a long hike. Although this does not assure perpetual protection for the rare communities, no protection actions for the upper 2/3 are currently needed. However, changes in use of the private lands in the lower portion, the forest lands themselves, or forest ownership may necessitate further protection actions.

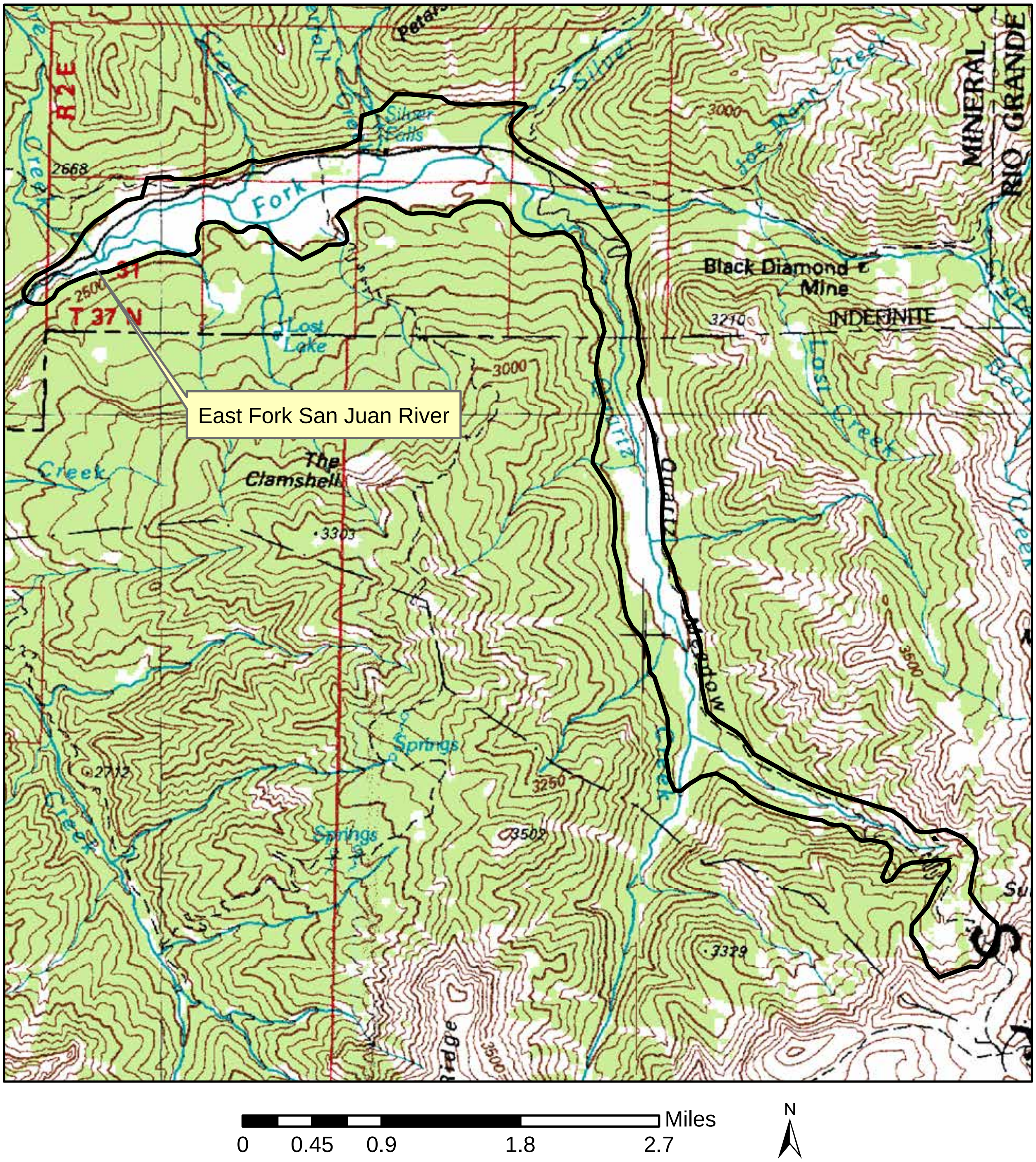
Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the quality of the occurrences. Potential development and weed invasion are the main threats to the lower portion of the site occurring on privately owned lands. Current management of the riparian zone on these private lands at the lower west end is directed towards a reduction and eventual elimination of livestock grazing, but native riparian vegetation has been impacted over the years and allowing regeneration would benefit the communities' viability. Some stream restoration work has occurred along the upper elevations, and there may be plans for further work downstream. In the upper portion of the site, current management seems to favor the persistence of the communities and rare species, but management actions may be needed in the future to maintain the current quality of the element occurrences. Recreational use of the trail by hikers and horse riders as well as grazing cattle have the potential to adversely affect the elements through introduction of non-native plants and increased erosion. Monitoring would aid in detecting the introduction of exotic plants and in determining when erosion, particularly along the trailside, is threatening the stability of critical watersheds. Disturbance of the rare plant population is unlikely because of its location on the cliff face, but the population depends on the continued supply of water to the site.

Management Needs Comments: The Quartz Creek Trail occurs along the upper 2/3 of the site, and its recreational use by hikers and horse riders as well as by grazing cattle has the potential to adversely affect the site through introduction of non-native plants and increased erosion. Enforcing a "weed-free" rule for horse feed on the trail would aid in limiting the introduction of non-native plants. Any disturbance of the snowmelt basin at the upper end has the potential to increase erosion and adversely affect the alpine wetland, and trailside erosion along the length of the site may threatening the stability of many of the steep hillsides, including those within the snowmelt basin and along the upper reaches of the East Fork of Quartz Creek. The establishment of a monitoring program would aid in detecting the introduction of exotic plants and in determining when erosion threatens the viability of these riparian and wetland communities. The riparian system across the privately owned lands on the lower 1/3 is in need of weed management and willow restoration. The private property owner is aware and concerned about the weeds. Regeneration of native plants especially willows, alders, and cottonwoods would increase the biological value of the private lands within the site. A reduction in livestock grazing may enhance natural reproduction of the native vegetation.

Land Use Comments: The Forest Service and Wilderness areas are closed to motorized vehicles except on designated Forest Roads. Hiking, horse riding, hunting, fishing, camping and wildlife use are the dominant land uses in moderate seasons. Grazing occurs on the Forest Service portion of the site. The private land at the west end currently is not being grazed, but there is moderate recreational use in the area in summer. Portions of the East Fork of the San Juan River on the private inholding have undergone river restoration techniques beginning in 1986. This river restoration was done on the mile of river just below its confluence with Quartz Creek. The goal was to minimize channel braiding, minimize bank erosion, and to increase riparian vegetation along the channel (Rosgen 1996). It is not known whether subsequent restoration projects have been done since the initial project.

Exotic Species Comments: In the upper reaches weedy species are uncommon; however, grazing and horse packing in the area threaten to introduce exotic species into the subalpine meadows. Weeds are again uncommon in the mid-reaches, but red clover (Trifolium pratense) occurs along Quartz Creek Trail. Kentucky bluegrass (Poa pratensis) and common dandelion (Taraxacum officinale) are the most common weeds in the herbaceous understory of the riparian zone along Quartz Creek. Other weeds have not yet invaded the community in large numbers, but the possibility exists since adjacent meadows are heavily grazed. Much of the riparian system along the East Fork of the San Juan River is in need of weed management. The private property owner is aware and concerned about the weeds.

Information Needs: Lynx (Lynx canadensis) have been historically documented as recently as 1994. New surveys for this species as well as wolverine (Gulo gulo) and Peregrine Falcon (Falco peregrinus), both occurring in this area of the San Juan Mountains, would benefit by possibly providing additional motivation for protection of the area from potential development in the downstream reaches. Some river restoration has occurred on the upper portion of the East Fork of the San Juan River on private lands, and more may be planned for additional reaches. We recommend researching the historical geomorphology in order to understand if the current braided stream is natural.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 02/27/2006

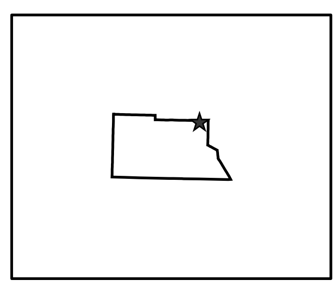
Legend

PCA Boundary

Antonito, 37106-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 18. Quartz Creek at East Fork San Juan River Potential Conservation Area, B3: High Biodiversity Significance

Rio Chama

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Archuleta Creek

Size: 191 acres (77 ha) **Elevation:** 8,800 - 8,920 ft. (2,682 - 2,719 m)

General Description: The Rio Chama flows south in the extreme southeast corner of Archuleta County, east of the Continental Divide. The stream channel lies within the Rio Grande National Forest, in a broad, U-shaped valley surfaced with alluvium and landslide deposits. The rough land surface in the valley in addition to seasonal flooding marks the area as a very dynamic, active riparian system. The broad floodplain has large amounts of alluvium, abandoned river channels, and downed logs. There are backwater channels and active and inactive beaver ponds supporting emergent vegetation. The dominant plant associations within the valley include narrowleaf cottonwood/thinleaf alder (Populus angustifolia/Alnus incana ssp. tenuifolia) woodlands and mountain willow (Salix monticola) shrublands. The cottonwood/alder plant association occupies the riverbanks and immediate floodplain as well as large areas on the broad alluvial terrace, and displays an open canopy cover of narrowleaf cottonwood. Thinleaf alder dominates an understory of mixed riparian shrubs including mountain willow and Drummond's willow (Salix drummondiana). There is some branch dieback on the alder, typical of conditions throughout the county; otherwise the woody vegetation is vigorous and regenerating, with cottonwood and blue spruce (Picea pungens) saplings noted. A sparse herbaceous layer exists in the understory with a high percentage of rock, soil, and sand (alluvium). Within the lower half of the site, a large, broad willow carr occurs on the floodplain extending across the valley floor, displaying a dense to open canopy of mountain willow, alder, Drummond's willow and planeleaf willow (Salix planifolia). A dense to open canopy cover of mesic native grasses such as bluejoint reedgrass (Calamagrostis canadensis), as well as meadow horsetail (Equisetum pratense) and introduced pasture grasses makes up the herbaceous understory. The willow canopy is tall; though the lower willow branches reachable by wildlife or domestic grazers are moderately browsed. Shrubs exhibit a high vigor and apparently have been browsed very little in the current year. Wildlife trails and scat are common within the carr. Spruce-fir (Picea spp.-Abies lasiocarpa/Pseudotsuga menziesii) forests and stands of quaking aspen (Populus tremuloides) dominate the surrounding hillsides.

Key Environmental Factors: The geology of the area is mapped as Quaternary Landslide upstream, and Quaternary Alluvium and Mancos Shale (Tweto 1979). The area is not delineated by the local soil survey (USDA 1981). A soil sample within the floodplain displays a surface horizon 6 cm deep comprised of sand with high percent of roots; the next horizon is 10 cm of loamy sand with 25% mottling; and the next horizon is 4 cm of sandy loam with some cobble and tree roots. The last horizon is rocky alluvium. The soil pit and cut streambank indicates an active flooding regime with several depositional layers. Within the willow carr, the soil sample displays a surface horizon of 6 cm of light gray clay with high percentage of roots and 5% black organic pieces; the next horizon is 20 cm of sandy clay, with 10% mottling and few roots. The lowest horizon is 14 cm of silty clay with very few roots.

Biodiversity Significance Rank Comments (B3): The site contains a good (B-ranked) occurrence of Mountain Willow (Salix monticola)/Mesic Graminoid Montane Riparian Willow Carr, a globally vulnerable community (G3/S3) that covers nearly 65 acres. This community type is often impacted by grazing, but tends to be stable and long-lived (Carsey et al. 2003). The site also encompasses a fair (C-ranked) occurrence of Narrowleaf Cottonwood/Thinleaf Alder (Populus angustifolia/Alnus incana ssp. tenuifolia) Montane Riparian Forest, also a globally vulnerable community (G3/S3). The cottonwood/alder plant association is considered mid-seral and is characterized by a dense overstory of cottonwood with a thick stand of alder occurring along the riverbank.

Natural Heritage element occurrences at the Rio Chama PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia / Alnus incana Woodland	Montane Riparian Forest	G3	S3				C	2005-08-16
Natural Communities	Salix monticola / Mesic Graminoids Shrubland	Montane Riparian Willow Carr	G3	S3				B	2005-08-16

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the element occurrences and the ecological processes necessary for the viability of the element occurrences; specifically the immediate watershed and the groundwater and surface water flows. The boundary also identifies a buffer including trails and grazing allotments where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and where impacts may promote weed invasion. It should be noted that not all the hydrologic processes necessary to the element occurrences are contained within the boundary. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is entirely within the Rio Grande National Forest.

General Protection Comments: The site is owned and managed by the Rio Grande National Forest, and present land protection is adequate. However, future changes in status or use of the land may warrant additional protection actions.

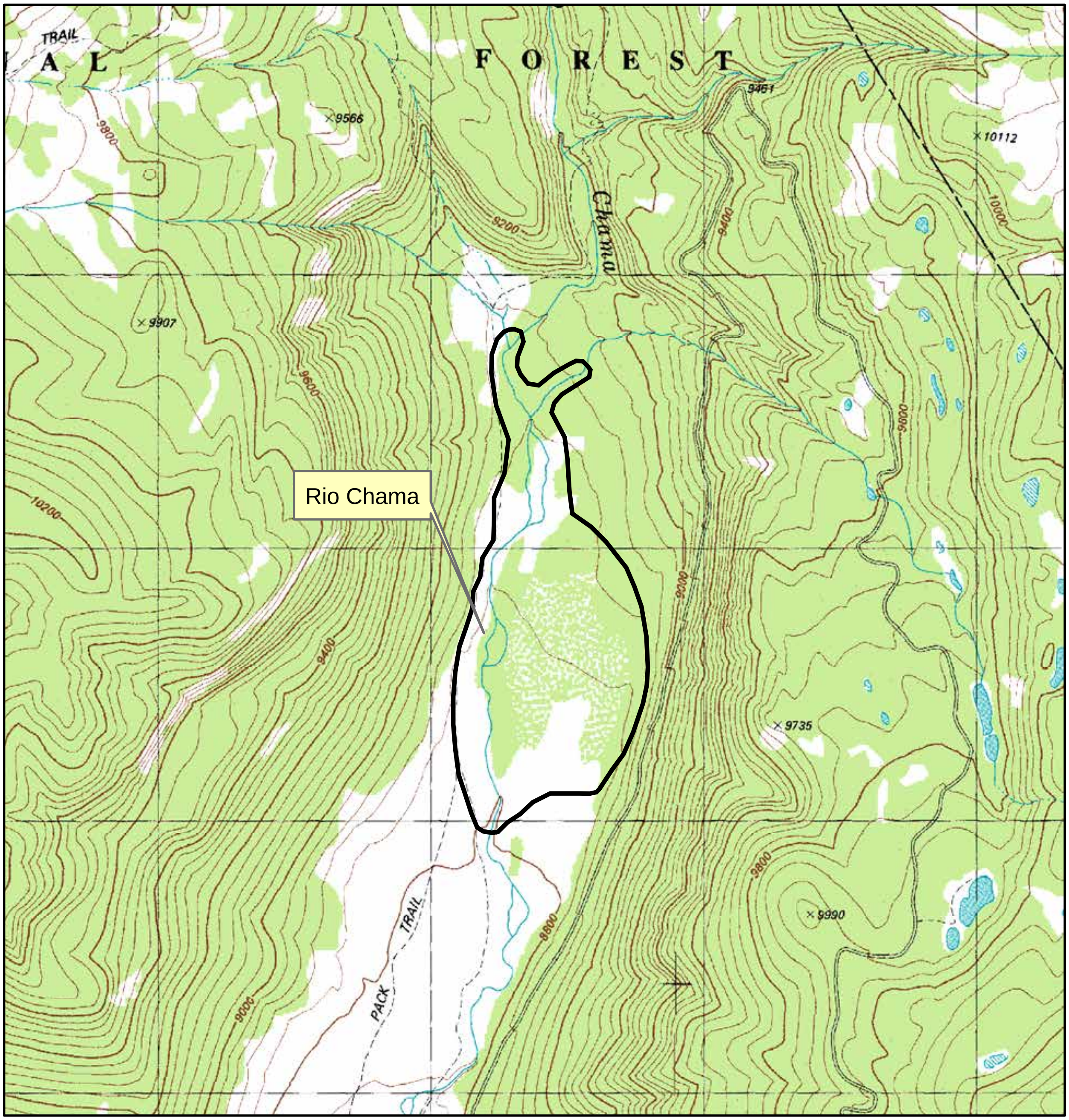
Management Urgency Rank Comments (M3): New management action may be needed within 5 years to maintain current quality of the element occurrences. Improper grazing and weed invasion are the main threats.

Management Needs Comments: Monitor and control weed invasion, especially along the creek within the riparian zone. Popular trails and the current grazing regime have contributed to the introduction and spread of weed species. Encourage and enforce weed seed free feed for packhorses. It may be beneficial to evaluate and improve the current grazing regime (including duration, frequency, and carrying capacity) to help reduce soil compaction, stream bank erosion, sedimentation, and weed invasion, especially as it relates to the riparian zone. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Land Use Comments: Current land uses include grazing, hunting, horse use, and hiking. There is a USFS campground downstream, and trails run through the site on both sides of the river. A USFS road (FR 121) parallels the valley bottom for nearly 3 miles before it is closed by a gate, 1.5 miles past the USFS boundary. Vehicle use witnessed in the area near the campground downstream of the site included ORVs, which are allowed on local trails, though no ORV evidence was seen within the site.

Exotic Species Comments: Along the river, the herbaceous understory is impacted by horse and cattle grazing and displays a high canopy cover of non-native vegetation such as common dandelion (Taraxacum officinale), pasture grasses such as Kentucky bluegrass (Poa pratensis) and timothy (Phleum pratense), and Canada thistle (Cirsium arvense). Grazing impacts the meadow surrounding the willow carr in the same manner, though the weed invasion is not as dense within the willow stand itself.

Off-Site Considerations: Private land (a large ranch) occurs one mile downstream of the site. A landslide apparently occurred 1/2 mile east and upslope of the northern end of the site recently (USDA 2002), destroying part of FR 121 (leading to the road's closure), and contributing large quantities of sediment to the plant communities and tributaries on the east edge of the site.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

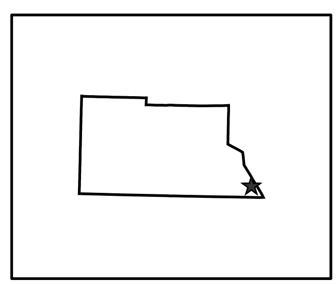
Legend

PCA Boundary

Archuleta Creek, 37106-A5

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 19. Rio Chama Potential Conservation Area, B3: High Biodiversity Significance

Round Meadow Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Pagosa Junction

Size: 274 acres (111 ha) **Elevation:** 6,540 - 6,800 ft. (1,993 - 2,073 m)

General Description: Round Meadow Creek is located in the south-central portion of Archuleta County southwest of Cat Creek Gap, west of Cat Creek, and north of Pagosa Junction. It is a small perennial stream within a moderately broad, lower montane valley augmented by multiple seeps and springs within the river channel and on adjacent slopes. The creek is sinuous with incised banks in many areas and headcuts within the channel, indicating grazing induced impacts. Soils are also naturally erosive, as adjacent steep hillslopes that drop to the creek bed are naturally sloughing soils along some reaches of the stream. The riparian area is characterized as patchy woodland dominated by mature and regenerating narrowleaf cottonwood (Populus angustifolia) and Rocky Mountain juniper (Juniperus scopulorum), interspersed with wet meadows. The riparian zone has a sparse canopy cover of woody vegetation, but the shrub layer is vigorous and somewhat diverse, and includes sandbar willow, skunkbush sumac, Woods' rose and black chokecherry (Salix exigua, Rhus trilobata, Rosa woodsii and Prunus virginiana var. melanocarpa). The herbaceous understory contains a mixture of non-native and native graminoids, dominated by Kentucky bluegrass, western wheatgrass, and cheatgrass (Poa pratensis, Pascopyrum smithii, and Bromus tectorum). The floodplain is limited in some reaches and accessible only in patches, especially at the locations of the wet meadows. Where the channel is incised, there are fringes of hydrophytic vegetation along the stream channel including Baltic rush, woolly sedge, clustered field sedge and pale bulrush (Juncus balticus var. montanus, Carex pellita, C. praegracilis and Scirpus pallidus). Broad wet meadows along the creek display a dense canopy of herbaceous vegetation, dominated by woolly sedge, Kentucky bluegrass, clustered field sedge and Baltic rush, with patches of broadleaf cattail (Typha latifolia) and small-fruit bulrush (Scirpus microcarpus). Ponderosa pine-juniper (Pinus ponderosa ssp. scopulorum-Juniperus spp.) forests and Gambel oak (Quercus gambelii) shrublands dominate the surrounding hillsides. A dirt road parallels Round Meadow Creek along its length, usually within several hundred feet of the creek. It appears seldom used though it is well maintained.

Key Environmental Factors: The surface geology is primarily the Animas Formation comprised of Arkosic sandstone, shale and conglomerate and contains an abundance of volcanic material (Tweto 1979). The area has not been delineated by the local soil survey (USDA 1981). Soils within the channel are alluvial with silty clay depositions, and soil sampled within the large wet meadow was saturated to the surface at time of the survey. The surface horizon to 15 cm depth is clay loam; the next horizon from 15 cm to 42 cm is gleyed clay, with oxidized root channels present.

Biodiversity Significance Rank Comments (B3): The site supports a linear occurrence of narrowleaf cottonwood-Rocky Mountain juniper (Populus angustifolia-Juniperus scopulorum) montane riparian forest, a globally imperiled to vulnerable (G2G3/S2S3) community in fair (C-ranked) condition. A generally open canopy of narrowleaf cottonwood characterizes this community, with juniper in the secondary canopy and a sparse herbaceous understory. This community type is often impacted by grazing and usually exhibits a non-native herbaceous layer dominated by pasture grasses and common weedy species (Carsey et al. 2003). This site also supports the globally vulnerable (G3/S3) woolly sedge (Carex pellita) montane wet meadow plant association in fair (C-ranked) condition. This plant association typically occurs on mineral soils subjected to seasonal flooding and runoff, where the soils are saturated seasonally. With improper grazing, Kentucky bluegrass (Poa pratensis) becomes a more dominant species, and downcutting of the channel is common, resulting in a permanent change from a wet meadow to a dry meadow (NatureServe 2005).

Natural Heritage element occurrences at the Round Meadow Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-06-01
Natural Communities	Carex pellita Herbaceous Vegetation	Montane Wet Meadows	G3	S3				C	2005-06-01

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates a 500 foot buffer from the element occurrences that will allow as much of the natural hydrological processes from surrounding drainages as possible to continue contributing to the flows in Round Meadow Creek. Seasonal flooding and sediment deposition will help maintain a viable population of the elements along the creek and within the wet meadow. The boundaries also provide a small buffer from nearby roads and non-irrigated pastures where erosion-causing disturbances may contribute to excessive sediment deposition and elevated nutrient levels in the wet meadow and the creek and invite weed invasion. It should be noted that the hydrological processes necessary to the elements are not fully contained by the site boundaries.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The land is owned and managed by the Southern Ute Indian Tribe as Tribal Trust Land.

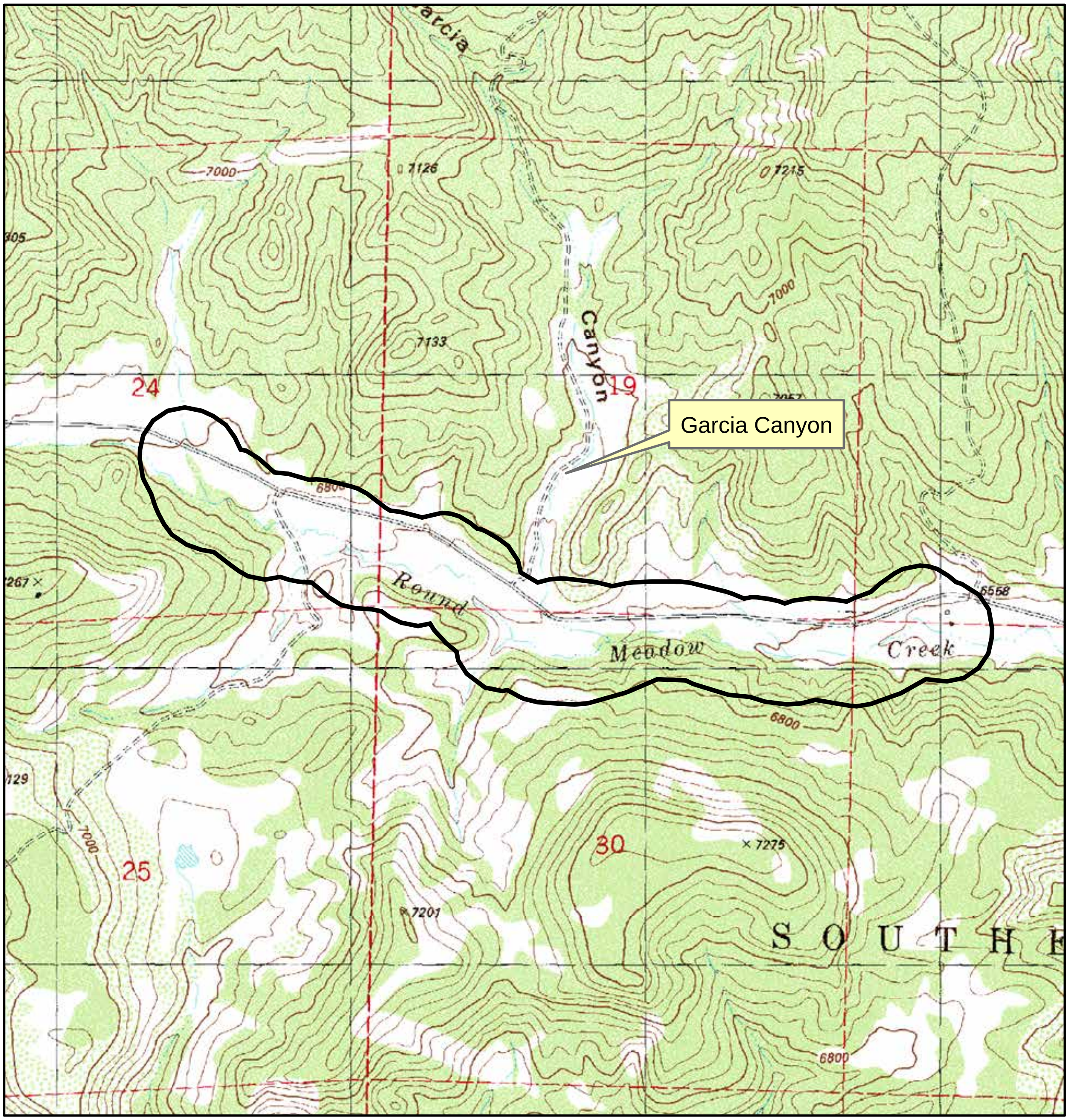
General Protection Comments: The site is entirely within Southern Ute Indian Tribal Trust lands, with a few privately owned parcels scattered nearby. Land use practices such as gas well development or residential/agricultural development may threaten the element occurrences. Education regarding riparian ecology may encourage volunteer efforts toward conserving this natural resource.

Management Urgency Rank Comments (M2): New management actions may be needed within 5 years to prevent the loss of the element occurrences. Improper grazing threatens to permanently change the hydrology supporting the riparian and wet meadow vegetation, and weed invasion is an impending threat.

Management Needs Comments: The area appears to be impacted by heavy and possibly long-term grazing, as evidenced by headcuts, incised channels, and erosion. Both cattle and elk graze in the area. Saturated conditions within the broad wet meadow may provide intrinsic protection from direct impacts; however, channel headcuts are present throughout and often severe, and threaten to drain the wet meadow through lowering of the groundwater table. Monitoring for grazing impacts, streambank/headcut erosion, and weed invasion would assist managers in determining management actions needed for domestic and/or wildlife species. This area would provide an excellent site for demonstration riparian restoration activities that could benefit other areas on Southern Ute lands and on private lands in the area by education and example.

Land Use Comments: The area is currently used for grazing only. A well maintained dirt road parallels Round Meadow Creek along its length and typically within 400 feet of the creek.

Exotic Species Comments: Invasive and non-native species are present in moderate to high abundance within the riparian zone and the wet meadow, including dandelion (Taraxacum officinale), Canada thistle (Cirsium arvense), yellow sweetclover (Melilotus officinalis), and redstem stork's bill (Erodium cicutarium) as well as pasture grasses such as smooth brome (Bromus inermis), Kentucky bluegrass (Poa pratensis), and crested wheatgrass (Agropyron cristatum). Cheatgrass (Bromus tectorum) occurs in high percentages along with tansymustard (Descurainia sp.) on the adjacent drier meadows and terraces.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

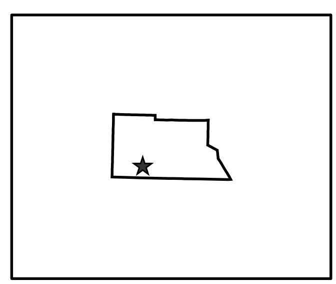
Legend

PCA Boundary

Pagosa Junction, 37107-A2

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 20. Round Meadow Creek Potential Conservation Area, B3: High Biodiversity Significance

San Juan River at Carracas

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Bancos Mesa, Carracas

Size: 273 acres (111 ha) **Elevation:** 6,120 - 6,150 ft. (1,865 - 1,875 m)

General Description: The San Juan River at Carracas site consists of a broad river floodplain associated with the San Juan River in the southwest corner of Archuleta County. Mountains rise beyond the floodplain on the south bank of the river on the border with New Mexico. North of the river, rolling hills and mesas covered with pinon pine, juniper and sagebrush (Pinus edulis, Juniperus spp. and Artemisia spp.) rise gently from the floodplain to an elevation of nearly 8,000 ft. The San Juan River is very active in this reach, with many signs of channel migration across the floodplain. The floodplain is readily accessible by the river, and signs of recent seasonal flooding include scouring, sediment deposition, and drift lines. Many old, abandoned or secondary river channels occur within the larger floodplain, contributing to a high diversity of habitats, including riparian forests, scrub-shrublands, and emergent wetlands. In the immediate floodplain, secondary or abandoned channels often hold standing water or saturated soils which support stands of silver buffaloberry (Shepherdia argentea), Pacific willow (Salix lucida ssp. lasiandra), sandbar willow (Salix exigua), and narrowleaf cottonwood (Populus angustifolia) saplings, and herbaceous hydrophytic species such as baltic rush (Juncus balticus) and cattail (Typha spp.). Gravel bars in the immediate floodplain are dominated by pioneering cottonwood saplings and sandbar willow, with scattered silver buffaloberry shrubs. The riparian vegetation is dominated by a large, broad mosaic of cottonwood/silver buffaloberry woodland, cottonwood-Rocky Mountain juniper woodland (Populus spp.-Juniperus scopulorum), and silver buffaloberry shrubland associations. The secondary terraces are dominated by several cottonwood species including Rio Grande cottonwood (Populus deltoides ssp. wislizenii), narrowleaf cottonwood, and lanceleaf cottonwood (Populus x acuminata) with Rocky Mountain juniper in an open canopy. The understory is very weedy, with cheatgrass, smooth brome, and sweetclover (Bromus tectorum, Bromus inermis, and Melilotus spp.) being very common especially on drier ground. An old railroad grade, slightly higher than the surrounding floodplain, runs through the site on the north bank and contributes to the microtopography in the area. The associated soil disturbance may have provided access for invasive weedy species noted on the higher, drier areas, but also supports sporadic hairy false golden-aster (Heterotheca villosa) and an unidentified cactus species. Although the entire north bank of the river has been previously grazed and is invaded by a weedy herbaceous layer, the tree and shrub layers are native, vigorous, and regenerating. The south bank is largely inaccessible except by boat, and appears to be in better condition with more dense woody growth and fewer weeds. Russian olive (Eleagnus angustifolia) occurs infrequently on both banks. A major county road occurs within 1/4 mile of the site, and irrigation diversions and agricultural practices upstream and downstream of the site create a fragmentation of riparian communities along the banks of the San Juan River. Navajo Reservoir begins one mile downstream of the site when water levels are normal, and Navajo Dam is more than 15 miles downriver. A small population of roundtail chub (Gila robusta) occupies a 22 mile stretch of the San Juan River between Navajo Reservoir and the small community of Trujillo upriver, as documented by an electroshocking survey. However, the presence of smallmouth bass (Micropterus dolomieu) poses a significant threat to the ongoing viability of this small population. The San Juan River channel has migrated significantly since it was photo-revised on the 1971 USGS 7.5' topographic quadrangle map, and currently is quite active and braided, supporting many areas of bare sandbars and islands, cobble point bars, and pioneering sandbar willow colonies. Many ill-defined secondary and overflow channels occur within the site due to the migratory activity of the main channel. This creates a very interesting mosaic of microtopography and habitats.

Key Environmental Factors: The surface geology is mapped to show mostly Modern Alluvium formation (comprised of unconsolidated surficial deposits and rocks) in the upper half of the site and on the north side of the river channel, and San Jose formation (comprised of siltstone, shale and sandstone) in the lower half and on the south side of the river channel (Tweto 1979). A soil survey has not been prepared for this area of Archuleta County, but onsite soil investigations show the immediate floodplain is made up of finer soils such as silt and sand, as well as gravels. Secondary terraces consist of finer soils as well. The riverbed and banks consist of gravels and cobbles. Old, abandoned or secondary channels are saturated, with gleyed silty clay.

Biodiversity Significance Rank Comments (B3): The site supports a fair (C-ranked) occurrence of the globally imperiled (G3/S3) narrowleaf cottonwood/strapleaf willow-silver buffaloberry (Populus angustifolia/Salix ligulifolia-Shepherdia argentea) riparian forest. This occurrence is common on the terraces of alluvial floodplains in broad, low-elevation river valleys, and is found within Colorado in western and southwestern counties. As of 2005, several known occurrences are within Archuleta County along the Piedra River and the San Juan River. Other riparian communities supported within the site include a fair (C-ranked) occurrence of the globally imperiled (G2G3/S2S3) narrowleaf cottonwood-Rocky Mountain juniper (Populus angustifolia-Juniperus scopulorum) montane riparian forest, and a fair (C-ranked) occurrence of the state rare (G3G4/S1) silver buffaloberry (Shepherdia argentea) foothills riparian shrubland.

Natural Heritage element occurrences at the San Juan River at Carracas PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-06-16
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				C	2005-06-16
Natural Communities	Shepherdia argentea Shrubland	Foothills Riparian Shrubland	G3G4	S1				C	2005-06-16

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, channel migration, and sediment deposition to continue, and to maintain viable populations of the riparian communities along the San Juan River. The broad floodplain and the steep slopes adjacent to the occurrences that would most likely impact the riparian zone if altered are also included. It should be noted that all the hydrological processes necessary to support the riparian communities and the fish population are not fully contained by the site boundaries. Given that the riparian communities are dependent on natural hydrological processes associated with the river and its tributaries, upstream activities such as water diversions and impoundments, improper livestock grazing, and development are detrimental to the hydrology of the riparian area. Although this site was not designed for the roundtail chub (Gila robusta) occurrence, these riparian communities also may provide adequate riparian vegetation for cover and possible prey (insect) needs for the fish habitat, though this may not be sufficient to ensure the persistence of the population. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P3): Protection actions may be needed, but probably not within the next 5 years. The site covers a patchwork of privately owned and tribal lands (Southern Ute). It is estimated that current stresses including potential residential development and continuing agricultural uses may reduce the viability of the element occurrences if protection action is not taken.

General Protection Comments: The site exists over a patchwork of privately owned lands and Southern Ute Indian Tribe (SUIT) lands. Conservation easement education for the private landowners and the SUIT would be an excellent step toward protection for the areas containing element occurrences. Conservation easements placed on private lands may conserve the natural values of the site as well as providing tax credits and other financial benefits to the landowner. Education about riparian ecology and fish habitat may also benefit landowners and land managers, especially those landowners who currently graze livestock within the riparian zone.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences. Impacts from improper grazing on the riparian vegetation, weed invasion, water diversions, and stocking of non-native predatory or competitive species are the main threats that could be minimized with new management practices.

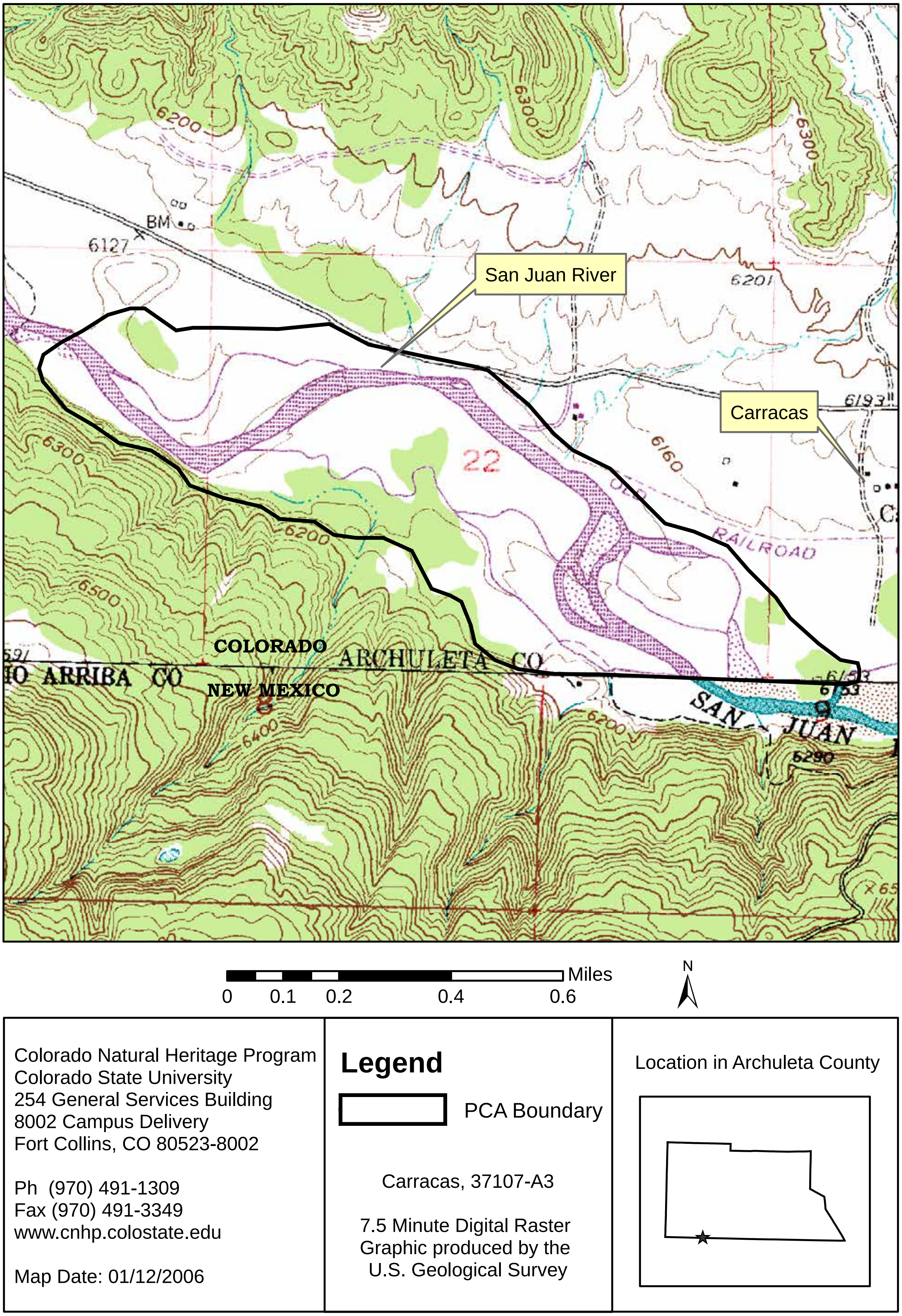
Management Needs Comments: Saltcedar (Tamarix ramosissima) and Russian olive (Elaeagnus angustifolia) are extremely aggressive, Colorado-prioritized invasive weeds that are known to occur either within the site or downstream at Navajo Reservoir. Removal of existing plants, and initiating a monitoring program to track new occurrences of saltcedar and Russian olive, would be beneficial to the long-term health and viability of all native riparian communities. Control of musk thistle and other invasive herbaceous weeds would also benefit the long-term viability of the communities. Musk thistle is both Colorado-prioritized and Archuleta County-listed noxious weed species (State of Colorado, no date). Removing grazing from the riparian area will also protect the regenerating cottonwood, silver buffaloberry and willow species. In lieu of removing grazing, improved grazing management (duration, rotation) may assist landowners in gaining control over some of the herbaceous weeds. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may also provide some assistance with control and eradication of non-native species. In regards to the roundtail chub population, management of riparian grazing will benefit the population by allowing more vegetation to shade portions of the river and provide cover and forage (insects), but unless non-native predatory and competitive fish species are reduced or eradicated from the river, the chub population may never reach a large, healthy size (Japhet 2003).

Land Use Comments: Residential housing and agricultural development in the form of irrigated pastures, hay meadows, and livestock grazing are the most common land uses. Fishing access points occur along the SUIT-owned lands. Irrigation diversions are common along the entire length of the San Juan River, and adjacent upland terraces are commonly irrigated for hay meadows or irrigated pasture. Scattered residences and outbuildings also occur. An old railroad grade passes through the site, and Trujillo Road (County Road 500), a maintained gravel road, borders a portion of the site. River rafting trips float through this stretch of river, but typically do not disembark within the riparian zone during their trips. In high water years, Navajo Reservoir begins one mile downstream of the site boundary.

Exotic Species Comments: Russian olive (Elaeagnus angustifolia) occurs within the site and saltcedar (Tamarix ramosissima) is known to occur downstream at Navajo Reservoir. Taking immediate steps to eradicate existing plants and establish a monitoring program to track the potential spread of these very invasive, quickly spreading species would be beneficial to the native riparian communities. The riparian communities along the San Juan River typically exhibit an herbaceous layer that is quite weedy and lacking native species due to the many years of grazing pressure and agricultural development. Typical weeds found within the understory include but are not limited to: cheatgrass (Bromus tectorum), Kentucky bluegrass (Poa pratensis), musk thistle (Carduus nutans), black medic (Medicago lupulina), yellow sweetclover (Melilotus officinalis), white sweetclover (Melilotus alba), common dandelion (Taraxacum officinale), and salsify (Tragopogon dubius). In addition, smallmouth bass (Micropterus dolomieu) have been identified as a potential predatory species for the roundtail chub within the river (Japhet 2003).

Off-Site Considerations: Weeds, non-native fish populations and recreational use increase dramatically one mile downstream at Navajo Reservoir.

Information Needs: This area could serve as excellent restoration projects focusing on maintenance of native riparian shrub cover and eradication of noxious weeds and non-native grasses. Landowners may benefit from restoration assistance programs provided by the Colorado Division of Wildlife-sponsored Southwest Wetlands Focus Group, or the Natural Resources Conservation Service (NRCS).



Map 21. San Juan River at Carracas Potential Conservation Area, B3: High Biodiversity Significance

San Juan River at Juanita

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Pagosa Junction, Trujillo

Size: 1,768 acres (715 ha) **Elevation:** 6,450 - 6,800 ft. (1,966 - 2,073 m)

General Description: The San Juan River is a major tributary to the Colorado River in the southwest United States, whose headwaters begin in Mineral and Archuleta counties in Colorado. Within the San Juan River at Juanita site, the river flows 9.5 miles generally east to west, passing through canyon, mesa and foothill topography in the south-central part of Archuleta County. Several miles below the site to the west, the river enters Navajo Reservoir at the state line. The site passes through a patchwork of privately owned properties and Southern Ute Indian Tribal lands. At the upper end, Montezuma Creek feeds into the San Juan River. Montezuma Creek is a small, low-elevation creek flowing east to west down a small valley between a sandstone-outcrop mesa to the north and ponderosa pine - Rocky Mountain juniper - Douglas-fir (Pinus ponderosa-Juniperus scopulorum-Pseudotsuga menziesii) forested hills to the south. Large sandstone boulders dot the canyon, and a window or arch has been carved by wind and water in the sandstone cap of the mesa about midway up the canyon. Montezuma Creek runs intermittently at its headwaters, but it is spring-augmented one mile upstream from its confluence with the San Juan River and flows perennially from that point to the confluence. The community is characterized by open-canopy mature and mid-aged narrowleaf cottonwood (Populus angustifolia) intermixed with mid-aged Rocky Mountain juniper and sandbar willow (Salix exigua). The herbaceous understory is mostly weedy, with a few native species. Montezuma Creek is confined within an arroyo-like drainage that has steep, highly erosive soils and flashy hydrology, which regularly exposes and deposits bare soil and probably allows for weed establishment. A private dirt road runs mostly high above and parallel to the creek, but is adjacent to the creek near its confluence with the San Juan River. Below this confluence, the San Juan River flows alternately through narrow canyons and broad valleys, and the channel migrates over time within its floodplain, especially in the broader valleys where it is less constricted by topography. The natural flooding regime in this portion of the San Juan River above Navajo Reservoir is intact, with the exception of many small irrigation diversions. The river carries a high bedload of cobble and gravel, depositing these materials on many large islands and point bars. Throughout, a pattern of robust riparian communities fragmented by agricultural activities leapfrogs along the banks of the river. Where present, the riparian communities occur on one or both sides of the San Juan River, dominated by galleries of mature narrowleaf cottonwood and Rocky Mountain juniper above the bankfull level, and often with a dense component of silver buffaloberry (Shepherdia argentea) and mixed willows (Salix spp.) along the immediate floodplain. Hay grasses such as cheatgrass, smooth brome, and Kentucky bluegrass (Bromus tectorum, Bromus inermis, and Poa pratensis) nearly always dominate the herbaceous understory, along with weedy forbs like musk thistle (Carduus nutans), black medic (Medicago lupulina), and yellow sweetclover (Melilotus officinalis). Where cattle have not grazed regularly or cannot access the riparian zone, the riparian cottonwood-willow-buffaloberry community tends to be more dense and vigorous. Adjacent hillsides along the river have frequent sandstone and shale outcrops, and are dominated by Rocky Mountain juniper, Utah juniper (Juniperus osteosperma), Gambel oak (Quercus gambelii), skunkbush sumac (Rhus trilobata), mountain mahogany (Cercocarpus spp.), and ponderosa pine. A major unpaved county road parallels the river at various distances from the riverbank. Agriculture and new residential development occurs throughout the river valley, typically fragmenting the riparian zone into large sections. A small population of roundtail chub (Gila robusta) occupies a 22-mile stretch of the San Juan River between the small community of Trujillo and Navajo Reservoir, as documented by an electroshocking survey. However, the presence of smallmouth bass (Micropterus dolomieu) poses a significant threat to the ongoing viability of this small population.

Key Environmental Factors: The surface geology of the uppermost portion of the site on Montezuma Creek is mapped as Kirtland Shale and Fruitland Formation at the upper end of the creek, Pictured Cliffs Sandstone and Lewis Shale, and Animas Formation proceeding down the creek to its confluence with the San Juan River. The majority of the site on the San Juan River is mapped as Animas Formation containing Arkosic sandstone, shale and conglomerate and with abundant volcanic materials throughout the formation. Beginning just above Pagosa Junction, the lowest two miles of the river within the site are then mapped as Modern Alluvium (Tweto 1979). No soil surveys currently cover this portion of Archuleta County to give an overview of soil types for this report. However, soils tested on site are typically alluvial and highly erosive from sandstone and shale parent material. Soils on the terraces are deep loam, loamy sand, or sandy clay loams, sometimes recently deposited. Within the floodplain, soils will likely be deposited yearly or semi-yearly or scoured with flood or runoff waters. This pattern of flooding disturbance and sediment deposition is essential in supporting a regenerating cottonwood and willow component of the included plant community element occurrences (Carsey et al. 2003). Angular and rounded cobble with gravel paves the riverbed, islands, and point bars, and there are pockets of Mancos shale-derived clay on the floodplain in some locations. Large rock outcrops occurs infrequently, typically on the south bank of the river.

Biodiversity Significance Rank Comments (B3): This site supports three fair (C-ranked) occurrences of the globally imperiled to vulnerable (G2G3/S2S3) narrowleaf cottonwood-Rocky Mountain juniper (Populus angustifolia-Juniperus scopulorum) montane riparian forest. This plant association is characterized by an open canopy of cottonwood and a subcanopy of juniper, frequently with a sparse understory. This community is often found on the terraces and islands within broad meandering floodplains of lower elevation rivers. The site also supports a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) narrowleaf cottonwood/strapleaf willow-silver buffaloberry (Populus angustifolia/Salix ligulifolia-Shepherdia argentea) riparian forest. This occurrence is common on the terraces of alluvial floodplains in broad, low-elevation river valleys, and is found within Colorado in western and southwestern counties. As of 2005, several known occurrences are within Archuleta County along the Piedra River and the San Juan River.

Natural Heritage element occurrences at the San Juan River at Juanita PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-06-02
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-06-16
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				C	2005-08-17
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				C	2005-06-02

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, channel migration, and sediment deposition to continue, and to maintain viable populations of the riparian communities along the San Juan River and Montezuma Creek. The broad floodplain and the steep slopes adjacent to the occurrence that would most likely impact the riparian zone if altered are also included. The boundary also reflects an approximate 1,000 foot buffer on the San Juan River and a 500 foot buffer on Montezuma Creek, which includes nearby roads, houses, and hay meadows where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. It should be noted that all the hydrological processes necessary to support the riparian communities and the fish population are not fully contained by the site boundaries. Given that the riparian communities are dependent on natural hydrological processes associated with the river and its tributaries, upstream activities such as water diversions and impoundments, improper livestock grazing, logging, and development are detrimental to the hydrology of the riparian area. Although this site was not designed for the roundtail chub (Gila robusta) occurrence, these riparian communities also may provide adequate riparian vegetation for cover and possible prey (insect) needs for the fish habitat, though this may not be sufficient to ensure the persistence of the population. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P3): Protection actions may be needed, but probably not within the next 5 years. The site covers a patchwork of privately owned and tribal lands (Southern Ute). It is estimated that current stresses including potential residential development and continuing agricultural uses may reduce the viability of the element occurrences if protection action is not taken.

General Protection Comments: The site exists over a patchwork of privately owned lands and Southern Ute Indian Tribe (SUIT) lands. Conservation easement education for the private landowners and the SUIT would be an excellent step toward protection for the areas containing element occurrences. Conservation easements placed on private lands may conserve the natural values of the site as well as providing tax credits and other financial benefits to the landowner. Education about riparian ecology and fish habitat may also benefit landowners and land managers, especially those landowners who currently graze livestock within the riparian zone.

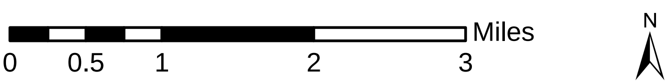
Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences. Impacts from improper grazing on the riparian vegetation, weed invasion, water diversions, and stocking of non-native predatory or competitive species are the main threats that could be minimized with new management practices.

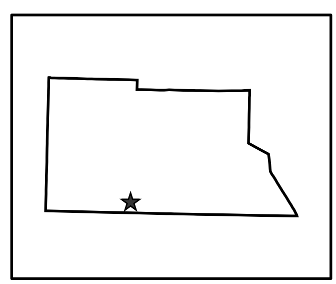
Management Needs Comments: The most urgent management need is gaining control of the state-prioritized noxious weed woody species of saltcedar and Russian olive while the populations are still small. At a minimum, the initiation of a monitoring program to track the spread of aggressively invasive, noxious weeds such as saltcedar, Russian olive, and musk thistle would benefit these riparian communities. Control of musk thistle and other invasive herbaceous weeds is a slightly lower priority than controlling the saltcedar and Russian olive, but would also benefit the long-term viability of the communities. Musk thistle is a Colorado-prioritized and Archuleta County-listed noxious weed species (State of Colorado, no date). Removing grazing from the riparian area will also protect the regenerating narrowleaf cottonwood, silver buffaloberry and willow species. In lieu of removing grazing, improved grazing management (duration, rotation) may assist landowners in gaining control over some of the herbaceous weeds. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may also provide some assistance with control and eradication of non-native species. In regards to the roundtail chub population, management of riparian grazing will benefit the population by allowing more vegetation to shade portions of the river and provide cover and forage (insects), but unless non-native predatory and competitive fish species are reduced or eradicated from the river, the chub population may never reach a large, healthy size (Japhet 2003).

Land Use Comments: Residential housing and agricultural development in the form of irrigated pastures, hay meadows, and livestock grazing are the most common land uses. Fishing access points occur along the SUIT lands. Irrigation diversions are common, and adjacent upland terraces are commonly irrigated for hay meadows or irrigated pasture. Scattered residences as well as clustered residential areas also occur. Small communities occur at Juanita and at Pagosa Junction, with associated residential and community buildings, as well as numerous sizes and types of outbuildings. An old railroad grade parallels the river through the lower 1/3 of the site, and Trujillo Road (County Road 500), a maintained gravel road, parallels the San Juan River. River rafting trips float through this stretch of river, but typically do not disembark within the riparian zone during their trips.

Exotic Species Comments: Several locations along the San Juan River have small stands of saltcedar (Tamarix ramosissima) or Russian olive (Elaeagnus angustifolia), and taking immediate steps to eradicate these very invasive, quickly spreading species is essential to prevent further spread of the species. Unfortunately, larger populations of both saltcedar and Russian olive are known to occur downstream at Navajo Reservoir, but eradication would benefit the community occurrences and prevent further spread. At the upper end of the site on Montezuma Creek, the understory is mostly weedy, presumably due to the flashy hydrology and erosive soils that constantly present ideal bare soil conditions for weed establishment. In addition, the riparian communities along the San Juan River typically exhibit an herbaceous layer that is quite weedy and lacks native species due to the many years of grazing pressure and agricultural development. Typical weeds found within the understory include but are not limited to: cheatgrass (Bromus tectorum), redtop (Agrostis gigantea), Kentucky bluegrass (Poa pratensis), musk thistle (Carduus nutans), black medic (Medicago lupulina), yellow sweetclover (Melilotus officinalis), white sweetclover (Melilotus alba), common dandelion (Taraxacum officinale), rough cocklebur (Xanthium strumarium), and common sunflower (Helianthus annuus). In addition, smallmouth bass (Micropterus dolomieu) have been identified as a potential predatory species for the roundtail chub within the river (Japhet 2003).

Information Needs: This area could serve as excellent restoration projects focusing on maintenance of native riparian shrub cover and eradication of noxious weeds and non-native grasses. Landowners may benefit from restoration assistance programs provided by the Colorado Division of Wildlife-sponsored Southwest Wetlands Focus Group, or the Natural Resources Conservation Service (NRCS).



Colorado Natural Heritage Program Colorado State University 254 General Services Building 8002 Campus Delivery Fort Collins, CO 80523-8002 Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu Map Date: 01/12/2006	**Legend** PCA Boundary Durango, 37107-A1 30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey	Location in Archuleta County 

Map 22. San Juan River at Juanita Potential Conservation Area, B3: High Biodiversity Significance

Spring Creek Lakes

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Chromo

Size: 180 acres (73 ha) **Elevation:** 8,740 - 9,540 ft. (2,664 - 2,908 m)

General Description: In the southeast portion of Archuleta County one mile southwest of the prominent geologic landmark called V Rock, a short chain of small lakes occur on Spring Creek, a small perennial tributary to the Little Navajo River, and support a Thinleaf Alder-Mixed Willow riparian shrubland, and a Smallwing Sedge montane wetland. Immediately north of Spring Creek, a moderately sized, mature and regenerating Bebb Willow (Salix bebbiana) - dominated shrubland occurs on a small, unnamed, intermittent tributary to Spring Creek. The site is within USFS land, and the northeast edge occurs within the South San Juan Wilderness. The entire site is on a moderately steep, south-facing hillside with a rough microtopography caused by its landslide origins. The slumpy, hummocky landform generally has some groundwater discharge and varied topography which holds pockets of moisture in a manner that can mimic human-created water retention berms, and can mislead an observer to believe there has been more berming across the hillside than has really occurred. These depressional areas as well as the creek drainages support mesic herbaceous and shrub vegetation. Along Spring Creek, a dense, vigorous alder-mixed willow community and a smallwing sedge community are associated with the stream channel, five small ponds, and other small depressional wetlands and stream backwaters. Pacific willow (Salix lasiandra), park willow (Salix monticola) and Bebb willow along with thinleaf alder all occur within the riparian zone, with beaked sedge (Carex utriculata) dominating the pond margins as well as the creek banks in the wettest, most saturated parts. On slightly higher ground, smallwing sedge and ebony sedge (Carex ebenea) dominate in broad stands, transitioning into vigorous and diverse native mesic forbs and the surrounding alder-mixed willow community. Canada thistle (Cirsium arvense), Kentucky bluegrass (Poa pratensis) and common dandelion (Taraxacum officinale) are common within and between the wetland complexes, but native mesic graminoids and forbs such as largeleaf avens (Geum macrophyllum) and bluebells (Mertensia sp.) dominate the herbaceous layer. The hillside on which Spring Creek flows is generally open with little overstory canopy cover away from the riparian corridor, except for a few tall, narrow quaking aspens (Populus tremuloides), which occur singly over the hillside among many old, fallen trees. It is unclear whether this is due to recent logging (no stumps observed) or a natural phenomenon. Above the second lowest pond on the creek, a mature spruce-fir (Picea spp.-Abies spp.) forest begins, and continues as a mature forest uphill from this point. North of Spring

Creek, a small, unnamed, intermittent tributary to Spring Creek supports a Bebb willow shrubland. The willow stands are vigorous, and alternately open-canopy and dense along the ill-defined rivulets of the stream. The herbaceous understory is a mixture of upland and weedy species, such as Rocky Mountain iris (Iris missouriensis), Colorado false hellebore (Veratrum tenuipetalum), Arizona mule-ears (Wyethia arizonica), and a large component of roundleaf snowberry (Symphoricarpos rotundifolius). On the adjacent upland hillsides is a mix of mature quaking aspen stands, mature Gambel oak (Quercus gambelii) stands, and open-cover roundleaf snowberry and Woods' rose (Rosa woodsii) stands in a matrix with native and non-native grasses and other native forbs. The site is within a current grazing allotment and sees heavy cattle use and subsequent weeds and erosion. Within the Bebb willow shrubland, cattle may be contributing to the ill-defined nature of the stream flow through hoof compaction and water spreading. Some browse was noted on the riparian shrubs, but not at severe levels. An OHV/hiking trail travels up the hillside and passes the Bebb willow shrubland on its southeastern edge, and crosses the Spring Creek drainage at the midpoint of the alder-mixed willow community.

Key Environmental Factors: A large portion of the geology on the west slopes of the Chalk Mountains, including the area within the site, is mapped as Landslide Deposits (Tweto 1979), which includes areas of thick colluvial deposits. This geology seems to predispose the area to having a stepped or hummocky microtopography where the groundwater table often is intercepted, forming many small pocket lakes and ponds. Soils in the lower 1/2 of the site are mapped as Hunchback clay loam, formed in alluvium and colluvium of mixed parent materials, and Animas loam, formed in landslide material derived from quartz latite, andesite, and other volcanic rock, and occurring in swales and lower parts of hummocky areas. Soils in the upper 1/2 of the occurrence are mapped as Castelleia loams, formed from similar parent material as the Animas loam, and found also in hummocky landslide areas (USDA 1981). A soil pit taken within a Carex spp.-dominated pond margin shows soils saturated to the surface, with little to no organic matter in the top layer. Only one horizon was noted in the 36 cm-deep pit, of silty clay with 10-25% mottling, and roots found throughout.

Land Use History: Grazing and recreation are likely the only past land uses in the area, though some logging may have been done historically.

Biodiversity Significance Rank Comments (B3): The site boundary is drawn for a good (B-ranked) occurrence of the globally vulnerable (G3/S3) thinleaf alder-mixed willow (Alnus incana-Salix (monticola, lucida, ligulifolia)) shrubland plant association. This community type is often associated with beaver ponds and grazing disturbances, and may indicate a shift in physical setting, such as from a steep narrow valley to a broader, gentler valley (Carsey et al. 2003). Also found within the site is a good (B-ranked) occurrence of the globally apparently secure (G4/S2?) smallwing sedge (Carex microptera) montane wetland, which commonly occurs in small patch size along streams and small ponds or marshes (Carsey et al. 2003). A fair (C-ranked) occurrence of the globally vulnerable (G3?/S2) Bebb willow (Salix bebbiana) montane willow carr follows a braided drainage just west of the other two occurrences.

Natural Heritage element occurrences at the Spring Creek Lakes PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix (monticola, lucida, ligulifolia) Shrubland	Thinleaf Alder - Mixed Willow Species	G3	S3				B	2005-06-24
Natural Communities	Salix bebbiana Shrubland	Montane Willow Carrs	G3?	S2				C	2005-06-24
Natural Communities	Carex microptera Herbaceous Vegetation	Montane Wetland	G4	S2?				B	2005-06-24

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes to continue, such as seasonal flooding, sediment deposition, and groundwater discharge, maintaining a viable population of the wetland and riparian communities. The boundary also provides a small buffer from nearby trails where surface runoff may contribute excess nutrients and sediment. It should be noted that the hydrological processes necessary to the elements are not fully contained by the site boundaries. Given that the elements are dependent on natural hydrological processes associated with runoff from the Chalk Mountains, activities such as water diversions, impoundments, and improper livestock grazing within riparian areas and along the wetland are detrimental to the hydrology within the site. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed within the foreseeable future. The site is fully within the San Juan National Forest, and the eastern, uppermost edge of the site is within the South San Juan Wilderness boundary.

General Protection Comments: Incorporation of the Spring Creek Lakes area into the South San Juan Wilderness may benefit the long-term protection and viability of the communities.

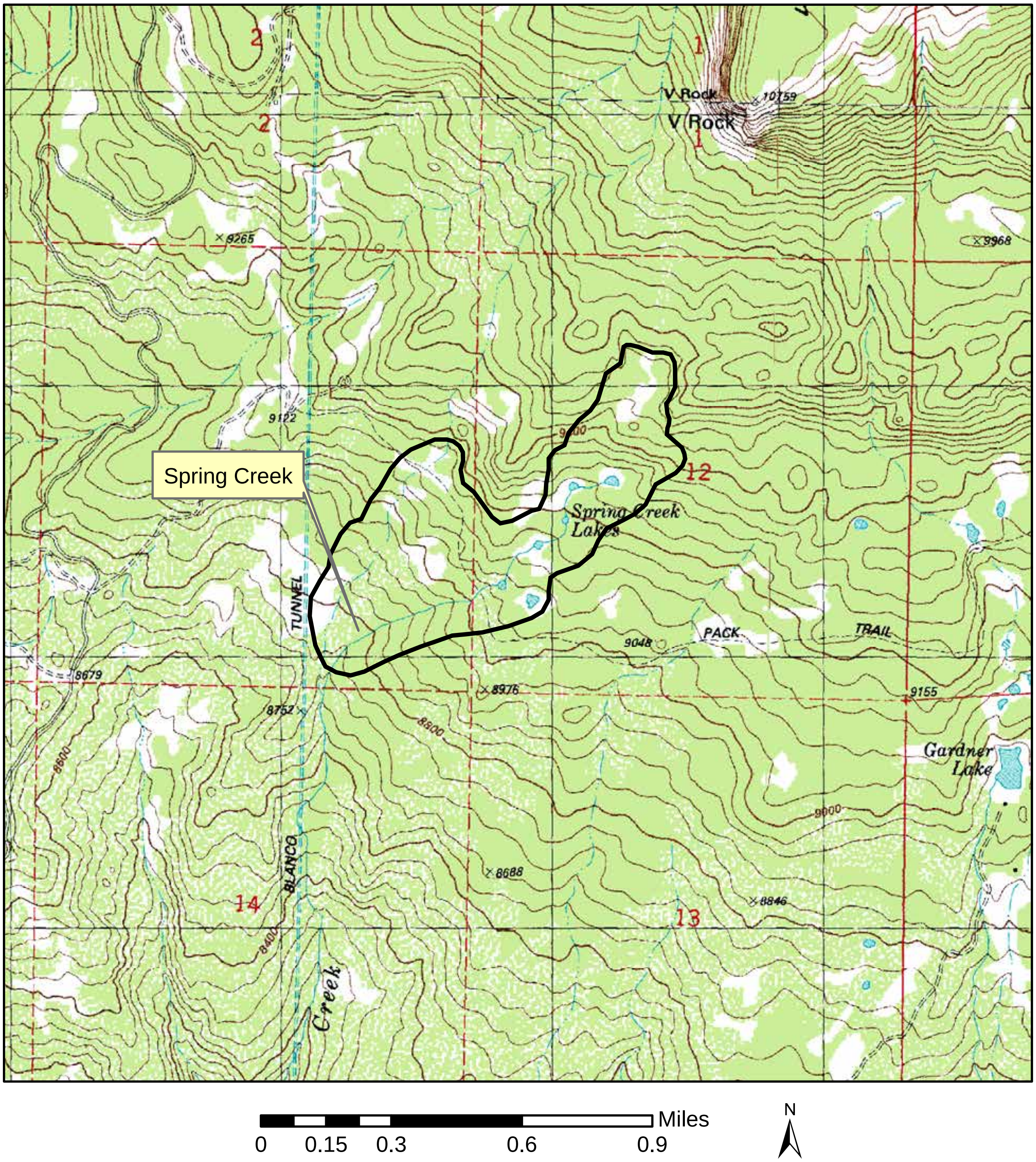
Management Urgency Rank Comments (M2): New management actions may be needed within 5 years to prevent the loss of the element occurrences within the site. Grazing pressure and associated weed invasion are threats.

Management Needs Comments: Grazing pressure and associated weed invasion are threats to this community. Review of the grazing rotation regime (season, duration, and frequency) on this allotment may benefit this occurrence by reducing overgrazing, creek bank and pond-edge erosion, soil compaction, introduction and spread of exotic/invasive weeds, and other impacts to wetland and riparian areas. Implementing a monitoring program within this allotment would allow land managers to document what actions are needed, and of those actions implemented, which ones are successful in improving conditions. Weed control would also benefit the communities, especially to prevent further spread of the Canada thistle. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Land Use Comments: Current land uses include heavy grazing, recreational access (hiking and horseback riding), and hunting.

Exotic Species Comments: Canada thistle (Cirsium arvense), Kentucky bluegrass (Poa pratensis) and common dandelion (Taraxacum officinale) are common in the riparian and wet meadow zones of the wetland complex along Spring Creek, and in the uplands immediately adjacent. In the Bebb willow shrubland the herbaceous understory also exhibits the same species.

Off-Site Considerations: Many downed trees occur in the area, especially aspen, but do not appear to be caused by logging activities. The Blanco Tunnel, a major US Bureau of Reclamation subterranean water diversion in the area, is mapped just outside the western boundary of the site but no surficial impacts to the area were noted. It was built in the late 1960's as part of the San Juan-Chama Project, to divert water from the San Juan River Basin across the Continental Divide and into the Rio Grande River Basin (USDI no date). V-Rock is a prominent landmark rising directly above the site. Also on the slope above and to the north of the site is an area of bare, light-colored exposed rock, which from a distance appears to be mined. However, evaluation of an aerial photo (USDA 2002) does not disclose any roads, trails, logging, or other disturbances in the area that may be present with a mining operation. It appears to be a natural outcrop.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

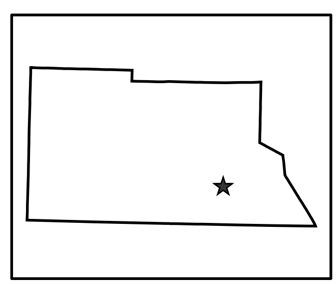
Legend

PCA Boundary

Chromo, 37106-A7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 23. Spring Creek Lakes Potential Conservation Area, B3: High Biodiversity Significance

Tribunary to Little Navajo River

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Chama Peak, Chromo

Size: 62 acres (25 ha) **Elevation:** 9,290 - 10,480 ft. (2,832 - 3,194 m)

General Description: The Tributary to Little Navajo River site is in the southeastern portion of Archuleta County within the South San Juan Wilderness, lying approximately 2 miles northwest of Navajo Peak. The unnamed tributary drains generally west, turning southwest as it nears its confluence with the Little Navajo River. Navajo Trail, a popular hiking trail, crosses the stream in the lower 1/3 of the site. The headwaters of the stream originate a mile east of the trail on the steep, west-facing slopes of the Chalk Mountains, amidst upland upper montane and subalpine forests dominated by dense to patchy stands of spruce, fir and quaking aspen (Picea spp., Abies spp., Pseudotsuga menziesii and Populus tremuloides), and interspersed with open shrublands and meadows. The stream cuts through a cool, steep, narrow V-shaped ravine that eventually widens and flattens below the trail crossing, at the lower extent of a quaking aspen/thinleaf alder (Populus tremuloides/Alnus incana ssp. tenuifolia) montane riparian plant community. The ravine has a very narrow floodplain and the streambed contains small gravels and sand, with few if any larger rocks or larger woody material. The stream channel is sinuous within its limited floodplain, but the stream course is overall fairly straight. The riparian vegetation is generally vigorous and dense, even lush. The channel and immediate floodplain are dominated by a dense, tall cover of mature thinleaf alder with the adjacent terraces occupied by mature to decadent aspen forests, with little regeneration. The herbaceous layer of mesic forbs and graminoids is diverse and includes cutleaf coneflower (Rudbeckia laciniata var. ampla), thimbleberry (Rubacer parviflorus ssp. parviflorus), Fendler's cowbane (Oxypolis fendleri), and Porter's licorice root (Ligusticum porteri). Adjacent uplands contain open shrublands dominated by roundleaf snowberry (Symphoricarpos rotundifolius), and grasslands with a high percentage of needlegrass (Stipa sp.). Downstream of where Navajo Trail crosses the creek, a very small, open-water emergent wetland occurs, supporting bluejoint grass (Calamagrostis canadensis), beaked sedge (Carex utriculata), and a fringe of Canada thistle (Cirsium arvense) and cutleaf coneflower. Navajo Trail is popular with hikers and horseback riders, especially during hunting season. The general area is well grazed, with ample evidence of cattle. Near the trail crossing, the channel is shallow-banked and spread out slightly, possibly caused by grazing impacts. Many cattle trails exist within the aspen component of the community, and several cross the creek up and downstream of the hiking trail.

Key Environmental Factors: Mixed landslide materials from quartz latite and igneous rock overlying shale and sandstone comprise the parent material for the soils in the area (USDA 1981). The geology of the lower two-thirds of the site is mapped as Landslide Deposits, including talus, rock-glacier and colluvial depositions. The upper third (the headwaters in the Chalk Mountains) is mapped as Pre-Ash Flow Andesitic Lavas, Breccias, Tuffs and Conglomerates (General Age 30-35 million years old) (Tweto 1979). Soils in this area are mapped as Castelleia loams, with small inclusions of poorly drained Animas loam and Hunchback clay loam in depressions and swales (USDA 1981). Soil samples taken on the streambank had a 10 cm thick layer of detritus over 10 cm of loam, then over 35 cm of silt loam; all horizons are a dark 10YR2/2 Munsell color.

Biodiversity Significance Rank Comments (B3): The site contains a good (B-ranked) occurrence of the globally vulnerable (G3/S3) quaking aspen/thinleaf alder (Populus tremuloides/Alnus incana) montane riparian forest. This community typically occurs on steep and narrow ravines where aspen intermix with riparian vegetation (Carsey et al. 2003). As of 2005, this is the only documented occurrence of this community type in Archuleta County.

Natural Heritage element occurrences at the Tributary to Little Navajo River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus tremuloides / Alnus incana Forest	Montane Riparian Forests	G3	S3				B	2005-09-08

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses the element occurrence and a 250 foot buffer to contain the immediate watershed and buffer the hydrologic processes (stream flow) necessary to the viability of the element. The boundary also provides a small buffer from nearby trails and grazing allotments where surface runoff may contribute excess nutrients, sediment and weed invasion. It should be noted that the hydrologic processes necessary to the element are not fully contained by the site boundary.

Protection Urgency Rank Comments (P5): No protection actions are needed in the foreseeable future. The site is entirely within the South San Juan Wilderness.

General Protection Comments: This site is entirely within the South San Juan Wilderness. Although this does not assure perpetual protection for the element occurrence, no protection actions are currently needed. However, any changes in use of the land or ownership may necessitate action.

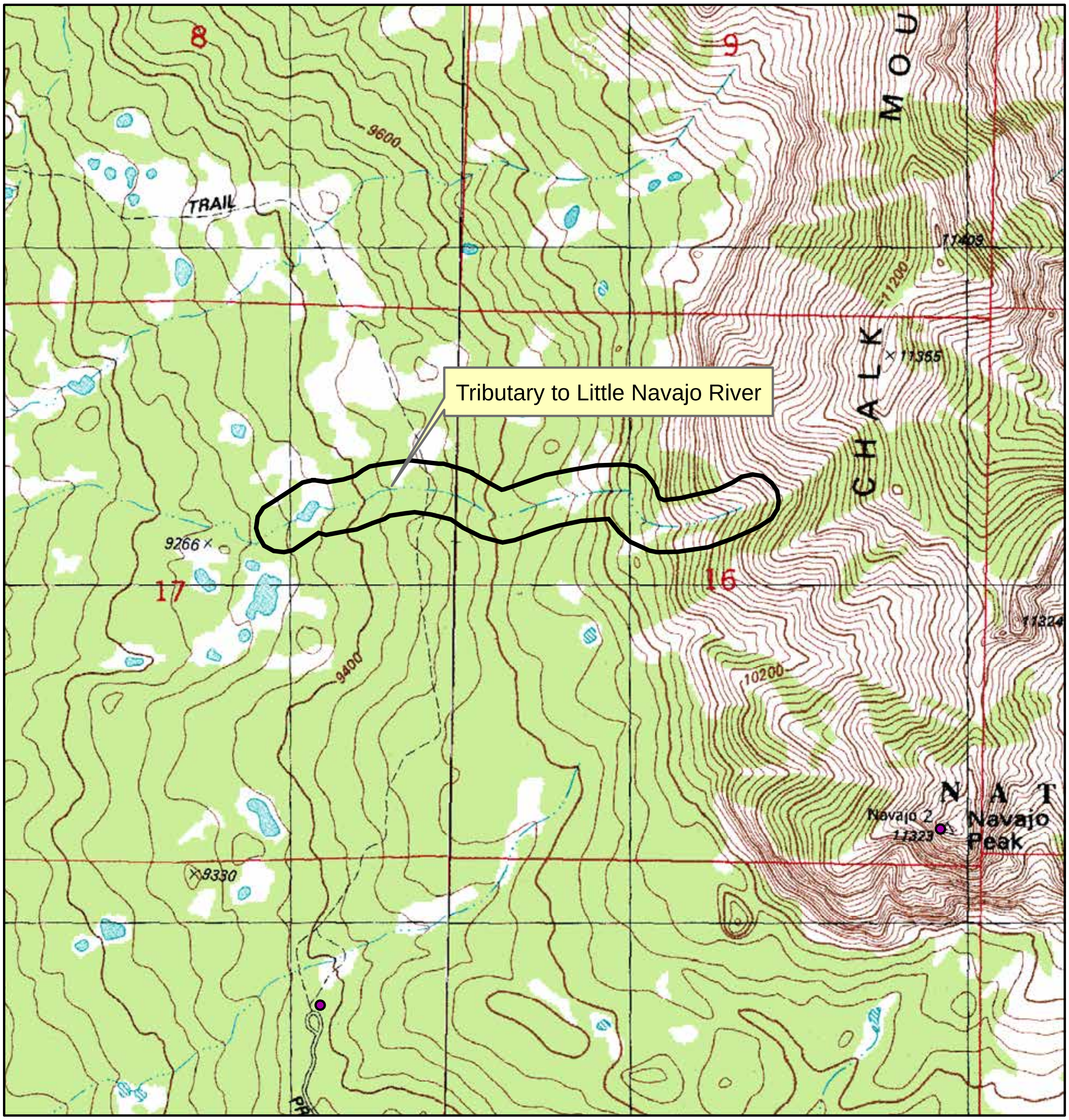
Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrence in the site. Improper grazing and weed invasion are the main threats.

Management Needs Comments: Grazing and trail impacts are noted at the trail crossing and just below in the wetland area, where erosion has caused the channel to spread and become ill defined. Cattle grazing still threatens this occurrence through weed introduction/spread and hoof erosion. Encourage also the use of weed-free seed feed for horse packing in this area.

Land Use Comments: Dominant land uses in this area include recreation (hiking, horseback riding, wilderness camping), hunting, grazing, and wildlife use.

Exotic Species Comments: Common dandelion (Taraxacum officinale) is found within the riparian area, and adjacent uplands harbor common weeds such as Canada thistle (Cirsium arvense), common dandelion, and hay grasses including Kentucky bluegrass (Poa pratensis). Canada thistle is especially common at the downstream edge of the site along the fringes of a small emergent wetland, just below the trail crossing.

Information Needs: Some alder along the creek have branches of leaves that appear to be suffering from a disease that turns the leaves rusty before they die. This may be the same as what is causing the branch dieback seen on the alder all along the creek. Alder branch dieback is common across the county, and research into the branch dieback would benefit this species across the county. Monitor grazing impacts on the riparian system, progression of the alder dieback, and lack of regeneration within the aspen portion of the community.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

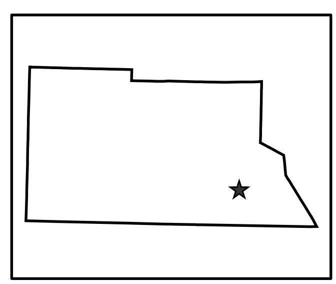
Legend

PCA Boundary

Chama Peak, 37106-A6
Chromo, 37106-A7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 24. Tributary to Little Navajo River Potential Conservation Area, B3: High Biodiversity Significance

Tributary to Rito Blanco

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Blackhead Peak

Size: 220 acres (89 ha) **Elevation:** 8,900 - 9,680 ft. (2,713 - 2,950 m)

General Description: In the northeast corner of Archuleta County, the Rito Blanco drains southwest from the Continental Divide to the San Juan River. Near the headwaters for Rito Blanco, on the northwest flank of Squaretop Mountain and between the Mariposa Creek and Sparks Creek drainages, a small, open, and northwest-facing wet meadow with a slight slope occurs within a mature and dense spruce, fir and quaking aspen (Abies spp.-Picea spp.-Populus tremuloides) forest. Two unnamed intermittent creeks converge at the top of the meadow and flow northwest to the Rito Blanco, passing through the meadow where several historic, nearly hidden 2 to 3-foot berms in disrepair step down the meadow. These berms, though broken, still retain some ponded water and allow soils to remain saturated, supporting sedges (Carex spp.) and other native and non-native mesic graminoids and mesic forbs. The vegetative structure in the clearing is mostly herbaceous, dominated by beaked sedge (Carex utriculata), retrorse sedge (Carex retrorsa), smallwing sedge (Carex microptera), mannagrass (Glyceria sp.), Colorado false hellebore (Veratrum tenuipetalum), bluebells (Mertensia sp.), Columbian monkshood (Aconitum columbianum), common cowparsnip (Heracleum maximum), checkerbloom (Sidalcea sp.), and cutleaf coneflower (Rudbeckia laciniata var. ampla). Sporadic, mature thinleaf alder (Alnus incana ssp. tenuifolia) stands create an open canopy overstory, mixed with a few scattered young spruce and fir saplings and mature trees. However, the alder (Alnus incana ssp. tenuifolia) in the meadow are experiencing significant branch dieback or decadence and are not in vigorous condition. Weeds and hay grasses are also common, and old stumps/snags, downed wood, and fallen logs are found frequently within the meadow. The retrorse sedge (Carex retrorsa) population is well distributed in the wet meadow complex and continues down the drainage, but it is unknown whether there are other populations on the same drainage upstream or further downstream. Subpopulations of retrorse sedge (Carex retrorsa) within the site are split up based on hydrologic circumstances, but are connected within the overall soil/hydrology/topographical location.

Key Environmental Factors: In general terms, in Archuleta County, retrorse sedge (Carex retrorsa) occurs in slightly higher ground along perennially wet areas, especially preferring banks along small channels, small to mid-size depressional wetlands, open mudflats at pond edges, and surface-drying mud. Retrorse sedge is nearly always found with beaked sedge (Carex utriculata), but seems to occupy slightly higher ground or the mudflat niche that beaked sedge doesn't colonize as aggressively. Clusters of retrorse sedge are spread around the basin in small subpopulations depending on the hydrology. The hydrology on site is altered by the historic construction of berms stepping down the hill which creates a wetland mosaic of small, flowing channels, shallow ponded areas, and moist-to-saturated soils with no surface standing water. These berms are in disrepair and well-vegetated by native shrubs and herbaceous plants as well as colonized by weeds such as various species of thistle (Cirsium sp. and Carduus sp.). However, it is likely this population would not exist without the flow detention and subsequent soil saturation provided by the berms. The stands are vigorous but impacted by hoof disturbances due to heavy grazing in the area; fortunately, the cattle seem to prefer browsing on beaked sedge and other plants rather than the retrorse sedge. However, the cattle impacts are otherwise threatening the population by contributing to soil erosion, soil compaction, and disruption of the stream channels.

Land Use History: Logging has historically occurred within two miles of the site, but it is unknown whether the forest immediately surrounding the population has been logged. Livestock grazing is a historic and current use on this portion of the San Juan National Forest, and is the probable reason that detention berms were once constructed within the meadow, presumably to create watering areas for the cattle on the allotment. Recreational uses such as hunting and hiking are also historic as well as current land uses.

Biodiversity Significance Rank Comments (B3): The site is drawn for a good (B-ranked) occurrence of the globally secure (G5) but statewide critically imperiled (S1) retrorse sedge (Carex retrorsa). As of 2005, this site contains the largest known population of retrorse sedge at one site in Archuleta County.

Natural Heritage element occurrences at the Tributary to Rito Blanco PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Carex retrorsa	retrorse sedge	G5	S1				B	2005-07-26

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary was drawn to include the known extent of the occurrence of retrorse sedge (Carex retrorsa) and an additional area large enough to include the natural hydrologic flows, including surface and groundwater flows, which support the habitat for the species. The boundary represents the immediate watershed for the basin in which the species occurs, with a minimum 1,000 foot buffer except where the watershed boundary is closer to the occurrence than 1,000 feet. The intent of this buffer is to minimize sedimentation, protect the species population and associated wetland and riparian plant communities from direct disturbance such as trampling, and to allow additional individuals to become established over time. Given that this species is dependent on perennially wet or moist soils associated with the drainages within this small basin (Johnston 2001), upstream activities such as water diversions, impoundments, and improper livestock grazing are detrimental to the hydrology of the wetland area. The boundary indicated is the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest.

General Protection Comments: The site is entirely within the San Juan National Forest, and therefore owned and managed by the U.S. Forest Service and the Pagosa Ranger District office.

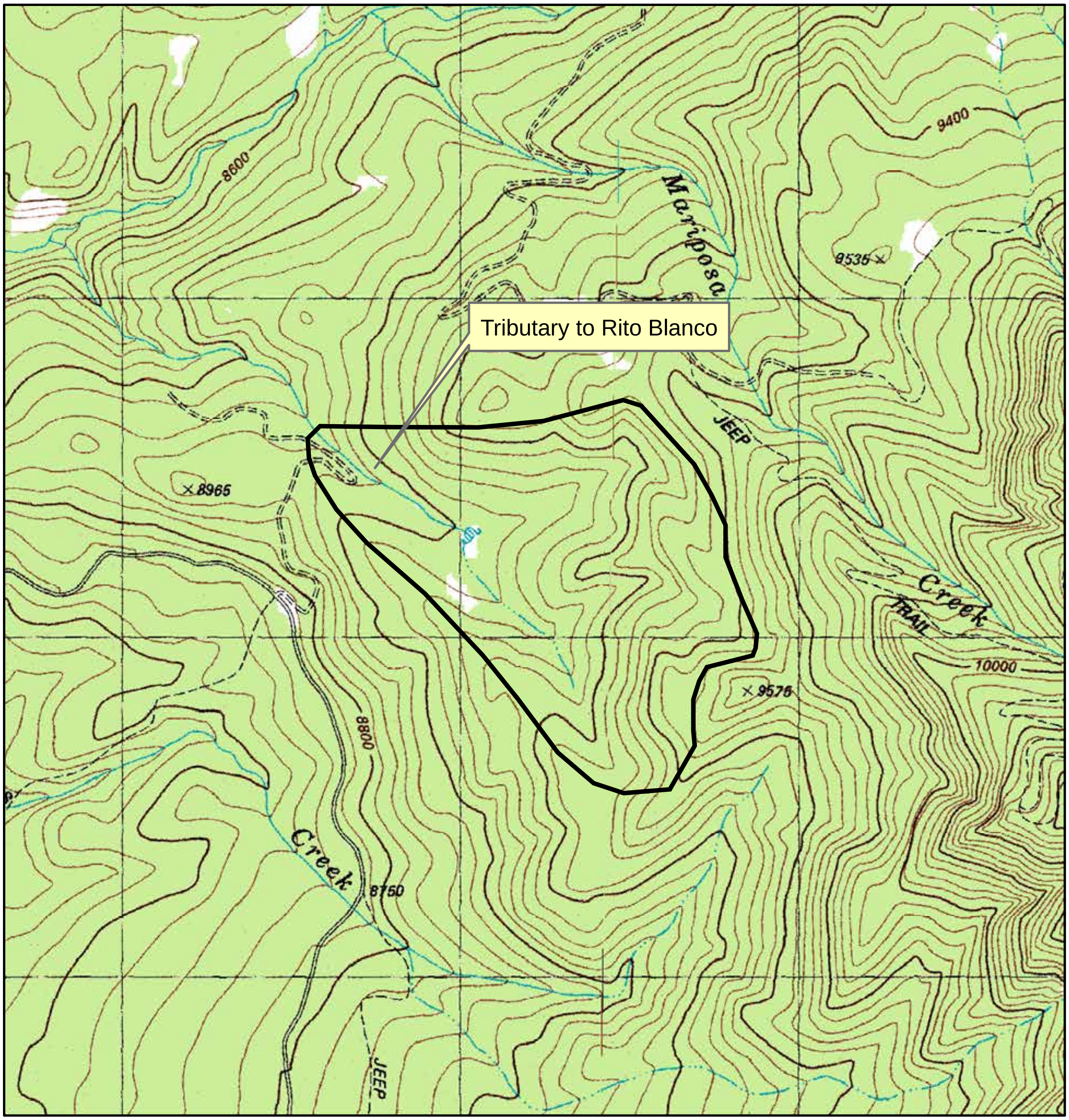
Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the viability of the species and its habitat. Recreational use by hunters, hikers and ATV users, and heavy cattle grazing may have deleterious effects on the rare plant population. Monitoring for changes in the population and in the hydrology of the site would help to ensure the long-term viability of this rare plant occurrence.

Management Needs Comments: Cattle grazing affects this area through the direct impact of trampling, soil compaction, and bank erosion, which appears to be altering the hydrology and threatening the longterm viability of the population. Protection of the site from continued grazing by the installation of a fencing exclosure would elicit the best protection for the population; in lieu of that, yearly monitoring of the hydrology and continued grazing impacts is highly recommended. An old OHV/4WD road occurs on the south side of the site. Currently it is not accessible from FR 024 by vehicle to due trail erosion and downed logs; however, vehicle access is possible from north of the site, in the next drainage. Continued OHV use may promote the expansion of non-natives, e.g., Canada thistle (Cirsium arvense), oxeye daisy (Leucanthemum vulgare), and hay grasses that are currently located along the existing OHV trail.

Land Use Comments: The site is on USFS land that is open to OHV use; however, the main OHV road from FR 024 is essentially impassible for vehicles due to hillside erosion and large-diameter downed trees. OHV access is possible from the north, from the Mariposa Creek drainage. The closest forest road (FR 024) is 1/2 mile away. The area is used for hunting as evidenced by shell casings along the OHV trail and within the meadow, and past logging in the area is possible since it has occurred elsewhere along FR 024. Intensive cattle grazing on this allotment is the major threat to the rare plant population. It is estimated that these land uses may reduce the viability of the population if the area remains under the current level of management.

Exotic Species Comments: Canada thistle (Cirsium arvense), a Colorado-prioritized and Archuleta County-listed noxious weed species (State of Colorado, no date), occurs frequently in dense patches on the top of the old berms within the wetland complex, and could easily expand its presence to other areas of the wetland. Eradication or control of this species would benefit the retrorse sedge (Carex retrorsa) population by reducing competition for resources and providing better opportunities for expanding colonization. Oxeye daisy (Leucanthemum vulgare), also a Colorado-prioritized noxious weed species, and various haygrasses (Poa pratensis, Phleum pratense, Bromus inermis) are also present. Control of these species would benefit the population by again reducing competition for resources, but would be very difficult due to their widespread distribution and high percentage of canopy cover across the site.

Information Needs: Since retrorse sedge (Carex retrorsa) is considered an S1 (critically imperiled) species in Colorado, further research is needed on the distribution and habitat needs for retrorse sedge (Carex retrorsa) in the state in order to develop specific and appropriate management plans for sites on private and U.S. Forest Service lands that support retrorse sedge (Carex retrorsa) populations.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

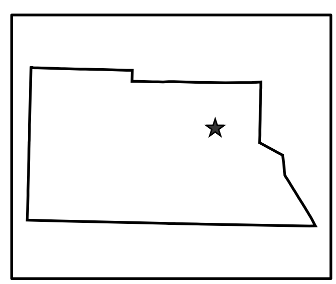
Legend

PCA Boundary

Blackhead Peak, 37106-C7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 25. Tributary to Rito Blanco Potential Conservation Area, B3: High Biodiversity Significance

Upper First Fork Piedra River

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Baldy Mountain, Granite Peak

Size: 451 acres (182 ha) **Elevation:** 7,720 - 8,200 ft. (2,353 - 2,499 m)

General Description: The First Fork Piedra River site is located in the extreme northwest corner of Archuleta County, on the north slope of Baldy Mountain and south of Slide Mountain. The First Fork of the Piedra River flows steeply east-southeast through a steep-walled, narrow V-shaped valley between these two mountains to join with the Piedra River 7 miles downstream. At the canyon floor along the creek, thinleaf alder (Alnus incana spp. tenuifolia) and Drummond's willow (Salix drummondiana) dominate the shrub layer, with an overstory of mature narrowleaf cottonwood (Populus angustifolia), blue spruce (Picea pungens), and white fir (Abies concolor). Rocky Mountain maple (Acer glabrum) occurs on the first terrace above the creek. The stream bank vegetation is sparse due to the large cobble on the creek banks, but where sediment has been deposited in the floodplains and on the benches, there is a healthy understory of mesic graminoids and forbs. This herbaceous understory is dominated by meadowrue (Thalictrum sp.), cutleaf coneflower (Rudbeckia laciniata var. ampla), thimbleberry (Rubacer parviflorus ssp. parviflorus), fringed brome (Bromus ciliatus), fowl bluegrass (Poa palustris), and bluejoint grass (Calamagrostis canadensis). The creek is slightly sinuous, with a narrow floodplain constricted by the narrow canyon in most places, and a few terraces/benches in wider canyon areas, supporting larger populations of cottonwood, blue spruce, white fir, alder and Drummond's willow. The surrounding forest is comprised of spruce, fir and aspen (Picea spp., Abies spp. and Populus tremuloides), in mosaic with open, weedy meadows with high concentrations of nodding plumeless thistle (Carduus nutans) and Canada thistle (Cirsium arvense). The surrounding area is USFS land, though it is used by hunters and other non-motorized recreationists. A hunting camp occurs at the upstream end.

Key Environmental Factors: Seasonal flooding and associated sediment deposition along this active floodplain provides the germination substrate necessary for the persistence of the narrowleaf cottonwood component of the plant community. The geology in this area is mapped as Morrison, Wanakah and Entrada formations (Tweto 1979), and soils at the occurrence are mapped as Sandstone outcrop-Ustorthents complex (USDA 1981). Ustorthents soils occur on the hillsides above the creek, and are fairly coarse textured and well-drained, with rapid precipitation runoff and a high erosion hazard. Soils in the creek bed are alluvial, with angular boulders, rounded cobble, gravel and coarse sand deposits. The banks are shallow mineral soils over rocky alluvium, topped with forest litter (duff).

Biodiversity Significance Rank Comments (B3): This site contains a fair (C-ranked) occurrence of a plant community considered globally imperiled (G2/S2). As of 2005, there are only 15 known locations of the white fir-(blue spruce)-narrowleaf cottonwood/Rocky Mountain maple (Abies concolor-(Picea pungens)-Populus angustifolia/Acer glabrum) montane riparian forest in Colorado, and this occurrence represents one of two known occurrences within Archuleta County.

Natural Heritage element occurrences at the Upper First Fork Piedra River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Abies concolor - Picea pungens - Populus angustifolia / Acer glabrum Forest	Montane Riparian Forests	G2	S2				C	2005-08-18

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding and sediment deposition to maintain the riparian forest along First Fork Creek. The adjacent steep slopes that would most likely impact the riparian forest if altered are also included. Given that the riparian forest is dependent on natural hydrological processes associated with First Fork Creek, upstream activities such as logging, water diversions, impoundments, and improper livestock grazing are detrimental to the hydrology of the riparian area. The boundary also includes an approximate 1,000 foot buffer, which includes nearby trails, grazing allotments and campsites where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. It should be noted that the hydrological processes necessary to the riparian forest are not fully contained by the site boundaries. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is within the San Juan National Forest.

General Protection Comments: Protection for the site is mostly ensured by its location within the San Juan National Forest. Furthermore, access to this site is very difficult and requires significant off-trail hiking in heavily vegetated, steep terrain, through known bear country. However, logging within the watershed and on the steep slopes adjacent to the creek would be detrimental to the long-term viability of the element occurrence. Review and revision (if necessary) of land use and logging plans in this area would benefit the community by ensuring protection of the watershed.

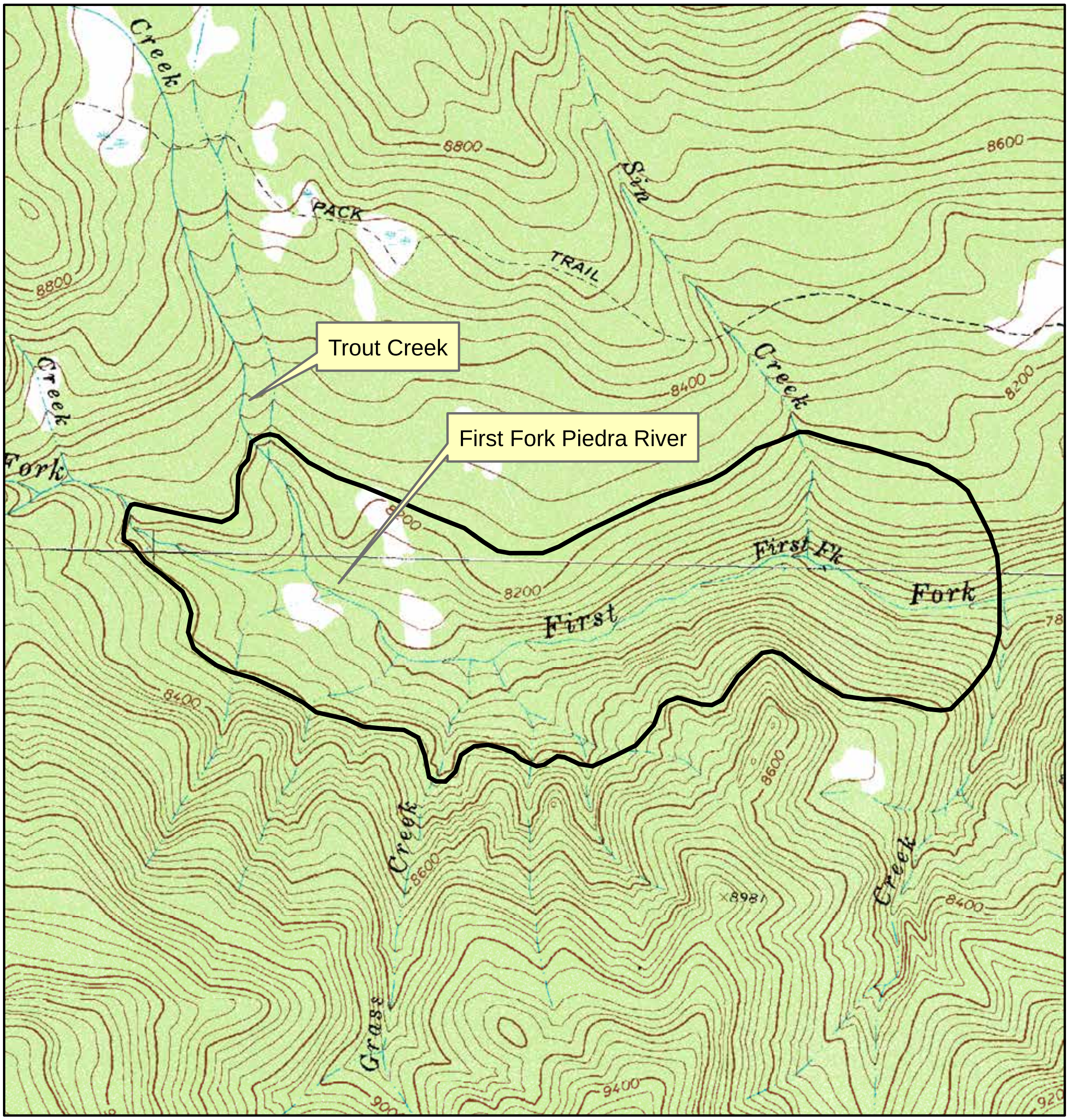
Management Urgency Rank Comments (M2): New management action may be needed within 5 years to prevent the loss and further degradation of the element occurrence. Weed invasion and grazing impacts are the greatest threats to the condition of the element occurrence.

Management Needs Comments: Control of the extensive population of nodding plumeless thistle (Carduus nutans) and Canada thistle (Cirsium arvense) and other weedy species in the surrounding uplands is urgently needed not only to prevent invasion into the riparian zone, but also to limit spread throughout the forest. Additionally, cattle grazing in the area is contributing to accelerated erosion on the steep hillsides above the creek. Soils are already predisposed to erosion in this area (USDA 1981), and because of the high soil permeability only a thin cover of vegetation anchors the soil. Continued grazing in this area could significantly contribute to heavy erosion of steep hillsides and the decline of both upland forests and riparian zones from soil denudation on the hillsides and sediment loading into the creek.

Land Use Comments: Current land use is dominated by grazing and wildlife use; the area is also used during hunting season as evidenced by at least one well-established hunting camp along the creek.

Natural Hazard Comments: Bears were seen in the area during the 2005 visit, and because there is no trail to the site cross-country travel over steep and heavily vegetated terrain can be hazardous.

Exotic Species Comments: Several weed-infested meadows occur on the terraces above the creek, and are dominated by large, robust stands of nodding plumeless thistle (Carduus nutans) with an understory of Canada thistle (Cirsium arvense), Kentucky bluegrass (Poa pratensis), common dandelion (Taraxacum officinale) and other weedy species. This is notable because this area is not accessible by any designated trail, yet the upland meadows are severely invaded by weeds. No logging in the immediate area was noted, and the closest trail is nearly 2 miles away, and the closest road nearly 4 miles away. A few weeds occur in the understory of the riparian area, but considering the high percentage of weeds in adjacent upland areas, the weed population within the riparian area is very minimal.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

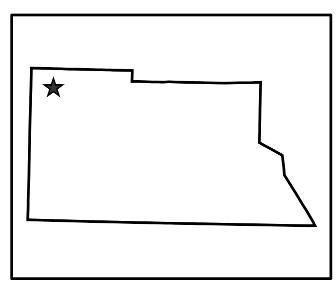
Legend

PCA Boundary

Baldy Mountain, 37107-C4
Granite Peak, 37107-D4

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 26. Upper First Fork Piedra River Potential Conservation Area, B3: High Biodiversity Significance

Upper Indian Creek

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Baldy Mountain

Size: 501 acres (203 ha) **Elevation:** 9,000 - 9,560 ft. (2,743 - 2,914 m)

General Description: In the extreme northwest corner of Archuleta County, Baldy Mountain rises gradually from Yellowjacket Pass to an elevation of 10,100 feet. Its long southwestern slope is broken by several steps in the slope containing small creeks including Indian Creek, which drains perpendicular to the slope of Baldy Mountain towards the southeast, eventually feeding the Piedra River. The surrounding forests are dominantly blue spruce (Picea pungens) and quaking aspen (Populus tremuloides), broken by open meadows ranging from very large to very small. Meadows near the creek are dominated by hay grasses such as timothy (Phleum pratense), and roundleaf snowberry (Symphoricarpos rotundifolius), Woods' rose (Rosa woodsii), and mountain goldenbanner (Thermopsis montana). The headwaters of Indian Creek begin at Moonlick Springs 1 and 2, and the creek is additionally fed downstream by drainages and other springs upslope to the northeast on Baldy Mountain. It travels down a generally narrow, U-shaped draw; sometimes constrained into short, narrow canyons by adjacent sandstone outcrops. The narrow floodplain and minimally sinuous creek bed below the two Moonlick Springs has a cobble and angular-rock (sandstone) substrate, and the creek at the upper end of the site supports a dense to open canopy of mixed willows (Salix spp.) punctuated with sporadic narrowleaf cottonwood (Populus angustifolia) individuals or small stands. Thinleaf alder (Alnus incana ssp. tenuifolia) begins to occur within the community about at the midpoint of the site, where the community transitions to a dense to open canopy of mixed willow species punctuated with frequent alder stands, with the narrowleaf cottonwood dropping out and blue spruce beginning to encroach on the riparian zone at the lower end before the creek enters a steeper canyon above Devil's Hole. The understory within the entire riparian zone consists of a diverse mix of mesic graminoids and forbs, including water sedge (Carex aquatilis), bluejoint reedgrass (Calamagrostis canadensis), white marsh marigold (Caltha leptosepala) and Franciscan bluebells (Mertensia franciscana). Indian Creek has a low flow by mid-summer with small pools of standing water, and is not incised or downcut. The banks are well vegetated with riparian shrubs and mesic forbs and graminoids. Seasonal flows probably limit fish habitat, but the riparian corridor likely provides excellent forage for deer and elk, and supports a diverse avian population. Most songbirds were not identified, but a few species positively identified by sight or song included Northern Flicker (Colaptes auratus), Black-capped and Mountain Chickadees (Poecile atricapilla and P. gambeli), Hermit

Thrush (Catharus guttatus), Rufous Hummingbird (Selasphorus rufus), Western Tanager (Piranga ludoviciana), and Green-tailed Towhee (Pipilo chlorurus).

Key Environmental Factors: Many springs occur on the slopes of Baldy Mountain, several of which eventually supply the Indian Creek drainage. Moonlick Springs 1 and 2 at the head of Indian Creek are the main source for the creek, but are currently being detrimentally impacted by OHV off-trail impacts. The geology of the area is mapped as Dakota Sandstone and Burro Canyon Formation, comprised of sandstone, shale and conglomerate (Tweto 1979), and evidenced by large sandstone boulders strewn across the adjacent hillsides, and periodic sandstone outcrops or escarpments occurring along the drainage. Soils within the upper 2/3 of the occurrence are mapped as Dunton loams, deep, well-drained soils formed from sandstone. The lower 1/3 of the occurrence is mapped as Chris gravelly loam, again derived from sandstone (USDA 1981). Soils within the floodplain are alluvial, with the creekbed comprised of rounded cobble sandstone and large angular rock. The cobble tends to average 1"-2.5" in diameter, with the angular rock averaging 12"-18" in diameter.

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) thinleaf alder-mixed willow (mountain willow, shining willow, strapleaf willow)(Alnus incana-Salix (monticola, lucida, ligulifolia)) shrubland and a good (B-ranked) occurrence of the globally vulnerable (G3/S3) narrowleaf cottonwood/mixed willow (Populus angustifolia/Salix (monticola, drummondiana, lucida)) woodland. Both communities can occur on active floodplains on a variety of stream channels, from steep and narrow to moderately sloped and broad montane streams. The alder community is often associated with grazing disturbances and may indicate a shift in physical setting, such as from a broader, gentler valley to a steep narrow valley (Carsey et al. 2003). The cottonwood community commonly consists of younger to mid-age cottonwoods with a diverse mix of riparian shrubs in the understory, representing an early to mid-seral riparian community (Carsey et al. 2003).

Natural Heritage element occurrences at the Upper Indian Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix (monticola, lucida, ligulifolia) Shrubland	Thinleaf Alder - Mixed Willow Species	G3	S3				B	2005-07-14
Natural Communities	Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	Narrowleaf Cottonwood / Mixed Willows Montane Riparian Forest	G3	S3				B	2005-07-14

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as groundwater discharge (springs), seasonal flooding, and sediment deposition to maintain the riparian forest along Upper Indian Creek. The immediate, adjacent steep slopes that would most likely impact the riparian forest if altered are also included. Given that the riparian forest is dependent on natural hydrological processes associated with Indian Creek, upstream activities such as OHV use and roads, logging, water diversions or impoundments, and improper livestock grazing are detrimental to the hydrology of the riparian area. The boundary also includes an approximate 500 foot buffer, which includes nearby four-wheel drive roads, OHV trails, and grazing allotments where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. It should be noted that the hydrological processes necessary to the riparian communities are not fully contained by the site boundaries. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is fully within the San Juan National Forest.

General Protection Comments: Protection for the site is mostly ensured by its location within the San Juan National Forest. However, current land uses within this portion of the District, especially OHV use and logging, does not support the perpetuation of intact, weed-free, natural riparian communities. Review and revision (if necessary) of land use and logging plans in this area, as well as OHV-use enforcement, would benefit the communities by ensuring protection of the source springs and of the watershed. Future changes in protection status, ownership, or use of the land may warrant additional protection actions.

Management Urgency Rank Comments (M1): Management actions may be required within one year or the element occurrences could be lost or degraded.

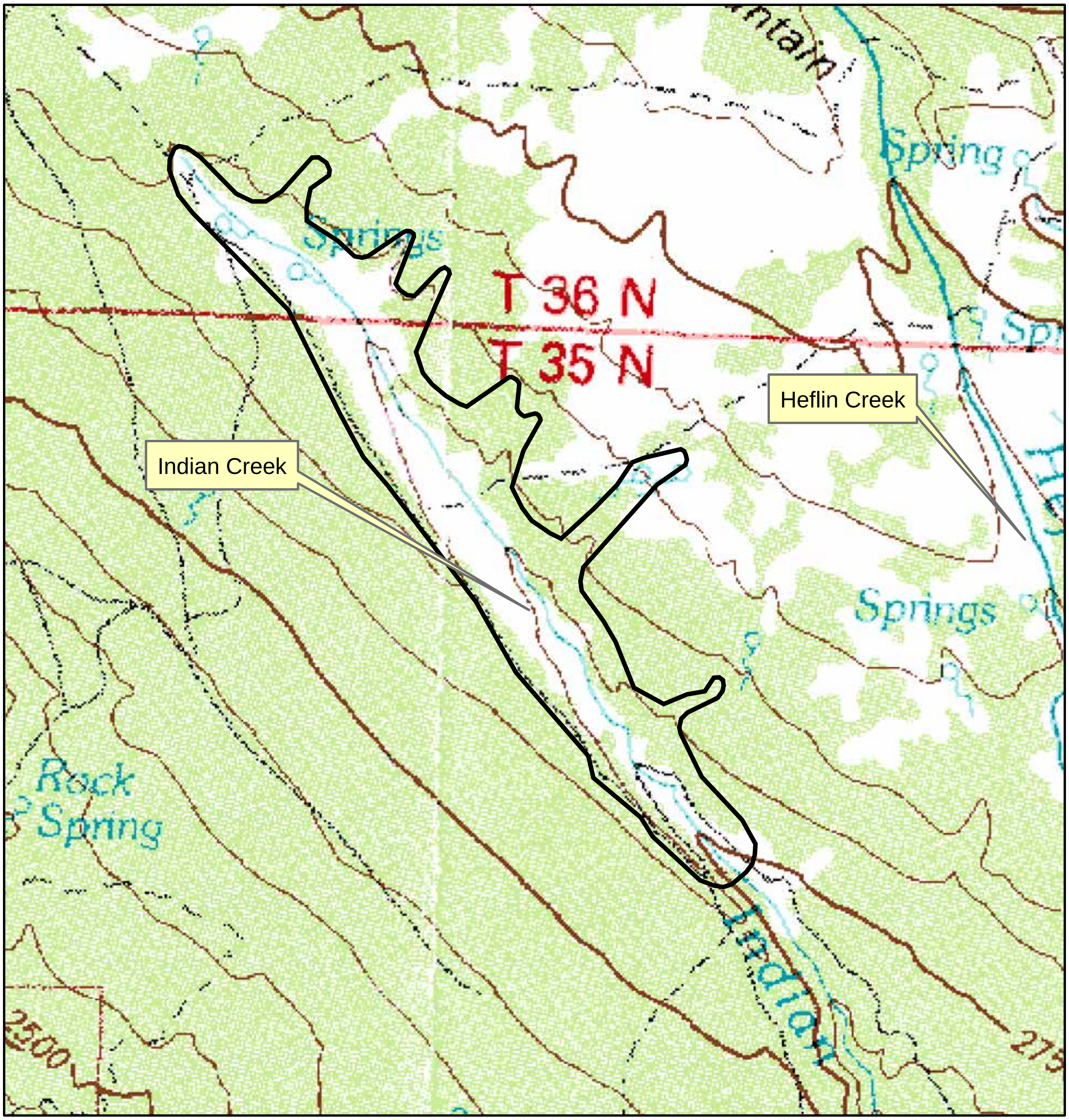
Off-trail OHV use within the springs feeding Indian Creek is the main threat to the ongoing viability of the riparian system.

Management Needs Comments: Management of OHV use at the two source springs (Moonlick Springs 1 and 2) for Indian Creek is critical to maintaining the flows in the creek necessary to support the riparian communities. Current OHV disturbance within the meadow is dewatering the meadow and the springs, and therefore limiting the creek flows downstream. Signage designating the area closed to OHVs has not discouraged the OHV use within the wet meadow, and road closure on FR 620-First Notch Road, either seasonal or permanent, may be required to limit the ongoing impacts. Monitoring of the ongoing impacts of grazing within the area would benefit the riparian communities to control the spread of exotic and invasive species into the riparian zone, since it is currently mostly weed-free.

Land Use Comments: There is evidence of grazing in the area, old cow patties and fencing, but no signs of grazing in the current season. Upstream at Moonlick Spring 1 and 2, source waters for Indian Creek, the hydrology is manipulated by a low, metal weir at the low end of Moonlick Spring 1, creating a 5+ acre wet meadow above the spring. The soils at the spring have deep organic layers, but OHV use in the wet meadow is destroying the soil matrix and drying the meadow. Many deep tracks are evident within the once moist and remaining moist areas. This OHV activity detrimentally affects the riparian communities downstream by altering and potentially removing the source hydrology that supports the creek and the communities themselves. An OHV trail (seasonally open) also crosses the occurrences at the downstream end, and a four-wheel drive road parallels the creek throughout the site within 600 feet of its south bank, at the top of a steep hill that rises from the creek bed. Recent aerial photography (USDA 2002) indicates active logging is occurring in the local area, though no current logging is known within the direct watershed for Indian Creek.

Exotic Species Comments: Few weeds occur within the riparian zone, apart from some hay grasses such as timothy (Phleum pratense) and Kentucky bluegrass (Poa pratensis), common dandelion (Taraxacum officinale), and red clover (Trifolium pratense). The adjacent uplands also have few weeds apart from hay grasses and dandelions.

Off-Site Considerations: Active logging is occurring along Forest Road 135 (Beaver Meadows Road) and in the adjacent watershed just downhill from the Indian Creek watershed.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

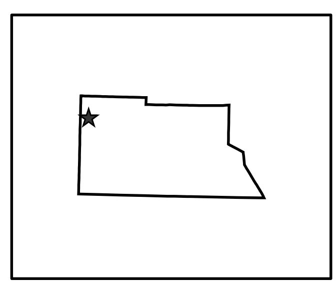
Legend

PCA Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 27. Upper Indian Creek Potential Conservation Area, B3: High Biodiversity Significance

Buckles Lake

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Harris Lake

Size: 123 acres (50 ha) **Elevation:** 9,500 - 9,640 ft. (2,896 - 2,938 m)

General Description: Buckles Lake is a hydrologically manipulated lake in the southeast portion of Archuleta County, on the west slope of the Chalk Mountains. The site is mostly within the San Juan National Forest, with a portion of the north boundary privately owned. The South San Juan Wilderness boundary begins approximately one mile east of Buckles Lake and encompasses much of the watershed for the lake and its tributaries. The lake is located in a natural basin below and to the northwest of V Mountain. Runoff from numerous small drainages of the Chalk Mountains supplies water to the basin and Buckles Lake. The lake's main outlet drains through an earthen berm to the northwest, eventually joining with Big Branch Creek, a tributary to the Rio Blanco. In addition, an irrigation structure in the berm diverts an unknown percentage of the outflow to a secondary outlet (irrigation ditch), which drains directly to Harris Lake downstream. Both lakes were enhanced many years ago and are well established and support extensive native wetland and riparian plant associations. The geomorphology of the Chalk Mountains area includes landslide deposits and generally slumpy, stepped topography which often results in groundwater discharge, and therefore creates many small ponds, lakes, drainages, wetlands and several fens. These water bodies subsequently support an extraordinarily rich and diverse mosaic of wetland and riparian habitats. The western slopes of the Chalk Mountains typically have steep slopes, a dense, mature Picea spp.-Abies spp.-Populus tremuloides forest, and large rockslides and outcrops. An abundance of birds and insects occupy the basin and a trail skirts Buckles Lake on its west side. A forest service road ends within one-quarter mile of the lake and recreational use by hikers, fisherman and hunters in the basin is high. Blanco Tunnel, a major US Bureau of Reclamation subterranean water diversion in the area built in the late 1960's as part of the San Juan-Chama Project to divert water from the San Juan River Basin across the Continental Divide and into the Rio Grande River Basin (USDI no date), is mapped within the western boundary of the site, but no surficial impacts to the area were noted. A number of uncommon wetland and riparian communities are found within the site, including two types of montane wet meadow plant communities, the water sedge-beaked sedge (Carex aquatilis-Carex utriculata) montane wet meadow and white marsh marigold (Caltha leptosepala) montane wet meadow. Also occurring here are two examples of a park willow/mesic graminoid (Salix monticola/mesic graminoid) montane riparian willow carr. In moderately broad meadow opening east of Buckles Lake, an unnamed spring-fed tributary to the lake flows and supports a small, open-canopy willow carr dominated by park willow (Salix monticola) and Geyer's willow (Salix geyeriana), with a vigorous herbaceous graminoid understory and saturated to inundated soils. Kentucky bluegrass (Poa pratensis) and water sedge (Carex aquatilis) dominate the herbaceous layer, and the fringes of the wet meadow are occupied by shrubby cinquefoil (Dasiphora floribunda) and mixed graminoids such as Kentucky bluegrass and ebony sedge (Carex ebenea). Several rivulets run through the community, converging into one channel toward the downstream end of the community. Beaver may have historically influenced the area, but there is no current sign of active beaver. At the south end of Buckles Lake, a large, open wetland supports a mosaic of hydrophytic and mesic graminoids and forbs, punctuated by patches of willows (Salix spp.). Park willow and diamondleaf willow (Salix planifolia) occur in large, dense stands on the south and east edges of the wetland, in a narrow fringe on the west edge, and extending as a "finger" north through the center of the polygon toward but not reaching the edge of the open water. The more mesic edges, especially on the east and south edge, support good stands of thinleaf alder (Alnus incana ssp. tenuifolia). The dominant graminoids in the understory and within the open herbaceous stands are beaked sedge (Carex utriculata) and water sedge. Co-dominating with the sedge stands in slightly higher, less saturated soils are large patches of white marsh marigold (Caltha leptosepala). The herbaceous layer is minimally diverse, with these three species constituting the majority of the cover. The entire wetland is on a very slight grade, rising slowly from the edge of the open water at Buckles Lake south to the edge of the coniferous forest and beyond, providing a continuum of soil saturation levels from inundated at the edge of the open water, to moist or even dry at the southern-most, upper-most end of the wetland.

Key Environmental Factors: A large portion of the geology on the west slopes of the Chalk Mountains, including the area within the site, is mapped as Landslide Deposits (Tweto 1979), which includes areas of thick colluvial deposits. This geology seems to predispose the area to having a stepped or hummocky microtopography where the groundwater table often is intercepted, forming many small pocket lakes and ponds. Soils are mostly Castelleia loams, moderately deep and well-drained, but often limited by an underlying layer of impervious shale or sandstone. Pockets of Histic Cryaquepts occur frequently within the Castelleia matrix (USDA 1981), which appear to be directly related to locations of ponds, wetlands and fens, and correlates with the wetland communities within this site. A large pocket of Hunchback clay loams, which are deep, poorly drained and occurring on fans and toe slopes, occurs on the east side of Buckles Lake and supports a park willow (Salix monticola) montane riparian willow carr (USDA 1981).

Biodiversity Significance Rank Comments (B4): The Buckles Lake site contains a fair (C-ranked) occurrence of a park willow/mesic graminoid (Salix monticola/mesic graminoid) montane riparian willow carr wetland community that is globally vulnerable (G3/S3), a riparian plant community frequently occurring in areas of flooding or beaver activity. There are also fair (C-ranked) occurrences of a water sedge-beaked sedge (Carex aquatilis-Carex utriculata) montane wet meadow community and a white marsh marigold (Caltha leptosepala) montane wet meadow community in the site, both of which are globally apparently secure (G4/S4).

Natural Heritage element occurrences at the Buckles Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix monticola / Mesic Graminoids Shrubland	Montane Riparian Willow Carr	G3	S3				C	2005-07-11
Natural Communities	Caltha leptosepala Herbaceous Vegetation	Montane Wet Meadows	G4	S4				C	2005-07-11
Natural Communities	Carex aquatilis - Carex utriculata Herbaceous Vegetation	Montane Wet Meadows	G4	S4				C	2007-07-11

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain a viable population of the wetland and riparian communities within the site. The boundary includes the privately maintained earthen dam critical to providing adequate water levels in the lake to support the associated hydrophytic communities. The boundary also provides a small buffer from nearby trails and roads where surface runoff may contribute excess nutrients and sediment. It should be noted that the hydrological processes necessary to the elements are not fully contained by the site boundaries. Given that the elements are dependent on natural hydrological processes associated with runoff from the Chalk Mountains, activities such as water diversions, impoundments, and improper livestock grazing within riparian areas and along the wetland are detrimental to the hydrology within the site. This boundary indicates the minimum area that should be considered for any conservation management plan.

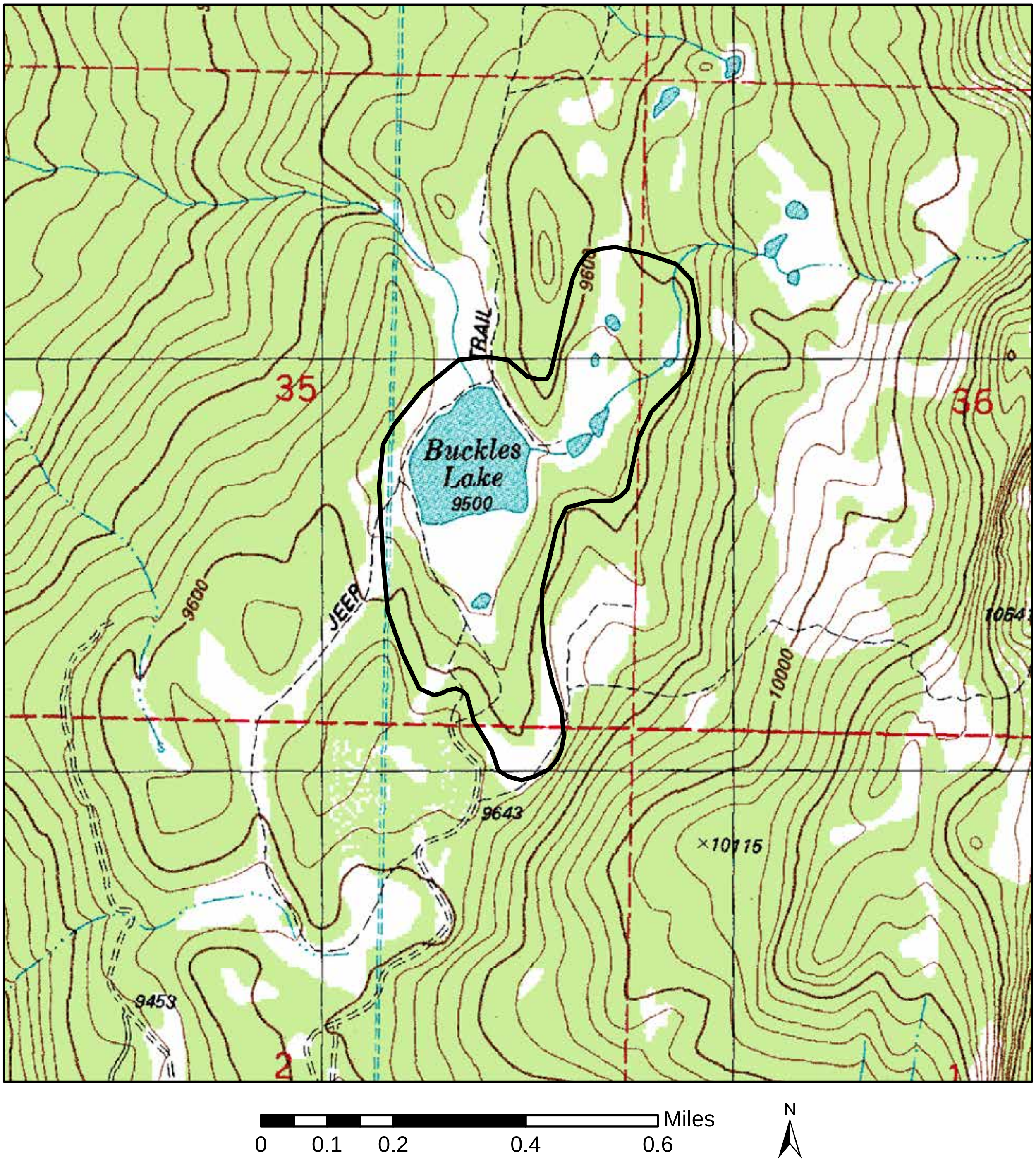
Protection Urgency Rank Comments (P3): Protection action may be needed, but probably not within the next 5 years. This site is located mostly within the San Juan National Forest, with a portion of private property along the northern perimeter of Buckles Lake and the northern portion of the site.

General Protection Comments: Although the majority of the site is within the San Juan National Forest, the earthen dam that forms Buckles Lake exists within a small, privately owned parcel. Ensuring protection of the private parcel and maintenance of this berm would be essential to providing the hydrology and therefore the long-term existence of most of the riparian and wetland communities within the site, with the exception of the riparian community that occurs east of the lake and is not dependent upon the lake's existence.

Management Urgency Rank Comments (M3): Current management seems to favor the persistence of the communities, but management actions may be needed in the future to maintain or improve the current quality of the area. Recreation and grazing should be monitored as they may impact soil erosion, soil compaction, sedimentation rates, nutrient loading, and result in the introduction of non-native plants. Exotic plant species along the southern boundary and along trails should be monitored for encroachment into the site.

Management Needs Comments: Cattle grazing impacts the area through hoof erosion, soil compaction, addition of nutrients to the water, willow browse, and distribution of weeds and exotic species. Cattle trails have also altered the hydrology of one riparian area within the site, drying parts of the wetland and possibly contributing to the braiding of the stream across the meadow into several rivulets. It is suggested to evaluate grazing practices where improper grazing can contribute to excessive erosion, soil compaction, hydrologic modification and weed invasion, and to have an ongoing monitoring program to evaluate the benefits of grazing modifications. Recreation in the area is dominated by hiking, camping and hunting.

Exotic Species Comments: Exotic species are not dominant within the wetland, but include frequent Kentucky bluegrass and patches of Canada thistle (Cirsium arvense).



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

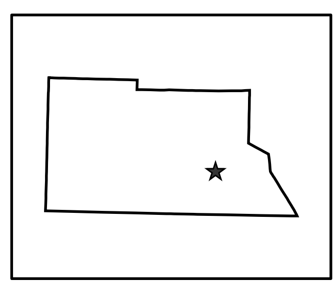
Legend

PCA Boundary

Harris Lake, 37106-B7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 28. Buckles Lake Potential Conservation Area, B4: Moderate Biodiversity Significance

Elk Creek at Piedra River

Biodiversity Rank - B4: Moderate Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Devil Mountain

Size: 202 acres (82 ha) **Elevation:** 6,700 - 8,000 ft. (2,042 - 2,438 m)

General Description: Elk Creek is located in the northwestern portion of Archuleta County. It is a tributary to the Piedra River and drains west from its headwaters at Devil Mountain, flowing through a moderately steep montane stream channel with very little sinuosity. The stream channel displays pools, narrow channels, and short cascades. There are smaller side channels or rivulets in some reaches where large boulders or downed wood divert water as the topography allows. Within the Elk Creek riparian zone, the tree layer occupies the channel banks and is dominated by conifers including Douglas-fir (Pseudotsuga menziesii) and white fir (Abies concolor) with scattered narrowleaf cottonwood (Populus angustifolia) and boxelder (Acer negundo var. interius). The stream channel has a dense shrub layer dominated by thinleaf alder (Alnus incana ssp. tenuifolia) and dense patches of red-osier dogwood (Cornus sericea). A vigorous, diverse, and dense to moderately dense canopy cover of native mesic forbs such as tall fringed bluebells (Mertensia ciliata), largeleaf avens (Geum macrophyllum), and field horsetail (Equisetum arvense) occurs within the floodplain, with various mosses growing on the soil and rock surfaces. Channel banks also display vigorous Rocky Mountain maple (Acer glabrum) plants in abundance. Surrounding uplands are dominated by spruce-fir (Picea spp.-Abies spp.) and ponderosa pine (Pinus ponderosa ssp. scopulorum) forests. A popular forest road (FR 622, First Fork Road) bisects the site, and Elk Creek passes through a large culvert, dumping onto steep terrain on the downstream (west) side of the road culvert.

Key Environmental Factors: The Elk Creek channel cuts through the beautiful sedimentary rocks of the Jurassic-age Morrison, Wanakah, Entrada Formation, the Triassic-age Dolores Formation comprised of red siltstone, shale, sandstone, and limestone pellet conglomerate, and the Permian aged Cutler Formation comprised of arkosic sandstone, siltstone and conglomerate (Tweto 1979). First Fork Road passes through the site where the red beds of the Dolores Formation are visible at the road cut. Soils in the riparian area of the site are alluvial with angular cobble and silty loam deposits. Soils are delineated as the Corta series, which are well drained soils derived from interbedded shale and sandstone (USDA 1981).

Biodiversity Significance Rank Comments (B4): The site supports the globally vulnerable (G3G4) and state vulnerable (S3) thinleaf alder - red-osier dogwood (Alnus incana - Cornus sericea) riparian shrubland in good (B-ranked) condition. This plant association is tolerant of flooding and requires a high water table (Carsey et al. 2003). The site also supports the apparently globally secure (G4) but state imperiled (S2) Douglas-fir/red-osier dogwood (Pseudotsuga menziesii/Cornus sericea) plant association in good (B-ranked) condition. The Douglas-fir/red-osier dogwood plant association is found in small patches in Colorado. Douglas-fir is not a riparian obligate but can establish in cool air drainages with well-drained colluvial soils (Carsey et al. 2003).

Natural Heritage element occurrences at the Elk Creek at Piedra River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana / Cornus sericea Shrubland	Thinleaf Alder - Red - osier Dogwood Riparian Shrubland	G3G4	S3				B	2005-06-21
Natural Communities	Pseudotsuga menziesii / Cornus sericea Woodland	Lower Montane Riparian Forests	G4	S2				B	2005-06-21

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the ecological processes necessary for the viability of the element occurrences. It also identifies a buffer from the road that may contribute excess nutrients, sediments and erosion to the system. It should be noted that not all the hydrologic processes necessary to the element occurrences are contained within the boundary.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest. The steep terrain and lack of an official trail in the Elk Creek drainage offers intrinsic protection to the element occurrences.

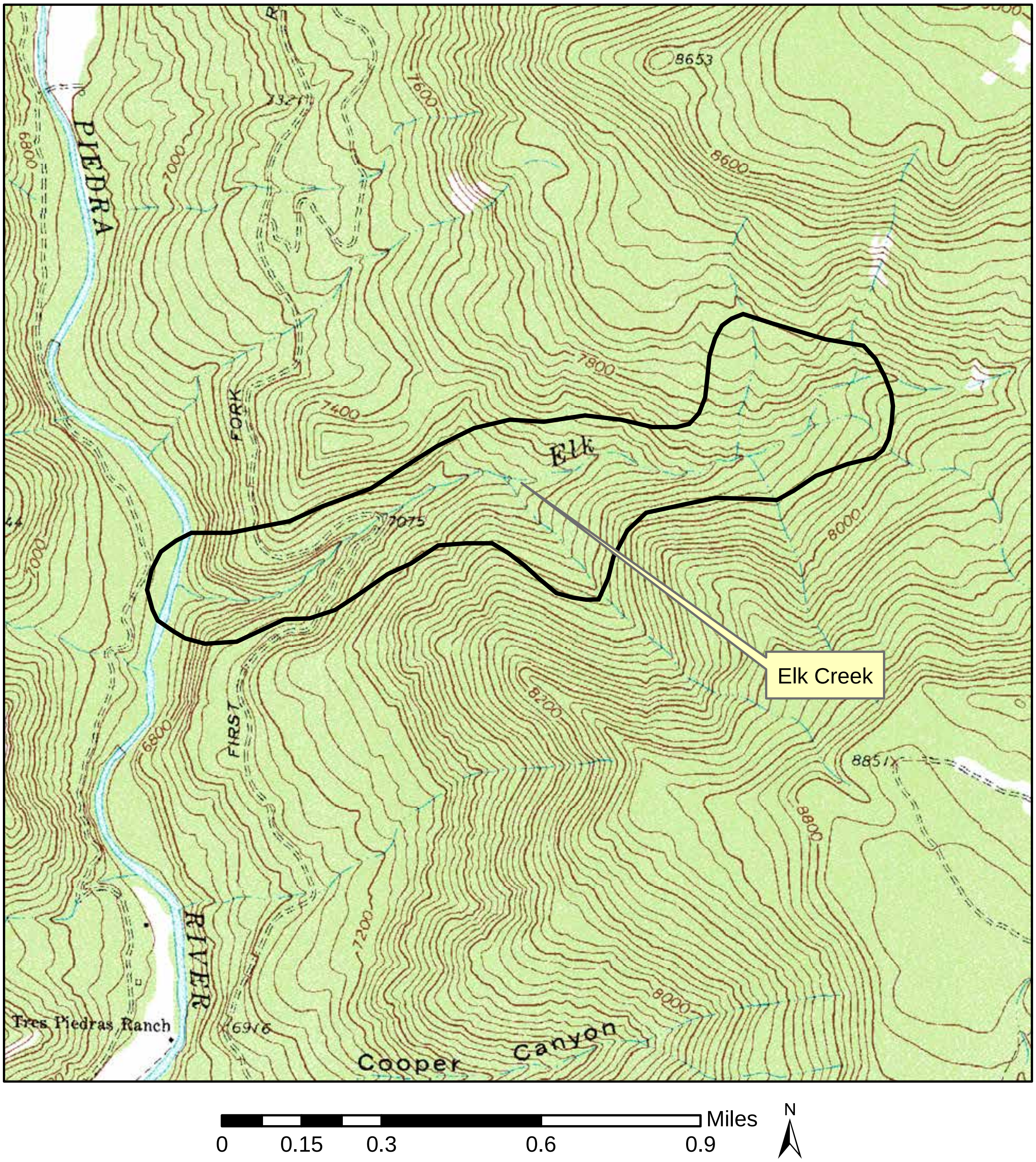
General Protection Comments: The site is entirely within the San Juan National Forest, and under management of the Pagosa Ranger District.

Management Urgency Rank Comments (M4): Current management seems to favor the persistence of the elements within the site, but management actions may be needed in the future to maintain the current quality of the element occurrences.

Management Needs Comments: The plant associations and stream channel are in good condition. Social trails from the road locally impact the riparian area through erosion and weed introduction; however, impacts do not advance beyond the short trails.

Natural Hazard Comments: Western poison ivy (Toxicodendron rydbergii) occurs frequently throughout the site.

Exotic Species Comments: Few weeds occur within the site and those are mostly localized near roads and trails.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/21/2005

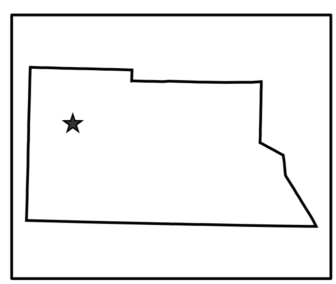
Legend

PCA Boundary

Devil Mountain, 37107-C3

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 29. Elk Creek at Piedra River Potential Conservation Area, B4: Moderate Biodiversity Significance

Hurt Canyon

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Lonetree Canyon

Size: 163 acres (66 ha) **Elevation:** 7,250 - 8,000 ft. (2,210 - 2,438 m)

General Description: In the central part of Archuleta County south of the prominent landmark of Broken Off Point, Hurt Canyon occurs as a narrow, steep, moderate elevation canyon with an intermittent stream draining northwest from Oakbrush Hill. After leaving its canyon, the stream channel meanders through a broad meadow of hay fields and residential homes and eventually joins Stollsteimer Creek, a tributary to the Piedra River more than 12 miles downstream. The site occurs in the lower reaches of Hurt Canyon, within Southern Ute Indian Tribal land. Here, the stream channel is narrow, moderately sinuous, and somewhat incised, with scoured banks, gravel bars and pools within the channel. There are signs of flooding, such as debris piles, gravel/rock deposits, and scoured banks. All erosion within the channel is probably due to natural causes such as relatively steep terrain, local geology and seasonal flooding. Stream flow is low and appears to be fed by groundwater discharges. The uplands immediately above the channel are dominated by ponderosa pine/Douglas-fir (Pinus ponderosa ssp. scopulorum /Pseudotsuga menziesii) forests and Gambel oak (Quercus gambelii) shrublands. The riparian zone along the channel is very narrow with a limited floodplain, and Douglas-fir dominates the tree canopy displaying mostly mature stature trees on the high banks of the channel. Patches of narrowleaf cottonwood (Populus angustifolia) are present but not dominant within the canyon, typically occurring at spring water discharges. Red-osier dogwood (Cornus sericea) dominates the shrub layer displaying dense patches and scattered individuals along the banks and within the channel bed. A riparian shrub mixture is present as well, including black chokecherry (Prunus virginiana var. melanocarpa), roundleaf snowberry (Symphoricarpos rotundifolius), Rocky Mountain maple (Acer glabrum), Saskatoon serviceberry (Amelanchier alnifolia), skunkbush sumac (Rhus trilobata var. trilobata) and Woods' rose (Rosa woodsii). The western white clematis vine (Clematis ligusticifolia) is abundant throughout the riparian areas in the canyon. The herbaceous understory is sparse, though vigorous, and appears typical of a shaded ravine. Gambel oak and creeping barberry (Mahonia repens) also occur within the riparian area, encroaching from the adjacent uplands. There are very few weeds of note within the site. Common dandelion (Taraxacum officinale) is the most common, occurring only sporadically in the understory. All the vegetation in the riparian zone appears vigorous, with no disease or excessive browsing noted. The canyon is generally shaded and moist, and there are downed logs in multiple locations within the site. No trails or roads travel up the canyon, so the area is quite densely vegetated and relatively pristine. A Cordilleran Flycatcher (Empidonax occidentalis) was seen at the mouth (west end) of the canyon; it sat in a willow and sang contentedly for several minutes, allowing excellent time for identification (Sibley 2000). This species is identified as high priority in high elevation riparian habitat under the Colorado Bird Conservation Plan (Colorado PIF 2000).

Key Environmental Factors: The geology within Hurt Canyon appears to be predominantly sandstone, and Tweto (1979) delineates the area as MesaVerde Group, comprised of sandstone and shale deposits. The soils are not described by the current soil survey of the region. Soils in the channel are alluvial with angular cobble and coarse deposits such as small gravel and sand. Scoured stream banks reveal a 50 cm deep horizon of black colored soils with 50-60% organic matter and duff, over loose rock.

Biodiversity Significance Rank Comments (B4): This site supports a good (B-ranked) occurrence of the globally apparently secure (G4) Douglas-fir/red-osier dogwood (Pseudotsuga menziesii/Cornus sericea) lower montane riparian forest, a community considered rare in Colorado (S2), and only documented in Western Slope forests of Colorado. It typically occurs above the floodplain in narrow valleys that funnel cold-air drainage, and often occurs as small patches. As of 2005, this community is documented only twice in Archuleta County, and the next closest documented occurrence in La Plata County was completely lost in the Missionary Ridge fire of 2002 (March et al. 2004).

Natural Heritage element occurrences at the Hurt Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Pseudotsuga menziesii / Cornus sericea Woodland	Lower Montane Riparian Forests	G4	S2				B	2005-06-09

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that encompasses the element occurrence and the immediate watershed, to buffer the hydrologic processes such as surface flows and groundwater discharges necessary for the viability of the element occurrences. It should be noted that all the hydrological processes necessary to the community are not fully contained by the site boundaries. Given that the community is dependent on the natural hydrology associated with the unnamed drainage in Hurt Canyon, upstream activities such as water diversions and impoundments, road and residential development, and improper livestock grazing may be detrimental to the hydrology of the riparian area. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P3): Protection action may be needed, but probably not within the next 5 years. It is estimated that current development pressure in the area may reduce the viability of the element in the site if protection action is not taken.

General Protection Comments: The land is owned by the Southern Ute Indian Tribe; however, private development at the mouth of the canyon and on the mesas above the canyon may provide the impetus to sell, trade, or develop the land due to rising property values in this portion of the county.

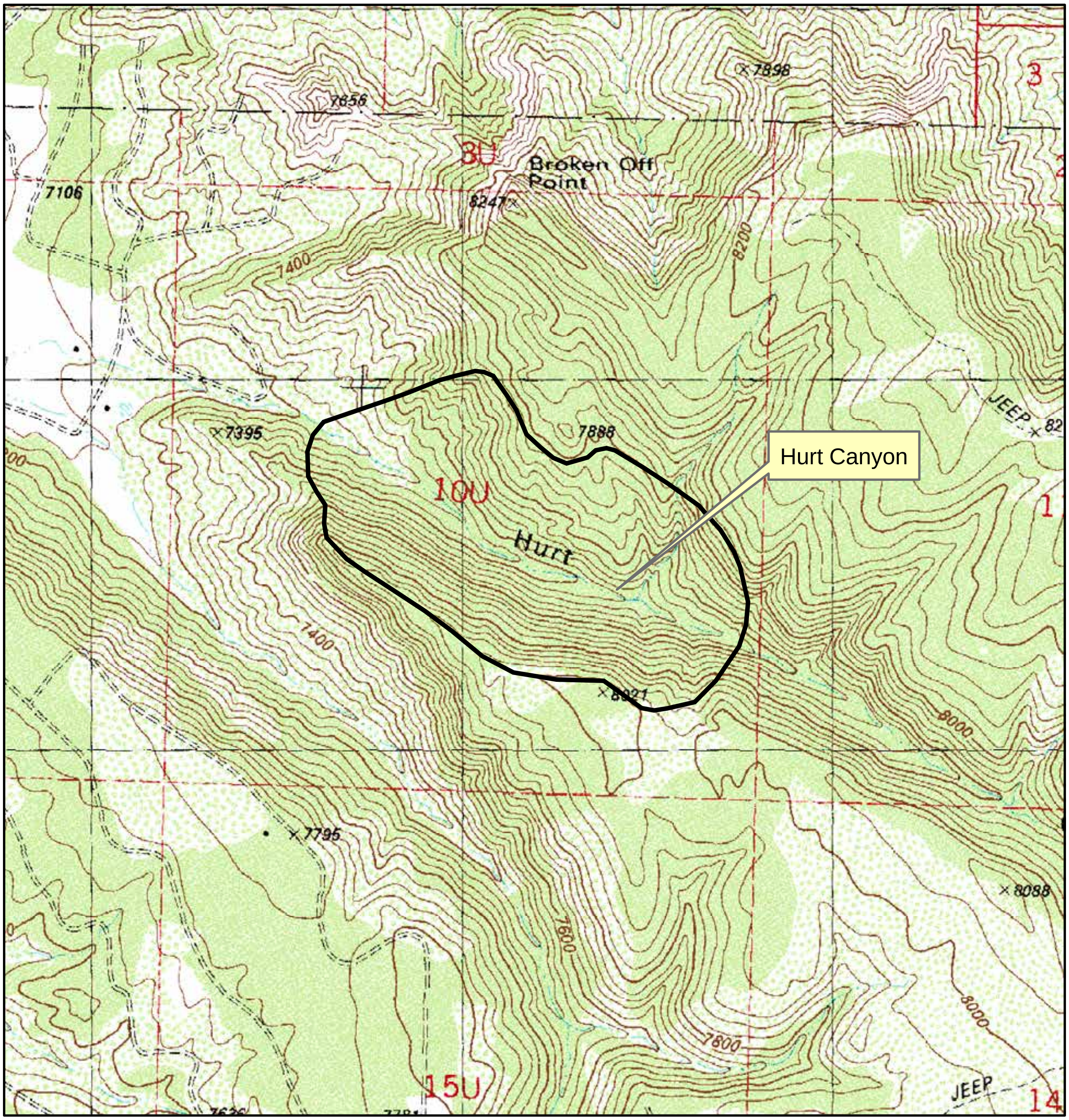
Management Urgency Rank Comments (M4): Although the area is not currently threatened and current management seems to favor the persistence of the element occurrence, management may be needed in the future to maintain its current quality.

Management Needs Comments: Monitor grazing practices upstream, and encroaching residential development around the site and its subsequent impacts, including weed invasion, erosion, and sediment loading into waterways such as the unnamed drainage within Hurt Canyon. Preparation of a baseline weed survey in the near future would benefit the element occurrence over time by providing a method to track development and/or grazing impacts on this site.

Land Use Comments: Current land use is unknown, but it is likely that cattle grazing occurs upstream. No trails or roads enter the area, but plenty of wildlife trails, tracks, and scat were noted within the site.

Natural Hazard Comments: Western poison ivy (Toxicodendron rydbergii) occurs sporadically throughout the canyon.

Exotic Species Comments: There are very few weeds in the site, but common dandelion (Taraxacum officinale) was noted in places.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

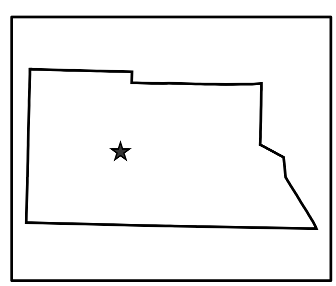
Legend

PCA Boundary

Lonetree Canyon, 37107-B2

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 30. Hurt Canyon Potential Conservation Area, B4: Moderate Biodiversity Significance

Porcupine Creek Meadow

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Blackhead Peak, Harris Lake

Size: 93 acres (38 ha) **Elevation:** 8,480 - 8,860 ft. (2,585 - 2,701 m)

General Description: Porcupine Creek Meadow site is located in the San Juan National Forest in the east central portion of Archuleta County. Squaretop Mountain rises to the east and the Rio Blanco flows downhill of the site. In a broad, very gently sloping meadow in a shallow, west-facing step in the slope below Squaretop Mountain, a Bebb's willow (Salix bebbiana) shrubland co-dominates with a mountain willow (Salix monticola)/Mesic Forb shrubland. The shrubland is in the northern portion of the meadow where an intermittent, unnamed stream flows in an entrenched channel. The meadow and willow shrubland is surrounded by quaking aspen (Populus tremuloides), spruce (Picea spp.), and subalpine fir (Abies lasiocarpa) forests, with a few signs of past logging but not in recent years. Within the shrubland, both willow species are mostly mature plants, with some regenerating plants that are being heavily browsed. The riparian understory is heavily grazed mesic graminoids and forbs, most of which are unidentifiable at their grazed height except where they grow within or between the willow stems. The meadow is also heavily grazed. At the time of the visit the graminoid stubble probably averaged 3 inches or less. It is very difficult to tell how weedy the community is, since it has been so heavily grazed. Many songbirds use the uplands and the willow shrublands for forage and shelter. The local area around the meadow and willow shrubland is used for grazing and for recreation, including OHV use and hunting.

Biodiversity Significance Rank Comments (B4): The site supports a fair (C-ranked) occurrence of the globally vulnerable (G3?) and state imperiled (S2) Bebb's willow (Salix bebbiana) montane willow carr. In Colorado, Bebb's willow stands are infrequent, forming tall thickets with an open to closed canopy. Bebb's willow stands often occur as a component of larger montane mixed-willow carrs or riparian mosaics with other species such as mountain willow (Salix monticola) or thinleaf alder (Alnus incana)(Carsey et al. 2003). The site also supports a fair (C-ranked) occurrence of a mountain willow (Salix monticola)/mesic forb montane riparian willow carr, a plant community considered globally apparently secure (G4) and vulnerable in the state (S3).

Natural Heritage element occurrences at the Porcupine Creek Meadow PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix bebbiana Shrubland	Montane Willow Carrs	G3?	S2				C	2005-07-25
Natural Communities	Salix monticola / Mesic Forbs Shrubland	Montane Riparian Willow Carr	G4	S3				C	2005-07-25

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses the element occurrence and the immediate watershed for the drainage that supports the occurrence. The boundary also includes an approximate 500 foot buffer, and includes nearby roads, trails, and grazing allotments where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. Given that the riparian shrubland is dependent on natural hydrological processes associated with the unnamed drainage where it occurs, upstream activities such as logging, roads, water diversions and impoundments, and improper livestock grazing are detrimental to the hydrology of the riparian area. It should be noted that the hydrological processes necessary to the riparian forest are not fully contained by the site boundaries. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P2): The site is just inside the San Juan National Forest, uphill from a large privately owned parcel. Protection action may be needed within 5 years, as it is estimated that current stresses may reduce the viability of the elements within this approximate timeframe. An opportunity exists to mitigate or eliminate the threats if action is taken in the near future.

General Protection Comments: The site is located just uphill of a large, privately owned parcel and just within the San Juan National Forest boundary where there are heavily used grazing allotments. The current land use (grazing) in this portion of the Forest may need to be reviewed in light of the apparent overgrazing occurring in the allotment.

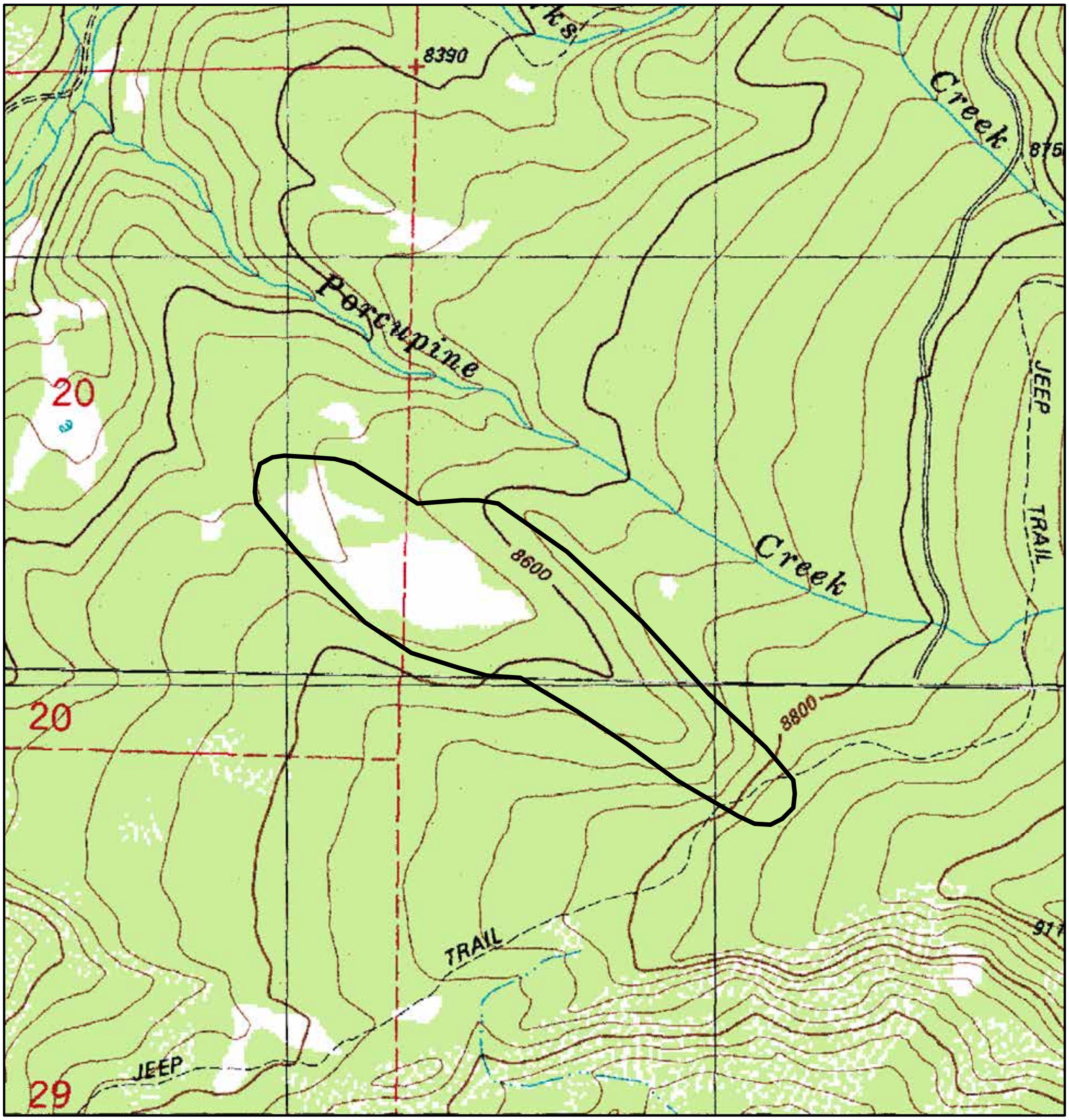
Management Urgency Rank Comments (M1): Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded. Improper grazing regimes are the main threat to the ongoing viability of the elements.

Management Needs Comments: Grazing impacts are severe on this montane meadow and willow carr. Forage height at the time of the visit averaged less than 3 inches across the entire meadow and within the willow shrubland, with the exception of Colorado false hellebore plants and forbs unreachable within the matrix of dense willows. Willows show typical "mushroom" shape from browse, especially on the edges of the carr. Soil compaction and erosion are apparent across the meadow, and hoof erosion is damaging the creek channel within the carr and altering the hydrology by spreading the water in high-traffic areas. It is possible that the impacts of grazing on the drainage channel (entrenchment, erosion) are lowering the water table and inhibiting regeneration of the willow species. A review of the grazing regime within this allotment, including at a minimum the duration, rotation, frequency, season of use, and carrying capacity will be essential in ensuring the ability of the willow carr to persist and regenerate.

Land Use Comments: Intensive grazing is occurring within the meadow where the willow carr occurs, and OHV use and hunting is common in the area. OHV trails criss-cross the hillside around the site.

Exotic Species Comments: It is very difficult to tell how weedy the community is, since it has been so heavily grazed and all that remains is stubble. Most forbs and graminoids are unidentifiable. A very large grasshopper population was heavily predating the Colorado false hellebore (Veratrum tenuipetalum) and what was left of other forbs in the adjacent meadow after intensive cattle grazing. The mesic forbs within the willow shrubland were also being eaten by grasshoppers, but not to the extent of the upland forbs.

Off-Site Considerations: An OHV trail descends the hillside just to the south of the meadow and enters a large private parcel below the National Forest boundary (USDA 2002).



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/05/2006

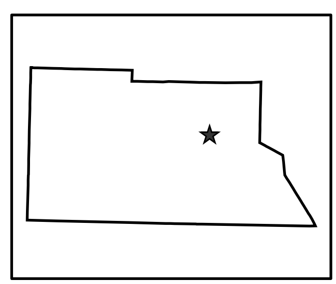
Legend

PCA Boundary

Harris Lake, 37106-B7
Blackhead Peak, 37106-C7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 31. Porcupine Creek Meadow Potential Conservation Area, B4: Moderate Biodiversity Significance

Rio Blanco at Deadman Canyon

Biodiversity Rank - B4: Moderate Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Harris Lake, Serviceberry Mountain

Size: 394 acres (159 ha) **Elevation:** 7,100 - 7,300 ft. (2,164 - 2,225 m)

General Description: The Rio Blanco at Deadman Canyon is located in central Archuleta County, twelve miles south of Pagosa Springs and two miles southeast of Serviceberry Mountain. The Rio Blanco is a mid-elevation river flowing in a one half mile wide valley with a broad floodplain and well-defined riparian zone. It is moderately sinuous within its floodplain, depositing cobble on bars within the river and sediment on higher ground, where dense stands of thinleaf alder (Alnus incana ssp. tenuifolia) and sandbar willow (Salix exigua) dominate the riverbanks and are regenerating well. The alder displays some branch dieback as seen in other parts in the county, but is not as widespread as in other county locations. At the upper (east) end of the site, Pacific willow (Salix lucida ssp. lasiandra) and strapleaf willow (Salix ligulifolia) both occur within thinleaf alder/mixed willow community, but in low percentages. On the terraces, the alder decreases and sandbar willow is dominant, with strapleaf willow, Woods' rose (Rosa woodsii), redosier dogwood (Cornus sericea) and sapling narrowleaf cottonwood (Populus angustifolia). The understory is fairly weedy in the higher areas with exotic forb and graminoid species, but a narrow fringe of native hydrophytic plants such as common spikerush (Eleocharis palustris) occurs in flat, depositional areas along the river's edge. Blanco River Campground, a popular and heavily used USFS campground, occurs at the downstream end of the documented thinleaf alder/mixed willow community, and human-induced impacts immediately surrounding the campground boundaries can be heavy. The middle stretch of the river, below Blanco River Campground, has relatively low impacts except by cattle grazing. No roads directly access the river here, and dense Douglas-fir (Pseudotsuga menziesii) and blue spruce (Picea pungens) forests between the road and the river restrict views and limit accessibility. Within this stretch, riparian vegetation is vigorous and regenerating and dominated by a mix of willow species and scattered blue spruce and narrowleaf cottonwood individuals in the floodplain. At the lower end of the site, the banks of the river are occupied by dense stands of alder, mixed willow species and patches of silver buffaloberry (Shepherdia argentea), with a somewhat sparse herbaceous understory of mesic forbs and graminoids such as starry false lily of the valley (Maianthemum stellatum), cutleaf coneflower (Rudbeckia laciniata var. ampla), and creeping bentgrass (Agrostis stolonifera). Here another thinleaf alder/mixed willow community co-dominates with a Silver Buffaloberry shrubland community. There is a scattered, mature narrowleaf cottonwood component, especially near the downstream end of the occurrence. The forest on the surrounding hillsides consists of Douglas-fir and blue spruce on north-facing slopes, with a ponderosa pine (Pinus ponderosa ssp. scopulorum) forest with a hay grass understory on warmer, higher, dryer aspects. The area sees moderately heavy recreational use, particularly fishing and camping. The hydrology of the river has been altered upstream by a large, regional irrigation diversion, and Highway 84 crosses the river several hundred yards downstream of the site.

Key Environmental Factors: The wide valley floor and old side channels allows the river to spread in the event of a flood. The riverbanks are generally low and well vegetated, though some portions of the steeper banks on the north side of the river are eroding, apparently from natural causes, not necessarily from grazing impacts. The soils and streambed substrate are porous and probably provide significant groundwater recharge. The habitat diversity is limited to narrow fringes of emergent habitat and the more dominant scrub-shrub woody riparian vegetation. The canopy cover is dense in the shrub layer, but the tree canopy is open or nonexistent, providing little shade to the river. This, along with a fairly broad and shallow river with few deep pools, detracts from quality fish habitat.

Biodiversity Significance Rank Comments (B4): This site supports a fair (C-ranked) occurrence of thinleaf alder-mixed willow (Alnus incana ssp. tenuifolia-Salix (monticola, lucida, ligulifolia)) shrubland, a plant community that is globally vulnerable (G3/S3). This community type is often associated with beaver ponds and grazing disturbances, and may indicate a shift in physical setting, such as from a steep narrow valley to a broader, gentler valley (Carsey et al. 2003). The site also supports a fair (C-ranked) occurrence of silver buffaloberry (Shepherdia argentea) foothills riparian shrubland, a globally vulnerable (G3G4) plant community that is extremely rare (S1) in Colorado. This mesic community typically occurs in mosaic with other riparian plant communities such as willows or cottonwoods, and often occurs along broad river floodplains that, in Colorado, are typically impacted by improper grazing practices and altered hydrology. As of 2005, this community type is known from only 11 locations in the state, and the majority of these are located in southwestern Colorado.

Natural Heritage element occurrences at the Rio Blanco at Deadman Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix (monticola, lucida, ligulifolia) Shrubland	Thinleaf Alder - Mixed Willow Species	G3	S3				C	2005-07-19
Natural Communities	Shepherdia argentea Shrubland	Foothills Riparian Shrubland	G3G4	S1				C	2005-07-19

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, channel migration, and sediment deposition to continue, maintaining a viable population of the riparian shrubland along the Rio Blanco. However, it is unclear if the linear gravel mounds present alongside the river channel in its lower reach prevent natural flooding of the terrace. The adjacent steep slopes that would most likely impact the riparian shrubland if altered are also included. The boundary also provides a small buffer from nearby roads where surface runoff may contribute excess nutrients, pollutants, and sediment. Eliminating disturbance within this buffer would also aid in reducing impacts from sedimentation (Karr and Schlosser 1978), and assist in maintaining the integrity of the occurrence and its associated avian, macroinvertebrate and periphyton communities (Noel et al. 1986, Spackman and Hughes 1995).

Protection Urgency Rank Comments (P4): This site is entirely within the San Juan National Forest, but is located just inside the forest boundary and there is development on the private land adjacent to the boundary. If forest ownership is maintained, this area should be adequately protected and no protection actions are needed in the foreseeable future.

Management Urgency Rank Comments (M1): Management actions may be required within one year or the riparian shrubland could be irretrievably degraded. Management of non-native plant species is needed to prevent further degradation of the community and implementation of appropriate grazing practices would benefit the riparian shrubland. A levee-like berm occurs along the downstream-most 1/3 mile of river, preventing lateral river migration except in exceptionally high flows. It is undetermined whether this "levee" is natural deposition or man-made, but an old abandoned river channel is obvious between the "levee" and the well-traveled Forest Service road.

Management Needs Comments: Monitor the spread of invasive species from cattle grazing and recreational uses in the area. Dispersed camping areas in the floodplain show impacts from vehicular travel, fire rings, and significant litter and other debris;

land managers may want to consider monitoring usage and disturbances in this area to determine if closing the area to dispersed camping would minimize ongoing impacts.

Land Use Comments: The site occurs on USFS land, and is surrounded by USFS land. Forest Road 656 parallels the river for 2.5 miles on the south side, but is not immediately adjacent to the river. This road dead-ends at the popular Blanco Campground upstream. Downstream of the campground, near the highway, dispersed camping occurs on the broad floodplain as evidenced by short access roads, fire rings and litter. Grazing also occurs within the site, contributing to streambank erosion and the spread of weeds.

Exotic Species Comments: The herbaceous understory of the riparian zone contains some invasive species including Canada thistle (Cirsium arvense), American licorice (Glycyrrhiza lepidota), and smooth brome (Bromus inermis). However, the uplands adjacent to the riparian zone are dominated by weeds in the herbaceous layer, with patches of bare soil.

Off-Site Considerations: A busy road, Highway 84 between Pagosa Springs and Chama, New Mexico, is located immediately downstream of the communities, and the river runs under a large bridge at the highway and enters private land. Upstream of the site on the Blanco River, there are large ranches, stock ponds, small diversions and a large irrigation diversion at the Blanco Dam, though no reservoir exists at this location. A large, lightening-caused fire burned in the watershed on the north side of the river on the Winter Hills in 2005. Impacts to the community are not noticeable at this time, but increased sediment loading to the river for several years would not be unexpected.

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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

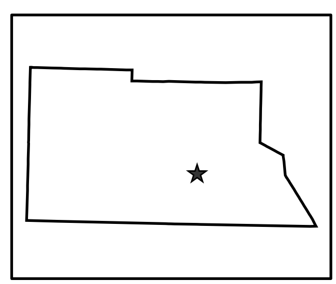
Legend

PCA Boundary

Harris Lake, 37106-B7
Serviceberry Mtn, 37106-B8

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 32. Rio Blanco at Deadman Canyon Potential Conservation Area, B4: Moderate Biodiversity Significance

San Juan River at Trujillo

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Oakbrush Hill, Trujillo

Size: 1,412 acres (572 ha) **Elevation:** 6,520 - 6,740 ft. (1,987 - 2,054 m)

General Description: The San Juan River is a major tributary to the Colorado River in the southwest United States, whose headwaters begin in Mineral and Archuleta counties in Colorado. Within the site, the river flows 7.5 miles generally north to south, passing through canyon, mesa and foothill topography in the south-central part of Archuleta County. Several miles below the site to the southwest, the river enters Navajo Reservoir at the state line. The river passes through mostly privately owned properties, and a few small parcels belonging to the US Forest Service and the Southern Ute Indian Tribe. The river flows alternately through narrow canyons and broad valleys, and the channel migrates over time within its floodplain, especially in the broader valleys where it is less constricted by topography. The natural flooding regime in this portion of the San Juan River above Navajo Reservoir is intact, with the exception of many small irrigation diversions. The river carries a high bedload of cobble and gravel, depositing these materials on many large islands and point bars which in turn support pioneering sandbar willow (Salix exigua), and narrowleaf cottonwood (Populus angustifolia) saplings. In several places, stands of silver buffaloberry (Shepherdia argentea) and sandbar willow occur in the understory of a cottonwood gallery on the first terrace above the river. The silver buffaloberry is in dense stands, often along both sides of the river, with a nearly contiguous component of sandbar willow mixed in. Hay grasses such as cheatgrass, smooth brome, and Kentucky bluegrass (Bromus tectorum, Bromus inermis, and Poa pratensis) nearly always dominate the herbaceous understory, along with weedy forbs like musk thistle (Carduus nutans), oxeye daisy (Leucanthemum vulgare), and yellow sweetclover (Melilotus officinalis). Where cattle have not grazed regularly or cannot access the riparian zone, the riparian cottonwood-willow-buffaloberry community tends to be more dense and vigorous. Under the mature cottonwood canopy on the terrace, a mid-story canopy of boxelder (Acer negundo var. interius) may occur, and the native vine western white clematis (Clematis ligusticifolia) often densely climbs all over the silver buffaloberry and sandbar willow on the riverbank. Hydrophytic vegetation such as common spikerush (Eleocharis palustris) may exist in small, patchy fringes along the river. In general, the terraces within the floodplain of the lower San Juan River typically support a patchwork of narrowleaf cottonwood galleries, often with a subcanopy of Rocky Mountain juniper (Juniperus scopulorum) and scattered boxelder, and a riparian shrub layer dominated by sandbar willow, patches of silver buffaloberry, and a mix of other riparian shrubs on the terraces. Periodically along the river, the native vegetation at the riverbanks has been replaced with hay meadows, pastures or residential development, only to have stands of riparian vegetation reappear downstream and between openings. This pattern is typical and continues down the length of the San Juan River from Pagosa Springs to Navajo Reservoir. Adjacent hillsides along the river have frequent sandstone and shale outcrops, and are dominated by Rocky Mountain juniper, Utah juniper (Juniperus osteosperma), skunkbush sumac, mountain mahogany (Cercocarpus spp.), and ponderosa pine. A small population of roundtail chub (Gila robusta) occupies a 22 mile stretch of the San Juan River between the small community of Trujillo and Navajo Reservoir, as documented by an electroshocking survey. However, the presence of smallmouth bass (Micropterus dolomieu) poses a significant threat to the ongoing viability of this small population.

Key Environmental Factors: The surface geology of the upper half of the site is mapped as a mix of Mancos shale and Mesaverde Group, Undivided, which is composed of sandstone and shale. The lower half then enters a long stretch of Mesaverde Group, afterwards transitioning into Pictured Cliffs Sandstone and Lewis Shale (Tweto 1979). Soils within the floodplain are alluvial, with cobble and large sandy deposits on the floodplain, point bars, banks, and on the first terrace. Rounded cobbles pave the riverbed averaging 4"-15" in diameter. Soils on the first terrace are characterized by a relatively shallow horizon of sandy loam, often mottled and with few roots, over a mix of cobble, gravel and sand.

Biodiversity Significance Rank Comments (B4): The site supports two fair (C-ranked) occurrences of the globally vulnerable (G3/S3) narrowleaf cottonwood/strapleaf willow-silver buffaloberry (Populus angustifolia/Salix ligulifolia-Shepherdia argentea) riparian forest. This occurrence is common on the terraces of alluvial floodplains in broad, low-elevation river valleys, and is found within Colorado in western and southwestern counties. As of 2005, several known occurrences are within Archuleta County along the Piedra River and the San Juan River.

Natural Heritage element occurrences at the San Juan River at Trujillo PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				C	2005-08-11
Natural Communities	Populus angustifolia / Salix ligulifolia - Shepherdia argentea Woodland	Narrowleaf Cottonwood Riparian Forests	G3	S3				C	2005-08-17

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary incorporates an area that will allow natural hydrological processes such as seasonal flooding, channel migration, and sediment deposition to continue, and to maintain viable populations of the riparian communities along the San Juan River. The broad floodplain and the steep slopes adjacent to the occurrences that would most likely impact the riparian zone if altered are also included. The boundary also reflects an approximate 1,000 foot buffer, which includes nearby roads, houses, and hay meadows where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. It should be noted that all the hydrological processes necessary to support the riparian communities are not fully contained by the site boundaries. Given that the riparian communities are dependent on natural hydrological processes associated with the San Juan River, upstream activities such as water diversions and impoundments, improper livestock grazing, logging, and development are detrimental to the hydrology of the riparian area. Although this site was not designed for the roundtail chub (Gila robusta) occurrence, these riparian communities also may provide adequate riparian vegetation for cover and possible prey (insect) needs for the fish habitat, though this may not be sufficient to ensure the persistence of the population. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P3): Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses including potential residential development and continuing agricultural uses may reduce the viability of the element occurrences if protection action is not taken.

General Protection Comments: The site exists mostly over privately owned lands, though a small portion is owned by the US Forest Service, and several portions in the downstream half are owned by the Southern Ute Indian Tribe (SUIT). The uppermost portion (one river mile), a private parcel, is under conservation easement, but the remaining area has no protections at this time. Conservation easement education for the private landowners and the SUIT would be an excellent step toward protection for the areas containing element occurrences. Conservation easements placed on private lands may conserve the natural values of the site as well as providing tax credits and other financial benefits to the landowner. Education about riparian ecology and fish habitat may also benefit landowners and land managers, especially those landowners who currently graze livestock within the riparian zone.

Management Urgency Rank Comments (M3): New management actions may be needed within 5 years to maintain the current quality of the element occurrences. Impacts from improper grazing on the riparian vegetation, weed invasion, water diversions, and stocking of non-native predatory or competitive species are the main threats that could be minimized with new management practices.

Management Needs Comments: The most urgent management need is in gaining control of the state-prioritized noxious weed saltcedar, while the population is still small. Control of Canada thistle, musk thistle and other invasive herbaceous weeds is a slightly lower priority than controlling the saltcedar, but would also benefit the long-term viability of the communities. Canada thistle and Musk thistle are both Colorado-prioritized and Archuleta County-listed noxious weed species (State of Colorado, no date). Removing grazing from the riparian area will also protect the regenerating narrowleaf cottonwood, silver buffaloberry and willow species. In lieu of removing grazing, improved grazing management (duration, rotation) may assist landowners in gaining control over some of the herbaceous weeds. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may also provide some assistance with control and eradication of non-native species. In regards to the roundtail chub population, management of riparian grazing will benefit the population by allowing more vegetation to shade portions of the river and provide cover and forage (insects), but unless non-native predatory and competitive fish species are reduced or eradicated from the river, the chub population may never reach a large, healthy size (Japhet 2003).

Land Use Comments: Residential development on 5-40 acre parcels, and agricultural development in the form of irrigated pastures, hay meadows, and livestock grazing are the most common land uses. Fishing access points may occur along the SUIT lands. Irrigation diversions are common, and adjacent upland terraces are commonly irrigated for hay meadows or irrigated pasture. Scattered residences as well as clustered residential areas also occur, and a historic cemetery exists within the southernmost portion of the site. Trujillo Road (County Road 500), a maintained gravel road, parallels the San Juan River. River rafting trips float through this stretch of river, but typically do not disembark within the riparian zone during their trips.

Exotic Species Comments: Several specimens of saltcedar (Tamarix ramosissima) were located in the southernmost part of the site, and taking immediate steps to eradicate the saltcedar is essential to prevent further spread of this very invasive, quickly spreading species. Unfortunately, larger populations of saltcedar are known to occur downstream at Navajo Reservoir, but eradication would benefit the community occurrences and prevent further spread. The herbaceous layer within the riparian zone along most of the San Juan River consists of mostly weedy species, which is a common finding in low elevation riparian zones that have experienced heavy grazing over many years (Carsey et al. 2003). Weeds commonly found include but are not limited to: cheatgrass (Bromus tectorum), foxtail barley (Hordeum jubatum), redtop (Agrostis gigantea), musk thistle (Carduus nutans), black medic (Medicago lupulina), yellow sweetclover (Melilotus officinalis), oxeye daisy (Leucanthemum vulgare), common dandelion (Taraxacum officinale), rough cocklebur (Xanthium strumarium), and whitetop (Cardaria draba). Other species occurring on the terraces but not necessarily within the communities include alfalfa (Medicago sativa), field bindweed (Convolvulus arvensis), white clover (Trifolium repens), tumble mustard (Sisymbrium sp.) and chicory (Cichorium intybus). In addition, smallmouth bass (Micropterus dolomieu) have been identified as a potential predatory species for the roundtail chub within the river (Japhet 2003).

Information Needs: This area could serve as excellent restoration projects focusing on maintenance of native riparian shrub cover and eradication of noxious weeds and non-native grasses. Landowners may benefit from restoration assistance programs provided by the Colorado Division of Wildlife-sponsored Southwest Wetlands Focus Group, or the Natural Resources Conservation Service (NRCS).

0 0.4 0.8 1.6 2.4 Miles

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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
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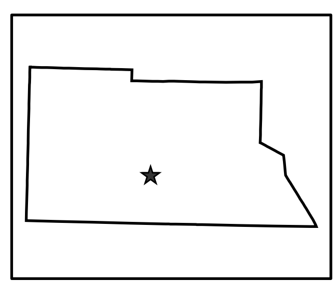
Legend

PCA Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 33. San Juan River at Trujillo Potential Conservation Area, B4: Moderate Biodiversity Significance

Sparks Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

U.S.G.S. 7.5-minute quadrangles: Blackhead Peak

Size: 560 acres (227 ha) **Elevation:** 8,400 - 9,800 ft. (2,560 - 2,987 m)

General Description: In the northeast corner of Archuleta County, Sparks Creek is a small, perennial creek with a moderate grade flowing westward off the flanks of Squaretop Mountain in a small, narrow and shallow draw. It eventually joins the Rito Blanco about one mile below the site. The creek sinuosity is good, and the creek has a narrow floodplain and is not incised. A narrow and mature blue spruce/thinleaf alder (Picea pungens/Alnus incana ssp. tenuifolia) riparian woodland dominates the immediate floodplain and this overstory provides even shade to most of the creek. Both mature and sapling alder and blue spruce occur throughout the community and are vigorous and healthy. The thinleaf alder (Alnus incana ssp. tenuifolia) are not displaying the extent of branch dieback seen in other parts of the county, although some dieback is occurring downstream of the occurrence. The understory is fairly open and comprised of mesic forbs such as common cow parsnip (Heracleum maximum) and cutleaf coneflower (Rudbeckia laciniata var. ampla), graminoids such as fowl mannagrass (Glyceria striata) and bluejoint grass (Calamagrostis canadensis), and riparian shrubs such as twinberry honeysuckle (Lonicera involucrata var. involucrata) mixed with open areas of litter, fallen logs, and duff. Hydrophytic vegetation, including small stands of retrorse sedge (Carex retrorsa) and smallwing sedge (Carex microptera), occurs in flat, seepy areas, usually within the floodplain or near the creek. The surrounding forest and adjacent uplands have mature corkbark fir (Abies lasiocarpa var. arizonica), blue spruce (Picea pungens), Rocky Mountain maple (Acer glabrum), and quaking aspen (Populus tremuloides) growing on short, steep hillsides with a forb and graminoid understory. Few weeds were found in the understory, although the presence of hay grasses such as orchardgrass (Dactylis glomerata), Kentucky bluegrass (Poa pratensis), and timothy (Phleum pratense) increases downstream. Weeds seem to be localized along forest roads and OHV trails, although oxeye daisy (Leucanthemum vulgare) and common dandelion (Taraxacum officinale) were seen in a few places near the creek as well. The site is within the San Juan National Forest, and the surrounding forest is mature with a few signs of long-past logging. The hydrologic regime is mostly intact except for twin culverts at the Forest Road 024 crossing, and culverts at two downstream OHV trail crossings. In the middle of the site an old jeep trail, which is signed prohibiting vehicular travel, crosses the bed of Sparks Creek without culverts just upstream from FR 024. There is no evidence of recent vehicular travel on this jeep trail. Trampling and soil disturbance by cattle occurs mostly above the culverts at any road or OHV crossings, otherwise grazing impacts to the creek are not frequent. However, a salt lick placed near the midpoint of the site concentrates the cattle on the allotment, and the creek in that location is heavily impacted by the cattle as evidenced by severely eroding banks, broken branches, pushed-over trees and shrubs, and denuded soils, especially within 200 feet of the salt lick and along the creek banks.

Key Environmental Factors: Field ecologists in 2005 found that retrorse sedge appears to occupy clayey soils on muddy shorelines or creek banks, and sometimes within shallow standing water roughly between 8,000 and 9,500 feet elevation. In this site, the soils in which the retrorse sedge was growing were determined to be silty clay loams, with a higher component of sandy soils within the creek bed.

Biodiversity Significance Rank Comments (B4): The site is drawn for a fair (C-ranked) occurrence of the globally vulnerable (G3) and state vulnerable (S3) blue spruce/thinleaf alder (Picea pungens/Alnus incana) montane riparian forest plant community, which typically occurs in shady canyons and narrow valleys subject to infrequent flood events. A fair (C-ranked) occurrence of the globally secure (G5) but statewide critically imperiled (S1) retrorse sedge (Carex retrorsa) also occurs within the site.

Natural Heritage element occurrences at the Sparks Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				C	2005-07-20
Vascular Plants	Carex retrorsa	retrorse sedge	G5	S1				C	2005-07-20

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary was drawn to include the known extent of the element occurrences and an additional area large enough to include the natural hydrologic flows, including surface and groundwater flows, which support the habitat for the element occurrences. The boundary represents the immediate watershed for the riparian system in which the elements occur, with a minimum 500-foot buffer. The boundary indicated is the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest.

General Protection Comments: The site is entirely within the San Juan National Forest. No special protection is in place, and should not be required if the present management and level of public use continues.

Management Urgency Rank Comments (M3): New management actions are needed within 5 years to maintain the viability of the element occurrences in the site. Removal of or changing the location of the salt lick at Sparks Creek during grazing duration on this allotment may help to minimize impacts and help to ensure longterm viability of the elements in the site.

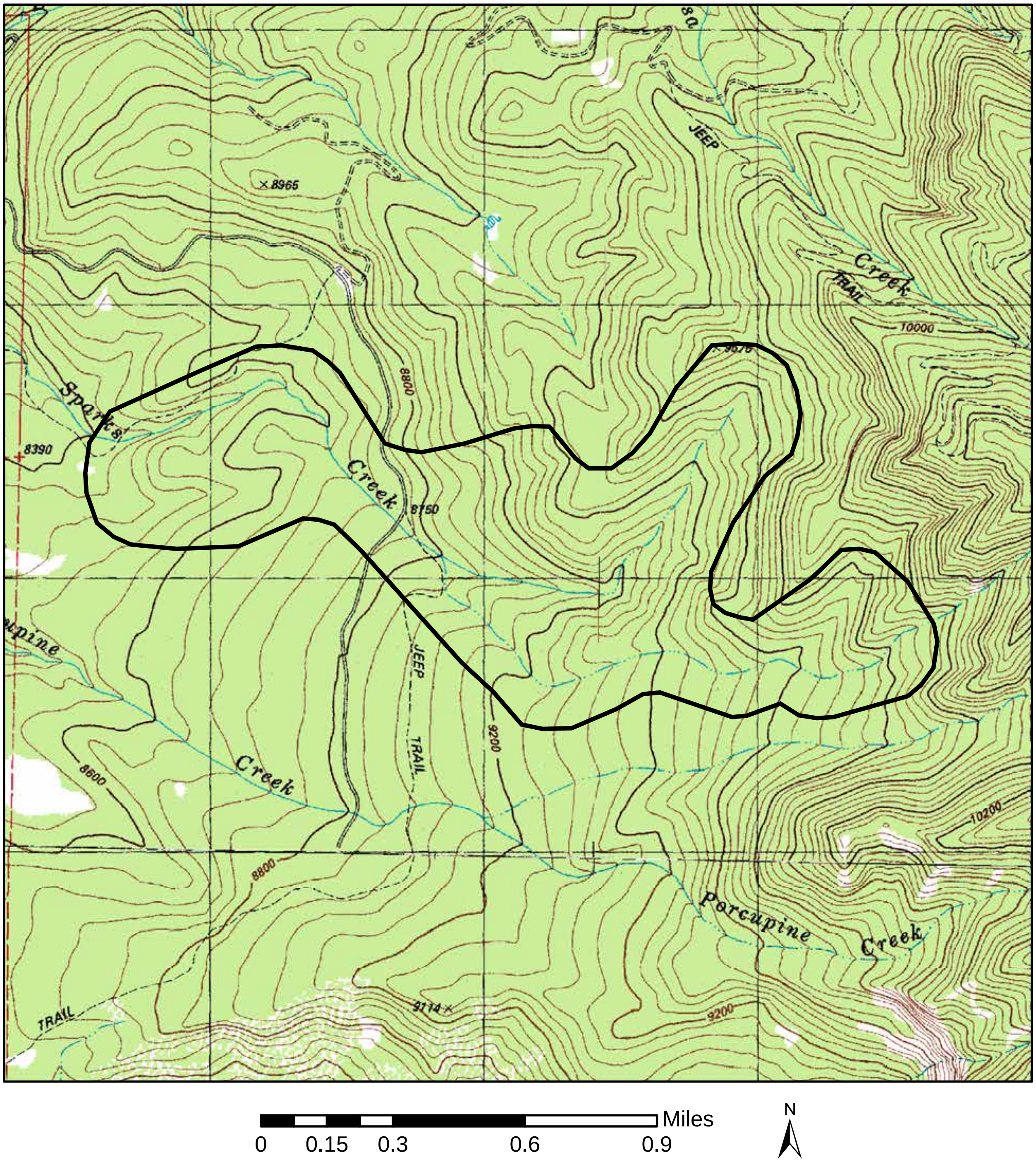
Management Needs Comments: Recreational use by OHV users and heavy cattle grazing may have deleterious effects on the element occurrences. Monitoring for changes in the element occurrences, cattle and OHV impacts, and hydrology of the site would help to ensure the long-term viability of the element occurrences.

Land Use Comments: An old jeep track follows Sparks Creek above where the creek crosses FR 024. Signs on the track at its junction with FR 024 state that vehicular travel is prohibited, but no gates or other physical barriers prevent unauthorized use. Several active four-wheel drive or OHV trails criss-cross the slope below FR 024, and cross the creek in several places. These are most likely used most frequently during hunting season. Logging has occurred in the past on this part of the San Juan National Forest, and the tree stumps do not appear to be recent (at least 10 years old).

Exotic Species Comments: Exotic or invasive plant species, notably oxeye daisy and common dandelion, are infrequent within this site and appear to be localized mostly near the Forest Road and OHV trails, as well as the area near the existing salt lick where cattle tend to congregate.

Off-Site Considerations: A large privately owned parcel occurs 1,000 feet down slope of the site. Ocular reconnaissance from USFS lands and aerial photos (USDA 2002) indicate that it currently has a road that crosses Sparks Creek below the site, but otherwise the parcel appears undeveloped and utilized only for grazing. Sparks Creek's blue spruce/thinleaf alder riparian community is in much better shape than the same community on the adjacent Porcupine Creek drainage (to the south). Porcupine Creek is much more utilized by cattle and is more impacted, and the alder on that riparian system is exhibiting significant branch dieback.

Information Needs: A survey to determine the full extent of the population of retrorse sedge and the blue spruce/thinleaf alder community would be beneficial for management of the area.



Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
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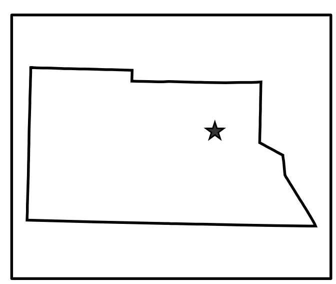
Legend

PCA Boundary

Blackhead Peak, 37106-C7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 34. Sparks Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

Turkey Creek at Snowball Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Jackson Mountain, Saddle Mountain

Size: 356 acres (144 ha) **Elevation:** 7,840 - 8,280 ft. (2,390 - 2,524 m)

General Description: Turkey Creek is located in the north central portion of Archuleta County north of Jackson Mountain. It flows generally southward from its headwaters in Hinsdale County to its confluence with the San Juan River, north of Pagosa Springs. Turkey Creek flows through a moderately narrow montane valley with steep side slopes dominated by montane spruce-fir forests comprised of blue spruce (Picea pungens), corkbark fir (Abies lasiocarpa var. arizonica) and white fir (Abies concolor). Within this very productive valley, Turkey Creek, groundwater discharges, and seeps from an ill-defined ditch diversion (Snowball Ditch) support a lush diversity of riparian vegetation and mossy areas with tall mesic forbs. On a step of a northeast-facing side slope above Turkey Creek, retrorse sedge (Carex retrorsa) occupies the moist fringes of a depressional wetland. The wetland is groundwater and surface water fed, and overflow drains down slope into Turkey Creek. The pond displays a diverse vegetation structure; riparian shrub communities dominated by thinleaf alder (Alnus incana ssp. tenuifolia), red-osier dogwood (Cornus sericea), Rocky Mountain maple (Acer glabrum), park willow (Salix monticola) and tall mesic forbs occupy the south (north-facing) and west shorelines, which are steep and rocky. The more gently sloping shorelines of the wetland are dominated by retrorse sedge (Carex retrorsa) and meadow sedge (Carex praticola), with more saturated areas dominated by northern water plantain (Alisma triviale) and beaked sedge (Carex utriculata). Most of the pond is open, deeper water, while emergent vegetation including common spikerush (Eleocharis palustris) and narrowleaf bur-reed (Sparganium angustifolium) occur in shallow standing water near the shoreline. Soil on the shoreline is silty clay loam. Impacts due to recreation include dispersed campsites, fishing trails, and associated soil compaction and erosion, and some weed invasion by pasture grasses. Most impacts occur near the streambanks, and there are few direct impacts upslope at the wetland, which supports the element occurrence.

Key Environmental Factors: Field ecologists in 2005 found that retrorse sedge (Carex retrorsa) occupies clayey soils on muddy shorelines, and sometimes within shallow standing water, of depressional wetlands roughly between 8,000 and 9,500 feet elevation. Soils at the wetland shoreline display a single horizon (42 cm+) of silty clay loam with wood pieces and few roots. Water collected at 20 cm depth in the soil pit and soil was saturated to the surface.

Biodiversity Significance Rank Comments (B4): The site supports a good (B-ranked) example of the demonstrably globally secure (G5) and state critically imperiled (S1) retrorse sedge (Carex retrorsa). Retrorse sedge (Carex retrorsa) has a broad distribution throughout the north half of North America, but, as of 2005, is known only in Colorado from several locations in Archuleta County.

Natural Heritage element occurrences at the Turkey Creek at Snowball Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Carex retrorsa	retrorse sedge	G5	S1				B	2005-07-08

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the ecological processes necessary for the viability of the element occurrence; specifically the immediate watershed and the groundwater and surface water flows that support the element occurrence. The boundary also identifies a buffer around the trails and dispersed campsites where surface runoff may contribute nutrients and sediment, and where impacts may promote weed invasion. It should be noted that not all the hydrologic processes necessary to the element occurrences are contained within the boundary.

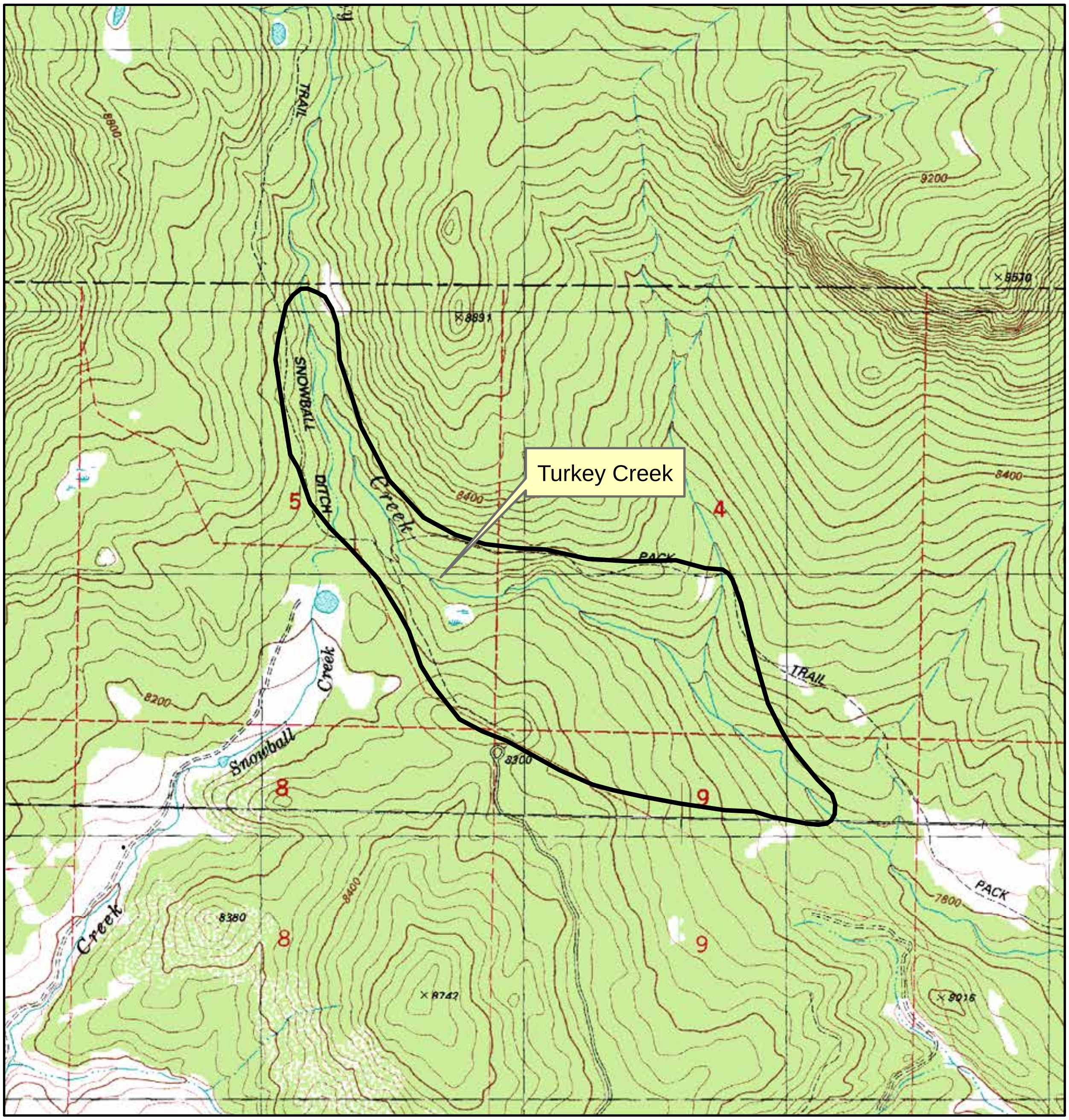
Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is almost entirely within the San Juan National Forest, with a small portion of the western edge under private ownership.

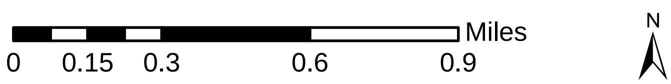
General Protection Comments: The site is almost entirely within the San Juan National Forest-Pagosa Ranger District, with a small portion of the western edge under private ownership.

Management Urgency Rank Comments (M4): Current management seems to favor the persistence of the element within the site, but management actions may be needed in the future to maintain the current quality of the element occurrence.

Management Needs Comments: There are few impacts directly to the element occurrence, though the plants appear to be grazed by wildlife. It may be beneficial to monitor and restore impacts caused by dispersed camping and fishing trails along Turkey Creek. The first few miles of Turkey Creek trail, which passes through the site and uphill from the wetland area, is open to ATV and motorcycle use up to the Wilderness boundary. Impacts by motorized vehicles are evident on and near the trail (tracks, erosion). The fork of the trail that drops down to the creek is not easily accessible by motorized vehicles and may provide intrinsic protection to the area surrounding Turkey Creek.

Exotic Species Comments: Weed invasion appears to be localized near trails. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.





Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

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Fax (970) 491-3349
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Map Date: 12/22/2005

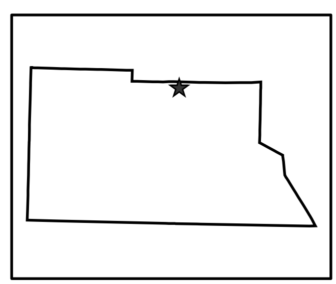
Legend

PCA Boundary

Jackson Mountain, 37106-C8
Saddle Mountain, 37106-D8

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 35. Turkey Creek at Snowball Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

Upper Coyote Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Chromo

Size: 183 acres (74 ha) **Elevation:** 8,560 - 9,800 ft. (2,609 - 2,987 m)

General Description: Coyote Creek site is located in the southeast portion of Archuleta County, in the San Juan National Forest, draining west-southwest from below V-Rock until it joins with Spence Creek and turns south, joining the Navajo River many miles downstream. Coyote Creek flows through a narrow, montane channel with a moderate gradient, little sinuosity, and many pools caused by downed wood, rocks and gradient changes. The rough land surface is caused in part by the surface geology in the area, which is dominated by landslide deposits (Tweto 1979) visible in the slumping hillsides. The creek passes through a culvert where it crosses FR 663. Grazing is heavy in the area, and impacts noted include cow trails, hoof shearing and bank erosion in areas where cattle water or cross the creek. Tall thinleaf alder (Alnus incana ssp. tenuifolia) dominates the stream channel, with a lush diversity of mesic forbs in the understory. Examples of the native composition within the herbaceous component include beaked sedge (Carex utriculata), tall mannagrass (Glyceria elata), smallwing sedge (Carex microptera), largeleaf avens (Geum macrophyllum), Fendler's cowbane (Oxypolis fendleri), common cowparsnip (Heracleum maximum), Fendler's waterleaf (Hydrophyllum fendleri) and several others. Weedy species include common dandelion (Taraxacum officinale) within the riparian area and pasture grasses such as Kentucky bluegrass (Poa pratensis) on adjacent uplands. Surrounding uplands consist of spruce-fir (Picea spp.-Abies spp.) forests on north-facing slopes and quaking aspen/snowberry (Populus tremuloides/Symphoricarpos rotundifolius) forests on the south-facing slopes. In open meadows there are stands of Colorado false hellebore (Veratrum tenuipetalum).

Key Environmental Factors: Soils in the riparian area are alluvial with angular cobble and silty clay, silty loam, and sandy deposits. Soils are mapped as Hunchback clay loams, which occur on fans and toe slopes and are derived from fine textured alluvium and colluvium from mixed rock sources (USDA 1981).

Biodiversity Significance Rank Comments (B4): The site supports the globally vulnerable (G3/S3) thinleaf alder (Alnus incana)/mesic forbs riparian shrubland plant association in fair (C-ranked) condition. This plant association is characterized by a tall riparian shrub component with fewer shorter shrubs and a lush diversity of mesic forbs and wetland graminoids (Carsey et al. 2003). Upper Coyote Creek site displays a classic example of the association. Alder is typically considered an early-seral species where it is one of the first to establish on fluvial or glacial deposits (Carsey et al. 2003).

Natural Heritage element occurrences at the Upper Coyote Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				C	2005-06-23

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the element occurrence and areas that are identified as a buffer that reflect the ecological processes supporting the wetland, including the immediate watershed, surface runoff, and groundwater discharge. The boundary also identifies an area that can provide a buffer from nearby trails, roads and open range where surface runoff may contribute excess nutrients, sediment and weed invasion. It should be noted that the hydrologic processes necessary to the element are not fully contained by the site boundaries.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is within the San Juan National Forest.

General Protection Comments: Lands are owned and managed by the San Juan National Forest, Pagosa Ranger District. Grazing allotments within the site and in surrounding areas are heavily used and grazing pressure can be considered moderate to heavy.

Management Urgency Rank Comments (M2): New management actions may be needed within 5 years to prevent the loss of the element occurrence within the site. Heavy grazing, especially on the uplands adjacent to the riparian area, are negatively affecting the viability of the element. The Blanco Tunnel, a major US Bureau of Reclamation subterranean water diversion in the area, is mapped within the western boundary of the site but no surficial impacts to the area were noted. It was built in the late 1960's as part of the San Juan-Chama Project, to divert water from the San Juan River Basin across the Continental Divide and into the Rio Grande River Basin (USDI no date).

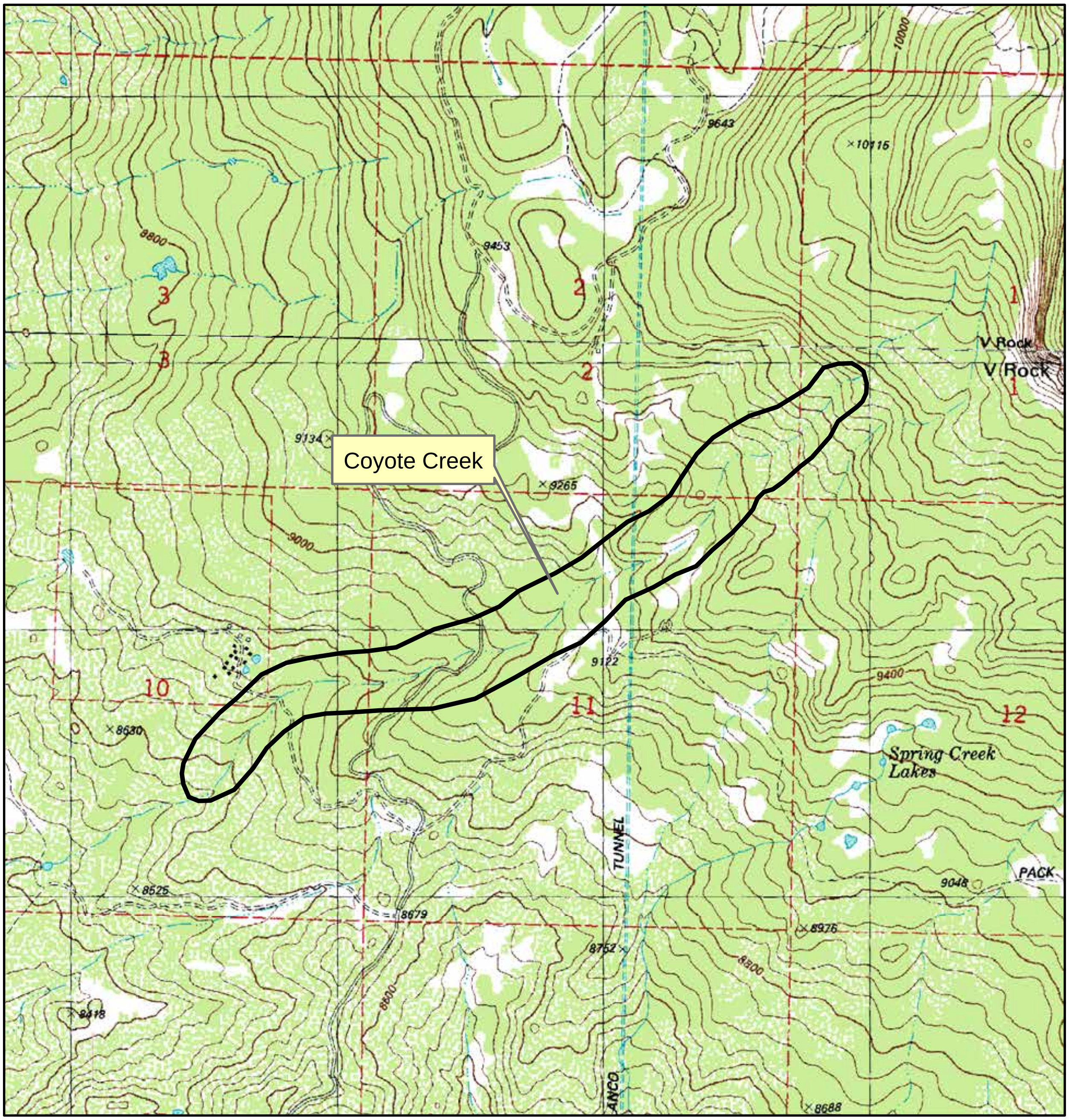
Management Needs Comments: Moderate to heavy cattle grazing shows obvious impacts to the area. It may be beneficial to evaluate and improve the current grazing regime, including duration, frequency, and carrying capacity, to help reduce soil compaction, stream bank erosion, sedimentation, and weed invasion. Riparian area management is also more effective when considered along with upland pasture management, as adjacent uplands can affect the watershed condition with excessive sedimentation, erosion, runoff (Leonard et al. 1997), and weed invasion. Weeds are currently concentrated in the upland areas near the riparian zone, but threaten to invade if grazing practices continue. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Land Use Comments: Grazing is currently the dominant land use in the site. Recreation occurs in the general vicinity and includes hiking, camping, OHV use, hunting, and horse use. Other impacts include erosion and sediment loading from the road crossing and the culvert.

Natural Hazard Comments: California nettle (Urtica dioica ssp. gracilis), a stinging nettle, is common along the stream. Uplands surrounding the site have patches of bare soil with anthills and hornet nests.

Exotic Species Comments: Currently the community is vigorous with a few weeds noted in the herbaceous understory, including Kentucky bluegrass (Poa pratensis) and common dandelion (Taraxacum officinale). Canada thistle (Cirsium arvense) was noted on adjacent hill slopes in past surveys (Randolph et al. 1994).

Off-Site Considerations: A private 160-acre parcel, entirely surrounded by USFS lands, is located just north of the west edge of the site. A dirt road leading to the private parcel crosses Coyote Creek and the site at its lower end, and several buildings are clustered in the corner of the parcel closest to the boundary (USDA 2002).



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Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

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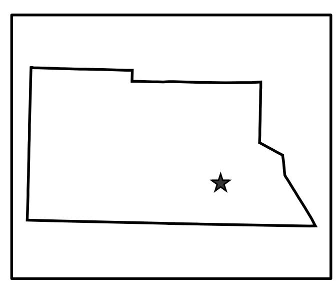
Legend

PCA Boundary

Chromo, 37106-A7

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 36. Upper Coyote Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

Upper Rito Blanco

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Blackhead Peak

Size: 865 acres (350 ha) **Elevation:** 8,520 - 10,120 ft. (2,597 - 3,085 m)

General Description: The Rito Blanco, a montane river in northeast Archuleta County, originates below Blackhead Peak (12,500'), Nipple Mountain (12,060') and Sand Mountain (12,410') on the west side of the Continental Divide, and flows down a steep, V-shaped valley before joining with the Rio Blanco 20 miles downstream. The river flows as a riffle-pool complex, but the steep tributaries consist of more step-pool complexes. The riverbed typically consists of large, rounded cobbles and gravel, but pockets of shale bedrock along its length contribute additional angular bedload material. Steep, narrow topography along the river and its tributaries limits human and cattle access to the river so the riparian forest is fairly pristine. Mature subalpine fir-Engelmann spruce (Abies lasiocarpa-Picea engelmannii) forests occurs on the valley slopes with stands of quaking aspen (Populus tremuloides) on higher slopes, and narrowleaf cottonwood (Populus angustifolia) occurring along the floodplain, increasing in frequency as the river drops in elevation. Riparian areas in the floodplain and adjacent to the river and its tributaries typically are lush and dense with riparian shrubs and a high diversity of mesic forbs. Mature and large thinleaf alder (Alnus incana ssp. tenuifolia) and Drummond's willow (Salix drummondiana) co-dominate the shrub layer along the river. The understory is comprised of dense mesic forbs such as bluebells (Mertensia franciscana and M. ciliata), arrowleaf ragwort (Senecio triangularis), Sierra corydalis (Corydalis caseana ssp. brandegeei), brook saxifrage (Saxifraga odontoloma), Carolina tassel-rue (Trautvetteria caroliniensis), bluejoint grass (Calamagrostis canadensis) and very few weeds. Riverbanks are well vegetated in the lower reaches of Rito Blanco, and more sparsely vegetated in the steeper parts of the drainage higher in the watershed. Forest Road 665 generally follows the occurrence, but is typically far uphill from the occurrence due to the steep topography. It crosses several of the tributaries to the Rito Blanco with culverts and several stretches of riparian forest that reach up the tributaries, but the riparian community occurs with vigor both above and below these crossings. Forest Road 735 crosses the Rito Blanco at one point within the occurrence, with a flat concrete road crossing/flow-over, but the community is still vigorous to the edges of the concrete. Songbirds and insects including many types of moths and flies are very common in the riparian community and game trails occur throughout the riparian forest. A good population of Sierra corydalis (Corydalis caseana ssp. brandegeei), a CNHP watchlisted species, occurs in the upper reaches of the Rito Blanco, especially at the easternmost reach of the site, on a side tributary above and below the Forest Road at about 10,000 feet.

Key Environmental Factors: The majority of the occurrence is mapped on the geologic formation Pre-Ash-Flow Andesitic Lavas, Breccias, Tuffs and Conglomerates (General Age 30-35 million years old). The lowest 0.4 mile on the main stem of the Rito Blanco below Mariposa Creek is mapped as Eocene Prevolcanic Sedimentary Rocks, including mudstones, sandstones and conglomerates (Tweto 1979). Soils within the community are mapped (from the upstream extent downward) as Grenadier loams and Castelleia loam. Small pockets of Igneous outcrop-Cryorthents complex and Muggins cobbly loam occur on several tributaries (USDA 1981). Soils within the riparian zone are alluvial with a thin layer of forest duff on the terraces. Shaley-gravel deposits occur along the length of the community.

Biodiversity Significance Rank Comments (B4): The site supports a large example of a good (B-ranked) occurrence of the globally secure (G5/S5) subalpine fir/thinleaf alder (Abies lasiocarpa/Alnus incana) montane riparian forest plant association. This plant community may be a late-seral association, representing a slow succession from a deciduous-dominated to coniferous-dominated riparian zone along drainages with infrequent disturbances such as flooding. The dominant understory shrub, thinleaf alder, typically co-dominates with Drummond's willow (Salix drummondiana), with the willow becoming more dominant at higher elevations and alder more dominant at lower elevations (Carsey et al. 2003).

Natural Heritage element occurrences at the Upper Rito Blanco PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Abies lasiocarpa / Alnus incana Forest	Montane Riparian Forests	G5	S5				B	2005-07-20

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary encompasses the element occurrence and the immediate watershed for the drainages that support the occurrence. The adjacent steep slopes that would most likely impact the riparian forest if altered are also included. Given that the riparian forest is dependent on natural hydrological processes associated with Rito Blanco and its tributaries, upstream activities such as logging, water diversions, impoundments, and improper livestock grazing are detrimental to the hydrology of the riparian area. The boundary also includes an approximate 500 foot buffer, which includes nearby roads, trails, and grazing allotments where surface runoff may contribute excess nutrients, sediment (Karr and Schlosser 1978), and weed invasion. It should be noted that the hydrological processes necessary to the riparian forest are not fully contained by the site boundaries. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Urgency Rank Comments (P4): No protection actions are needed in the foreseeable future. The site is located entirely within the San Juan National Forest.

General Protection Comments: The entire site is within the San Juan National Forest, and is surrounded by steep topography. The nearest private lands are over one mile from the site, and the South San Juan Wilderness protects the upper watershed of the Rito Blanco and its tributaries.

Management Urgency Rank Comments (M4): Current management seems to favor the persistence of the element, but management actions may be needed in the future to maintain the current quality of the element occurrence.

Management Needs Comments: The lands within the site are owned and managed by the San Juan National Forest-Pagosa Ranger District. Weeds, and recreational and grazing impacts currently are minimal. The area is most likely self-protected from these impacts by its steep topography. Current management seems to favor the persistence of the element, and monitoring its condition and impacts would assist in maintaining its current quality and size.

Land Use Comments: Forest Road 665 (Nipple Mountain Road) parallels Rito Blanco, crossing tributaries to Rito Blanco and portions of the element occurrence along its length, but often remaining uphill of the occurrence by 60 to 80 vertical feet. Forest Road 735 crosses Rito Blanco via a concrete road crossing/flow-over, to access Mariposa Creek, and also crosses the element occurrence on Mariposa Creek via culverts. The road is closed by locked gate before it reaches the Mariposa Creek crossing. Recreation in the area is dominated by hiking and hunting, though horse use is probable also. The area is closed to OHV use, but open to snowmobile use in the winter. Grazing, though not witnessed during the site visit, is probable and expected. The steep terrain limits extensive recreational use and probably limits utilization by cattle in some areas.

Exotic Species Comments: This is a large, vigorous, and fairly pristine community protected from many impacts by steep topography. Few or no weeds occur in the understory of the riparian community.

Miles
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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/10/2006

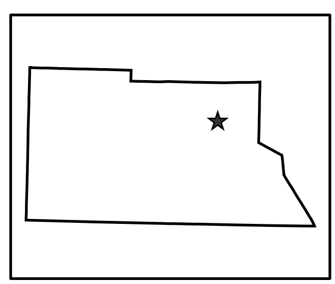
Legend

PCA Boundary

Antonito, 37106-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 37. Upper Rito Blanco Potential Conservation Area, B4: Moderate Biodiversity Significance

Snow Spring

Biodiversity Rank - B5: General Biodiversity Interest
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Chris Mountain, Devil Mountain

Size: 682 acres (276 ha) **Elevation:** 7,040 - 9,000 ft. (2,146 - 2,743 m)

General Description: Snow Spring site is located on the east slope of Devil Mountain, in the western portion of Archuleta County, west and upslope from Devil Creek, a tributary to the Piedra River. Ponderosa pine (Pinus ponderosa ssp. scopulorum) and Gambel oak (Quercus gambelii) shrublands dominate the shale and sandstone hill slopes of the Devil Creek drainage. Springs discharge in several locations on the slopes west of Devil Creek, supporting ponds and wetlands occurring on broad benches or steps on east-facing slopes. Near Snow Spring, at least two depressional wetlands with very little open water support dense stands of awned sedge (Carex atherodes). The wetland supporting the largest stand of awned sedge displays rings of vegetation where hardstem bulrush (Schoenoplectus acutus var. acutus) dominates the deepest water in the center of the depression and awned sedge occurs in solid stands in standing water. Bebb willow (Salix bebbiana) individuals are scattered along the west shoreline and along the rivulet draining from the Snow Spring discharge. Awned sedge mixes with fox sedge (Carex vulpinoidea) and Kentucky bluegrass (Poa pratensis) along the shoreline. Drier sites on the shoreline also support dense fringes of mountain rush (Juncus balticus var. montanus) and smooth horsetail (Equisetum laevigatum). There are other wetlands in the area dominated by narrowleaf willow (Salix exigua) and fringes of emergent vegetation. Narrowleaf cottonwood (Populus angustifolia) occupies patches on the benches where several seeps and rivulets from visible springs occur. Weed invasion is common; for example, Canada thistle (Cirsium arvense) and pasture grasses such as orchardgrass (Dactylis glomerata) and Kentucky bluegrass are abundant adjacent to the wetland. Pasture grasses also dominate an old road through the area, and several of the wetlands and much of the uplands in the area display a high percentage of Canada thistle. Overall, the seeps and springs support productive wetland and riparian vegetation within the otherwise arid ponderosa pine forests. Impacts and potential threats include heavy grazing, ATV use and other recreation including hunting, hiking and camping.

Key Environmental Factors: The geology of the area is described predominantly as Mancos shale, with portions of the edges of the site mapped as Morrison-Wanakah-Entrada formation and Dakota sandstone-Burro canyon formation, both comprised of sedimentary rocks such as sandstone, shale and conglomerates (Tweto 1979). Soils are generally mapped as Chris stony loam, a sandstone-derived and well drained soil with an underlying sandstone bedrock, with frequent sandstone outcrops and pockets of Hunchback clay loam, a deep and poorly draining soil type (USDA 1981). It is within these pockets of Hunchback clay loam that discharging springs collect on the surface as wetlands. At the site of the element occurrence, the surface horizon displayed 15 cm of muck over a deep horizon of silty clay loam. The soils sampled were saturated to the surface and water collected in the pit.

Biodiversity Significance Rank Comments (B5): The site supports an apparently globally secure (G3G5) and state imperiled (S2?) occurrence of awned sedge (Carex atherodes) montane wetland in fair (C-ranked) condition. Awned sedge is an obligate wetland species that is uncommon in Colorado and is listed as Endangered in four eastern states (USDA 2005).

Natural Heritage element occurrences at the Snow Spring PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Carex atherodes Herbaceous Vegetation		G3G5	S2?				C	2005-06-30

** The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

Boundary Justification: The boundary is drawn to encompass the element occurrence, its soil type (USDA 1981), associated seeps and springs, and to protect the groundwater discharges necessary for the long-term viability of the element. The boundary also identifies a buffer around nearby roads and ATV trails (identified in the field and not necessarily shown on the 1968 USGS topographic quadrangle map) and open range areas where surface runoff may contribute excess nutrients and sediment, and may provide a continuing vector for the spread of weeds. It should be noted that all the hydrologic processes necessary to the element occurrence are not fully contained by the boundary.

Protection Urgency Rank Comments (P4): The site is entirely within the San Juan National Forest.

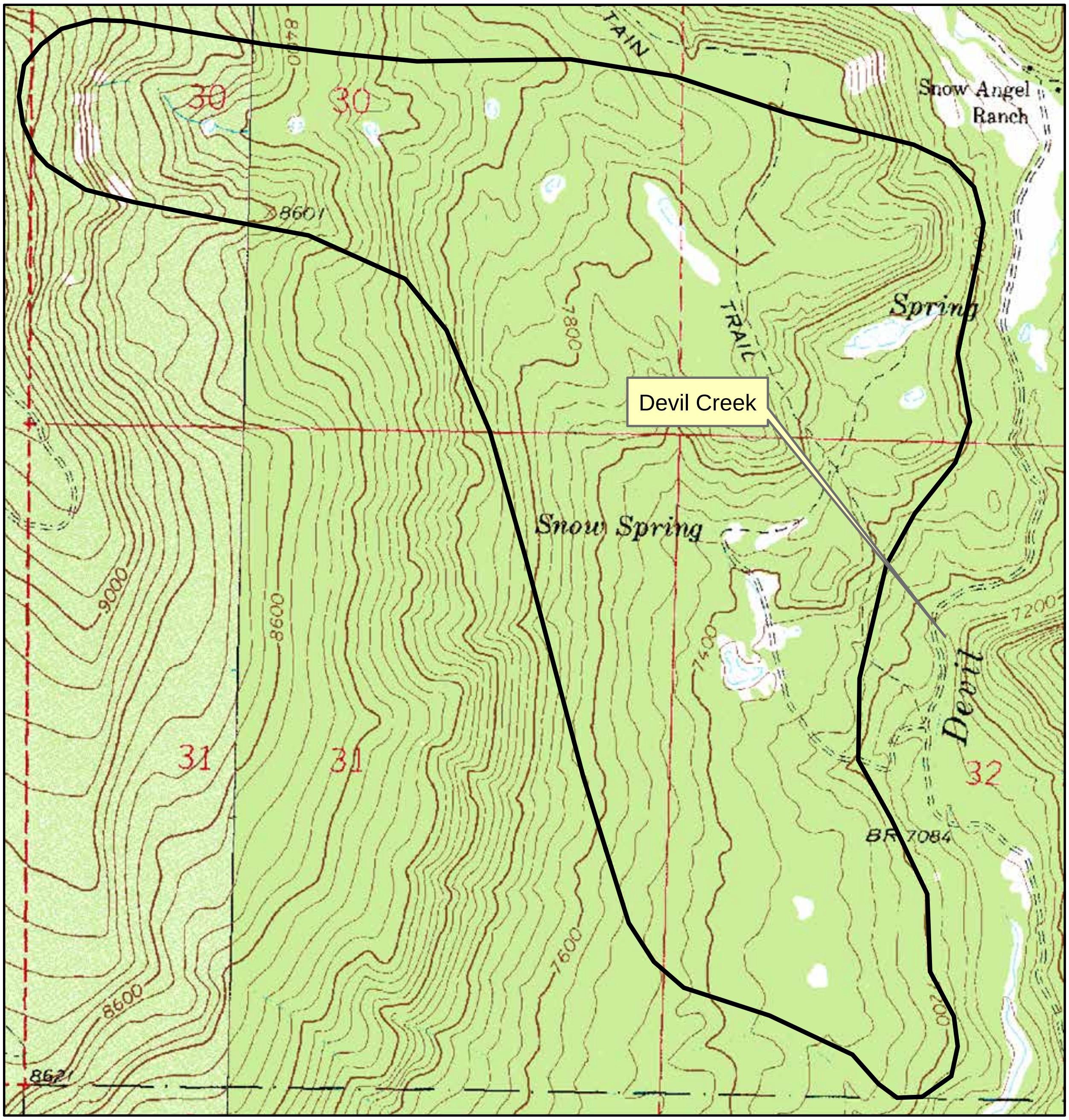
General Protection Comments: No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest, and should be adequately protected as long as forest ownership is maintained.

Management Urgency Rank Comments (M2): Management actions are essential within 5 years or the element occurrence may be reduced or lost. Weed invasion is heavy in the area, and the potential for unauthorized, off-trail ATV use is a threat to the element occurrence and the hydrology supporting it.

Management Needs Comments: Limiting vehicle access on the ATV trail would provide the best protection for the element occurrence, or at minimum providing monitoring of the ATV use throughout the season would serve to protect the wetlands and the springs that feed them. The element occurrence would benefit from weed control in the area, especially on the upland immediately surrounding the wetlands and along the old road leading from the ATV trail to the wetlands. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Land Use Comments: ATV use is popular in the area, especially during the summer and the fall hunting season. A well-used ATV track passes within 1,300 feet of the element occurrence, and an old, faint road leads from the ATV track to the wetland. This access provides a potential threat to the population from off-trail, unauthorized ATV use within the wetland areas, which are attractively muddy for recreational ATV users. This old road has already been accessed by ATV users as evidenced by flagging tape tied on shrubs and trees along the faint road, and by vehicular tracks on the east shoreline of the wetland containing the element occurrence.

Off-Site Considerations: A small gravel mining operation, horse grazing, and a residence occur on the private property (Snow Angel Ranch) along Devil Creek, to the northeast of the site.



0 0.1 0.2 0.4 0.6 Miles

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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 12/22/2005

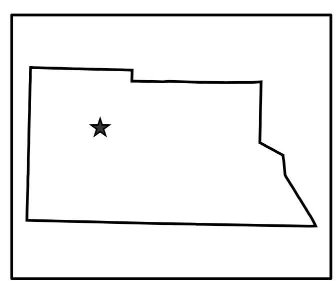
Legend

PCA Boundary

Chris Mountain, 37107-C2
Devil Mountain, 37107-C3

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 38. Snow Spring Potential Conservation Area, B5: General Biodiversity Interest

ECHO CANYON SWA SITE OF LOCAL SIGNIFICANCE

Location: The Echo Canyon SWA Site of Local Significance is located in central Archuleta County, south of Pagosa Springs within the Echo Canyon Reservoir State Wildlife Area (SWA).

U.S.G.S. 7.5 minute quadrangle: Serviceberry Mountain

Size: Approximately 213 acres (86 ha) **Elevation:** 7,200 ft. (2,195 m)

General Description: The Echo Canyon Reservoir SWA is located about four miles south of the Town of Pagosa Springs to the west of Highway 84 on Echo Creek. The reservoir covers approximately 118 surface acres when full, and is utilized for recreation including fishing, boat use and picnicking. Fish reported by the Colorado Division of Wildlife include rainbow trout (stocked annually), largemouth bass, channel catfish, green sunfish and yellow perch (http://wildlife.state.co.us/swa/). The area is locally well known for excellent bird watching; though no unusual species were seen at the time of the visit in 2005, several species noted include Red-winged Blackbird (*Agelaius phoeniceus*), Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), American Coot (*Fulica americana*), and Mallard (*Anas platyrhynchos*).

The majority of the small reservoir displays steep banks with a limited shoreline dominated by a fringe of cattails (*Typha latifolia*). However, within the shallow gradient at the east end of the reservoir approximately two acres of shallow water supports emergent vegetation dominated by cattails, Baltic rush (*Juncus balticus* var. *montanus*) and beaked sedge (*Carex utriculata*). Banks adjacent to the emergent vegetation are dominated by common spikerush (*Eleocharis palustris*), clustered field sedge (*Carex praegracilis*), foxtail barley (*Hordeum jubatum*) and beaked sedge. Weedy species within the wetland vegetation display a low percent canopy cover and include yellow sweetclover (*Melilotus officinalis*), red top (*Agrostis gigantea*), prickly lettuce (*Lactuca serriola*) and bull thistle (*Cirsium vulgare*). Open water near the emergent wetland is patterned with algae and aquatic species. There are pondweeds (*Potamogeton* spp.) and smartweed present (*Persicaria* sp.).

Upland areas surrounding the site are moderately developed (a highway, numerous county/residential/ranch roads, residential development, and agriculture), and hillslopes are dominated by ponderosa savannas (*Pinus ponderosa* / *Festuca thurberi* and other grasses) that include other native and non-native herbaceous forbs and pasture grasses. The dominant surface geology is comprised of Mancos Shale (Tweto 1979).

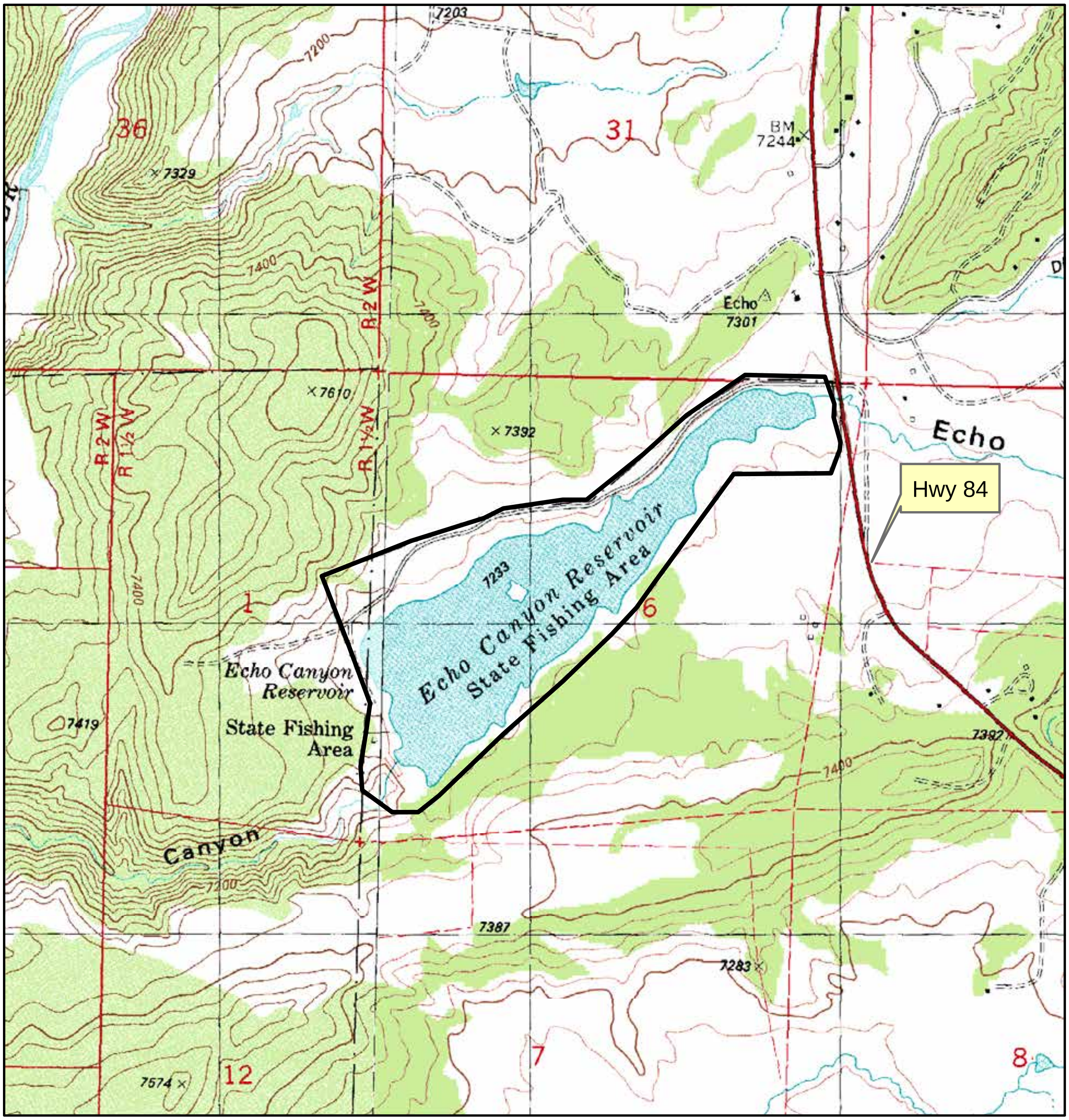
Protection Comments: The SLS is within a State Wildlife Area, owned and managed by the Colorado Division of Wildlife (CDOW), and is surrounded by privately owned parcels.

Management Comments: Recreation impacts include bank erosion, trails, litter, and weed invasion. Grazing occurs at the east end of the reservoir, mainly by horses. Weedy species noted include Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), bull thistle, common dandelion (*Taraxacum officinale*), yellow sweetclover, prickly lettuce, red top, and cheatgrass (*Bromus tectorum*). The main threats to the marshy area at the east end of the reservoir are grazing impacts and weed invasion. Weeds currently display a small canopy cover within the wetland, but are abundant on adjacent uplands. The marsh is currently managed as a spawning area for bass and sunfish (http://wildlife.state.co.us/swa/).

Soils Description: Soil survey information is not available for the site. The current soil survey published for the area (Soil Survey of Piedra Area, Colorado: Parts of Archuleta, Hinsdale, La Plata, Mineral, and Rio Grande Counties, USDA 1981) does not cover this portion of the county. No soil information was collected at the site.

Restoration Potential: The system is anthropogenic (a reservoir) and subject to water fluctuations and/or static levels based on the controlled outlet. The reservoir is actively managed to maintain the wildlife and recreation values, which includes maintaining hydrology for the marsh (fish and bird habitat) and the open water.

Controlling weeds will maintain the quality of vegetation for wildlife habitat. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.



0 0.15 0.3 0.6 0.9 Miles

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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 02/27/2006

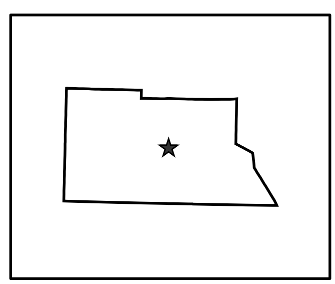
Legend

SLS Boundary

Serviceberry Mountain, 37106-B8
Oakbrush Hill, 37107-B1

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Archuleta County



Map 39. Echo Canyon State Wildlife Area Site of Local Significance

NAVAJO STATE PARK SITE OF LOCAL SIGNIFICANCE

Location: The Navajo State Park Site of Local Significance is located in southwest Archuleta County, east of the town of Arboles and along the shores of Navajo Reservoir.

U.S.G.S. 7.5 minute quadrangles: Allison, Carracas

Size: Approximately 817 acres (331 ha) **Elevation:** 6,085 - 6,110 ft. (1,855 – 1,865 m)

General Description: In the southwest quadrant of Archuleta County, the Piedra River flows north to south, and the San Juan River flows east to west. The confluence of these two large rivers occurs in the extreme southwest corner of the county, within the northernmost portion of Navajo Reservoir, a Bureau of Reclamation reservoir that straddles the border of Colorado and New Mexico. At high water, the reservoir extends into Colorado 4 miles up the Piedra River, and 7 miles up the San Juan River. Navajo Dam controls the reservoir levels, and is located 35 miles downstream near Bloomfield, New Mexico (USDI 2005). The spillway elevation at the dam is 6,085 feet, with the normal water surface elevation at 6,101 feet and the crest elevation of the dam at 6,108 feet (USDI no date). A fringe of riparian habitat is supported along the edges of Navajo Reservoir where the water levels fluctuate, especially along the northern shore. In the floodplains of the San Juan River Arm and the Piedra River Arm, this riparian fringe can be broad, nearly 2,000 feet across. In other areas where the mesa slopes rise steeply from the reservoir, this riparian fringe is very narrow.

Over the course of the last twenty years, the San Juan River basin has seen periods of normal and high precipitation, as well as periods of drought including the most recent drought starting in 2001. With this fluctuation in water levels, bare mineral soils are exposed at the water's edge, providing prime substrate for the establishment of pioneering Rio Grande cottonwood (*Populus deltoides* ssp. *wislizenii*) and sandbar willow (*Salix exigua*). Other cottonwood species are also found, including narrowleaf cottonwood (*Populus angustifolia*) and its hybrid with Rio Grande cottonwood, lanceleaf cottonwood (*Populus x acuminata*). Cottonwoods within the water level fluctuation zone are typically seedling, sapling or pole-sized, with mature cottonwoods occurring above the high water line. The herbaceous layer within the newly established cottonwood-willow canopy is typically very sparse or non-existent, due to the seasonal inundation. Just above the current water levels, the recent drought years have allowed mesic weedy herbaceous species to establish, including red-root flatsedge and rough cocklebur (*Cyperus erythrorhizos*; *Xanthium strumarium*), and large stands of reed canarygrass (*Phalaris arundinacea*). Curly top knotweed and Pennsylvania smartweed (*Polygonum lapathifolium; P. pensylvanicum*) also occur along the waterline. On slightly higher ground, above the pioneering communities but still within ready accessibility of groundwater, saltcedar (*Tamarix ramosissima*) flourishes in patches all along the edge of the reservoir, along with scattered Russian olive (*Elaeagnus angustifolia*) and an understory of alfalfa, yellow sweetclover, thistle, clover, smooth brome, Kentucky bluegrass (*Medicago sativa; Melilotus officinalis; Cirsium sp.; Trifolium sp.; Bromus inermis; Poa pratensis*) and reed canarygrass.
Surrounding uplands also tend to have a fairly weedy herbaceous layer under native trees and shrubs. The typical upland plant association on the mesa slopes adjacent to the reservoir is pinyon pine and juniper (*Pinus edulis; Juniperus* spp.). Big sagebrush and rubber rabbitbrush (*Artemisia tridentata; Ericameria nauseosa*) are common in dry soils, and closer to the reservoir, serviceberry and Gambel oak (*Amelanchier* sp.; *Quercus gambelii*) can be found. Dominant understory grasses include cheatgrass, crested wheatgrass, and slender wheatgrass (*Bromus tectorum; Agropyron cristatum; Elymus trachycaulus*), which are often associated with tansy-

mustard, redstem stork's bill, prickly lettuce, scarlet globemallow, and common dandelion (*Descurainia sophia; Erodium cicutarium; Lactuca serriola; Sphaeralcea coccinea; Taraxacum officinale*).

Although many animals are sure to use the reservoir edge, none were observed in 2005. Likely species to occur in the area include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), blacktail jackrabbit (*Lepus californicus*), cottontails (*Sylvilagus* sp.), prairie dogs (*Cynomys* sp.), rattlesnake (*Crotalis viridis*), bullsnake (*Pituophis catenifer*), and short-horned lizard (*Phrynosoma hernandesi*) (NMSPD 2003, CDNR 2006). Waterfowl are common along the reservoir edges; Mallard, Western Grebe, and Canada Goose (*Anas platyrhynchos; Aechmophorus occidentalis; Branta canadensis*) were seen in 2005. Great Blue Heron (*Ardea herodias*) forage in the shallows, and Red-winged Blackbird and Western Meadowlark (*Agelaius phoeniceus; Sturnella neglecta*) frequent marshy areas, especially at the upper end of the Piedra Arm. Red-tailed Hawk, Common Raven, and Northern Harrier (*Buteo jamaicensis; Corvus corax; Circus cyaneus*) are commonly seen soaring in many areas along the reservoir.

Land use adjacent to the reservoir is dominated by recreational use and scattered residential development. State Highway 151 runs along to the western shore of the Piedra Arm, and Archuleta County Road 500 (Trujillo Road) parallels the east shore of the Piedra arm and the entire north arm of the San Juan River. Colorado State Parks manages a number of day-use areas within the SLS accessed directly off either of these two roads; most are primitive and consist solely of a gravel parking area with fee collection stations and signs describing recreational use and limitations. Recreational activities along the shoreline are popular; day-use areas may provide access for boats, windsurfers, picnickers, anglers, bicyclers and hikers. This high use promotes the introduction and spread of weedy species and is likely the main cause for the high-canopy cover of non-native herbaceous species along the riparian shoreline. Other land uses near the reservoir include agriculture (irrigated pastures and hay meadows, predominantly) and oil/gas well development.

Protection Comments: The Bureau of Reclamation (BOR) owns the lands surrounding Navajo Reservoir, but these lands and recreational activities at the reservoir are managed by Colorado State Parks through an agreement with the BOR (USDI 2005). Navajo Reservoir water levels are controlled by the BOR at Navajo Dam, 35 miles downstream on the San Juan River drainage in New Mexico.

Management Comments: The main threats to the riparian fringes along the reservoir are noxious weed invasion and intensive recreational use. Vigorous and reproducing stands of saltcedar (*Tamarix ramosissima*) are known to occur in many shoreline locations within the SLS. Gaining control over this species is essential and is presented as a high priority for pest management under the current Resource Management Plan/Draft Environmental Assessment for Navajo Reservoir (USDI 2005). Additionally, wetland fringes and adjacent uplands display a large component of non-native invasive species such as thistle (*Cirsium* sp.), yellow sweetclover (*Melilotus officinalis*), tansy-mustard (*Descurainia sophia*), rough cocklebur (*Xanthium strumarium*), and cheatgrass (*Bromus tectorum*). Controlling both noxious shrubs and herbaceous weeds will benefit the wildlife habitat structure within the reservoir's riparian fringes, and promote natural propagation of native species.

Intensive recreational use is also a threat, providing a vector for invasive weed introduction and spread, increased erosion, litter, and other direct and indirect impacts to the SLS. The Resource Management Plan proposes increased management for certain programmatic areas of use. For example, the plan proposes to close and reclaim unauthorized trails, protect wildlife wintering areas and eagle roosting trees, limit vehicular access to designated roads, and enforce day use limitations. The plan would also enforce a carrying capacity for recreational usage at areas within the State Park, including vehicular parking, boat usage (especially at low reservoir levels), and limits on angler numbers in specific areas at given times (USDI 2005). Although recreation will always be a component of Navajo State Park, providing reasonable limitations on usage and enforcement of these limitations will ensure that the natural beauty of the reservoir area will remain for future generations and the natural systems will remain as functional habitat for wildlife.

Soils Description: Soils within the saturated reservoir edge were primarily sandy in texture. Upland soils were not sampled. The NRCS does not currently have soil survey information for this portion of Archuleta County. The most recent soil survey published for the area (Soil Survey of Piedra Area, Colorado: Parts of Archuleta, Hinsdale, La Plata, Mineral, and Rio Grande Counties, USDA 1981) does not cover this portion of the county.

Restoration Potential: If the proposed Navajo Reservoir Resource Management Plan-"Proposed Action" alternative is approved, a number of restoration activities are planned for implementation. These activities would be carried out by the managing entity, Colorado State Parks, under direction from the Bureau of Reclamation. These activities include inventory and monitoring of the condition and composition of riparian and wetland vegetative communities, revegetation of disturbed areas, planting native trees and shrubs at selected locations, and control of noxious weeds under an Integrated Pest Management Plan (USDI 2005).

Exotic species control is the primary restoration need at this site. Eradication of non-native species, especially saltcedar, requires long-term control and monitoring. Since this is a high-profile public site managed for environmental education, it provides an excellent opportunity for Colorado State Parks to involve the community (e.g., local schools or community groups) in establishing an identification and eradication program, and regular monitoring for new weed growth. Weed control programs at this site have the potential to be an excellent demonstration area for weed eradication in similar areas across adjacent counties. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

The weedy uplands and areas of sparse herbaceous vegetation may benefit from reseeding with native herbaceous species adapted to the site's climate and hydrology. Again, a native reseeding project could be an excellent demonstration project.

Unauthorized grazing and incidental grazing associated with reserved livestock trailing and watering rights occur within portions of Navajo State Park, including the Piedra and San Juan Arms (USDI 2005). As part of the draft Resource Management plan, the Bureau of Reclamation is considering working with those livestock owners with reserved rights to develop methods of incidental use that minimize impacts. Proposed control for unauthorized grazing includes construction, mending and maintenance of exclusionary fencing. Minimizing grazing impacts within the site would benefit vegetative productivity and reduce soil erosion and the spread of weeds.

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 02/27/2006

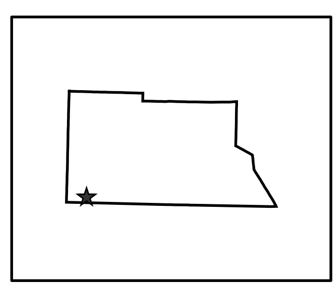
Legend

SLS Boundary

Durango, 37107-A1

30 x 60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 40. Navajo State Park Site of Local Significance

PIEDRA RIVER MARSH SITE OF LOCAL SIGNIFICANCE

Location: The Piedra River Marsh Site of Local Significance is located in southwest Archuleta County, one mile north of the intersection of Highway 151 and Fosset Gulch Road (FR 613) and just west of the highway.

U.S.G.S. 7.5 minute quadrangles: Chimney Rock, Carracas

Size: Approximately 76 acres (31 ha) **Elevation:** 6,180 ft. (2,502 m)

General Description: The Piedra River, located in western Archuleta County, flows generally north to south through canyon, mesa and foothill topography before entering the Navajo Reservoir at the state line. The lower Piedra River, southwest of Chimney Rock Archeological Area and between its confluence with Stollsteimer Creek and Navajo Reservoir, has a relatively low gradient and meanders well within its broad floodplain. It carries a high bedload of cobble and gravel, depositing these materials on many large islands and point bars. Over the course of time, the river channel has migrated across the floodplain, sometimes leaving abandoned oxbow ponds and overflow channels in its wake. These wetlands are charged by river overflow and high groundwater, and typically become drier as the summer progresses and the river level drops. At the Piedra River Marsh SLS, several abandoned oxbow ponds and channels combine to create a large wetland and riparian mosaic of cattail-dominated (*Typha* sp.) marshy areas, open water, and riparian shrub and mature cottonwood (*Populus* spp.) stands not seen elsewhere in the County. This site is privately owned with no public access, and is surrounded by other private lands and lands owned by the Southern Ute Indian Tribe.

The floodplain along the lower Piedra River typically supports large narrowleaf cottonwood, Rio Grande cottonwood, and the hybrid lanceleaf cottonwood (*Populus angustifolia*, *Populus deltoides* ssp. *wislizenii*, and *Populus x acuminata*) galleries. A riparian shrub layer occurs at the channel banks with the cottonwoods, and along the margins of the wetland complex, and is dominated by sandbar willow (*Salix exigua*), with scattered patches of silver buffaloberry (*Shepherdia argentea*), and pacific willow (*Salix lucida* ssp. *lasiandra*).

The marsh complex is dominated by a dense mosaic of sandbar willow, broadleaf cattail (*Typha latifolia*), stands of mixed sedges (*Carex* spp.), and open water or mudflats, depending on the seasonal water levels. Sedges had already dropped their seed heads at the time of the visit, and were no longer identifiable. Other non-dominating native hydrophytic species are found within the wetlands, including the graminoids common spikerush, jointleaf rush, and hardstem bulrush (*Eleocharis palustris*, *Juncus articulatus* and *Schoenoplectus acutus* ssp. *acutus*), along with the non-native species quackgrass and reed canarygrass (*Elymus repens* and *Phalaris arundinacea*). Narrowleaf bur-reed, smooth horsetail and longroot smartweed (*Sparganium angustifolium*, *Equisetum laevigatum* and *Persicaria amphibia*) are a few of the hydrophytic forbs also found in the ponds.

The higher ground surrounding the ponds supports native shrubs and trees, as well as a largely non-native but diverse herbaceous layer. Rocky Mountain juniper, Gambel oak, river hawthorn, and skunkbush sumac (*Juniperus scopulorum, Quercus gambelii*, *Crataegus rivularis*, and *Rhus trilobata*) are scattered throughout the uplands, and are sometimes draped with western white clematis (*Clematis ligusticifolia*). The understory grass cover consists of crested wheatgrass, smooth brome, and western wheatgrass (*Agropyron cristatum, Bromus inermis* and *Pascopyrum smithii*) with more cheatgrass (*Bromus tectorum*) as soils become higher and drier. The forb component of the uplands is quite diverse, including the native clasping-leaf dogbane, showy milkweed, tall willowherb, purple-disk helianthella, mountain golden-banner, and white prairie aster (*Apocynum sibiricum, Asclepias speciosa, Epilobium brachycarpum, Helianthella microcephala, Thermopsis montana, Symphyotrichum falcatum*). Other species occurring on the uplands considered native but aggressive and somewhat weedy are American licorice, common sunflower and wild tarragon (*Glycyrrhiza lepidota, Helianthus annuus*, and *Oligosporus dracunculus*). Musk thistle, Canada thistle, prickly lettuce, yellow sweetclover, and common mullein (*Carduus nutans, Cirsium arvense, Lactuca serriola, Melilotus officinalis,* and *Verbascum thapsus*) are invasive weeds that are common throughout the uplands. Adjacent dry hillsides and uplands have a high density of cheatgrass punctuated by sagebrush (*Artemisia* sp.), broom snakeweed (*Gutierrezia sarothrae*), and longflower rabbitbrush (*Chrysothamnus depressus*).

This diversity of habitat and vegetative structure is excellent for attracting and supporting various kinds of wildlife, including a wide variety of songbirds, shorebirds such as Great Blue Heron (*Ardea herodias*) and Common Snipe (*Gallinago gallinago*), and many species of waterfowl, including but not limited to Mallard (*Anas platyrhynchos*) and Canada Goose (*Branta canadensis*). Mammals also use the site, including elk (*Cervus canadensis*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), and mountain lion (*Felis concolor*), as evidenced by many tracks found in the mud of drying ponds, droppings, and even an old beaver lodge. Reptiles and amphibians also rely on the diverse habitats here, including painted turtles (*Chrysemys picta*), bullsnakes (*Pituophis catenifer*), and garter snakes (*Thamnophis* sp.).

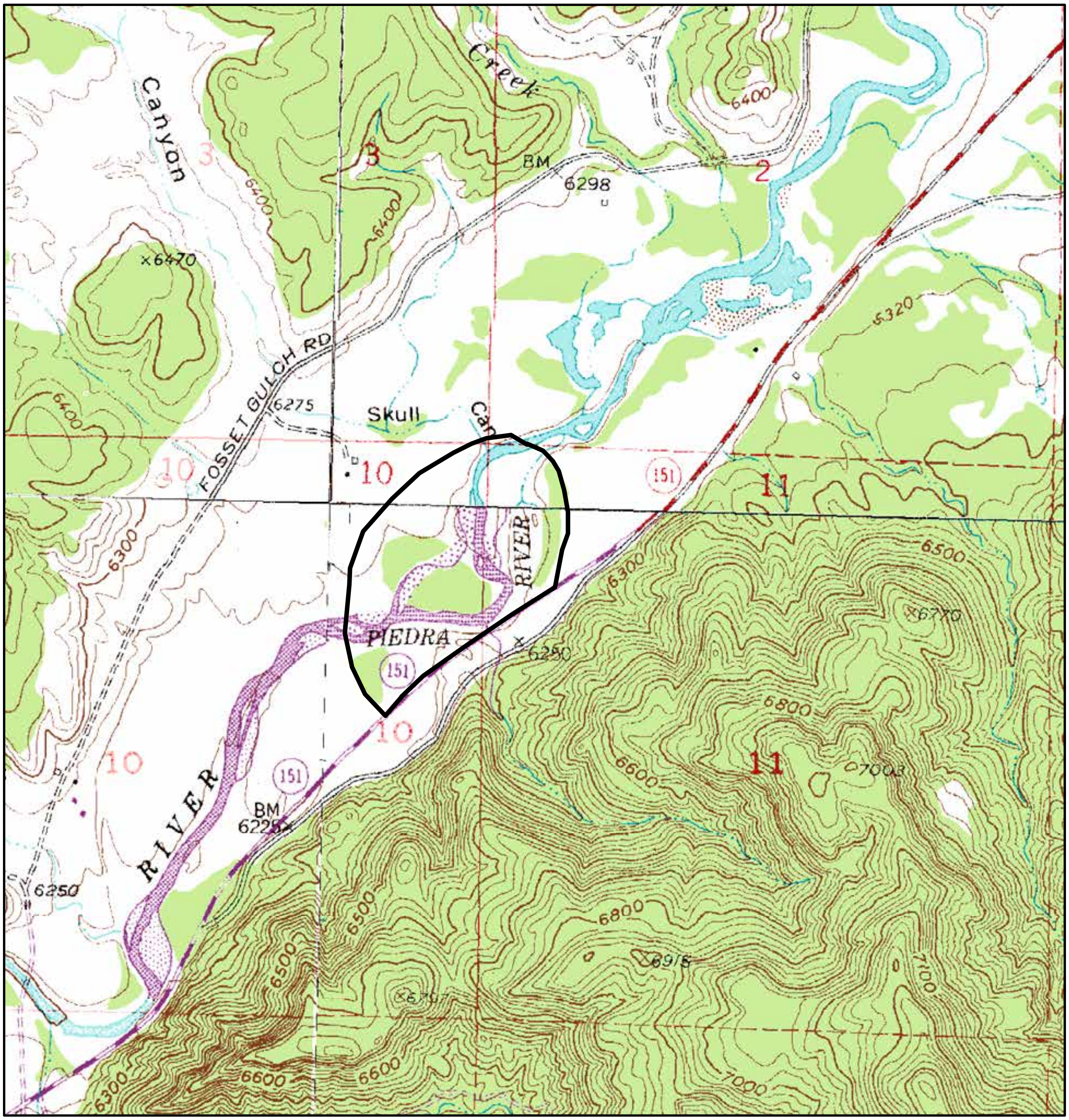
Upstream there are no major water diversions, only small irrigation diversions used for agriculture along the floodplain. Five miles downstream however, Navajo Reservoir begins and continues many long miles down the river valley of the San Juan to Navajo Dam, in New Mexico. Though this hydrologic modification does not directly affect the Piedra River Marsh SLS, the reservoir and associated recreational activities create an environment conducive to the introduction and spread of aggressively invasive weeds, which find their way upriver to this site and beyond. Though none were discovered at the site during the 2005 survey, saltcedar and Russian olive (*Tamarix ramosissima* and *Elaeagnus angustifolia*) are common at the reservoir and have been found along portions of the Piedra River both upstream and downstream of the site. Invasion of this site by these species would be highly detrimental, and regular monitoring for these species is suggested.

Protection Comments: The Piedra River Marsh SLS covers several privately owned parcels. Conservation easement education for the private landowners would be an excellent step toward protection for this unique area. Conservation easements placed on private lands may conserve the natural values of the site as well as providing tax credits and other financial benefits to the landowner. Education regarding riparian and wetland ecology may also benefit landowners and land managers, especially those landowners who currently graze livestock within the riparian/wetland zone.

Management Comments: The main threat to the wetland complex is weed invasion. Fringes of the wetlands and the adjacent uplands display a component of non-native invasive species such as Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), common mullein (*Verbascum thapsus*), quackgrass (*Elytrigia repens*), and cheatgrass (*Bromus tectorum*). Evidence of past grazing activity on adjacent uplands may be an indicator of how these weeds were introduced and spread, and if grazing continues, a change in grazing regime may help in controlling these species. Controlling weeds will maintain the quality and diversity of vegetation for wildlife habitat.

Soils Description: A scoured bank along the active channel of the Piedra River reveals a cobble layer at least 45 cm deep. Soils within the floodplain on slightly higher ground show a thick surface horizon of sandy clay loam, 45 to 60 cm deep, over a cobble horizon, further documentation that the Piedra River channel actively migrates across its floodplain, depositing sediments and cobble/gravel bedloads as it travels. The NRCS does not currently have soil survey information for the site. The most recent soil survey published for the area (Soil Survey of Piedra Area, Colorado: Parts of Archuleta, Hinsdale, La Plata, Mineral, and Rio Grande Counties, USDA 1981) does not cover this portion of the county.

Restoration Potential: Restoration opportunities for this site exist mainly in weed eradication, weed monitoring, and adaptive grazing techniques to manage non-native species. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species. Bank stabilization, erosion control, or marsh enhancement projects are not feasible at this site due to the dynamic floodplain and actively migrating channel. It is expected that over time, this marsh area will continue to be changed, reshaped, and perhaps even reclaimed by the migrating river channel.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 02/27/2006

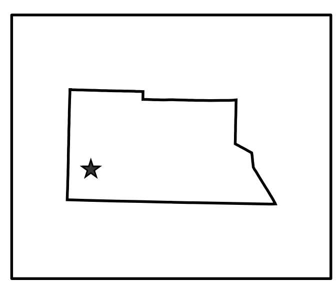
Legend

SLS Boundary

Carracas, 37107-A3
Chimney Rock, 37107-B3

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 41. Piedra River Marsh Site of Local Significance

SAMBRITO WETLANDS AREA SITE OF LOCAL SIGNIFICANCE

Location: The Sambrito Wetlands Area Site of Local Significance is located in extreme southwest Archuleta County, 3 miles southwest of Arboles and one mile south of Allison. The site is located at the south end of Archuleta County Road 988 on the north shore of the Sambrito Cove portion of Navajo Reservoir.

U.S.G.S. 7.5 minute quadrangles: Allison

Size: Approximately 135 acres (55 ha) **Elevation:** 6,100 ft. (1,860 m)

General Description: Navajo Reservoir is located at the southwest corner of Archuleta County, where it borders the New Mexico state line. Navajo Dam controls the reservoir, and is located 35 miles downstream near Bloomfield, New Mexico. At high water, the reservoir extends into Colorado 4 miles up the Piedra River, and 7 miles up the San Juan River into Colorado; otherwise the reservoir is located within New Mexico (USDI 2005). A small finger of the reservoir called Sambrito Cove extends into Colorado at the extreme southwest corner of Archuleta County. Here, the Colorado Department of Natural Resources (including staff from Colorado State Parks and the Division of Wildlife) with help from BP America, Inc. have restored and enhanced an area of wetlands along Scoggins Creek and an unnamed intermittent drainage, for wildlife habitat and environmental education opportunities.

Though named the Sambrito Wetlands Area, the namesake Sambrito Creek actually occurs 2/3 mile east of the site and is not part of the wetland complex. The wetlands consist of small open water pond areas, areas of saturated soils between ponds, and stream channels and ditches which distribute the water across the site. The main hydrologic source for the area is supplied by irrigation tail-water from the surrounding irrigated pastures and hay meadows, supplemented by what perennial and intermittent flows occur in Scoggins Creek and in the unnamed drainage east of Scoggins Creek. The fringes of the ponds and the marshy areas between ponds are dominated by acres of dense stands of nearly monotypic broadleaf cattail (*Typha latifolia*), which also occur along the stream channels and ditches, and the fringe of the reservoir inlet to the south. The cattails are typically very dense, mature and regenerating, and encroaching into the small amount of open water at the ponds. Small patches of reed canarygrass (*Phalaris arundinacea*) and sedges (*Carex* spp.) sometimes occur on saturated soils slightly higher than the cattails, especially at pond edges, and scattered dense stands of Baltic rush (*Juncus balticus* var. *montanus*) can be found between cattail stands on higher ground, especially in the northern portion of the SLS. Other fringe species include smartweed (*Polygonum* sp.), yellowcress (*Rorippa* sp.), mousetail (*Myosurus* sp.), plantains (*Plantago lanceolata* and *P. major*), and foxtail barley (*Hordeum jubatum*). The channels and ditches also support cattails, Baltic rush, hardstem bulrush (*Schoenoplectus acutus* var. *acutus*), Torrey's rush (*Juncus torreyi*) and curly dock (*Rumex crispus*), along with a large component of sandbar willow (*Salix exigua*) and aggressively colonizing saltcedar (*Tamarix ramosissima*). A few individual Rio Grande cottonwood trees (*Populus deltoides* ssp. *wislizenii*) are found on the site as well, though most are mature and do not appear to be regenerating.

The uplands immediately surrounding the wetlands support sagebrush and greasewood, with a dominant understory of cheatgrass (*Artemisia* sp., *Sarcobatus vermiculatus* and *Bromus tectorum*). Also found in this transitional area is a diversity of native herbaceous species, such as Hooker's evening primrose (*Oenothera elata* ssp. *hirsutissima*), wild tarragon (*Oligosporus dracunculus*), and white prairie aster (*Symphyotrichum falcatum*) along with many weedy species, including musk thistle chicory, Canada thistle, tansy-mustard, common sunflower, black medic, yellow sweetclover, and Russian thistle (*Carduus nutans, Cichorium intybus, Cirsium arvense, Descurainia* sp., *Helianthus annuus, Medicago lupulina, Melilotus officinalis, Salsola kali*). Higher ground supports stands of pinyon pine (*Pinus edulis*), Rocky Mountain juniper (*Juniperus scopulorum*), and sagebrush, with scattered antelope bitterbrush (*Purshia tridentata*) and a very sparse herbaceous layer. Although the Bureau of Reclamation management plan prohibits grazing in Sambrito Wetlands Area, a high incidence of livestock trespass occurs in the area resulting in overgrazing of the uplands, weed introduction and spread, and soil erosion. This trespass is due to lack of fencing or poorly maintained fencing (USDI 2005). The surrounding landscape consists of mesas rising above the lowlands at the reservoir, typically vegetated by pinyon pine, Rocky Mountain juniper and Utah juniper (*Juniperus osteosperma*) forests with a sparse herbaceous understory dominated by native and non-native grasses.

The wetland complex with its adjacent pinyon-sagebrush uplands supports a diversity of wildlife. Many bird species are known to use the area, and the following species were seen in 2005: American Coot (*Fulica americana*), Western Meadowlark (*Sturnella neglecta*), Red-winged Blackbird (*Agelaius phoeniceus*), Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), Northern Harrier (*Circus cyaneus*), American Kestrel (*Falco sparverius*), and Golden Eagle (*Aquila chrysaetos*). Bald Eagles (*Haliaeetus leucocephalus*) are common winter residents and migrants, and a nest has been documented in the past, one mile north of the SLS on private land (CNHP 2005), but it was not active in 2005. Other animals also use the site, as attested to by the abundance of coyote scat (*Canis latrans*) and raccoon (*Procyon lotor*) prints in the mudflats surrounding the ponds and at the reservoir edge. Frogs commonly sing among the cattails, several cottontails (*Sylvilagus* sp.) were seen on site, and a prairie dog (*Cynomys* sp.) town exists on the north edge of the site, though whether it is currently occupied or not is not known. Even if empty, the prairie dog town provides potential habitat for western burrowing owl (*Athene cunicularia hypugaea*) (USDI 2005).

The SLS is surrounded on three sides by developed lands, including agricultural fields, pastures, residences, and oil /gas well development, with the reservoir bordering the south side. This southwest corner of Archuleta County is on the rim of the San Juan Basin, where the Fruitland geologic formation surfaces. This formation contains coal seams and associated pockets of methane gas, which is being aggressively pursued as an energy source across the San Juan Basin in southwest Colorado and northwest New Mexico (Cullicot *et al.* 2002). These coalbed methane wells, along with oil and traditional gas wells are frequent in the area, and one well pad exists immediately northeast of the SLS boundary.

Within the SLS, a county road leads to a parking area with a large picnic shelter and restroom facility. A ¾ mile-long trail winds out to a reservoir overlook with periodic interpretive signage describing the wetlands, vegetation, wildlife, and the reservoir. The trail is open to pedestrian and horse use, but does not appear to be heavily used. Some Russian olive (*Elaeagnus angustifolia*) was once planted near the picnic shelter/restroom facility and along beginning of trail, but it appears to be declining on its own and not regenerating.

Protection Comments: The Bureau of Reclamation (BOR) owns the Sambrito Wetlands Area SLS and recreational activities at the reservoir are managed by Colorado State Parks through an agreement with the BOR (USDI 2005). Navajo Reservoir water levels are controlled by the BOR at Navajo Dam, 35 miles downstream on the San Juan River drainage in New Mexico.

Management Comments: The Bureau of Reclamation has directed the Sambrito Wetlands Area to be managed for wetlands, wildlife, and environmental education (USDI 2005). The main threat to the wetland complex is noxious weed invasion and loss of hydrology supporting the wetland habitat. Dense, reproducing stands of saltcedar (*Tamarix ramosissima*), an aggressively spreading noxious shrub, line Scoggins Creek and other unnamed drainages within the SLS. Gaining control over this species is essential and is presented as a high priority for pest management under the current Resource Management Plan/Draft Environmental Assessment for Navajo Reservoir (USDI 2005). Additionally, wetland fringes and adjacent uplands display a large component of non-native invasive species such as Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), yellow sweetclover (*Melilotus officinalis*), Russian thistle (*Salsola kali*), common mullein (*Verbascum thapsus*), and cheatgrass (*Bromus tectorum*). Controlling both noxious shrubs and herbaceous weeds will benefit the habitat structure within the wetland complex.

Hydrologic alteration is also a threat. The wetlands are currently supported by natural drainages that are augmented by irrigation tail-water (runoff) from agricultural fields upstream. With both Archuleta and La Plata counties undergoing extensive development and growth, the potential for agricultural fields to be replaced by housing or gas wells is good. This would result in less hydrologic input and therefore shrinking and drying of the wetland area.

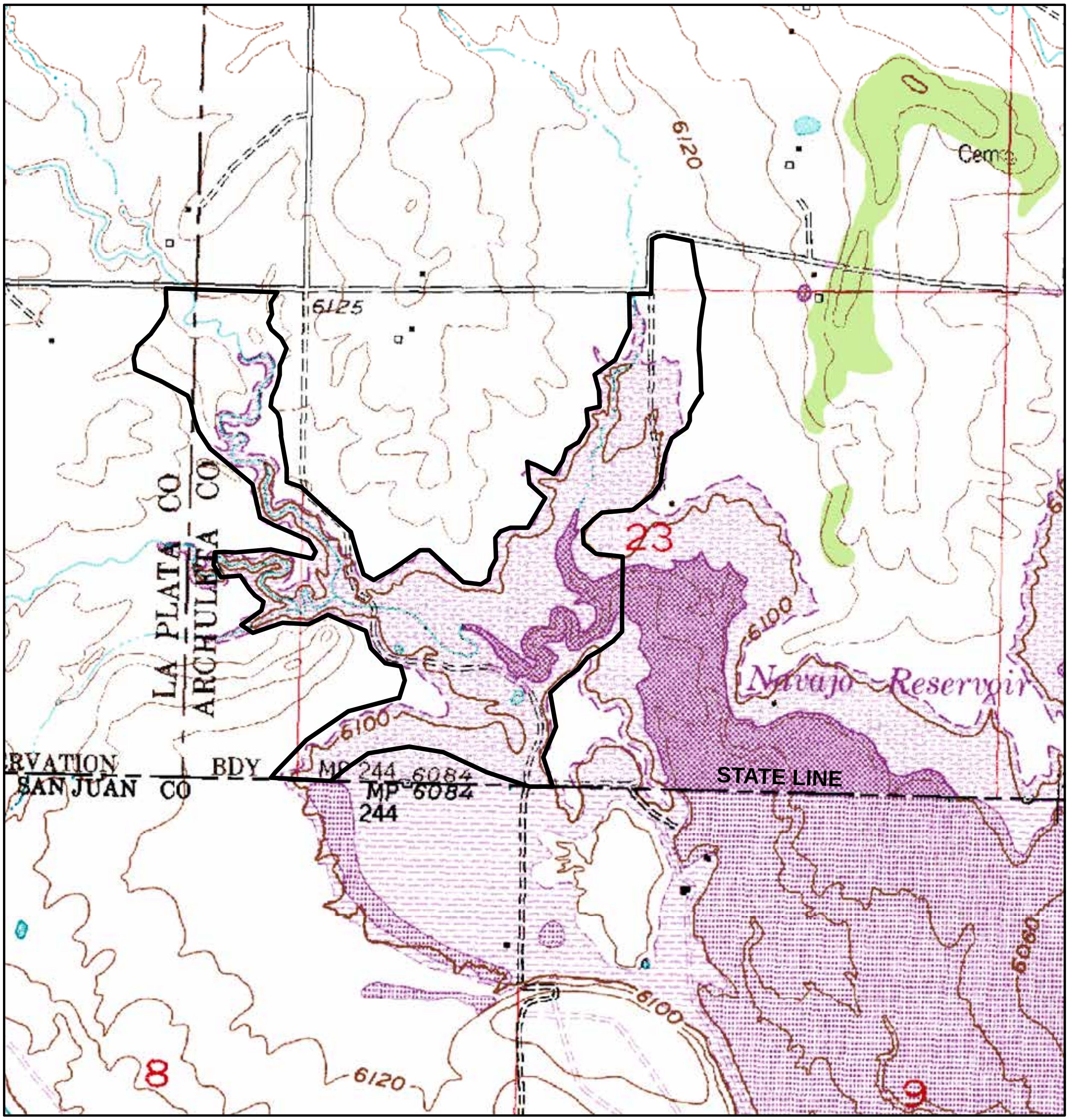
Soils Description: Soils within the saturated wetlands exhibited a thin layer of mucky organic materials over a thick layer of silty clay. Upland soils were not sampled. The NRCS does not currently have soil survey information for this portion of Archuleta County. The most recent soil survey published for the area (Soil Survey of Piedra Area, Colorado: Parts of Archuleta, Hinsdale, La Plata, Mineral, and Rio Grande Counties, USDA 1981) does not cover this portion of the county.

Restoration Potential: Restoration opportunities for this site exist in weed eradication and weed monitoring, pond enhancement/restoration, fence construction, and possible native plant revegetation. Eradication of non-native species, especially saltcedar, requires long-term control and monitoring. Since this is a high-profile public site managed for environmental education, it provides an excellent opportunity for Colorado State Parks to involve the community (e.g., local schools or community groups) in establishing an eradication program and regular monitoring for new weed growth, and potential as a demonstration area for weed eradication in similar areas across adjacent counties. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.

Since this site is managed for wetlands and wildlife use, it may be beneficial to enhance the wetlands to provide for waterfowl and other wildlife species that rely on larger areas of open water or more heterogeneous habitat than monotypic stands of cattails. Currently, the cattail component of the wetlands is very dense and encroaching into the existing pond areas. This is likely due to the shallow gradient of the drainages, the shallow depth of the pond areas, and the addition of high-nitrogen component agricultural fertilizers being delivered to the wetland complex via the irrigation tailwater which supports the complex (Apfelbaum 1985). Cattails can be controlled through water level modification, physical control, burning, shading, or chemical control, or a combination of these methods. This also provides an excellent hands-on demonstration opportunity for wetland restoration, and could involve local school groups, community groups, or local landowners in conjunction with Colorado State Parks.

The weedy uplands and areas of sparse herbaceous vegetation (possibly due to heavy grazing) may benefit from reseeding with native herbaceous species adapted to the site's climate and hydrology. Again, this being an area of environmental education, a native reseeding project could be an excellent demonstration project. Trespass grazing is a known problem within the Sambrito

Wetland Area (USDI 2005). However, prior to the initiation of any vegetation restoration or monitoring projects, it is highly recommended that new fencing be installed or current fencing be repaired in order to prevent further trespass grazing. Removing grazing from the area would benefit vegetative productivity and reduce soil erosion and the spread of weeds.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
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Map Date: 02/27/2006

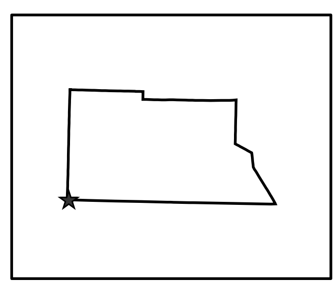
Legend

SLS Boundary

Allison, 37107-A4

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 42. Sambrito Wetlands Area Site of Local Significance

STOLLSTEIMER CREEK RESTORATION PROJECT SITE OF LOCAL SIGNIFICANCE

Location: The Stollsteimer Creek Restoration Project Site of Local Significance is located on Stollsteimer Creek in southwest Archuleta County, southwest of Chimney Rock geological formation/archeological site, and approximately 7 miles south on State Highway 151 from its junction with U.S. Highway 160.

U.S.G.S. 7.5 minute quadrangles: Chimney Rock

Size: Approximately 50 acres (20 ha) **Elevation:** 6,320-6,350 ft. (1,926 – 1,935 m)

General Description: In the west-central portion of Archuleta County, Stollsteimer Creek flows west, paralleling U.S. Highway 160 and then following State Highway 151 beneath the silhouette of Chimney Rock southwest to its confluence with the Piedra River. The creek flows through foothill and mesa topography, and is fed by perennial creeks such as Martinez Creek and Archuleta Creek, as well as many ephemeral drainages and a few springs discharging from areas with historic mining activity.

Approximately one mile above the confluence with the Piedra River and near the old settlement of Stollsteimer, the creek winds around the toe slopes of a mesa with moderate sinuosity and a relatively broad floodplain. Portions of this reach have been severely grazed in the past, and consequently show little or no riparian vegetation. Other portions have never been grazed, and exhibit dense and diverse riparian vegetation. Within this reach between the overgrazed and never-grazed areas, a 1-mile stretch of creek is being restored and enhanced. In-stream structures, limitations on grazing, and weed management are all contributing to a marked improvement in the riparian composition and structure along the creek.

Within the immediate floodplain of the restoration area, sandbar willow and narrowleaf cottonwood (*Salix exigua; Populus angustifolia*) are pioneering the re-establishment of riparian vegetation, dominating the canopy cover. The herbaceous understory is comprised of mostly bare soils and litter, with smooth brome (*Bromus inermis*), foxtail barley (*Hordeum jubatum*), Baltic rush (*Juncus balticus* var. *montanus*), white clover (*Trifolium repens*), and some yellow and white sweetclover (*Melilotus officinalis; M. albus*). Other species occurring sporadically include wild licorice (*Glycyrrhiza lepidota*), smooth scouring rush (*Equisetum laevigatum*), field horsetail (*Equisetum arvense*), field mint (*Mentha arvense*), and common plantain (*Plantago major*). Along the upper edges of the floodplain, some mature riparian deciduous trees occur, obviously having survived the intense grazing and able to reach the dropping water table. These trees include boxelder (*Acer negundo*), Rio Grande cottonwood (*Populus deltoides* ssp. *wislizenii*), and narrowleaf cottonwood.

At the upstream extent of the SLS where grazing has not occurred, mature examples of these tree species as well as Rocky Mountain juniper (*Juniperus scopulorum*), Saskatoon serviceberry (*Amelanchier alnifolia*), black chokecherry (*Prunus virginiana* var. *melanocarpa*), and strapleaf, Bebb, Pacific and mountain willow (*Salix ligulifolia; S. bebbiana; S. lucida* ssp. *lasiandra; S. monticola*) populate the floodplain and first terrace. Silver buffaloberry (*Shepherdia argentea*), a native silvery gray riparian shrub, occurs in large patches within this vigorous riparian area. Another silvery gray-leaved plant, Russian olive (*Elaeagnus angustifolia*), also occurs within the riparian zone and is considered a noxious weed. Similarly, saltcedar (*Tamarix ramosissima*) is another extremely invasive noxious woody shrub found within this northern portion of the SLS. The herbaceous understory has a higher canopy cover of native species than downstream, including a fringe of Nebraska sedge (*Carex nebrascensis*), hardstem bulrush (*Schoenoplectus acutus* ssp. *acutus*), and common spikerush (*Eleocharis palustris*) along the streambank and within the immediate floodplain. These species are also beginning to populate the understory and water's edge downstream within the restoration area.

Adjacent upland terraces on both sides of the creek within the SLS consist of old pastures and hay meadows with a lot of bare ground, currently populated with a diversity of native and weedy species, including smooth brome (*Bromus inermis*), cheatgrass (*Bromus tectorum*), western wheatgrass (*Pascopyrum smithii*), desert alyssum (*Alyssum desertorum*), musk thistle (*Carduus nutans*), spotted knapweed (*Centaurea biebersteinii*), goosefoot (*Chenopodium* sp.), field bindweed (*Convolvulus arvensis*), annual sunflower (*Helianthus annuus*), and alfalfa (*Medicago sativa*). The landowner intends to re-establish irrigation in these areas, and cultivate hay meadows.

The side slopes of the mesas that rise from the creek floodplain are steep and dry, with frequent sandstone and shale outcrops. The mesa tops hold historic anthropological and archeological sites from ancient Native American cultures. These uplands support typical pinyon pine-juniper (*Pinus edulis-Juniperus osteosperma; J. scopulorum*) habitat, with associated shrub species such as mountain mahogany (*Cercocarpus montanus*), cliff fendlerbush (*Fendlera rupicola*), broom snakeweed (*Gutierrezia sarothrae*), Gambel oak (*Quercus gambelii*), and skunkbush sumac (*Rhus trilobata*). The herbaceous understory is typically sparse, but due to past grazing impacts currently supports a high canopy cover of cheatgrass (*Bromus tectorum*). Several blooming specimens of four-o'clock (*Mirabilis* sp.) were found on an open east-facing slope.

Wildlife usage of the site is good. Large populations of elk (*Cervus elaphus*) migrate through the area, and mule deer (*Odocoileus hemionus*) are frequently seen in spring, fall and winter. Coyote (*Canis latrans*) and mountain lion (*Felis concolor*) have been seen on site, and the landowner states he once saw a river otter (*Lontra canadensis*) on the creek. River otter were reintroduced on several western Colorado rivers including the Piedra River between 1976 and 1992 (Fitzgerald 1994), and the river continues to support a self-sustaining population (CDNR 2006). American beaver (*Castor canadensis*) once had dams and lodges at the upper end of the SLS, but high flows washed the dams out and the beaver have since left the area. Wildlife surveys on site have revealed Woodhouse's toad (*Bufo woodhousii*), painted turtle (*Chrysemys picta*), and northern leopard frog (*Rana pipiens*) sightings, and electroshocking surveys were done in the early 1990's and in recent years to determine the makeup of the fish population within Stollsteimer Creek. Native species found within this reach include bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), mottled sculpin (*Cottus bairdi*), and speckled dace (*Rhinichthys osculus*). Non-native species were also found, including rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), white sucker (*Catostomus commersoni*), green sunfish (*Lepomis cyanellus*), and fathead minnow (*Pimephales promelas*) (Miller 2000; Garcia 2005). Crayfish (*Orconectes* sp.) are also commonly found within the creek.

Upstream, small agricultural irrigation diversions and stockponds are the only known hydrologic modifications. Eight miles downstream however, Navajo Reservoir begins and continues over 30 miles down the river valley of the San Juan River to Navajo Dam, in New Mexico. Though this hydrologic modification does not directly affect the Stollsteimer Creek Restoration Project SLS, it has isolated native and non-native fish populations to rivers and tributaries located above the dam. In addition, the reservoir and its associated recreational activities create an environment conducive to the introduction and spread of aggressively invasive weeds, which find their way upriver to this site and beyond. Saltcedar and Russian olive are known to occur within the SLS; they are common at the reservoir and have been found along portions of the Piedra River and Stollsteimer Creek, mainly below (downstream of) the site. Invasion of this site by these species has the potential to be highly detrimental, and eradication and regular monitoring for re-infestation of these species is suggested.

Protection Comments: The Stollsteimer Creek Restoration Project SLS covers several privately owned parcels and a portion of US Forest Service property. The private party that owns the majority of the site is responsible for the initiation of the restoration project along Stollsteimer Creek. Conservation easement education for all the private landowners would be an excellent step toward protection of this reach of Stollsteimer Creek. Conservation easements placed on private lands may assist in conserving the natural values of the site as well as providing tax credits and other financial benefits to the landowner. Education regarding riparian and wetland ecology may also benefit landowners along Stollsteimer Creek, especially those landowners who currently graze livestock within the riparian/wetland zone.

Management Comments: The main threat to the riparian areas within the Stollsteimer Creek Restoration Project SLS is weed invasion. The historic grazing impacts in the area introduced significant weed populations within the upland and riparian areas that are not yet fully under control, and impacts associated with restoration that disturb and leave areas of bare soil provide conditions amenable to additional weed infestation if not carefully controlled and monitored. The understory of the riparian area and the adjacent uplands display a light to moderate invasion of herbaceous noxious weeds such as spotted knapweed (*Centaurea biebersteinii*), musk thistle (*Carduus nutans*), goosefoot (*Chenopodium* sp.), field bindweed (*Convolvulus arvensis*), white sweetclover (*Melilotus albus*), yellow sweetclover (*M. officinalis*), rough cocklebur (*Xanthium strumarium*), and cheatgrass (*Bromus tectorum*). Mature saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) were noted within the riparian zone at the upstream (northern) end of the SLS, and coordinated eradication and management by the USFS and private landowners at that location is important, if the spread of these invasive species is to be prevented. Controlling both herbaceous and woody weeds will maintain the quality and diversity of vegetation, for wildlife habitat both in uplands and riparian areas.

The SLS was severely overgrazed previous to 2000; the majority landowner is now managing grazing on the property to a limited period of “flash grazing”; the property is leased for about two weeks early in the season to allow up to 40 head of cattle to graze before all livestock is moved off the property for the rest of the season. The riparian zone is currently fenced on one side, and with additional grants, the landowner intends to fence the other side within the next two years to prevent livestock grazed on adjacent private properties from freely entering the restoration area along the creek. Water gaps in the fencing are provided to allow watering access for livestock.

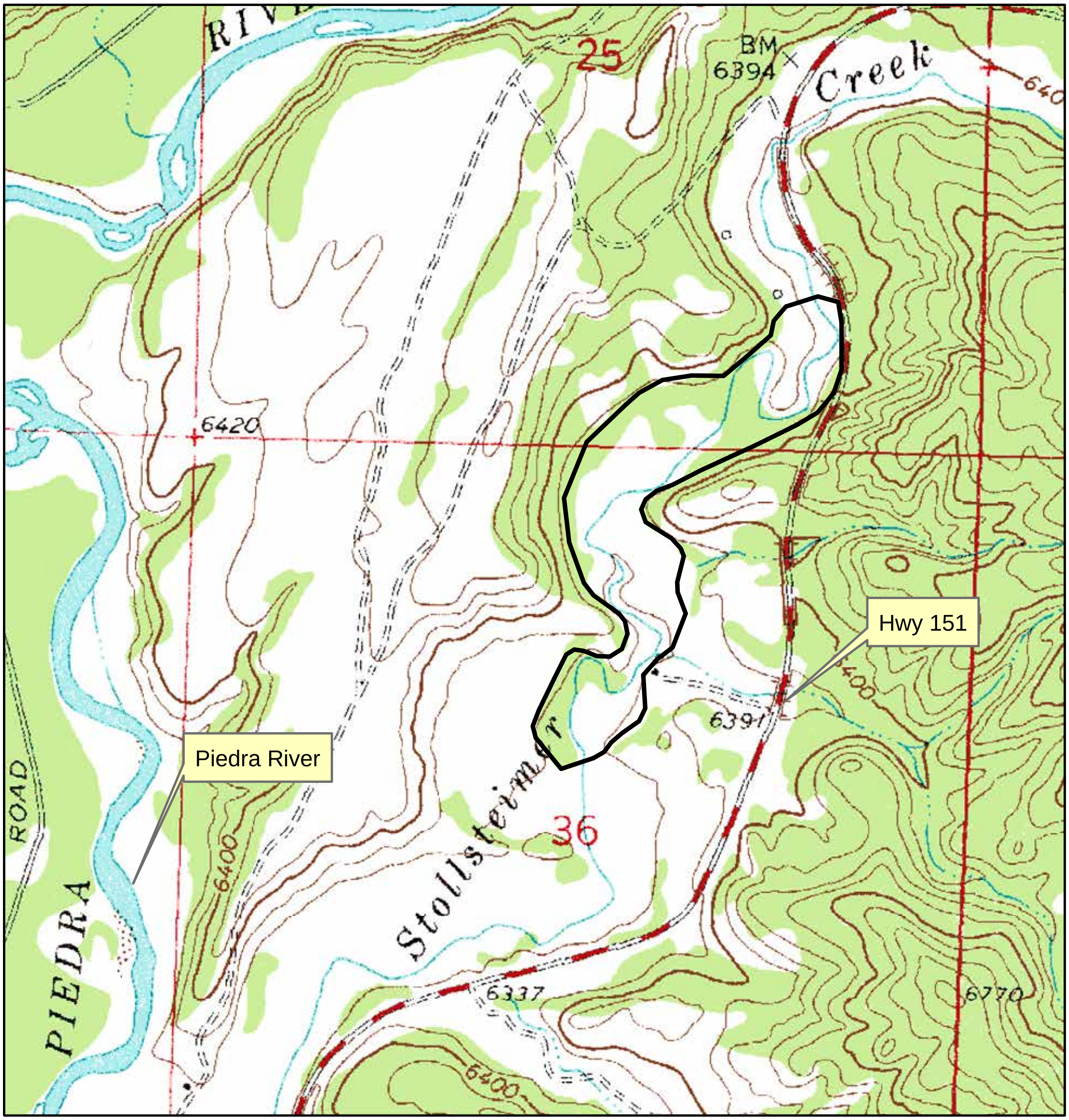
Soils Description: Soils along Stollsteimer Creek are predominantly alluvial and derived from the sandstone and shale occurring throughout this western portion of Archuleta County. The NRCS soil survey for the area (USDA-SCS 1981) indicates that the reach of Stollsteimer Creek from the crossing at US Highway 160 and continuing south for seven miles to just below the SLS is predominantly Nunn loam. This deep and well-drained soil type is derived from the shale and sandstone readily observed in the area, such as the exposed sandstone formations of Chimney Rock. Immediately downstream of the site, the soils are documented as Pescar sandy loams, a soil type which continues along the creek to its confluence with the Piedra River, where the soil survey ends. Pescar sandy loams are also deep, but somewhat poorly drained.

Surface soils within the riparian zone on site were noted to be sandy loam and very erosive. Detailed soil information was not collected at the site.

Restoration Potential: The private landowner who owns most of the land within the Stollsteimer Creek Restoration Project SLS has independently initiated restoration of the riparian zone on his property. Through grants from the Colorado Division of Wildlife and other sources, he has installed riparian exclusionary fencing with water gaps for livestock access, and in-stream structures to control streambank erosion, prevent further streambed down cutting, minimize lateral movement in critical areas of erosion, and to provide varying stream depths for fish habitat.

Limiting grazing within the riparian zone has resulted in natural recruitment of pioneering riparian species, such as sandbar willow and narrowleaf cottonwood. This regeneration of woody riparian species is helping to stabilize the streambanks, and is providing shade to reaches of the stream that were once entirely open and unshaded, resulting in a reduction of water temperatures, an increase in terrestrial invertebrate habitat, and a subsequent improvement in habitat and food source for native fish species (Cushing 2001). The owner also plans to stock fish in the stream as habitat continues to improve.

Remaining restoration opportunities for this site exist mainly in weed eradication, weed monitoring, and possibly adapting current grazing strategies to better manage non-native weedy species. Bare soil areas created during restoration activities can be revegetated with native herbaceous species adapted to the site's climate and hydrology, which will help to minimize invasion by non-native invasive species. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.



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Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

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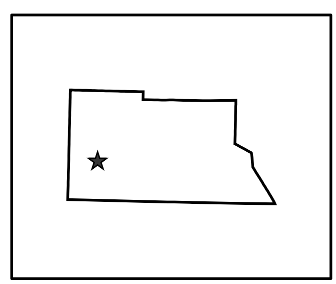
Legend

SLS Boundary

Chimney Rock, 37107-B3

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 43. Stollsteimer Creek Restoration Project Site of Local Significance

TOWN OF PAGOSA SPRINGS WETLANDS SITE OF LOCAL SIGNIFICANCE

Location: The Town of Pagosa Springs Wetlands Site of Local Significance is at the core of Old Town Pagosa Springs, along or above the San Juan River. The Pagosa Springs municipal facilities (Town Hall, Community Center) occur on the west side of Hot Springs Boulevard, and the wetlands are located between these facilities and the San Juan River.

U.S.G.S. 7.5 minute quadrangle: Pagosa Springs

Size: Approximately 19 acres (7.75 ha) **Elevation:** 7,040 ft. (2,145 m)

General Description: The Town of Pagosa Springs is situated on the San Juan River in north-central Archuleta County. Once Ute territory, the area was explored by gold seekers and mapping expeditions in the 19th century. The existence of the mineral hot springs along the San Juan River was first publicized as a result of an expedition led by Captain J.N. McComb in the mid-1850's. Fort Lewis, a military post, was established at the current site of downtown Pagosa Springs in the 1870's, and subsequently the hot springs became more well known (http://pagosa.com/history.htm). Modern-day Pagosa Springs derives much of its local economy from the draw of these large hot springs.

The original hot springs source surfaces just south of Highway 160 as it passes through downtown Pagosa Springs, on a bench just above the east bank of the San Juan River. The Town of Pagosa Springs wetland complex is located below this bench and just above the immediate floodplain of the San Juan River. Over the course of time, this area on the east bank of the San Juan River has experienced gravel mining, river channelization, and river restoration projects. The current wetland complex is a mosaic of small ponds, marshy areas, alkaline flats and uplands. The wetlands, though not pristine, merit recognition and open space protection due to the unusual composition of alkaline wetland plants for this region.

The wetland complex is predominantly recharged with fresh water input from river overflows and the groundwater table associated with the river. Though the geothermal waters are largely controlled and distributed to local hot spring resorts and used for geothermal heat for the town, some mineral waters seep into the groundwater and discharge into the complex. Some surface flows were also once directed into the wetlands via a head gate; however, surface input has been currently discontinued with disputes over water rights and the future development of the discharge location.

The wetland complex is comprised of several shallow ponds of open water surrounded by higher ground supporting riparian species, upland graminoids and forbs, and alkaline flats. Shallow marshy areas appear to accommodate a small flow between the ponds. The small ponds themselves support a dense underwater mat of common hornwort (*Ceratophyllum demersum*), an aquatic plant, which is covered with a whitish film of precipitated minerals in each pond. The fringes of the ponds and connective marshy areas support a mosaic of emergent wetland plants, including water hemlock (*Cicuta douglasii*) and stands dominated by spikerush species (*Eleocharis compressa; E. palustris*), Baltic rush (*Juncus balticus* var. *montanus*), cattails (*Typha latifolia*), bulrushes (*Schoenoplectus acutus* var. *acutus; S. pungens*) and inland saltgrass (*Distichlis spicata*). Areas where alkaline deposits have accumulated or where the mineral waters are more prominent, alkaline-adapted species such as saltgrass, seaside arrowgrass (*Triglochin maritima*), alkali crowfoot (*Halerpestes cymbalaria* ssp. *saximontana*), and possibly alkaline aster (*Symphyotrichum frondosum*) flourish.

Elevated portions of the wetland, between the ponds and marshy areas, support upland and riparian vegetation. Mature narrowleaf cottonwoods (*Populus angustifolia*) line the riverbanks, with a shrub understory of sandbar willow, black chokecherry, golden currant, Woods' rose, and skunkbush sumac (*Salix exigua, Prunus virginiana* var. *melanocarpa, Ribes aureum, Rosa woodsii*, and *Rhus trilobata*) along the river and surrounding the ponds. Scattered silver buffaloberry (*Shepherdia argentea*) occurs along the riverbanks, along with river hawthorn (*Crataegus rivularis*). Upland shrub species such as rubber rabbitbrush, creeping barberry and Colorado barberry (*Ericameria nauseosa; Mahonia repens; Berberis fendleri*) occur on areas of higher soils. Native species within the herbaceous understory include fleabane (*Erigeron* sp.) siskiyou aster (*Symphyotrichum lanceolatum* ssp. *hesperium*), giant milkweed (*Asclepias speciosus*), blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), silver sage (*Artemisia frigida*), curlycup gumweed (*Grindelia squarrosa*), hairy false golden-aster (*Heterotheca villosa*), and yarrow (*Achillea millefolium*).

The vegetation in the wetland complex reflects the mineral or chemical input; for example, bulrush and spikerush stands are typically supported by fresh water, whereas saltgrass typically occurs in saline or alkaline situations. Saltgrass is typically found in alkaline soils along shores of playa lakes or streamsides due to an accumulation of bases and soluble salts in poorly drained soils (Carsey *et al.* 2003a). Saltgrass is an uncommon occurrence within the San Juan River watershed.

Weedy species within the wetland complex display a low percent canopy cover and include musk thistle (*Carduus nutans*), white and yellow sweetclover (*Melilotus albus*; *M. officinalis*), flat-spine bursage (*Ambrosia acanthicarpa*), and witchgrass (*Panicum capillare*). Non-native species in upland areas include common mullein (*Verbascum thapsus*), black medic (*Medicago lupulina*), alfalfa (*Medicago sativa*), wild tarragon (*Oligosporus dracunculus*), crested wheatgrass (*Agropyron cristatum*), and cheatgrass (*Bromus tectorum*).

The mosaic of riparian and wetland habitats in this small area provides excellent potential for bird watching. It is possible that migrating neotropical songbirds may take advantage of the diversity of vegetation here, and consistent open water in spring and fall may encourage migrating waterfowl species to visit. Tall cottonwoods along the river provide excellent potential roosts for a diversity of raptors. Species known to occur at the site include Red-winged Blackbird (*Agelaius phoeniceus*), Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), Mallard (*Anas platyrhynchos*), Blue-winged Teal (*Anas discors*), Belted Kingfisher (*Ceryle alcyon*), Canada Goose (*Branta canadensis*), and Western Meadowlark (*Sturnella neglecta*).

Upland areas surrounding the site are developed with residential housing, municipal buildings, hotels and restaurants, and asphalt roads. The open, broad terrace immediately above and to the east of the wetlands (south of the hot springs source) will be developed in the near future. Ponderosa pine (*Pinus ponderosa*) forests and stands of Gambel oak (*Quercus gambelii*) dominate the undeveloped hillslopes in the surrounding area. Sparsely vegetated slopes of Mancos shale, the dominant surface geology within and surrounding the Town of Pagosa Springs (Tweto 1979), are also common throughout the area.

Protection Comments: The SLS is within the municipal boundaries of Town of Pagosa Springs, and the land is owned by the Town of Pagosa Springs. A conservation easement exists over the property and is held by the local land trust, the Southwest Land Alliance. However, the discharge of geothermal mineral waters is located on adjacent private property and release of these waters into the wetland complex to support the alkaline species is largely controlled by private entities.

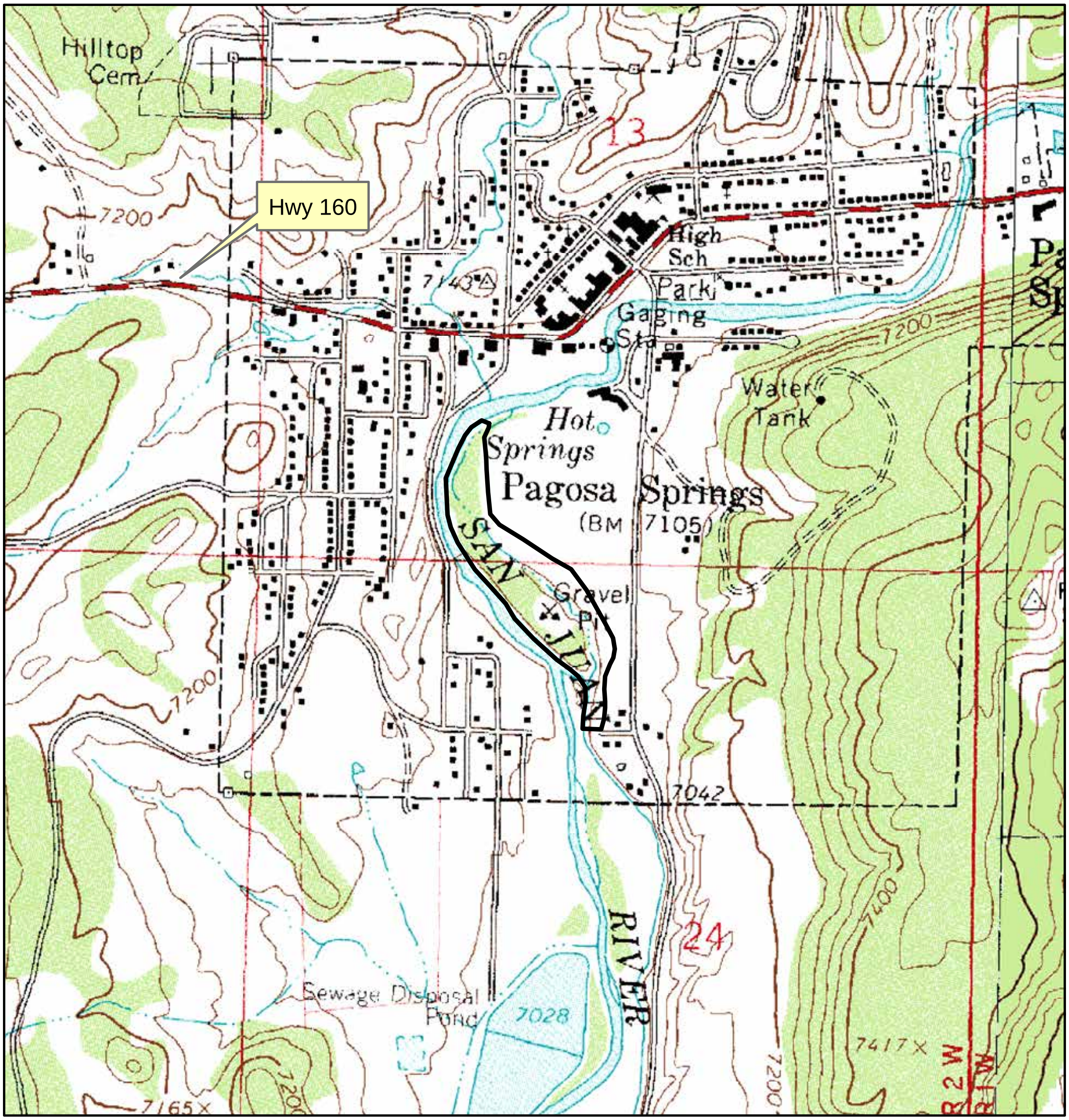
Management Comments: The Town of Pagosa Springs owns the wetland area, and the wetlands occur immediately behind the Town Hall, providing an excellent opportunity to educate the public about the uniqueness of these wetlands. The town has plans to construct the next phase of the San Juan River Trail, a recreational-use trail, at the far eastern upland edge of the wetlands. The trail will have several interpretive signs describing the wetland, and through signage pedestrians will be encouraged to stay on the trail to preserve the wetland area.

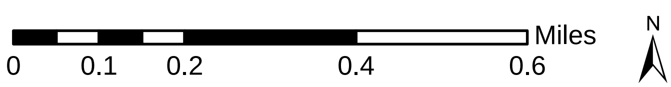
The main threats to the wetland complex are weed invasion, and changes in, or loss of, supporting hydrology. The groundwater hydrology (including discharge from the hot springs) is essential to maintaining the unique variety of alkaline species and extremely important to the long-term viability of the wetland complex. In addition, future development on the broad terrace above the wetland may also compromise the hydrology of the wetlands. Stormwater runoff from this future development, tainted with petroleum products, litter, sediment, and other undesirable contents may have potentially detrimental effects to the wetlands. Discharge of this additional fresh water supply to the wetlands may also skew the mineral content of the wetlands such that they no longer support the unique alkaline communities. To ensure the protection of the critical hydrology of the wetland complex, it is recommended that the Town of Pagosa Springs work with adjacent landowners to secure sufficient water rights and re-establish consistent discharge of mineral waters into the complex. The Town may also wish to study and subsequently require adequate stormwater treatment and discharge plans for any development that may take place above the wetlands.

Weeds currently display a small canopy cover within the wetland complex, but are more abundant on adjacent uplands. A few Russian olive saplings (*Elaeagnus angustifolia*) occur within the site, and immediate eradication of these is recommended before the species spreads further. Other weedy species across the site include musk thistle (*Carduus nutans*), yellow sweetclover (*Melilotus officinalis*), white sweetclover (*M. albus*), black medic (*Medicago lupulina*), alfalfa (*Medicago sativa*), common mullein (*Verbascum thapsus*), and cheatgrass (*Bromus tectorum*). Weed control would benefit the ongoing viability of the native plants within the wetland mosaic.

Soils Description: Soil survey information is not available for the site. The current soil survey published for the area (Soil Survey of Piedra Area, Colorado: Parts of Archuleta, Hinsdale, La Plata, Mineral, and Rio Grande Counties, USDA 1981) does not cover this portion of the county. No soil information was collected at the site.

Restoration Potential: The wetland complex is somewhat anthropogenic, since it relies on manipulated input from the hot springs to preserve the high mineral content in the water, which supports the unique alkaline wetland plants. Acquiring water rights or binding agreements with adjacent landowners to maintain the input of geothermal water is the highest priority for restoring and maintaining the wetland complex. Controlling weeds will also maintain the unique plant species, and the quality of vegetation for wildlife habitat. Referring to such resources as the Nature Conservancy's web site on invasive species (http://tncweeds.ucdavis.edu/index.htm.) or http://www.invasivespecies.gov/ may provide some assistance with control and eradication of non-native species.





Colorado Natural Heritage Program
Colorado State University
254 General Services Building
8002 Campus Delivery
Fort Collins, CO 80523-8002

Ph (970) 491-1309
Fax (970) 491-3349
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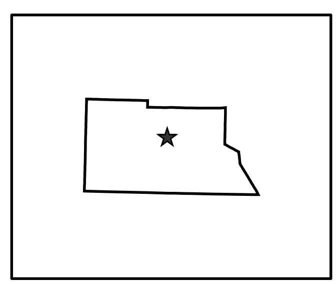
Legend

SLS Boundary

Pagosa Springs, 37107-C1

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Archuleta County



Map 44. Town of Pagosa Springs Wetlands Site of Local Significance

NATURAL HISTORY INFORMATION FOR WETLAND / RIPARIAN PLANT COMMUNITIES OF ARCHULETA COUNTY

(adapted from Carsey *et al.* 2003a)

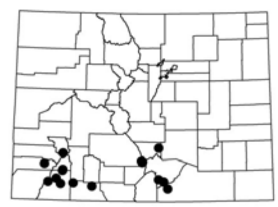
White fir - (Blue spruce) - Narrowleaf cottonwood / Rocky Mountain maple Forest

Abies concolor - (Picea pungens) - Populus angustifolia / Acer glabrum

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
7,200-9,100 ft (2,200-2,770 m)



General Description
The *Abies concolor-(Picea pungens)-Populus angustifolia/Acer glabrum* (white fir-blue spruce-narrowleaf cottonwood/Rocky Mountain maple) plant association is a diverse, mixed conifer-deciduous forest occurring on active floodplains and stream banks of montane valley floors. The presence of *Abies concolor* distinguishes this community from the more common *Populus angustifolia-Picea pungens/Alnus incana* ssp.*tenuifolia* (narrowleaf cottonwood-blue spruce/thinleaf alder) plant association, and is indicative of the southern-most mountains in Colorado. *Picea pungens* (blue spruce) is often an upper canopy component but is not present in all stands. This is reflected in the association name by placing *Picea pungens* in parentheses.

This community is located in narrow to moderately wide valleys, 50-300 ft (17-100 m) on immediate stream banks, floodplains and upper terraces, 1-6.5 ft, 1.5 ft avg. (0.3-2.0 m, 0.35 avg. m), above the channel high-water level. Streams are steep to moderately steep, straight to moderately sinuous (2-6%, average 4% gradient). The soils are well drained and poorly developed mineral soils with shallow sandy loams over coarse alluvial materials.

Vegetation Description
The upper canopy is diverse, dominated by *Populus angustifolia* (narrowleaf cottonwood) and *Abies concolor* (white fir) and usually including several other tree species such as *Picea pungens* (blue spruce), *Abies lasiocarpa* (subalpine fir), and *Pseudotsuga menziesii* (Douglas-fir). Shrubs are thickest near the stream channel with *Acer glabrum* (Rocky Mountain maple) being the most commonly encountered and abundant species. Other shrubs often present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Betula occidentalis* (river birch), *Cornus sericea* (red-osier

dogwood), *Amelanchier utahensis* (Utah serviceberry), *Jamesia americana* (wax flower), *Lonicera involucrata* (twinberry honeysuckle), *Mahonia repens* (Oregon grape), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. monticola* (mountain willow), *Symphoricarpos* spp. (snowberry), *Ribes* spp. (current), and *Rosa woodsii* (Woods rose).

The herbaceous undergrowth is variable, depending on site conditions, but is generally sparse, with less than 20% total cover. No one species is present in all stands. Common forb species include *Heracleum maximum* (common cowparsnip), *Geranium richardsonii* (Richardson geranium), *Vicia americana* (American vetch), *Viola* spp. (violet), *Osmorhiza berteroi* (sweet cicely), *Maianthemum stellatum* (starry false Solomon seal), *Mertensia ciliata* (tall fringed bluebells). Graminoid species include *Elymus glaucus* (blue wildrye), *Bromus inermis* (smooth brome), and *Poa pratensis* (Kentucky bluegrass).

Ecological Processes

This plant association is a mid- to late-seral community. High elevations and cool, shaded canyon bottoms create an environment for *Abies concolor* (white fir) and *Picea pungens* (blue spruce). The active channel flooding and sediment deposition along the reach allows *Populus angustifolia* (narrowleaf cottonwood) to persist. On higher terraces that no longer experience flooding, *Abies* and *Picea* may become the climax tree species.

Potential Conservation Areas supporting this community type are Navajo River at Banded Peak PCA and Upper First Fork Piedra River PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=15)
45	(20-100%)	Populus angustifolia	14
33	(5-60%)	Picea pungens	6
29	(5-66%)	Abies concolor	13*
20	(1-62%)	Acer glabrum	12
15	(1-50%)	Alnus incana ssp. tenuifolia	10
13	(1-36%)	Pseudotsuga menziesii	10
12	(1-27%)	Salix drummondiana	5
8	(1-30%)	Heracleum maximum	5
7	(1-30%)	Amelanchier alnifolia	7
7	(1-30%)	Elymus glaucus	5
6	(1-20%)	Lonicera involucrata	8
5	(1-10%)	Symphoricarpos oreophilus	5

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-10%), Taraxacum officinale (1-7%), Rosa woodsii (1-10%), Geranium richardsonii (1-7%), Poa pratensis (1-11%), Maianthemum stellatum (1-4%), Thalictrum fendleri (1-3%), Chamerion angustifolium ssp. circumvagum (1-4%), Actaea rubra ssp. arguta (1-3%), Equisetum arvense (1-3%), Galium triflorum (1-3%), Mertensia ciliata (1-3%), Oxypolis fendleri (1%), Achillea millefolium var. occidentalis (1%).

*Abies concolor occurred in all stands, but was not captured in every sample plot.

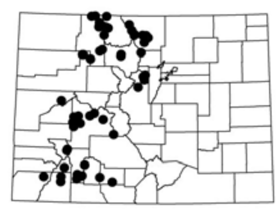
Subalpine fir / Thinleaf alder Forest

Abies lasiocarpa / Alnus incana* ssp. *tenuifolia

Global rank/State rank
G5 / S5

HGM subclass: R2, R3/4

Colorado elevation range:
7,200-10,300 ft (2,200-3,100 m)



General Description
Occurs on heavily forested stream reaches where *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) forests also occur on adjacent hillslopes. Tall *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Salix drummondiana* (Drummond willow) grow in a thick band along the edge of the stream. At lower elevations, *Alnus incana* ssp.*tenuifolia* is more abundant than *Salix drummondiana*. At mid-elevations, the two shrubs can be codominant. At higher elevations, *Salix drummondiana* becomes dominant and *Alnus incana* ssp.*tenuifolia* drops out, forming the *Abies lasiocarpa/Salix drummondiana* plant association.

This is a common community on first- and second-order streams above 8,000 ft in elevation. It is generally found on stream benches and banks in narrow, 150-800 ft (40-250 m) wide, V-shaped valleys. Most commonly occurs within 15-20 ft (5-6 m) of the channel edge and is rarely more than 2 ft (0.5 m) above the stream bank. Stream channels are narrow and steep, moderately wide with a moderate gradient or wide and very sinuous.

Soils are shallow, dark-colored, thin layers of loamy sands, silty loams, and sandy clay loams over cobbly alluvium. There is generally a high organic matter content in the top 20 inches (50 cm) and mottles at 40 inches (100 cm), becoming skeletal at 60 inches (150 cm).

Vegetation Description
Picea engelmannii (Engelmann spruce) and/or *Abies lasiocarpa* (subalpine fir) dominates the upper canopy, with *Picea engelmannii* present more often that *Abies lasiocarpa.* Other tree species such as *Picea pungens* (blue spruce), *Pinus contorta* (lodgepole pine), and *Populus tremuloides* (quaking aspen) are occasionally present. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is always present in the shrub canopy layer, and other shrubs are often present as well. The

herbaceous undergrowth is usually rich in forb species, with an overall herbaceous cover of 20-70%.

Ecological Processes
This association appears to be a late-seral, or at least a long-lived, riparian community that may represent a successional change from deciduous-dominated overstory to a conifer-dominated overstory at lower elevations, a shift which may be attributed to a lack of flooding or other frequent disturbance. The successional process of the spruce-fir forest is slow (200 + years); factors such as fire frequency, wind-throw and insect attack can affect the composition and age structure of *Abies lasiocarpa* and *Picea engelmannii* stands.

A Potential Conservation Area supporting this community type is the Upper Rito Blanco PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=56)
34	(1-80%)	Alnus incana ssp. tenuifolia	56
31	(1-82%)	Picea engelmannii	51
22	(1-53%)	Cornus sericea ssp. sericea	8
21	(1-77%)	Abies lasiocarpa	43
17	(3-30%)	Salix geyeriana	8
14	(2-48%)	Pinus contorta	9
12	(1-32%)	Acer glabrum	9
12	(1-43%)	Corydalis caseana ssp. brandegeei	7
9	(0.1-95%)	Calamagrostis canadensis	32
9	(1-43%)	Equisetum arvense	29
7	(1-20%)	Salix drummondiana	25
7	(1-10%)	Picea pungens	9
6	(1-30%)	Lonicera involucrata	40
5	(0.1-15%)	Carex aquatilis	9
5	(1-21%)	Populus tremuloides	15
5	(1-20%)	Salix monticola	6

Other species with < 5% average cover present in at least 10% of plots:
Heracleum maximum (0.1-25%), Oxypolis fendleri (1-34%), Mertensia ciliata (0.1-11%), Mertensia franciscana (1-7%), Amelanchier alnifolia (1-10%), Maianthemum racemosum ssp. amplexicaule (1-18%), Rubus parviflorus (1-10%), Streptopus amplexifolius var. chalazatus (1-8%), Pyrola asarifolia ssp. asarifolia (1-10%), Cardamine cordifolia (1-11%), Glyceria striata (1-14%), Ribes inerme (1-10%), Saxifraga odontoloma (1-10%), Symphyotrichum foliaceum (1-10%), Hydrophyllum fendleri (1-10%), Vaccinium scoparium (1-8%), Ribes lacustre (1-7%), Viola canadensis var. scopulorum (0.1-20%), Galium trifidum ssp. subbiflorum (1-10%), Equisetum pratense (1-6%), Osmorhiza depauperata (1-10%), Aconitum columbianum (1-10%), Actaea rubra ssp. arguta (1-8%), Senecio triangularis (1-9%), Arnica cordifolia (1-7%), Thalictrum fendleri (1-10%), Mitella pentandra (1-10%), Geranium richardsonii (1-8%), Rosa woodsii (1-7%), Chamerion angustifolium ssp. circumvagum (1-6%), Maianthemum stellatum (1-8%), Osmorhiza berteroi (1-3%), Dodecatheon pulchellum (1-5%), Galium triflorum (1-8%), Chaenactis douglasii (1-4%), Elymus glaucus (1-5%), Carex disperma (0.1-5%), Orthilia secunda (1-3%), Conioselinum scopulorum (0.1-5%), Rubus idaeus ssp. strigosus (1-3%), Luzula parviflora (0.1-4%), Taraxacum officinale (1-3%), Achillea millefolium var. occidentalis (1-5%), Poa pratensis (1-4%), Pyrola minor (1-3%), Geum macrophyllum var. perincisum (0.1-3%), Fragaria virginiana ssp. glauca (1-3%), Pseudocymopterus montanus (1-2%), Galium boreale (1-3%), Carex microptera (1-2%), Bromus ciliatus var. ciliatus (1%).

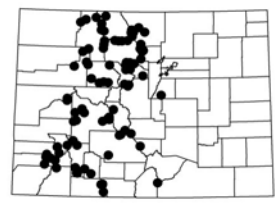
Subalpine fir / Tall fringed bluebells Forest

Abies lasiocarpa / Mertensia ciliata

Global rank/State rank:
G5 / S5

HGM subclass: S1/2?, R2, R3/4

Colorado elevation range:
8,200-11,500 ft (2,500-3,500 m)



General Description
This association is a heavily shaded forest with no shrubs and a thick line of wildflowers lining the stream edge. It is a common community in the subalpine zone along first- and second-order streams. *Mertensia ciliata* (tall fringed bluebells) is nearly always present but can be absent. Other forbs consistently present include *Cardamine cordifolia* (heartleaf bittercress), *Saxifraga odontoloma* (brook saxifrage) and *Senecio triangularis* (arrowleaf ragwort). *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), and *Ribes* (currant) species can be present, but with less than 10% cover. At high elevations, *Vaccinium myrtillus* (whortleberry), typically an upland species, can intergrade with this riparian plant association on the stream banks. This is a common plant association throughout the southern Rocky Mountains of Colorado and occurs in all mountain ranges and National Forests in Colorado, comprising approximately 2,000+ miles of stream habitat in Colorado alone.

This association occurs in narrow to wide valleys, 35-350 feet (10-100 m) wide, and is limited to the immediate stream channel edge and overflow areas. It usually establishes within 15 feet (5 m) of the channel and within 2 feet (0.5 m) of channel bankfull height. Typically this association occurs along steep (2-15% gradient), narrow streams, but can also be found along moderate gradient stretches. Soils range from a thin layer of skeletal sandy loams to somewhat deep, mottled loamy sands over colluvial boulders. Total soil depth is never more than 7 feet (2 m), and is typically less than 3 feet (1 m). Consistent to all profiles is a deep, dark brown color and high organic content.

Vegetation Description
Either *Picea engelmannii* (Engelmann spruce) or *Abies lasiocarpa* (subalpine fir) is present, although they are not always present together. The tree canopy can be very thick, completely overhanging the stream, or it can be quite open, with a wide gap over the stream. There is generally very little shrub cover. *Vaccinium myrtillus* (whortleberry), can be abundant, but it was present in only a third of the stands sampled. Other shrub species that may be present include *Salix drummondiana* (Drummond willow), *S. planifolia* (planeleaf willow), *S. monticola* (mountain willow), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Lonicera involucrata* (twinberry honeysuckle), and several *Ribes* (currant) species.

The dense, mossy forb layer is the diagnostic part of this vegetation type. The forb layer is usually very narrow, often well under 3 ft (1 m) wide, clinging to and undulating with the side of the narrow stream channel. It is species-rich with 20-80% total combined forb cover. No single forb species is consistently present in every stand, however, a distinct suite of species is present in varying combinations.

Ecological Processes
Many first- and second-order streams run through subalpine spruce-fir forests providing habitats for obligate riparian shrubs, forbs, and grasses, forming a number of riparian *Abies lasiocarpa - Picea engelmannii* (subalpine fir-Engelmann spruce) plant associations. Although *Abies lasiocarpa* and *Picea engelmannii* are not obligate riparian species, the two species strongly influence subalpine riparian ecosystems.

This plant association is not documented within a designated PCA in Archuleta County; however, it can be found along the West Fork of Rio Chama.

Avg. Cover %	(Range)	Species Name	# Plots (N=92)
33	(1-100%)	Picea engelmannii	89
17	(1-90%)	Abies lasiocarpa	79
13	(2-24%)	Alnus incana ssp. tenuifolia	12
10	(1-50%)	Senecio triangularis	70
10	(1-50%)	Vaccinium myrtillus var. oreophilum	31
10	(1-50%)	Cardamine cordifolia	82
9	(1-20%)	Ribes lacustre	14
9	(1-53%)	Mertensia ciliata	80
7	(1-56%)	Saxifraga odontoloma	66
7	(1-21%)	Vaccinium scoparium	17
7	(1-20%)	Oxypolis fendleri	72
6	(1-20%)	Trollius laxus ssp. albiflorus	15
5	(1-27%)	Ribes montigenum	18
5	(1-37%)	Carex aquatilis	26

Other species with < 5% average cover present in at least 10% of plots:
Calamagrostis canadensis (1-40%), Caltha leptosepala (1-20%), Salix planifolia (1-20%), Salix drummondiana (1-10%), Streptopus amplexifolius var. chalazatus (1-18%), Erigeron peregrinus ssp. callianthemus (1-10%), Equisetum arvense (1-20%), Salix monticola (1-20%), Arnica mollis (1-16%), Arnica cordifolia (1-29%), Lonicera involucrata (1-20%), Heracleum maximum (1-20%), Mitella pentandra (1-15%), Ligusticum porteri (1-10%), Aconitum columbianum (1-10%), Geranium richardsonii (1-15%), Conioselinum scopulorum (1-16%), Deschampsia caespitosa (1-11%), Bromus ciliatus var. ciliatus (1-10%), Juncus balticus var. montanus (1-5%), Maianthemum stellatum (1-3%), Chamerion angustifolium ssp. circumvagum (1-10%), Orthilia secunda (1-7%), Osmorhiza depauperata (1-6%), Polygonum bistortoides (1-3%), Achillea millefolium var. occidentalis (1-5%), Fragaria virginiana ssp. glauca (1-5%), Luzula parviflora (1-10%), Juncus drummondii (1-5%), Poa pratensis (1-4%), Rhodiola rhodantha (1-4%), Taraxacum officinale (1-6%), Viola canadensis var. scopulorum (1-4%), Pyrola minor (1-3%), Listera cordata (1-2%), Veronica wormskjoldii (1-2%), Platanthera dilatata var. albiflora (1%).

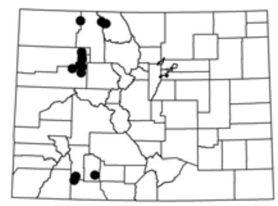
Subalpine fir / (western prickly gooseberry, bristly black currant, white-stem gooseberry) Forest

Abies lasiocarpa / Ribes spp.

Global rank/State rank:
G5 / S3

HGM subclass: R2, R3/4?

Colorado elevation range:
8,300-12,200 ft (2,500-3,700 m)



General Description
The *Abies lasiocarpa /Ribes* spp. (subalpine fir/western prickly gooseberry, bristly black currant, white-stem gooseberry) association forms a heavily shaded forest with a very open shrub layer of just a few individual shrubs. This association has a wide elevational range, and is a common and facultative riparian community. It occurs along steep or moderate gradient streams where the riparian area is narrow and dominated by species of the surrounding forest. *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) dominate the tree canopy, while *Ribes* (currant) species dominate the shrub layer.

This is a small community in Colorado, occuring throughout mountainous regions of the state. It has been documented from the Flat Tops Plateau in the White and Colorado River Basins and in the San Juan, Rio Grande, Gunnison, White River, Routt, San Isabel and Pike National Forests. In Colorado, this plant association occurs along narrow to moderately wide streams in steep ravines and valleys. Stream channels are narrow and steep or moderately wide and sinuous with a moderate gradient. Soils are sands or loam over sand, gravel, and cobbles.

Vegetation Description
This community is very similar to the *Abies lasiocarpa /Mertensia ciliata* plant association, with a similar overstory and herbaceous characteristics. The difference lies in the consistent presence of a shrub layer with *Ribes* spp. often as the dominant species. *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) dominate the tree canopy.

The shrub layer is dominated by 1-50% cover of usually one and occasionally a mix of any of the following *Ribes* (currant) species: *Ribes inerme* (whitestem gooseberry), *R. lacustre* (prickly currant), *R. montigenum* (gooseberry currant), or *R. wolfii* (Wolf currant). Other shrubs that may be present include *Lonicera involucrata* (twinberry honeysuckle) and *Sorbus scopulina* (mountain ash). Willows may be present along the stream edge (usually less abundant than the *Ribes),* and can include *Salix drummondiana* (Drummond willow), *S. monticola*, (mountain willow) *S. bebbiana* (Bebb willow), or *S. boothii* (Booth willow). A variable forb layer is present.

Ecological Processes
Many first- and second-order streams run through subalpine spruce-fir forests providing habitats for obligate riparian shrubs, forbs, and grasses, forming a number of riparian *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) plant associations. Although *Abies lasiocarpa* and *Picea engelmannii* are not obligate riparian species, the two species strongly influence subalpine riparian ecosystems.

A Potential Conservation Area supporting this community type is Upper Mosca Creek PCA[1].

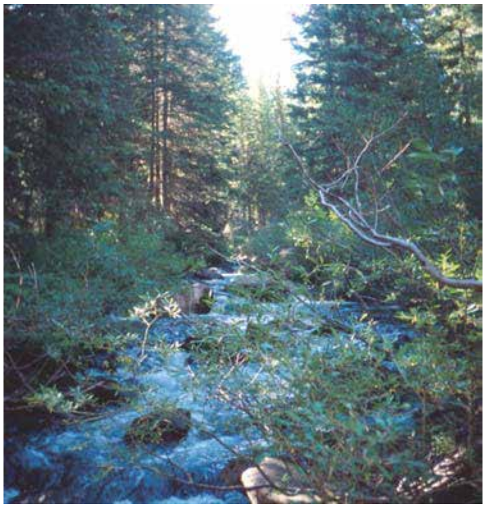
Avg. Cover %	(Range)	Species Name	# Plots (N=14)
21	(1-50%)	Picea engelmannii	14
18	(5-38%)	Abies lasiocarpa	13
12	(1-20%)	Ribes wolfii	3
12	(1-30%)	Lonicera involucrata	13
12	(3-22%)	Ribes inerme	6
12	(1-20%)	Ribes lacustre	4
11	(4-20%)	Ribes montigenum	4
10	(1-40%)	Ribes laxiflorum	5
7	(1-17%)	Sorbus scopulina	4
6	(3-10%)	Salix drummondiana	5
6	(1-13%)	Actaea rubra ssp. arguta	3
5	(2-10%)	Mertensia franciscana	3
5	(1-12%)	Oxypolis fendleri	3
5	(1-14%)	Geranium richardsonii	12
5	(1-10%)	Chamerion angustifolium ssp. circumvagum	6
5	(1-20%)	Senecio triangularis	11

Other species with < 5% average cover present in at least 10% of plots:
Cardamine cordifolia (1-10%), Heracleum maximum (1-10%), Erigeron coulteri (1-7%), Mertensia ciliata (1-10%), Aconitum columbianum (1-10%), Mitella pentandra (1-5%), Carex microptera (1-5%), Conioselinum scopulorum (1-5%), Arnica cordifolia (1-5%), Rubus idaeus ssp. strigosus (1-5%), Alnus incana ssp. tenuifolia (1-5%), Saxifraga odontoloma (1-9%), Streptopus amplexifolius var. chalazatus (1-10%), Vaccinium myrtillus var. oreophilum (1-6%), Sambucus racemosa var. racemosa (1-5%), Vaccinium scoparium (1-6%), Equisetum arvense (1-5%), Calamagrostis canadensis (1-5%), Hydrophyllum fendleri (1-3%), Achillea millefolium var. occidentalis (1-5%), Mimulus guttatus (1-5%), Polemonium pulcherrimum ssp. delicatum (1-5%), Maianthemum stellatum (1-7%), Fragaria virginiana ssp. glauca (1-6%), Bromus ciliatus var. ciliatus (1-5%), Deschampsia caespitosa (1-5%), Urtica dioica ssp. gracilis (1-3%), Galium triflorum (1-3%), Orthilia secunda (1-3%), Thalictrum fendleri (1-3%), Viola canadensis var. scopulorum (1-2%), Osmorhiza depauperata (1-2%), Luzula parviflora (1%), Geum macrophyllum var. perincisum (1%), Taraxacum officinale (1%), Erigeron elatior (1%), Elymus glaucus (1-%), Angelica grayi (1%), Galium boreale (1%), Poa reflexa (1%), Poa pratensis (1%).

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Subalpine fir / Drummond's willow Forest

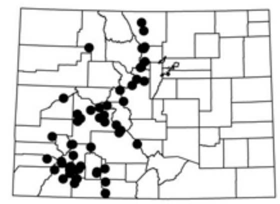
Abies lasiocarpa / Salix drummondiana



Global rank/State rank:
G5 / S4

HGM subclass: R2, R3/4

Colorado elevation range:
8,400-10,900 ft (2,600-3,300 m)



General Description
This association is a heavily forested type found along second and third-order streams above 8,400 ft (2,600 m) where *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) forests also occur on adjacent hillslopes. Tall *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Salix drummondiana* (Drummond willow) grow in a thick band along the edge of the stream. At lower elevations, *Alnus incana* ssp.*tenuifolia* is more abundant than *Salix drummondiana*. At mid-elevations, the two shrubs can be co-dominant. At higher elevations, *Salix drummondiana* becomes dominant and *Alnus incana* ssp.*tenuifolia* drops out, forming the *Abies lasiocarpa/Salix drummondiana* plant association. *Picea pungens* (blue spruce) is occasionally present at the stream edge and represents a variation of this type.

This common and well-documented plant association occurs in the San Juan Mountains and the Colorado, Gunnison, Arkansas, and South Platte River Basins. It is commonly found on steep (2-25% gradient), narrow (<35 ft, 10 m), first-order streams in moderate to deep V-shaped valleys. The thick shrub canopy is restricted to a narrow band along the rocky stream bank. It can also occur in wider valleys along moderate gradient reaches with channel bottoms that range from bedrock to gravel and one site in the Gunnison River Basin occurs along a braided stream channel. Soils are typically shallow (<3 ft, 1 m) sandy loams to sandy clay loams packed between large angular boulders and cobbles with a thin layer of partially decomposed organic matter under the litter layer.

Vegetation Description
This association does not generally form a mosaic and is often the only riparian association along a stream reach. It typically has a dense canopy of 20-90% cover of *Abies lasiocarpa* (subalpine fir) and/or *Picea engelmannii* (Engelmann spruce). *Picea pungens* (blue spruce) is occasionally present in lower elevation, wet stands, and *Pinus contorta* (lodgepole pine) may be present in drier, early-seral stands. *Salix drummondiana* (Drummond willow) is always present as part of a narrow but dense strip of shrubs. Other shrubs that occur with less frequency include *Salix monticola* (mountain willow), *Salix brachycarpa* (barrenground willow), *Salix planifolia*

(planeleaf willow), *Lonicera involucrata* (twinberry honeysuckle), *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Cornus sericea* (red-osier dogwood). The dense herbaceous undergrowth is formed by a variety of species.

Ecological Processes

The dense overstory, thick shrub canopy, and thick forb undergrowth of this association indicate that it is late-seral. High forb cover suggests that with time, further upper canopy closure, and a continued high water table, this association may shift to an *Abies lasiocarpa/Mertensia ciliata* (subalpine fir/bluebells) plant association. With a more open forest canopy, shrubs such as *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or *Salix drummondiana* (Drummond willow) may have higher abundance. Stands with high cover of both *Salix drummondiana* and *Alnus incana* in the understory may be transitional as *Salix drummondiana* replaces *Alnus incana* ssp. *tenuifolia* at higher elevations.

This plant association is not documented within a designated PCA in Archuleta County; however, it can be found along the West Fork of Rio Chama.

Avg. Cover %	**(Range)**	**Species Name**	**# Plots (N=55)**
36	(1-90%)	Salix drummondiana	53*
32	(3-100%)	Picea engelmannii	52
15	(1-40%)	Alnus incana ssp. tenuifolia	15
13	(3-21%)	Pinus contorta	11
12	(1-40%)	Populus tremuloides	11
10	(1-40%)	Salix monticola	29
10	(1-36%)	Abies lasiocarpa	37
9	(1-34%)	Vaccinium myrtillus var. oreophilum	7
7	(1-20%)	Heracleum maximum	34
7	(1-30%)	Ribes inerme	8
7	(1-12%)	Picea pungens	8
6	(1-44%)	Streptopus amplexifolius var. chalazatus	14
6	(1-30%)	Calamagrostis canadensis	31
6	(1-31%)	Lonicera involucrata	38
6	(1-19%)	Equisetum arvense	22
6	(1-30%)	Mertensia ciliata	41
6	(1-12%)	Salix bebbiana	7
5	(1-13%)	Carex aquatilis	11
5	(1-27%)	Salix brachycarpa	8
5	(1-30%)	Senecio triangularis	29

Other species with < 5% average cover present in at least 10% of plots:

Oxypolis fendleri (1-16%), Orthilia secunda (1-12%), Cardamine cordifolia (1-15%), Mertensia franciscana (1-12%), Symphoricarpos oreophilus (1-10%), Arnica cordifolia (1-13%), Equisetum pratense (1-14%), Rosa woodsii (1-10%), Geranium richardsonii (1-12%), Ligusticum porteri (1-10%), Saxifraga odontoloma (1-17%), Chamerion latifolium (1-6%), Viola canadensis var. scopulorum (1-17%), Carex disperma (1-13%), Chamerion angustifolium ssp. circumvagum (1-9%), Conioselinum scopulorum (1-12%), Maianthemum stellatum (1-20%), Actaea rubra ssp. arguta (1-8%), Galium triflorum (1-8%), Taraxacum officinale (1-10%), Juncus compressus (1-3%), Aconitum columbianum (1-10%), Osmorhiza depauperata (1-10%), Fragaria virginiana ssp. glauca (1-5%), Poa pratensis (1-7%), Thalictrum fendleri (1-10%), Rubus idaeus ssp. strigosus (1-5%), Pseudocymopterus montanus (1-8%), Pyrola minor (1-3%), Deschampsia caespitosa (1-3%), Mitella pentandra (1-3%), Geum macrophyllum var. perincisum (1-3%), Galium boreale (1-3%), Achillea millefolium var. occidentalis (1-10%), Luzula parviflora (1-3%), Polygonum viviparum (1-3%), Mimulus guttatus (1-2%), Polygonum bistortoides (1-2%).

*Salix drummondiana occurred in all stands, but was not captured in every sample plot.

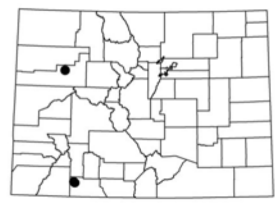
Box elder / Red-osier dogwood Forest

Acer negundo / Cornus sericea

Global rank/State rank:
G3? / S2

HGM subclass: R3/4

Colorado elevation range:
6,800-7,700 ft (2,070-2,300 m)



General Description

The *Acer negundo/Cornus sericea* (boxelder/red-osier dogwood) plant association is a medium-tall (5-15 ft, 1.5-4.5 m) deciduous forest. It flourishes in narrow, shady canyons, often with a controlled stream flow and is known from lower montane canyons in Utah and western Colorado.

This plant association occurs within narrow, 40 ft (12 m) wide, box canyons about 10 ft (2-3 m) above the channel bankfull level. Stream channels are steep and narrow or moderately wide and sinuous. The soil textures are sandy loams to clay loams.

Vegetation Description

Acer negundo (boxelder) dominates the overstory with 15-70% cover. The shrub layer is dense and diverse with *Cornus sericea* (red-osier dogwood) (40-60% cover) as the dominant shrub. Other shrub species (present with 50% or less frequency) include *Ribes inerme* (whitestem gooseberry), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Acer glabrum* (Rocky Mountain maple), *Salix exigua* (sandbar willow), *Quercus gambelii* (Gambel oak), *Rubus idaeus* (American red raspberry), and *Salix irrorata* (bluestem willow). Forb and graminoid species include *Heracleum maximum* (common cowparsnip), *Geranium richardsonii* (Richardson geranium), *Actaea rubra* (red baneberry), and *Mertensia franciscana* (Franciscan bluebells).

Ecological Processes

Acer negundo (boxelder) may be a riparian climax type, unless the site becomes too dry due to channel migration and downcutting. This association appears to flourish in narrow canyons with natural flood regimes or altered flows (e.g., Black Canyon of the Gunnison). With scouring floods, *Acer negundo* may survive only if it grows on upper colluvial slopes. This may provide a seed source for regeneration after flooding and deposition.

A Potential Conservation Area supporting this community type is Death Valley Creek[1].

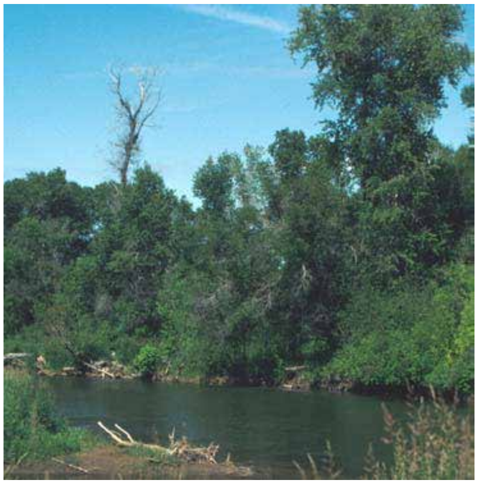
Avg. Cover %	(Range)	Species Name	# Plots (N=4)
47	(40-60%)	Cornus sericea	3*
33	(15-70%)	Acer negundo var. interius	4
33	(5-60%)	Ribes inerme	2
19	(12-26%)	Alnus incana ssp. tenuifolia	2
11	(7-14%)	Picea pungens	2
8	(1-15%)	Heracleum maximum	2
8	(5-10%)	Rubus idaeus ssp. strigosus	2
7	(5-10%)	Actaea rubra ssp. arguta	3
6	(4-8%)	Carex geyeri	2
6	(1-10%)	Geranium richardsonii	4
5	(4-5%)	Rosa woodsii	3
Other species with < 5% average cover present in at least 10% of plots:			
Abies concolor (4-5%), Viola canadensis var. scopulorum (1-5%), Poa pratensis (1-5%), Aconitum columbianum (1-5%), Rudbeckia laciniata var. ampla (1-5%), Dactylis glomerata (1-5%), Elymus glaucus (1-5%), Angelica ampla (1-5%), Equisetum pratense (1-4%), Ligusticum porteri (1-5%), Galium triflorum (1-5%), Lonicera involucrata (1-3%), Vicia americana (1-3%), Fragaria vesca ssp. bracteata (1-2%), Taraxacum officinale (1-2%), Agrostis gigantea (1-2%), Maianthemum stellatum (1%), Galium boreale (1%), Maianthemum racemosum ssp. amplexicaule (1%), Achillea millefolium var. occidentalis (1%).			

*Cornus sericea occurred in all stands, but was not captured in every sample plot.

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Box elder – Narrowleaf cottonwood / Red-osier dogwood Forest

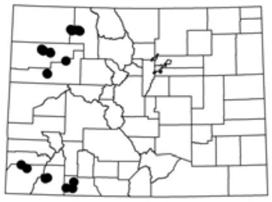
Acer negundo - Populus angustifolia / Cornus sericea



Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
5,700-7,700 ft (1,730-2,350 m)



General Description
The *Acer negundo-Populus angustifolia/Cornus sericea* (box elder-narrowleaf/red-osier dogwood) plant association is a tall (12-25 ft, 4-8 m), multi-layered, deciduous riparian forest. It is grows on broad alluvial floodplains with strongly meandering stream channels, where it can form extensive riparian forests. It can also occur as small stands on narrow streams at high elevations.

This plant association occurs along moderately sinuous stream reaches within narrow valleys or broad alluvial floodplains. It occurs at 2-10 ft (0.5-2 m) above the bankfull channel level. Stream channels are slightly meandering to strongly meandering. Soil textures range from loamy sand to silty clay loam with minimal skeletal fraction. Mottling may occur at about 20-25 inches (50-60 cm).

Vegetation Description
This community is characterized by a tall gallery forest of *Populus angustifolia* (narrowleaf cottonwood) and a subcanopy of *Acer negundo* (boxelder). In most of the stands sampled, *Acer negundo* (boxelder) formed a subcanopy underneath the taller canopy of narrowleaf cottonwoods. However, patches of *Acer negundo* (boxelder) do occur on the floodplain without the cottonwood overstory as part of the overall mosaic of different aged stands. These are thought to be older stands where the cottonwood has died. *Juniperus scopulorum* (Rocky Mountain juniper), *Pseudotsuga menziesii* (Douglas-fir), and *Picea pungens* (blue spruce) are occasionally present in small amounts.

Mesic shrubs form a dense and diverse mid-canopy layer. *Cornus sericea* (red-osier dogwood) is the most abundant and dominant shrub. Other shrub species which may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Rosa woodsii* (Woods rose), *Acer glabrum* (Rocky Mountain maple), *Rhus trilobata* (skunkbush sumac), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), *Salix boothii* (Booth willow), and *Salix lucida* ssp. *caudata* (shining willow). Forb and graminoid cover vary from low to abundant. Species include *Maianthemum racemosum* (feathery false Solomon seal), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), and *Solidago gigantea* (giant goldenrod). In disturbed stands *Cirsium arvense* (Canada thistle), *Agrostis gigantea* (redtop), and *Taraxacum officinale* (dandelion) can occur.

Ecological Processes

The *Acer negundo-Populus angustifolia/Cornus sericea* (boxelder-narrowleaf cottonwood/red-osier dogwood) plant association appears to be late-seral. This is evident from the mature *Populus angustifolia* trees and dense stands of *Cornus sericea* within the closed forest canopy. Young, early-seral stands of regenerating cottonwoods may be found on the inside bends of the channel and on point bars and lower terraces. Channel migration and meander movement may cut into the mature forest on the outside of meander bends, leaving the stands immediately adjacent to, yet potentially several meters above, the channel. Over time, the riparian communities can convert to upland plant associations.

Potential Conservation Areas supporting this community type are Archuleta Creek PCA[1], Devil Creek at Middle Mountain PCA, and Ignacio Creek PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=21)
41	(3-90%)	Populus angustifolia	19*
33	(1-90%)	Cornus sericea ssp. sericea	21
27	(1-80%)	Acer negundo var. interius	20*
19	(5-80%)	Solidago gigantea	6
19	(1-50%)	Prunus virginiana var. melanocarpa	5
18	(1-80%)	Bromus inermis	7
11	(1-30%)	Clematis ligusticifolia	5
10	(1-40%)	Poa pratensis	15
10	(1-30%)	Crataegus rivularis	9
10	(1-30%)	Agrostis gigantea	4
8	(1-27%)	Pseudotsuga menziesii	5
8	(1-15%)	Alnus incana ssp. tenuifolia	4
7	(1-20%)	Ribes inerme	6
7	(5-10%)	Osmorhiza depauperata	4
7	(1-20%)	Maianthemum racemosum ssp. amplexicaule	5
7	(1-20%)	Rosa woodsii	17
7	(1-23%)	Geranium richardsonii	6
6	(1-30%)	Dactylis glomerata	9
6	(1-20%)	Phalaris arundinacea	7
6	(1-20%)	Rudbeckia laciniata var. ampla	11
6	(1-20%)	Elymus glaucus	6
5	(1-30%)	Maianthemum stellatum	11
5	(1-20%)	Taraxacum officinale	14
5	(1-11%)	Quercus gambelii	5

Other species with < 5% average cover present in at least 10% of plots:

Rhus trilobata var. trilobata (1-10%), Amelanchier alnifolia (1-10%), Juniperus scopulorum (1-10%), Rubus idaeus ssp. strigosus (1-7%), Elymus repens (1-10%), Amelanchier utahensis (1-5%), Phleum pratense (1-10%), Mahonia repens (1-5%), Galium triflorum (1-5%), Symphoricarpos oreophilus (1-5%), Geum macrophyllum var. perincisum (1-5%), Lonicera involucrata (1-5%), Urtica dioica ssp. gracilis (1-5%), Vicia americana (1-3%), Melilotus officinalis (1-3%), Achillea millefolium var. occidentalis (1-2%), Galium boreale (1%), Mentha arvensis (1%)

*Populus angustifolia and Acer negundo were present in all stands, but were not captured in every sample plot.

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

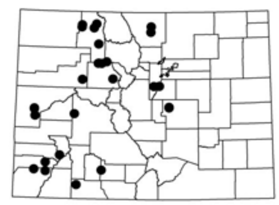
Thinleaf alder / Red-osier dogwood Shrubland

Alnus incana* ssp. *tenuifolia - Cornus sericea

Global rank/State rank:
G3G4 / S3

HGM subclass: R3/4

Colorado elevation range:
5600-9,000 ft (1,700-2,750 m)



General Description

The *Alnus incana* ssp. *tenuifolia-Cornus sericea* (thinleaf alder-red-osier dogwood) plant association is a narrow thicket of medium to tall shrubs lining the stream bank. Due to heavy shading, there is usually a limited herbaceous understory.

This plant association occurs on narrow, rocky banks and benches of small channels as well as narrow, constricted reaches of larger rivers. It can also occur along overflow channels and narrow tributaries. Stream channels are steep and narrow, wider and moderately sinuous, or wider and highly sinuous. Soils range from loamy sand to sandy clay loam. Mottling is evident at approximately 12 inches (30 cm) and gravel or cobble layers appear at 20-40 inches (50-100 cm) beneath the surface.

Vegetation Description

This plant association is characterized by a dense thicket of shrubs dominated by *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Cornus sericea* (red-osier dogwood). *Salix exigua* (sandbar willow) is often present. A wide variety of other shrub species may be present, including *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *Salix monticola* (mountain willow), *Lonicera involucrata* (twinberry honeysuckle), *Rosa woodsii* (Woods rose), *Betula occidentalis* (river birch), and *Rubus idaeus* (American red raspberry). Tree species are scattered and only occasionally present.
Forb cover is highly variable depending on the amount of light that penetrates the canopy. Forb species include *Rudbeckia laciniata* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Osmorhiza depauperata* (bluntseed sweetroot) and *Ligusticum porteri* (Porter licoriceroot). Graminoid cover is usually low, but can include *Poa pratensis* (Kentucky bluegrass). *Equisetum arvense* (field horsetail) is sometimes present.

Ecological Processes

Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop. *Alnus incana* ssp. *tenuifolia* is shade-intolerant, and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy.

In Colorado, the *Alnus incana* ssp. *tenuifolia*-*Cornus sericea* (thinleaf alder-red-osier dogwood) plant association is tolerant of flooding and requires a high water table each spring. It appears to be a stable, long-lived association where succession to other types can be very slow.

Potential Conservation Areas supporting this community type are Elk Creek at Piedra River PCA and Indian Creek at Piedra River PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=25)
47	(1-100%)	Alnus incana ssp. tenuifolia	25
35	(5-83%)	Cornus sericea ssp. sericea	25
31	(8-70%)	Salix bebbiana	3
11	(3-20%)	Betula occidentalis	6
10	(1-20%)	Salix drummondiana	4
10	(1-33%)	Juniperus scopulorum	4
10	(3-30%)	Salix ligulifolia	7
9	(1-30%)	Rudbeckia laciniata var. ampla	14
8	(1-20%)	Lonicera involucrata	10
8	(0.1-30%)	Heracleum maximum	15
7	(1-20%)	Salix monticola	7
7	(1-45%)	Poa pratensis	11
6	(1-25%)	Calamagrostis canadensis	8
6	(1-20%)	Rubus idaeus ssp. strigosus	8
5	(1-20%)	Rosa woodsii	18

Other species with < 5% average cover present in at least 10% of plots:
Carex pellita (1-10%), Ribes inerme (1-10%), Populus angustifolia (1-13%), Salix exigua (1-10%), Agrostis gigantea (0.1-10%), Equisetum pratense (2-7%), Osmorhiza depauperata (1-10%), Poa palustris (1-5%), Urtica dioica ssp. gracilis (1-5%), Equisetum arvense (0.1-10%), Solidago gigantea (1-9%), Symphoricarpos oreophilus (1-5%), Maianthemum stellatum (1-10%), Aconitum columbianum (1-5%), Actaea rubra ssp. arguta (1-5%), Streptopus amplexifolius var. chalazatus (1-3%), Glyceria striata (1-5%), Rhus trilobata var. trilobata (1-3%), Geranium richardsonii (1-3%), Amelanchier alnifolia (1-3%), Ligusticum porteri (1-3%), Prunus virginiana var. melanocarpa (1-3%), Amelanchier utahensis (1-3%), Geum macrophyllum var. perincisum (0.1-5%), Elymus glaucus (1-3%), Mentha arvensis (1-2%), Mertensia ciliata (1-2%), Taraxacum officinale (1-2%), Achillea millefolium var. occidentalis (1%), Fragaria virginiana ssp. glauca (1%), Cardamine cordifolia (1%), Chamerion angustifolium ssp. circumvagum (1%), Phleum pratense (1%).

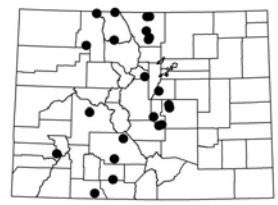
Thinleaf alder / Mesic forbs Shrubland

***Alnus incana* ssp. *tenuifolia* / Mesic forbs**

Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
5,800-9,600 ft (1,750-2,930 m)



General Description

This association is characterized by stands of medium-tall, deciduous shrubs and a thick, herbaceous undergrowth of forbs and wetland grasses. A low canopy of shorter shrubs may also be present with *Ribes* (currant) and *Salix* (willow) species and *Cornus sericea* (red-osier dogwood). Undisturbed stands have abundant forbs and native grasses. Stands disturbed by season-long livestock grazing have reduced forb cover and an increase in non-native grasses including *Poa pratensis* (Kentucky bluegrass) and *Agrostis stolonifera* (creeping bentgrass). Large stands (>0.5 acre, 0.2 ha) with the native herbaceous undergrowth intact are uncommon.

This plant association occurs along narrow, 130-230 ft (40-70 m) wide, alluvial benches and terraces of canyons and valleys. It also occurs as narrow bands in wider valleys and occasionally forms a wide band on the floodplain. Stream channels are highly variable. They can be steep (3-12%) gradient and narrow or wider, rocky, and moderately sinuous. Occasionally, stream channels are low gradient and highly sinuous, narrow and highly sinuous, or braided. Soils are well drained silt loams, loams, sandy clay loams, sandy loams, or just sand. Some profiles have a high percentage of organic matter and are either skeletal or stratified with skeletal layers. Some profiles have significant silt fractions in the upper layers.

Vegetation Description

Alnus incana ssp. *tenuifolia* (thinleaf alder) creates a dense, tall shrub canopy. Other shrubs occasionally present include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *R. montigenum* (gooseberry currant) *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. geyeriana* (Geyer willow), *S. lucida* ssp. *caudata* (shining willow) and *S. monticola* (mountain willow). A few trees, including *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), and *Populus angustifolia* (narrowleaf cottonwood) may be present along the edges of the stand.

The ground is generally very wet and covered with tall, 3-7 ft (1-2 m), forbs and graminoids. Forb cover is high in undisturbed stands, with total cover often exceeding 60%. Dominant forb species include *Heracleum maximum* (common cowparsnip), *Angelica ampla* (giant angelica), *Aconitum columbianum* (Columbian monkshood), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Viola canadensis* var. *scopulorum* (Canada white violet) and *Streptopus amplexifolius* (claspleaf twistedstalk). Graminoid species include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (bluejoint reedgrass), *Carex microptera* (smallwing sedge), and *C. utriculata* (beaked sedge) A dense ground cover also includes *Equisetum arvense* (field horsetail), *Equisetum hyemale* (scouringrush horsetail) and *Equisetum pratense* (meadow horsetail).

Ecological Processes

Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus incana* ssp.*tenuifolia* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop.

Potential Conservation Areas supporting this community type are Devil Creek at Middle Mountain PCA, Harris Lake PCA, and Upper Coyote Creek PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=56)
56	(10-98%)	Alnus incana ssp. tenuifolia	56
14	(0.1-70%)	Heracleum maximum	42
12	(1-70%)	Aconitum columbianum	27
9	(0.1-18%)	Picea engelmannii	14
8	(1-62.5%)	Senecio triangularis	27
7	(1-40%)	Mertensia ciliata	40
7	(1-20%)	Salix drummondiana	15
7	(1-20%)	Rudbeckia laciniata var. ampla	13
7	(1-20%)	Populus tremuloides	14
7	(1-18%)	Salix geyeriana	8
7	(1-70%)	Rosa woodsii	14
6	(1-30%)	Ribes inerme	12
6	(1-32%)	Salix lucida ssp. caudata, lasiandra	11
6	(1-30%)	Lonicera involucrata	25
6	(1-16%)	Salix monticola	13
6	(1-30%)	Equisetum arvense	39
5	(1-25%)	Cardamine cordifolia	21
5	(1-13%)	Urtica dioica ssp. gracilis	13
5	(1-20%)	Calamagrostis canadensis	31
5	(1-11%)	Salix bebbiana	7

Other species with < 5% average cover present in at least 10% of plots:
Maianthemum stellatum (0.1-27%), Glyceria striata (0.1-15%), Geranium richardsonii (1-15%), Elymus glaucus (1-10%), Mentha arvensis (1-14%), Oxypolis fendleri (1-37.5%), Rubus idaeus ssp. strigosus (1-15%), Carex utriculata (1-6%), Poa pratensis (1-12%), Streptopus amplexifolius var. chalazatus (0.1-10%), Saxifraga odontoloma (1-5%), Taraxacum officinale (1-13%), Conioselinum scopulorum (1-10%), Abies lasiocarpa (1-6%), Arnica cordifolia (1-11%), Mitella pentandra (1-6%), Galium boreale (1-10%), Carex aquatilis (1-5%), Galium triflorum (1-5%), Osmorhiza depauperata (1-5%), Thalictrum fendleri (1-5%), Achillea millefolium var. occidentalis (1-8%), Actaea rubra ssp. arguta (1-5%), Phleum pratense (0.1-10%), Bromus inermis (1-5%), Fragaria virginiana ssp. glauca (1-3%), Geum macrophyllum var. perincisum (0.1-3%), Carex microptera (1-3%), Chamerion angustifolium ssp. circumvagum (1%).

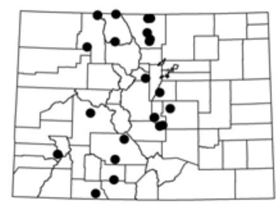
Thinleaf alder / Mesic graminoids Shrubland

***Alnus incana* ssp. *tenuifolia* / Mesic graminoids**

Global rank/State rank:
G3/ S3

HGM subclass: S3/4, R2, R3/4

Colorado elevation range:
6,400-9,800 ft (2,000-3,000 m)



General Description
The *Alnus incana* ssp. *tenuifolia*/mesic graminoid plant association is a stand of medium-tall deciduous shrubs with a thick herbaceous cover of mostly native forb and grass species and little to no overstory tree canopy. Heavily disturbed stands have abundant non-native grasses. While many stands in Colorado fit the latter description, there are also several stands that remain undisturbed where the undergrowth is dominated by native graminoid cover.

This plant association occurs on narrow to moderately wide floodplains, stream benches, frequently flooded pointbars, recently deposited islands, and dredged stream banks. It also occurs on isolated hillside seeps. Stream channels can be steep and straight to highly sinuous or moderately steep and sinuous. Where this association occurs on point bars, stream channels are low gradient (<1%) and highly sinuous. Soils are mostly coarse alluvium, but characteristically have silt loams or sandy clay loams at the surface with a high percentage of organic matter. Soils are shallow to moderately deep, 15-30 inches (35-62 cm), and become increasingly skeletal with depth. Most profiles have 10-50% mottles at 7-10 inches (18-25 cm) depth.

Vegetation Description
Alnus incana ssp. *tenuifolia* (thinleaf alder) dominates the upper canopy. Other shrubs occasionally present include *Rosa woodsii* (Woods rose), *Rubus deliciosus* (Boulder raspberry), *Salix bebbiana* (Bebb willow), *S. drummondiana* (Drummond willow), *S. exigua* (sandbar willow), and *S. monticola* (mountain willow). Trees are infrequent and may be scattered throughout the shrubland or they may occur along one edge. Tree species include *Pinus ponderosa* (ponderosa pine), *Populus tremuloides* (quaking aspen), and *Picea engelmannii* (Engelmann spruce).

The undergrowth is a thick carpet of grasses. Native graminoids include *Calamagrostis canadensis* (bluejoint reedgrass), *Carex utriculata* (beaked sedge), *Glyceria striata* (fowl mannagrass), *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge) and *Festuca rubra* (red fescue). Some stands are dominated by introduced, non-native grasses, including *Poa pratensis*

(Kentucky bluegrass), *Agrostis stolonifera* (creeping bentgrass), and *Bromus inermis* (smooth brome). Forb cover is usually low relative to the amount of graminoid cover in both disturbed and undisturbed stands, but can include a high variety of species, including *Mertensia ciliata* (tall fringed bluebells), *Mentha arvensis* (wild mint), *Cardamine cordifolia* (heartleaf bittercress) and *Caltha leptosepala* (marsh marigold).

Ecological Processes

Alnus incana ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop. *Alnus incana* ssp. *tenuifolia* is shade-intolerant, and many mature stands in Colorado are restricted to stream bank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy.

A Potential Conservation Area supporting this community type is East Side Chalk Mountains PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=25)
56	(8-95%)	Alnus incana ssp. tenuifolia	25
27	(1-65%)	Calamagrostis canadensis	14
15	(1-41%)	Poa pratensis	16
12	(2-26%)	Salix exigua	8
11	(2-26%)	Glyceria striata	6
10	(1-19%)	Carex disperma	4
10	(1-29%)	Salix bebbiana	4
10	(3-19%)	Betula occidentalis	4
9	(1-48%)	Rosa woodsii	8
9	(1-25%)	Agrostis stolonifera	6
9	(1-32%)	Carex utriculata	7
7	(1-23%)	Bromus inermis	5
6	(1-10%)	Pinus ponderosa var. scopulorum	5
6	(1-14%)	Salix ligulifolia	5
6	(1-20%)	Carex aquatilis	8
6	(1-15%)	Mertensia ciliata	12
5	(3-7%)	Carex microptera	5

Other species with < 5% average cover present in at least 10% of plots:
Heracleum maximum (1-11%), Salix monticola (1-16%), Juncus balticus var. montanus (1-10%), Mentha arvensis (0.1-14%), Equisetum arvense (1-14%), Cardamine cordifolia (1-8%), Ribes inerme (1-8%), Taraxacum officinale (1-14%), Trifolium repens (1-7%), Achillea millefolium var. occidentalis (1-13%), Geum macrophyllum var. perincisum (1-5%), Urtica dioica ssp. gracilis (1-5%), Galium boreale (1-3%), Rubus idaeus ssp. strigosus (1-5%), Geranium richardsonii (1-4%), Phleum pratense (1-2%), Fragaria virginiana ssp. glauca (1-2%), Oxypolis fendleri (1-2%), Maianthemum stellatum (0.1-2%).

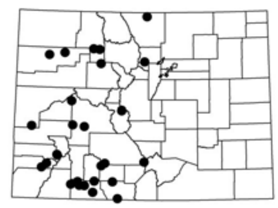
Thinleaf alder – Mixed willow Shrubland

Alnus incana* ssp. *tenuifolia - Salix (monticola, lucida, ligulifolia)

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
5,600-9,600 ft (1,700-2,930 m)



General Description
The *Alnus incana* ssp. *tenuifolia*/*Salix (monticola, lucida, ligulifolia)* (thinleaf alder/mixed willow species) plant association is a more general type than other *Alnus incana* ssp. *tenuifolia* types. It has a high diversity of associated shrub species, unlike the nearly pure stands of alder found in other *Alnus incana* ssp. *tenuifolia* dominated plant associations. The abundance of other shrubs may represent a transition in the physical setting, for example, from a broad floodplain dominated by *Salix* to a narrow valley bottom and channel lined with only *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

This association occurs along narrow, moderately steep streams (30-65 ft (10-20 m) wide with a gradient of 3-10%) and in moderately wide to wide river valleys on cobble point bars, islands, flat alluvial benches, and large alluvial floodplains. Stream channels are steep and narrow, moderately steep and wide, or wide and sinuous. Soils are poorly developed with loamy sands, sand, sandy loams, and silt loams over coarse alluvium.

Vegetation Description
This plant association is characterized by the dominance of *Alnus incana* ssp. *tenuifolia* (thinleaf alder). There is considerable variation of associated shrub species in the stands. Several willow species are often present, but no single willow species consistently occurred in all stands. Other shrubs frequently present include *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *S. monticola* (mountain willow), *S. drummondiana* (Drummond willow), *S. bebbiana* (Bebb willow), *S. exigua* (sandbar willow), *S. geyeriana* (Geyer willow), *S. ligulifolia* (strapleaf willow), *Acer glabrum* (Rocky Mountain maple), and *Amelanchier utahensis* (Utah serviceberry). Tree cover is sparse, but can include *Picea pungens* (blue spruce), *Populus tremuloides* (quaking aspen), *P. angustifolia* (narrowleaf cottonwood) and *Picea engelmannii* (Engelmann spruce).

The herbaceous undergrowth is varied with 10-90% total cover. Native herbaceous species include *Equisetum arvense* (field horsetail), *Heracleum maximum* (common cowparsnip), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Mertensia ciliata* (tall fringed bluebells) , *Calamagrostis canadensis* (bluejoint reedgrass) *Cardamine cordifolia* (heartleaf bittercress) and

Carex utriculata (beaked sedge). Introduced species include *Trifolium repens* (white clover), *Taraxacum officinale* (dandelion) and *Poa pratensis* (Kentucky bluegrass)

Ecological Processes

In Colorado, the *Alnus incana* ssp. *tenuifolia* -mixed *Salix* species plant association may represent response to recent changes in the environment. Several stands occur on abandoned beaver dams, for example. This shift in the physical environment may explain the diverse mix of shrub species in the canopy. If the water table lowers, this plant association may succeed to a more stable, drier community dominated by *Salix geyeriana* (Geyer willow) or *Populus tremuloides* (quaking aspen). Other stands appear to be disturbed by livestock grazing and may represent a grazing-induced stage of the *Alnus incana* ssp. *tenuifolia/*mesic forb plant association.

Potential Conservation Areas supporting this community type are Quartz Creek at East Fork San Juan River PCA, Rio Blanco at Deadman Canyon PCA, Spring Creek Lakes PCA, and Upper Indian Creek PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=28)
44	(5-100%)	Alnus incana ssp. tenuifolia	28
20	(3-50%)	Salix lucida ssp. caudata, lasiandra	17
19	(1-40%)	Salix ligulifolia	11
17	(1-57%)	Salix monticola	16
15	(3-39%)	Salix bebbiana	8
13	(1-70%)	Poa pratensis	20
12	(3-30%)	Salix geyeriana	6
12	(1-39%)	Salix exigua	13
10	(1-38%)	Calamagrostis canadensis	10
9	(1-27%)	Ribes inerme	11
9	(1-40%)	Salix drummondiana	10
8	(1-27%)	Trifolium repens	8
8	(1-30%)	Equisetum arvense	17
7	(3-13%)	Populus angustifolia	9
7	(1-21%)	Heracleum maximum	18
7	(1-15%)	Aconitum columbianum	5
7	(1-25%)	Mertensia ciliata	12
7	(1-22%)	Rudbeckia laciniata var. ampla	11
6	(1-30%)	Rosa woodsii	15
6	(1-20%)	Phleum pratense	10
6	(1-20%)	Picea pungens	6
6	(1-22%)	Mertensia franciscana	5
6	(1-18%)	Poa palustris	5
6	(1-15%)	Agrostis gigantea	5
5	(1-20%)	Dactylis glomerata	5
5	(1-20%)	Taraxacum officinale	21

Other species with < 5% average cover present in at least 10% of plots:
Glyceria striata (1-15%), Rubus idaeus ssp. strigosus (1-11%), Geranium richardsonii (1-17%), Cardamine cordifolia (1-19%), Lonicera involucrata (1-15%), Oxypolis fendleri (1-15%), Mentha arvensis (1-10%), Carex utriculata (1-10%), Achillea millefolium var. occidentalis (1-10%), Geum macrophyllum var. perincisum (0.1-10%), Juncus balticus var. montanus (1-8%), Urtica dioica ssp. gracilis (1-4%), Carex microptera (1-5%), Maianthemum stellatum (0.1-5%), Vicia americana (1-3%), Osmorhiza depauperata (1-3%), Galium boreale (1-2%).

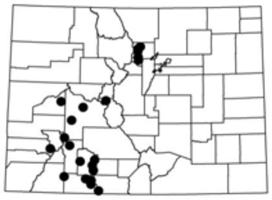
Thinleaf alder – Drummond's willow Shrubland

Alnus incana* ssp. *tenuifolia - Salix drummondiana

Global rank/State rank:
G3 / S3

HGM subclass: R2, R3/4

Colorado elevation range:
7,300-9,700 ft (2,200-3,000m)



General Description
Alnus incana ssp. *tenuifolia-Salix drummondiana* (thinleaf alder-Drummond willow) is a relatively common plant association on the Western Slope. The association is generally found along steep-gradient streams with stable, shaded stream banks. This association occurs in the Gunnison, Arkansas, and St. Vrain River Basins and the San Juan and Rio Grande National Forests.

This association occurs along very steep, fast-moving streams in sheer-walled, confined canyons. It also occurs along or within the active channel of moderately to slightly entrenched channels in wider valleys. Stream channels are steep and rocky, less steep with limited floodplains and gravel and cobble bottoms, or wide and sinuous. Soils of this association are highly variable, but most are stratified alluvium with buried A horizons. Stands with a rich, herbaceous undergrowth have a thick layer, 5-10 inches (10-30 cm), of fine sandy loam and sandy clay loam over a coarse alluvial deposit. Stands with little shrub cover and herbaceous growth have coarse, skeletal soils without an accumulated fine layer at the surface.

Vegetation Description
This plant association is characterized by a dense, closed canopy of *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Salix drummondiana* (Drummond willow) bordering the stream. Other willows that may be present include *Salix monticola* (mountain willow), *S. boothii* (Booth willow), *S. exigua* (sandbar willow), *S. lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), and *S. geyeriana* (Geyer willow). Other shrubs occasionally present include *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Amelanchier utahensis* (Utah serviceberry), *Acer glabrum* (Rocky Mountain maple), *Symphoricarpos oreophilus* (mountain snowberry), and *Ribes montigenum* (gooseberry currant).

Some stands have a rich herbaceous understory that includes *Oxypolis fendleri* (Fendler cowbane), *Heracleum maximum* (common cowparsnip), *Equisetum pratense* (field horsetail), *Mertensia ciliata* (tall fringed bluebells) *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), and

Angelica ampla (giant angelica). In some stands, the herbaceous undergrowth is sparse (less than 10% cover) due to shading and flood-scouring.

Ecological Processes

The *Alnus incana* ssp. *tenuifolia*-*Salix drummondiana* (thinleaf alder-Drummond willow) plant association is an early to midseral community restricted to stream margins, rarely forming large, extensive stands. Both species are prolific seed producers and are the first to colonize coarse-textured cobble bars and recently scoured alluvial surfaces. When young, these shrubs are flexible, can tolerate most flood events, and readily resprout. With time, *Salix drummondiana* may become more abundant by taking advantage of the nitrogen-rich soils associated with *Alnus incana* ssp. *tenuifolia.*

Potential Conservation Areas supporting this community type are Coal Creek Trailhead PCA, Fourmile Creek at Quien Sabe PCA, and Opal Lake PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
46	(14-98%)	Alnus incana ssp. tenuifolia	22
27	(7-60%)	Salix drummondiana	22
13	(2-70%)	Heracleum maximum	13
11	(2-30%)	Carex utriculata	4
10	(1-43%)	Salix monticola	12
9	(1-30%)	Calamagrostis canadensis	13
8	(1-30%)	Equisetum arvense	10
7	(1-23%)	Picea pungens	7
6	(1-25%)	Salix lucida ssp. caudata, lasiandra	6
6	(1-20%)	Lonicera involucrata	11
6	(1-16%)	Equisetum pratense	5
6	(1-10%)	Geranium richardsonii	9
5	(1-15%)	Mertensia ciliata	14
5	(1-11%)	Abies lasiocarpa	4
5	(1-10%)	Poa pratensis	10

Other species with < 5% average cover present in at least 10% of plots:
Cardamine cordifolia (1-11%), Rudbeckia laciniata var. ampla (1-10%), Taraxacum officinale (1-13%), Salix bebbiana (3-7%), Picea engelmannii (0.1-10%), Cornus sericea (1-10%), Ribes inerme (1-6%), Oxypolis fendleri (0.1-14%), Carex microptera (1-9%), Fragaria vesca ssp. bracteata (1-8%), Thalictrum fendleri (1-5%), Rubus idaeus ssp. strigosus (1-5%), Mertensia franciscana (1-6%), Achillea millefolium var. occidentalis (1-8%), Fragaria virginiana ssp. glauca (1-10%), Viola canadensis var. scopulorum (1-4%), Osmorhiza depauperata (1-3%), Galium triflorum (1-3%), Senecio triangularis (1-5%), Geum macrophyllum var. perincisum (0.1-4%), Galium boreale (1-5%), Conioselinum scopulorum (0.1-4%), Chamerion angustifolium ssp. circumvagum (1-2%), Luzula parviflora (0.1-4%), Maianthemum stellatum (1-2%), Rosa woodsii (1%).

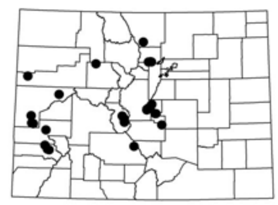
River birch / Mesic forbs Shrubland

Betula occidentalis / Maianthemum stellatum

Global rank/State rank:
G4? / S2

HGM subclass: R3/4

Colorado elevation range:
6,300-8,800 ft (1,900-2,700 m)



General Description

This association is characterized by a tall, narrow band of shrubs lining the stream channel. The undergrowth can be sparse or a thick carpet of grasses and forbs. In undisturbed stands, forb species richness can be high.

This association occupies moderately wide stream benches and floodplains in narrow to moderately wide valleys and on hillside seeps. At lower elevations along sunny valley bottoms, well-developed, large occurrences occupy relatively flat stream benches and often extend away from the channel edge. Stream channels are wide, rocky/cobble-bottomed, moderately steep, and sinuous, wide, cobble-bottomed, less steep, and highly sinuous, or braided from beaver activity. This association also occurs along small floodplains of steep-gradient, narrow streams where the valley side slope meets the stream edge. In such settings *Betula occidentalis* (river birch) is squeezed between large boulders and herbaceous growth is limited to small pockets, or is found around seeps adjacent to the stream channel and along isolated springs on hillslopes away from the valley bottom (these may be in different HGM subclasses). Soils are fairly shallow, ranging from 12 to 25+ inches (30-60+ cm). and have a surface layer of 50-90% organic matter. Subsurface layers are clay loams, sandy clays, and sandy loams. Stands along narrow, steep stream channels occur between large alluvial and colluvial boulders and have almost no soil development.

Vegetation Description

Betula occidentalis (river birch) forms a nearly continuous tall-shrub to small-tree canopy along the stream bank. Other shrubs may include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Salix exigua* (sandbar willow), *Jamesia americana* (cliffbush), *Amelanchier utahensis* (Utah serviceberry), *Prunus virginiana* (chokecherry), and *Salix monticola* (mountain willow). Along narrow valleys at higher elevations, conifers may overhang the stream edge. Conifer species include *Pseudotsuga menziesii* (Douglas-fir), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Pinus ponderosa* (ponderosa pine).

Although some stands have considerable herbaceous cover, herbaceous undergrowth is usually limited due to the dense shrub canopy. Forb cover can include *Maianthemum stellatum* (starry false Solomon seal), *Heracleum maximum* (common cowparsnip), *Thalictrum fendleri* (Fendler meadowrue) and *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower). Graminoid cover is usually low, but can include *Poa pratensis* (Kentucky bluegrass), *Carex utriculata* (beaked sedge), *Juncus balticus* var. *montanus* (mountain rush), *Calamagrostis canadensis* (bluejoint reedgrass), and *Agrostis stolonifera* (creeping bentgrass). *Equisetum arvense* (field horsetail) may also be present.

Ecological Processes
This association is considered a mid-seral type. With prolonged heavy grazing, it may succeed to a *Salix* (willow) dominated association. It may also be an early successional stage for conifer-dominated associations. *Betula occidentalis* can tolerate flooding, but not permanent inundation. *Betula occidentalis* occurs at slightly lower elevations and on lower- gradient stream reaches than *Alnus incana* ssp. *tenuifolia* (thinleaf alder). Because *Betula occidentalis* communities occupy low elevation, foothill habitats in Colorado, they are more threatened by development and stream impoundments than *Alnus incana* ssp. *tenuifolia* or *Cornus sericea* (red-osier dogwood) riparian communities.

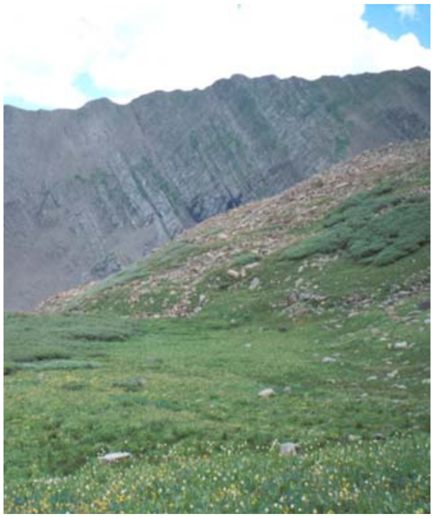
A Potential Conservation Area supporting this community type is Piedra PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=26)
55	(14-98%)	Betula occidentalis	26
18	(1-53%)	Cornus sericea ssp. sericea	11
16	(1-66%)	Pseudotsuga menziesii	7
16	(1-60%)	Angelica ampla	5
12	(8-21%)	Picea pungens	5
11	(1-38%)	Salix monticola	8
10	(1-40%)	Alnus incana ssp. tenuifolia	16
10	(1-30%)	Lonicera involucrata	5
10	(1-40%)	Maianthemum stellatum	19
9	(1-34%)	Poa pratensis	16
8	(1-34%)	Heracleum maximum	11
7	(1-16%)	Calamagrostis canadensis	5
7	(1-25%)	Salix exigua	8
7	(1-23%)	Carex utriculata	5
7	(4-13%)	Agrostis stolonifera	5
6	(1-17%)	Juniperus scopulorum	9
6	(1-36%)	Equisetum arvense	15
6	(1-17%)	Juncus balticus var. montanus	12
5	(1-18%)	Rosa woodsii	19
5	(1-17%)	Prunus virginiana var. melanocarpa	6

Other species with < 5% average cover present in at least 10% of plots:
Thalictrum fendleri (1-21%), Equisetum hyemale var. affine (1-10%), Geranium richardsonii (1-10%), Rubus idaeus ssp. strigosus (1-10%), Rudbeckia laciniata var. ampla (1-10%), Ribes inerme (0.1-10%), Cirsium arvense (0.1-5%), Mertensia ciliata (1-2%), Achillea millefolium var. occidentalis (1-3%), Vicia americana (1-2%), Galium boreale (0.1-2%), Taraxacum officinale (0.1-2%).

Marsh Marigold Herbaceous Vegetation

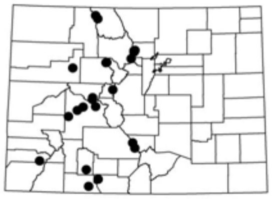
Caltha leptosepala



Global rank/State rank:
G4 / S4

HGM subclass: S1/2

Colorado elevation range:
8,900-13,100 ft (2,700-3,990 m)



General Description

The frequently seen *Caltha leptosepala* (marsh marigold) plant association occurs in the subalpine and lower alpine on perennially saturated ground. This association is often associated with shallow seeps on hillslopes. It can be recognized by the prominence of *Caltha leptosepala*, a near absence of shrubs, and low cover of *Rhodiola rhodantha* (redpod stonecrop). This association occurs in mountainous regions throughout Colorado.

This association typically occupies seeps, streamsides, springs, and wet, sub-irrigated meadows on slopes up to 30%.

Vegetation Description

A dense, conspicuous layer of *Caltha leptosepala* (marsh marigold) dominates the plant association. Many graminoids and forbs that tolerate long-term soil saturation may also be present. *Carex aquatilis* (water sedge) is very common and is sometimes a co-dominant with *Caltha leptosepala*. *Deschampsia caespitosa* (tufted hairgrass) may be present, but in small amounts. Other forb species present may include *Pedicularis groenlandica* (elephant head), *Stellaria umbellata* (umbell starwort), *Swertia perennis* (star gentian), *Sedum rhodanthum* (pink stonecrop), and several others.

Ecological Processes

Caltha leptosepala is considered a stable community type. This association receives little use by livestock due to the wet conditions and the bitter, acrid taste of the foliage. Elk and deer may use this association heavily.

A Potential Conservation Area supporting this community type is Buckles Lake PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=38)
42	(3-87%)	Caltha leptosepala	38
10	(0.1-40%)	Erigeron peregrinus ssp. callianthemus	10
9	(0.1-25%)	Ligusticum tenuifolium	4
9	(0.1-20%)	Calamagrostis canadensis	5
8	(1-20%)	Carex aquatilis	15
8	(3-15%)	Oxypolis fendleri	4
8	(0.1-20%)	Cardamine cordifolia	6
7	(0.1-17%)	Senecio triangularis	6
6	(0.1-15%)	Arnica mollis	6
5	(0.1-25%)	Carex scopulorum	10
5	(0.1-28%)	Deschampsia caespitosa	21
5	(0.1-10%)	Trollius laxus ssp. albiflorus	4

Other species with < 5% average cover present in at least 10% of plots:
Geum rossii var. turbinatum (0.1-17%), Swertia perennis (0.1-14%), Carex nigricans (0.1-25%), Saxifraga odontoloma (0.1-6%), Salix planifolia (0.1-10%), Veronica wormskjoldii (0.1-8%), Rhodiola rhodantha (0.1-15%), Pedicularis groenlandica (0.1-14%), Saxifraga oregana (0.1-7%), Polygonum bistortoides (0.1-5%), Juncus drummondii (0.1-7%), Primula parryi (0.1-6.8%), Potentilla diversifolia (0.1-4 %), Packera crocata (0.1-3%), Poa arctica (0.1-3%), Phleum alpinum (0.1-2%), Epilobium anagallidifolium (0.1-2%), Stellaria umbellata (0.1%).

Caltha leptosepala. Photo © CNHP by K. Freeman

Heartleaf bittercress – Tall fringed bluebells Herbaceous Vegetation

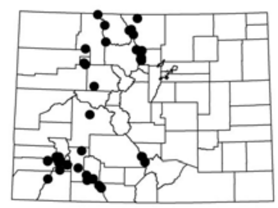
Cardamine cordifolia - Mertensia ciliata

Cardamine cordifolia – Mertensia ciliata community at Quartz Creek at East Fork San Juan River PCA.

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R1, R2

Colorado elevation range:
8,450-12,300 ft (2,570-3,800 m)



General Description

The generally small stands of the *Cardamine cordifolia-Mertensia ciliata* (heartleaf bittercress-tall fringed bluebells) plant association are found in and near running water of small streams, seeps, and springs. Associated taxa may vary greatly with this plant association, but the dominance of *Cardamine cordifolia*, *Mertensia ciliata* or *Senecio triangularis* is clear. All of these species, or only one of the three, may be present. If trees form a canopy above the forbs, the stand may belong to the *Abies lasiocarpa / Mertensia ciliata* (subalpine fir / tall fringed bluebells) association.

This association typically occurs on moderately steep to very steep first order streams, but can occur on less steep stream reaches as well. In many cases this habitat probably experiences a long period of snow cover. Soils can be moderately deep (15 in, 40 cm) sandy clay loam and sand, but in general are quite thin and skeletal.

Vegetation Description

This association is easy to recognize. It is a narrow band of forbs and mosses with one or more of the following three forb species being abundantly present: *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells) and *Senecio triangularis* (arrowleaf ragwort). All of these species may be present or only one of them. In addition, this type is always rich in other forbs. Stands generally have at least fifteen species, and often have as many as 45 forb species present. This diversity is made up of a wide variety of forb species; some can be quite abundant. Other forb species include *Saxifraga odontoloma* (brook saxifrage), *Mitella pentandra* (fivestamen miterwort), *Oxypolis fendleri* (Fendler cowbane), *Delphinium barbeyi* (tall larkspur), *Epilobium* spp. (willowherb), *Caltha leptosepala* (marsh marigold), *Geranium* *richardsonii* (Richardson geranium), *Arnica cordifolia* (heartleaf arnica), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Rhodiola integrifolia* ssp. *integrifolia* (ledge stonecrop), *Primula parryi* (Parry primrose), *Corydalis caseana* ssp. *brandegei* (Brandegee fumewort), *Senecio taraxacoides* (dandelion ragwort), *Heracleum maximum* (common cowparsnip), and *Ligusticum porteri* (Porter licoriceroot), among others.

Ecological Processes
This association is found in a habitat which is early-seral and experiences frequent fluvial depositions, keeping any invading conifers from advancing beyond the sapling stage. Although it is an early-seral community, the *Cardamine cordifolia-Mertensia ciliata* plant association is reasonably stable because it is maintained by frequent disturbance. However, with excessive grazing by sheep, it may be converted to communities dominated by various increaser species.

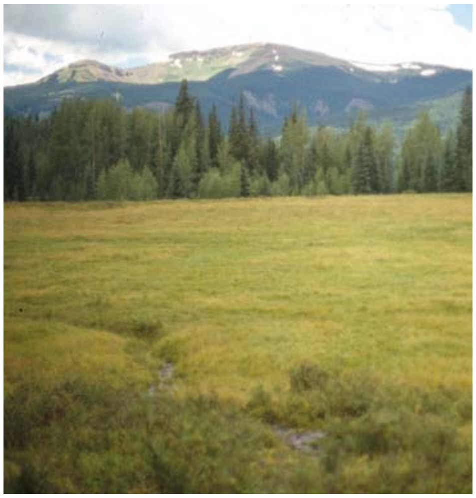
A Potential Conservation Area supporting this community type is Quartz Creek at East Fork San Juan River PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=57)
33	(1-87%)	Cardamine cordifolia	51
27	(1-80%)	Mertensia ciliata	36
24	(0.1-90%)	Senecio triangularis	37
11	(1-30%)	Heracleum maximum	10
8	(0.1-30%)	Oxypolis fendleri	19
8	(0.1-30%)	Rhodiola integrifolia	5
8	(0.1-37%)	Saxifraga odontoloma	31
7	(2-20%)	Equisetum arvense	11
7	(1-25%)	Carex aquatilis	7
7	(0.1-20%)	Calamagrostis canadensis	10
6	(0.1-30%)	Caltha leptosepala	24
6	(0.1-15%)	Carex scopulorum	6
6	(1-18%)	Geranium richardsonii	8
5	(0.1-28%)	Picea engelmannii	10
5	(1-24%)	Arnica mollis	8

Other species with < 5% average cover present in at least 10% of plots:
Aconitum columbianum (1-15%), Juncus mertensianus (0.1-15%), Deschampsia caespitosa (0.1-20%), Carex utriculata (1-7%), Conioselinum scopulorum (1-5%), Rhodiola rhodantha (1-3.1%), Primula parryi (0.1-13%), Mitella pentandra (0.1-6%), Taraxacum officinale (1-9%), Mimulus guttatus (1-3%), Poa leptocoma (0.1-5%), Erigeron peregrinus ssp. callianthemus (0.1-7%), Castilleja rhexiifolia (0.1-3%), Phleum alpinum (0.1-3%), Trollius laxus ssp. albiflorus (0.1-3%), Achillea millefolium var. occidentalis (1-3%), Sibbaldia procumbens (0.1-3%), Luzula parviflora (1-3%), Juncus drummondii (0.1-3%), Polygonum bistortoides (0.1-3%), Epilobium anagallidifolium (0.1-4%), Stellaria umbellata (0.1-1%), Veronica wormskjoldii (0.1-1%), Poa reflexa (0.1-1%).

Water sedge – Beaked sedge Herbaceous Vegetation

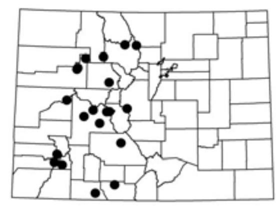
Carex aquatilis - Carex utriculata



Global rank/State rank:
G4 / S4

HGM subclass: D1, S1/2, S3/4

Colorado elevation range:
8,200-11,100 ft (2,500-3,400 m)



General Description

This plant association is recognized by the presence of both *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) in roughly equal proportions. This is a common association that generally occurs in small to moderate size patches in very shallow, slow-moving to still water or on saturated soils near low-order streams, lakes, and backwater areas of larger rivers.

This plant association occurs in broad, glaciated, subalpine meadows that remain saturated with snowmelt runoff for most of the growing season. It is also often associated with beaver activity. Stream channels are narrow, deep, and sinuous, or wide and shallow. Soils are often organic, thick peat or sandy clays and sandy clay loams originating from glacial till.

Vegetation Description

This plant association has relatively low species diversity due to saturated soil conditions. *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) co-dominate the association. Both species are present in equal or near equal amounts. For example, a stand with 10% cover of each *Carex* (sedge) species would classify as this type, however a stand with 10% *Carex aquatilis* (water sedge) and 80% *Carex utriculata* (beaked sedge) would classify as a *Carex utriculata* (beaked sedge) plant association. Other graminoid and forb species may also be present. Graminoid species include *Carex microptera* (smallwing sedge), *Deschampsia caespitosa* (tufted hairgrass), *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Carex nebrascensis* (Nebraska sedge), and *Carex canescens* (pale sedge). Forb species include *Caltha leptosepala* (marsh marigold), *Rhodiola rhodantha* (redpod stonecrop), *Cardamine cordifolia* (heartleaf bittercress), *Senecio triangularis* (arrowleaf ragwort), *Pedicularis groenlandica* (elephanthead lousewort), and *Epilobium* spp. (willowweed).

Ecological Processes

The difficulty in classifying mixed stands of *Carex aquatilis* (water sedge) and *Carex utriculata* (beaked sedge) has been discussed in the literature and attempts have been made to differentiate the types based on soil characteristics. In some cases a dominance of *Carex utriculata* on organic soils and *Carex aquatilis* on mineral soils has been noted, while in other cases the opposite trend where *Carex aquatilis* appears to occur more often on rich organic soils, while *Carex utriculata* occurs on less nutrient rich soils is observed.

In stands observed for this study, water availability appears to be a stronger factor in determining relative dominance of these two sedge species. *Carex utriculata* appears to tolerate standing water and may be a pioneering species since it readily establishes on exposed, saturated mineral soil. In Colorado, *Carex utriculata* occurs more often in standing water and often grades into a mesic terrestrial habitat where *Carex aquatilis* is commonly dominant. The *Carex aquatilis-Carex utriculata* plant association may, therefore, represent a spatial transition between a wet *Carex utriculata* association and a mesic *Carex aquatilis* association.

A Potential Conservation Area supporting this community type is Buckles Lake PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
32	(9-65%)	Carex utriculata	19*
30	(6-90%)	Carex aquatilis	20
18	(1-40%)	Deschampsia caespitosa	6
10	(3-20%)	Caltha leptosepala	4
7	(2-10%)	Carex canescens	3

Other species with < 5% average cover present in at least 10% of plots:
Carex microptera (1-10%), Poa pratensis (1-11%), Calamagrostis canadensis (1-13%), Juncus balticus var. montanus (1-7%), Pedicularis groenlandica (1-5%), Cardamine cordifolia (1-5%), Senecio triangularis (1-5%), Taraxacum officinale (1-3%), Achillea millefolium var. occidentalis (1-3%), Dasiphora floribunda (1-3%), Equisetum arvense (1-3%), Salix wolfii (1-3%).

*Carex utriculata occurred in all stands, but was not captured in every sample plot.

Awned Sedge Herbaceous Vegetation

Carex atherodes

Global rank/State rank:
G3G5 / S2?

There is no stand data compiled for *Carex atherodes* herbaceous vegetation in Colorado. This association is not included within *Field Guide to the Wetland and Riparian Plant Associations of Colorado* (Carsey *et al*. 2003a).

The following information is summarized from NatureServe Explorer (2005):

General Description
Carex atherodes (awned sedge) herbaceous vegetation distribution is within the northern tallgrass prairie region in the United States and Canada. Colorado, Iowa, Minnesota, North Dakota, and South Dakota document occurrences within the United States. This plant association typically occurs within depressional wetlands, but is also found along streams and rivers. Water can be saline or fresh. Soils are mineral or mucky.

Vegetation Description
Vegetation cover is usually high, and *Carex atherodes* (awned sedge) can form monotypic stands. Plant species that associate with awned sedge herbaceous vegetation include *Alisma triviale* (water plantain), *Symphyotrichum lanceolatum* (white panicle aster), *Eleocharis palustris* (common spikerush), *Glyceria grandis* (American mannagrass) (in drier stands), *Mentha arvensis* (wild mint), *Phalaris arundinacea* (reed canary grass), *Polygonum amphibium* (water smartweed), *Scolochloa festucacea* (common rivergrass), *Sium suave* (hemlock water parsnip), and, *Sparganium eurycarpum* (broad fruit bur-reed).

Ecological Processes
Carex atherodes (awned sedge) plant community occurs on lowlands that have standing water for several weeks of the season. Invasion by shrubs such as *Salix* spp, can occur especially in the eastern part of its range, where fire may be important to shrub invasion prevention. Cover or dominance by *Carex atherodes* can vary according with wet or dry years.

This plant association occurs within the Snow Spring PCA in Archuleta County.

References listed by NatureServe Explorer, for the *Carex atherodes* Herbaceous Vegetation webpage:

Brotherson, J. D. 1969. Species composition, distribution, and phytosociology of Kaslow Prairie, a mesic tallgrass prairie in Iowa. Unpublished Ph.D. dissertation, Iowa State University, Ames. 196 pp.

Dix, R. L., and F. E. Smeins. 1967. The prairies, meadows, and marsh vegetation of Nelson County, North Dakota. Canadian Journal of Botany 45:21-58.

Looman, J. 1982. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation, Part 2. Freshwater marshes and bogs. Phytocoenologia 10(4):401-423.

MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.

Midwestern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Minneapolis, MN.

Smith, A. L. 1973. Life cycle of the marsh grass *Scolochloa festucacea*. Canadian Journal of Botany 51:1661-1668.

Stewart, R. E., and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. USDI Bureau of Sport Fisheries and Wildlife Resources, Publication 92. Washington, DC. 77 pp.

Stewart, R. E., and H. A. Kantrud. 1972. Vegetation of prairie potholes, North Dakota, in relation to quality of water and other environmental factors. USDI Geologic Survey Professional Paper 585-d. 36 pp.

Walker, B. H., and R. T. Coupland. 1970. Herbaceous wetland vegetation in the aspen grove and grassland region of Saskatchewan. Canadian Journal of Botany 48:1861-1878.

Mud Sedge Herbaceous Vegetation

Carex limosa

Carex limosa community located on a floating-mat fen in Archuleta County.

Global rank/State rank:
G2 / S1S2

There is no stand data compiled for *Carex limosa* herbaceous vegetation in Colorado. This association is not included within *Field Guide to the Wetland and Riparian Plant Associations of Colorado* (Carsey *et al*. 2003a).

The following information is summarized from NatureServe Explorer (2005):

General Description
Carex limosa herbaceous vegetation occurs from the Rocky Mountains west into Utah, California and Washington at mid to high elevations ranging from 1787-3235 m (5860-10,600 feet). Stands occur in the most saturated areas in fens that have formed in glacial kettles, on pond margins, along low-gradient lake inlets or outlets, or in association with springs in broad valleys. Soils are typically highly organic and composed of deep fibric peat, with very little decomposition because of saturated conditions.

Vegetation Summary: Vegetation is characterized by the dominance of *Carex limosa* with 50% or greater cover, often occurring as a near monoculture. Several other species that are adapted to nutrient-poor conditions, including *Eriophorum* spp. (cottongrass), and *Menyanthes trifoliata* (buckbean) are sometimes present. In addition, *Carex aquatilis* (water sedge), *Carex buxbaumii* (Buxbaum sedge), *Carex utriculata* (beaked sedge), and *Comarum palustre* (marsh cinquefoil) may be present. A dense layer of moss that often includes *Sphagnum* spp. occurs in some stands. Scattered shrubs of *Betula glandulosa* (bog birch), *Dasiphora fruticosa* ssp.*floribunda* (shrubby cinquefoil), *Salix candida* (hoary willow), or *Salix planifolia* (planeleaf willow) may be present (Hansen *et al.* 1995).

Ecological Processes: This plant association is naturally rare, being restricted to the specialized habitat of nutrient-poor fens. Stands occupy very small areas of the landscape with the sum of patches usually being less than a few (5) acres. This community often occurs as floating organic mats held together by long rhizomes and roots of mostly graminoids (Padgett *et al.* 1989, Cooper 1990). Threats to the community include introduction of nutrients and sediment from activities such as roads, grazing and logging within the watershed, which may impact water chemistry of sites. Generally, these sites are so saturated that livestock typically do not enter to forage; however, drought years may make stands accessible to both domestic and wild grazing animals, resulting in areas of bare, rutted or hummocky soils, compaction of soils, alteration of hydrology, and introduction of non-native species. If a site becomes drier from water diversion, etc., *Carex aquatilis* (water sedge) will become more competitive and abundant (Padgett *et al.* 1989). *Carex limosa* is important in primary succession, spreading onto the water and shading out submergent and floating aquatic plants (Cooper 1990). As succession proceeds the species composition likely become more diverse. Soils are typically highly organic and composed of deep fibric peat (Borofibrists or Cryohemists), with very little decomposition because of saturated conditions (Hansen *et al.* 1995).

A Potential Conservation Area supporting this community type is Harris Lake PCA.

References listed by NatureServe Explorer, for the *Carex limosa* Herbaceous Vegetation webpage:

CONHP [Colorado Natural Heritage Program]. 2003. Unpublished data. List of Elements and Elcodes converted and entered into Biotics Tracker 4.0. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

Cooper, D. J. 1990. Ecology of wetlands in Big Meadows, Rocky Mountain National Park, Colorado. USDI Fish & Wildlife Service. Biological Report 90(15). Washington, DC. 45 pp.

Driscoll, R. S., D. L. Merkel, D. L. Radloff, D. E. Snyder, and J. S. Hagihara. 1984. An ecological land classification framework for the United States. USDA Forest Service. Miscellaneous Publication No. 1439. Washington, DC. 56 pp.

Kovalchik, B. L. 1993. Riparian plant associations on the national forests of eastern Washington - Draft version 1. USDA Forest Service, Colville National Forest, Colville, WA. 203 pp.

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

WANHP [Washington Natural Heritage Program]. No date. Unpublished data files. Washington Natural Heritage Program, Department of Natural Resources, Olympia, WA.

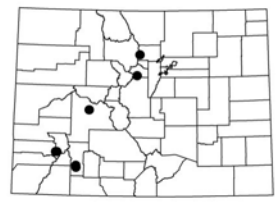
Small-wing sedge Herbaceous Vegetation

Carex microptera

Global rank/State rank:
G4 / S2?

HGM subclass: S1/2

Colorado elevation range:
8,900-11,700 ft (2,700-3,570 m)



General Description
The *Carex microptera* (smallwing sedge) association probably has a wide distribution throughout the state, but is overlooked due to its relatively small patch size. It has been documented from north-central Colorado and the San Juan National Forest in southwestern Colorado. This plant association typically forms small meadows on fine-textured, mesic soils. Its relationship with past heavy grazing may explain the relatively small occurrences. *Carex microptera* (smallwing sedge) typically dominates the association, but other graminoids are usually present and forb cover is minor.

This community is usually associated with meadows and stream terraces in wide, 350-500 ft (100-150 m), low-gradient valleys with narrow and sinuous stream channels. It also occurs near beaver dams and marshes. Soil textures range from fine, stratified alluvial material to clay with a thin organic layer on the surface.

Vegetation Description
Carex microptera (smallwing sedge) forms a dense graminoid layer with 10-85% cover. Other graminoid species typically have less than 1% cover and include *Juncus triglumis* (threehulled rush), *Juncus castaneus* (chestnut rush), *Juncus longistylis* (longstyle rush), *Deschampsia caespitosa* (tufted hairgrass), *Carex capillaris* (hairlike sedge), *Carex saxatilis* (rock sedge) and other sedge species. Forb cover is usually not more than 20%, and is more commonly less than 5%. Common forb species include *Rhodiola integrifolia* (ledge stonecrop), *Polygonum viviparum* (alpine bistort), *Gentiana algida* (whitish gentian), *Artemisia scopulorum* (alpine sagebrush), *Pedicularis groenlandica* (elephanthead lousewort), *Achillea millefolium* var. *occidentalis* (western yarrow), *Epilobium hornemannii* (Hornemann willowherb), and *Potentilla diversifolia* (varileaf cinquefoil).

Ecological Processes
Little is known about the successional status of this plant association, but it appears to be a stable community on moist to wet sites along streams.

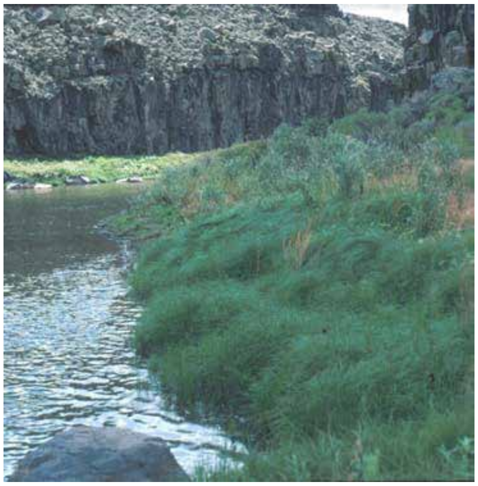
A Potential Conservation Area supporting this community type is Spring Creek Lakes PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
61	(10-87%)	Carex microptera	13
20	(2-50%)	Juncus longistylis	3
18	(10-25%)	Carex aquatilis	2
13	(5-20%)	Poa pratensis	2
12	(8-15%)	Deschampsia caespitosa	2
6	(1-10%)	Phleum pratense	2
5	(5-5%)	Agrostis scabra	2
5	(1-10%)	Achillea millefolium var. occidentalis	3

Other species with < 5% average cover present in at least 10% of plots:
Taraxacum officinale (1-10%), Salix monticola (3-5%), Epilobium hornemannii (3-5%), Geum macrophyllum var. perincisum (2-5%), Pedicularis groenlandica (0.1-5%), Phleum alpinum (2-2%), Glyceria striata (1-2%), Veronica americana (1-2%), Polygonum viviparum (0.1-5%), Carex saxatilis (0.1-3.1%), Carex capillaris (0.1-2%), Potentilla diversifolia (0.1-1%), Salix planifolia (0.1-1%), Rhodiola rhodantha (0.1-1%), Juncus castaneus (0.1-1%), Gentiana algida (0.1%), Rhodiola integrifolia (0.1%), Juncus triglumis (0.1%), Artemisia scopulorum (0.1%), Pedicularis sudetica ssp. scopulorum (0.1%), Dasiphora floribunda (0.1%), Carex scopulorum (0.1%), Juncus biglumis (0.1%), Polygonum bistortoides (0.1%).

Woolly sedge Herbaceous Vegetation

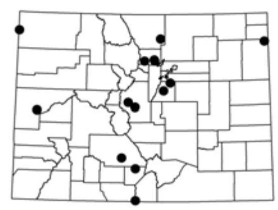
Carex pellita (=lanuginosa)



Global rank/State rank:
G3 / S3

HGM subclass: D2/3, S3/4, R5

Colorado elevation range:
4,600-9,300 ft (1,400-2,830 m)



General Description
Carex pellita is the name currently used by the USDA Plants Database for both *Carex lanuginosa* and *Carex lasiocarpa*. These species are recognized separately in Colorado, where *C. lasiocarpa* is much less common than *C. lanuginosa*. The *Carex lasiocarpa* association is ranked as S1 in Colorado and is currently known only from the subalpine fens on the east side of the Park Range.

Carex pellita (=C. lanuginosa) (woolly sedge) is a distinctive wetland-indicator sedge that forms small- to medium sized meadows. It occurs in depressions and swales at the saturated edge of stream channels or in standing water. On the eastern plains of Colorado, it can occur under the canopy of cottonwood trees, forming the *Populus deltoides/Carex pellita* (plains cottonwood/woolly sedge) plant association.

This plant association occurs in very wet conditions, generally at the saturated edge of the stream channel or in standing water. Stream channels are sinuous with a moderate gradient. Soils are deep silt loams to clays. Mottling often occurs throughout the profile.

Vegetation Description
This plant association is characterized by a nearly monotypic stand of *Carex pellita* (woolly sedge). Other graminoid cover is minor, but includes *Phalaris arundinacea* (reed canarygrass), *Carex nebrascensis* (Nebraska sedge), *Schoenoplectus pungens* (threesquare bulrush), and *Poa pratensis* (Kentucky bluegrass). Scattered forbs include *Mentha arvensis* (wild mint), and *Cirsium arvense* (Canada thistle). *Equisetum arvense* (field horsetail) and *Equisetum hyemale* (scouringrush horsetail) may also be present.

Ecological Processes
The *Carex pellita* (woolly sedge) plant association appears to be a fairly stable community because of its strongly rhizomatous roots and well developed soils. In Montana, the *Carex pellita* plant association can be associated with large amounts of *Carex lasiocarpa* (slender sedge). With season-long grazing, *Carex pellita* decreases in abundance, shifting dominance towards *Poa pratensis* (Kentucky bluegrass). In Colorado, stands of *Carex pellita* that occur on stream banks

with a consistent water table depth and heavy, cohesive clay soils, appear stable and long-lived as long as the water table level remains consistent.

A Potential Conservation Area supporting this community type is Round Meadow Creek PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
73	(20 -98%)	Carex pellita	22
25	(10-40%)	Phalaris arundinacea	2
12	(3-20%)	Polygonum amphibium var. emersum	2
11	(0.1-40%)	Mentha arvensis	6
10	(0.1-20%)	Muhlenbergia asperifolia	2
10	(0.1-30%)	Poa pratensis	7
10	(1-20%)	Argentina anserina	7
9	(1-40%)	Eleocharis palustris	7
8	(5-10%)	Calamagrostis stricta	2
6	(5-7%)	Lycopus asper	2
Other species with < 5% average cover present in at least 10% of plots:			
Deschampsia caespitosa (1-10%), Carex praegracilis (2-5%), Hordeum jubatum ssp. jubatum (0.1-10%), Carex nebrascensis (0.1-5%), Agrostis gigantea (2.5-3%), Schoenoplectus pungens (1-5%), Cirsium arvense (1-4%), Juncus balticus var. montanus (0.1-5%), Polygonum lapathifolium (0.1-2%), Rumex crispus (0.1-1%), Equisetum arvense (0.1-1%), Juncus torreyi (0.1-1%).			

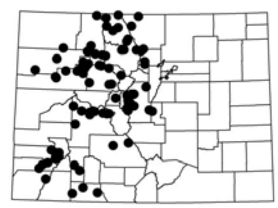
Beaked sedge Herbaceous Vegetation

Carex utriculata

Global rank/State rank:
G5 / S4

HGM subclass: D1, D2/3, R2, S1/2?, S3/4

Colorado elevation range:
5,600-11,000 ft (1,700-3,350 m)



General Description

The *Carex utriculata* (beaked sedge) plant association is a common wet meadow community that occurs around the edges of montane lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains. The water table is usually near the surface for most of the growing season. This association is well documented throughout the western states. A clear dominance of *Carex utriculata* over other *Carex* species including *C. aquatilis* (water sedge), sets this association apart from closely related types.

Carex utriculata (beaked sedge) grows in standing water or saturated soils. It also occurs along the margins of lakes and beaver ponds. Stream channels are wide and slightly sinuous, to wide and more sinuous. Soils are saturated organics or fine silty clays to clays over cobbles and alluvium. Mottling often occurs within a few centimeters of the surface.

Vegetation Description

This plant association is characterized by stands dominated by *Carex utriculata* (beaked sedge). Stands often appear to be nearly pure *Carex utriculata* (beaked sedge), but a variety of other graminoid species may be present as well. *Carex aquatilis* can be abundant, but if equal in cover to *C. utriculata*, see the similar *Carex aquatilis-Carex utriculata* association. Other *Carex* (sedge) species present include *Carex lenticularis* (shore sedge) and *C. microptera* (small-wing sedge), but usually with low cover relative to the amount of *C. utriculata* (beaked sedge) present. Other graminoid species that may be present include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (bluejoint reedgrass), and *Juncus balticus* var. *montanus* (mountain rush). Forb cover is very inconspicuous and can include *Mentha arvensis* (wild mint), *Mimulus guttatus* (seep monkeyflower), and *Geum macrophyllum* (largeleaf avens). Willow carrs (i.e., shrubland thickets) are often adjacent and a few scattered willows will occur within the *Carex utriculata* (beaked sedge) stand. Individual willows tend to be very short if present, either from limiting growth conditions (extremely cold and/or extremely wet), or because of heavy browsing by wildlife or livestock. The elevation of the site determines which willow species are in and adjacent to *Carex utriculata* (beaked sedge) stands. Willow species that are present may include *Salix monticola* (mountain willow), *S. drummondiana* (Drummond willow), *S. geyeriana* (Geyer willow), *S. planifolia* (planeleaf willow), and *S. exigua* (sandbar willow).

Ecological Processes
The *Carex utriculata* (beaked sedge) plant association occurs on the wettest sites of the riparian or wetland area, such as low-lying swales, and shallow margins of lakes and ponds, often in standing water. It is an early-seral community and is known to invade margins of newly formed beaver ponds, as well as the freshly exposed silt beds of drained beaver ponds. With time, the *Carex utriculata* plant association will grade into *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass) associations.

Successional shifts in species composition can be initiated by a change in the physical environment of the riparian area. Flooding events can result in sediments deposited on the floodplain, raising the surface higher above the water table. As aggradation, or build up, of the floodplain proceeds, the site can become drier and the dominant graminoid cover changes.

Abandoned beaver ponds also go through a similar succession. With time, ponds become silted-in and *Carex utriculata* establishes on the new, saturated substrate. As the site becomes firm and raised above the old pond level, *Carex aquatilis* and willows may become established. With further aggradation and time *Calamagrostis canadensis* may become established in the undergrowth. Depending on site characteristics, various willow species may become established in the overstory as well, creating the *Salix monticola/Carex utriculata* (mountain willow/beaked sedge) plant association or the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) plant association, for example.

Distance from the stream channel can also differentiate the graminoid dominance spatially within the riparian mosaic. *Carex utriculata* commonly occurs at the stream channel or pond edge where the water table is close to or at the ground surface. As the floodplain surface becomes higher with increased distance from the channel edge, the ground becomes slightly less saturated and shifts to mesic meadows of *Carex aquatilis*, or on higher surfaces, to slightly drier meadows of *Calamagrostis canadensis*.

A Potential Conservation Area supporting this community type is Quartz Creek at East Fork San Juan River PCA, though this community is common across the county.

Avg. Cover %	(Range)	Species Name	# Plots (N=143)
72	(7-100%)	Carex utriculata	143
9	(0.1-50%)	Carex aquatilis	40
7	(1-20%)	Carex microptera	15
7	(0.1-30%)	Calamagrostis canadensis	20
7	(1-20%)	Juncus balticus var. montanus	16
6	(1-10%)	Salix monticola	15
5	(0.1-15%)	Mentha arvensis	15
Other species with < 5% average cover present in at least 10% of plots:			
Equisetum arvense (0.1-20%), Glyceria striata (0.1-10%), Deschampsia caespitosa (1-10%), Geum macrophyllum var. perincisum (0.1-15%), Poa pratensis (1-10%).			

Native sedge Herbaceous Vegetation

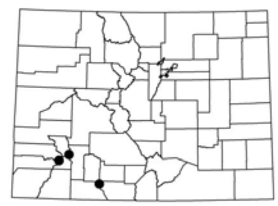
Carex vernacula

Carex vernacula Herbaceous Vegetation at Headwaters of Summit Creek PCA.

Global rank/State rank:
GU / S1

HGM subclass: S1/2

Colorado elevation range:
12,200-12,400 ft (3,700-3,800 m)



General Description

This plant association occurs along narrow and sinuous stream channels in gently-sloping, glaciated, alpine basins. *Carex vernacula* (native sedge) dominates the vegetation cover with *Caltha leptosepala* (marsh marigold) and *Deschampsia caespitosa* (tufted hairgrass) as common sub-dominants. *Carex vernacula* (native sedge) is known to occur from Wyoming and Colorado to Washington. However, stands of the *Carex vernacula* plant association have not been documented outside of Colorado where it is known from three stands in the San Juan National Forest in southwestern Colorado.

This plant association occurs in moderately wide, 85 ft (25 m), gently sloping, snow-melt basins. Stream channels are narrow and sinuous. The soils are stratified alluvial layers overlying gravel.

Vegetation Description

Carex vernacula (native sedge) dominates the graminoid layer with 25-75% cover. *Deschampsia caespitosa* (tufted hairgrass) is often present with up to 20% cover. *Caltha leptosepala* (marsh marigold) is usually the only forb with more than 10% cover.

Caltha leptosepala (marsh marigold) and *Eriophorum altaicum* (whitebristle cottongrass) meadows occur in adjacent swales, while *Deschampsia caespitosa* (tufted hairgrass) meadows occur on drier sites.

Ecological Processes
The *Carex vernacula* plant association is probably stable and long-lived. It is likely to recover very slowly from any disturbance due to cold soil temperatures and the short growing season at such high altitudes.

A Potential Conservation Area supporting this community type is Headwaters of Summit Creek PCA[1].

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
48	(25-75%)	Carex vernacula	3
25	—	Juncus drummondii	1
14	(8-19%)	Deschampsia caespitosa	2
12	(5-22%)	Caltha leptosepala	3
10	—	Salix planifolia	1
10	—	Salix brachycarpa	1
5	—	Pedicularis groenlandica	1
5	—	Eriophorum altaicum var. neogaeum	1
Other species with < 5% average cover present in at least 10% of plots:			
Carex microglochin (2%), Stellaria umbellata (1%), Primula parryi (1%), Carex microptera (1%).			

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

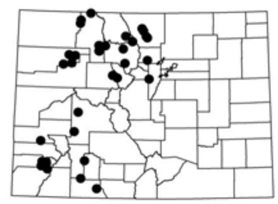
Blue spruce / Thinleaf alder Woodland

Picea pungens / Alnus incana* ssp. *tenuifolia

Global rank/State rank:
G3 / S3

HGM subclass:
R2, R3/4

Colorado elevation range:
6,100-10,650 ft (1,900-3,200 m)



General Description

The *Picea pungens/Alnus incana* ssp. *tenuifolia* (blue spruce/thinleaf alder) plant association occurs in montane riparian areas in Colorado. It occurs in deep, shaded canyons and narrow valleys along relatively straight stream reaches. It generally forms small patches, but can be continuous for several river miles.

This plant association occurs along narrow to moderately wide floodplains and stream benches in canyons subject to cold air drainage and limited sunlight. Stream channels are steep and narrow, moderately broad and slightly sinuous, or broad and highly sinuous. Soils are generally shallow and range from loamy sand to silty clay loams with heavy organic matter content over gravel, cobbles, and boulders.

Vegetation Description

Picea pungens (blue spruce) dominates the overstory with 1-70% cover. There are typically many seedling and saplings as well as mature trees. *Abies lasiocarpa* (subalpine fir) is usually present with up to 50% cover. Other tree species that occurred in half or fewer of the stands sampled include *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), *Pinus contorta* (lodgepole pine) and *Pinus ponderosa* (ponderosa pine).

The thick shrub understory is confined to a narrow band lining the stream channel. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) was present in all stands sampled, and ranged in cover from 1 to 80%. Other shrub species present were highly variable, with constancy of less then 40%, but often appearing with abundant cover when present. These shrubs include *Salix drummondiana* (Drummond willow), *Cornus sericea* (red-osier dogwood), *Ribes lacustre* (current), *Acer glabrum* (Rocky Mountain maple), *Vaccinium* spp. (whortleberry), *Salix boothii* (Booth willow), and *Salix wolfii* (Wolf willow).

The forb canopy layer is thick, up to 50% total cover and species-rich, often with more than 40 species represented in one stand. Species include *Actaea rubra* (red baneberry), *Conioselinum* *scopulorum* (Rocky Mountain hemlockparsley), *Oxypolis fendleri* (cowbane), *Geranium richardsonii* (Richardson geranium), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf cornflower), and *Equisetum arvense* (field horsetail).

Ecological Processes

In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species, and will remain until removed or damaged by a catastrophic flood. In Colorado, the closely related *Picea pungens/Equisetum arvense* (blue spruce/field horsetail) plant association is considered an indicator of frequent flooding. With less frequent flooding, this association may gradually change to a *Picea pungens/Alnus incana* ssp. *tenuifolia* (blue spruce/thinleaf alder) plant association.

Potential Conservation Areas supporting this community type are Hunter Campground PCA, Opal Lake PCA, Sparks Creek PCA, and Weminuche Creek PCA[1].

Avg. Cover %	(Range)	Species Name	# Plots (N=35)
32	(1-70%)	Picea pungens	35
28	(1-80%)	Alnus incana ssp. tenuifolia	34*
12	(1-85%)	Calamagrostis canadensis	13
12	(1-55%)	Salix exigua	5
12	(1-50%)	Abies lasiocarpa	15
9	(1-28%)	Acer glabrum	6
9	(1-32%)	Salix bebbiana	7
9	(1-28%)	Salix monticola	7
9	(1-18%)	Populus tremuloides	8
8	(1-45%)	Equisetum arvense	27
8	(1-40%)	Salix drummondiana	16
8	(1-20%)	Ribes lacustre	7
7	(1-32%)	Ribes inerme	10
7	(1-18%)	Pinus contorta	6
5	(1-25%)	Poa pratensis	20
5	(1-30%)	Lonicera involucrata	26
5	(0.1-20%)	Rudbeckia laciniata var. ampla	14
5	(1-10%)	Cornus sericea	8
5	(0.1-20%)	Trifolium repens	8
Other species with < 5% average cover present in at least 10% of plots:			
Saxifraga odontoloma (1-10%), Symphoricarpos oreophilus (1-20%), Heracleum maximum (1-15%), Rubus idaeus ssp. strigosus (0.1-20%), Mertensia ciliata (1-10%), Thalictrum fendleri (1-10%), Streptopus amplexifolius var. chalazatus (1-10%), Senecio triangularis (1-10%), Erigeron speciosus var. speciosus (1-9%), Maianthemum stellatum (0.1-13%), Geranium richardsonii (0.1-10%), Bromus ciliatus var. ciliatus (1-11%), Actaea rubra ssp. arguta (1-10%), Salix ligulifolia (1-5%), Rosa woodsii (1-10%), Aconitum columbianum (1-10%), Taraxacum officinale (0.1-15%), Poa palustris (1-5%), Amelanchier alnifolia (1-10%), Phleum pratense (1-10%), Cardamine cordifolia (1-10%), Urtica dioica ssp. gracilis (1-10%), Elymus glaucus (1-10%), Galium triflorum (1-10%), Luzula parviflora (0.1-8%), Conioselinum scopulorum (0.1-5%), Dasiphora floribunda (1-7%), Chamerion angustifolium ssp. circumvagum (1-10%), Osmorhiza depauperata (0.1-10%), Fragaria virginiana ssp. glauca (1-5%), Glyceria striata (0.1-5%), Achillea millefolium var. occidentalis (1-5%), Galium boreale (1-5%), Orthilia secunda (1-3%), Viola canadensis var. scopulorum (0.1-3%), Carex microptera (1-3%), Vicia americana (1-5%), Oxypolis fendleri (1-3%), Osmorhiza berteroi (1-3%), Geum macrophyllum var. perincisum (0.1-5%), Prunella vulgaris (1%), Ranunculus macounii (1%).			

*Alnus incana ssp. tenuifolia occurred in all stands, but was not captured in every sample plot.

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

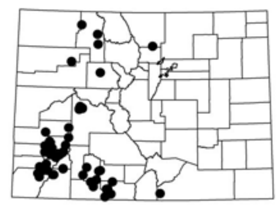
Narrowleaf cottonwood - Blue spruce / Thinleaf alder Woodland

Populus angustifolia - Picea pungens / Alnus incana* ssp. *tenuifolia

Global rank/State rank:
G3 / S3

HGM subclass: R2?, R3/4

Colorado elevation range:
6,800-9,600 ft (2,070-2,925 m)



General Description
This is a common mixed deciduous-evergreen community of montane valleys, where *Populus angustifolia* (narrowleaf cottonwood) and *Picea pungens* (blue spruce) are co-dominant along a stream reach. Frequently, other conifer trees are present, but not as abundant as *Picea pungens* (blue spruce). The shrub understory is typically dense and diverse. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is almost always present. Only a handful of good condition stands are known, and the community is highly threatened by improper livestock grazing, heavy recreational use, and stream flow alterations.

This association occurs in valleys with narrow to moderately wide floodplains, 30-600 ft (10-200 m), and in deep canyons. This association is commonly found on slightly meandering to meandering floodplains of broad reaches. Occasionally, stands occur along steep reaches. Soils range from shallow sandy loams to silty clay loams and clays over cobbles and boulders. Profiles are generally highly stratified, with layers of fine soils over layers of coarser sediments.

Vegetation Description
The upper canopy is dominated by *Populus angustifolia* (narrowleaf cottonwood) and either *Picea pungens* (blue spruce) or *Picea engelmannii* (Engelmann spruce). Other less frequently encountered tree species may also be present and include *Pseudotsuga menziesii* (Douglas-fir), *Abies concolor* (white fir), *Populus tremuloides* (quaking aspen), and *Abies lasiocarpa* (subalpine fir). *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is almost always present in the shrub canopy layer, although cover amounts vary and other shrub species may be more abundant. *Lonicera involucrata* (twinberry honeysuckle) is the most frequently encountered species after *Alnus*. Many other shrub species can occur within this association, including *Amelanchier alnifolia* (Saskatoon serviceberry), *Acer glabrum* (Rocky Mountain maple), *Salix drummondiana* (Drummond willow), *S. exigua* (sandbar willow), *S. lucida* ssp. *caudata* (shining willow), *S. geyeriana* (Geyer willow), *S. boothii* (Booth willow), *Prunus virginiana* (chokecherry), and *Symphoricarpos oreophilus* (mountain snowberry).

The undergrowth is diverse and can be sparse or dense, depending on local conditions. Total herbaceous cover rarely exceeds 40%. *Maianthemum stellatum* (starry false Solomon seal) and *Geranium richardsonii* (Richardson geranium) are frequently found. Graminoid cover is less diverse than forb cover.

Ecological Processes
This mixed deciduous-evergreen plant association is a mid-seral community. With continued fluvial activity, such as flooding, channel migration, sediment deposition, and scouring, narrowleaf cottonwood and blue spruce will continue to co-occur along the reach. Gradual and slightly sinuous stream channels that have overbank flow and sediment deposition favor establishment of *Populus angustifolia*. *Picea pungens* is favored along reaches in deep valleys with steep canyon walls that provide conditions for strong cold-air drainage. If the floodplain is no longer active, i.e., is no longer flooded because the stream channel has become lower (surface becomes a terrace) or upstream dams control floods, then cottonwoods will eventually die and the conifers may persist.

Potential Conservation Areas supporting this community type are Navajo River at Banded Peak PCA, Quartz Creek at East Fork San Juan River PCA, and Sand Creek PCA[1].

Avg. Cover %	(Range)	Species Name	# Plots (N=51)
34	(2-90%)	Populus angustifolia	51*
28	(1-60%)	Betula occidentalis	8
27	(0.1-90%)	Alnus incana ssp. tenuifolia	41
25	(1-80%)	Picea pungens	51
17	(1-50%)	Picea engelmannii	9
17	(1-96%)	Cornus sericea ssp. sericea	31
11	(1-50%)	Salix ligulifolia	15
11	(1-25%)	Pseudotsuga menziesii	17
9	(1-50%)	Acer glabrum	12
7	(1-40%)	Lonicera involucrata	33
7	(1-28%)	Populus tremuloides	8
7	(1-23%)	Abies concolor	9
7	(1-15%)	Salix drummondiana	11
6	(2-20%)	Salix exigua	8
6	(1-30%)	Calamagrostis canadensis	8
5	(1-30%)	Salix monticola	15
5	(1-20%)	Prunus virginiana var. melanocarpa	8
5	(1-15%)	Amelanchier alnifolia	17

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-16%), Symphoricarpos rotundifolius (1-30%), Salix bebbiana (0.1-15%), Equisetum arvense (1-10%), Maianthemum stellatum (0.1-30%), Elymus glaucus (1-20%), Equisetum hyemale var. affine (1-20%), Geranium richardsonii (1-10%), Heracleum maximum (1-11%), Osmorhiza depauperata (1-30%), Poa pratensis (1-16%), Actaea rubra ssp. arguta (1-10%), Taraxacum officinale (0.1-16%), Mertensia franciscana (1-9%), Ligusticum porteri (1-10%), Fragaria virginiana ssp. glauca (1-9%), Rosa woodsii (0.1-9%), Thalictrum fendleri (1-10%), Pseudocymopterus montanus (1-10%), Ribes inerme (1-5%), Viola canadensis var. scopulorum (1-10%), Amelanchier utahensis (0.1-3%), Paxistima myrsinites (1-4%), Galium triflorum (1-10%), Chamerion angustifolium ssp. circumvagum (1-3%), Equisetum pratense (1-4%), Rubus idaeus ssp. strigosus (1-5%), Geum macrophyllum var. perincisum (0.1-4%), Cardamine cordifolia (1-4%), Achillea millefolium var. occidentalis (1-5%), Vicia americana (1-5%), Galium boreale (0.1-5%), Oxypolis fendleri (1-4%), Mertensia ciliata (0.1-5%).

*Populus angustifolia occurred in all stands, but was not captured in every sample plot.

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Narrowleaf cottonwood / Thinleaf alder Woodland

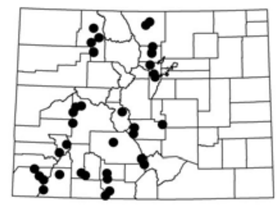
Populus angustifolia / Alnus incana* ssp. *tenuifolia

Populus angustifolia / Alnus incana ssp. *tenuifolia* Woodland on the Navajo River..

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
6,000-9,600 ft (1,830-2,930 m)



General Description

The *Populus angustifolia/Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) plant association is characterized by a dense stand of *Alnus incana* ssp.*tenuifolia* lining the stream bank and an open to nearly closed canopy of *Populus angustifolia*. Other shrubs may occur but *Alnus incana* ssp. *tenuifolia* (thinleaf alder) usually has at least 10-20% cover and is the most abundant of all other shrubs within the stand. It occurs along narrow, fast-moving stream reaches in montane areas.

This plant association occurs on active floodplains in narrow to broad valleys. It forms a narrow, dense band along stream banks and benches. Some of the stands have signs of recent flooding. Stream gradient and channel width are highly variable. Some sites occur along steep, narrow reaches with little sinuosity. Other sites occur along low gradient, moderately sinuous, broad channel reaches, low gradient, highly sinuous reaches, or very narrow and highly sinuous stream sections. Soils are mostly coarse textured ranging from deep sands to shallow sandy loams. Some profiles show stratification with loams to clay loams alternating with sands. Most profiles become skeletal at an average depth of 12 inches (30 cm).

Vegetation Description

The dominance of *Populus angustifolia* (narrowleaf cottonwood) and *Alnus incana* ssp. *tenuifolia* (thinleaf alder) are the key diagnostic characteristics of this association. Several other tree and shrub species may be present, but they rarely equal the abundance of the diagnostic species. The overstory is an open to dense canopy of *Populus angustifolia*, which is always present, if sometimes only as sapling-sized individuals. Other tree species that may be present include *Pseudotsuga menziesii* (Douglas-fir), *Juniperus scopulorum* (Rocky Mountain juniper), *Populus tremuloides* (quaking aspen), *Pinus ponderosa* (ponderosa pine), *Populus* x *acuminata* (lanceleaf cottonwood), *Abies concolor* (white fir), or *Picea pungens* (blue spruce). The shrub understory is dominated by a dense band of *Alnus incana* ssp. *tenuifolia* (thinleaf alder) lining the stream bank. A variety of other shrubs may be present, intermingling with the alder but usually providing less than the total alder cover. Other shrub species include *Salix bebbiana* (Bebb willow), *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* ssp. *caudata* (shining willow), *Salix exigua* (sandbar willow), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Acer glabrum* (Rocky Mountain maple), and *Betula occidentalis* (river birch).

The herbaceous undergrowth is generally sparse. Herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Equisetum arvense* (field horsetail), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Trifolium repens* (white clover), *Calamagrostis canadensis* (bluejoint reedgrass), *Oxypolis fendleri* (Fendler cowbane), and *Cardamine cordifolia* (heartleaf bittercress).

Ecological Processes

The *Populus angustifolia/Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) plant association is considered a mid-seral community (not the youngest and not the oldest stands of cottonwoods within a reach). With time and without flooding disturbance, stands may become dominated by invading conifers from adjacent upland communities such as *Pseudotsuga menziesii* (Douglas-fir), *Juniperus* spp. (juniper), or *Picea engelmannii* (Engelmann spruce).

Potential Conservation Areas supporting this community type are Archuleta Creek PCA[1], Navajo River at Banded Peak PCA, and Rio Chama PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
37	(3-84%)	Populus angustifolia	37
35	(1-80%)	Alnus incana ssp. tenuifolia	37
18	(1-40%)	Agrostis gigantea	5
13	(1-30%)	Salix lucida ssp. caudata, lasiandra	14
13	(3-28%)	Betula occidentalis	5
12	(1-48%)	Trifolium repens	7
11	(3-35%)	Salix drummondiana	10
10	(1-30%)	Poa pratensis	26
10	(1-30%)	Cornus sericea ssp. sericea	12
10	(1-34%)	Populus tremuloides	5
8	(1-32%)	Salix exigua	8
7	(1-15%)	Agrostis stolonifera	6
7	(1-14%)	Salix monticola	9
6	(1-22%)	Cardamine cordifolia	5
6	(0.1-40%)	Dactylis glomerata	9
6	(1-20%)	Rubus idaeus ssp. strigosus	6
6	(1-17%)	Calamagrostis canadensis	8
6	(1-14%)	Pseudotsuga menziesii	7
5	(1-14%)	Salix bebbiana	8
5	(1-11%)	Ribes inerme	5
5	(1-20%)	Rudbeckia laciniata var. ampla	12

Other species with < 5% average cover present in at least 10% of plots:
Acer glabrum (1-10%), Rosa woodsii (1-30%), Heracleum maximum (0.1-15%), Pyrola asarifolia ssp. asarifolia (1-10%), Poa palustris (1-10%), Taraxacum officinale (1-20%), Juniperus scopulorum (1-11%), Salix ligulifolia (1-10%), Lonicera involucrata (0.1-10%), Equisetum arvense (0.1-18%), Oxypolis fendleri (1-11%), Urtica dioica ssp. gracilis (1-10%), Prunus virginiana var. melanocarpa (1-7%), Maianthemum stellatum (0.1-10%), Osmorhiza depauperata (1-4%), Achillea millefolium var. occidentalis (0.1-12%), Clematis ligusticifolia (1-3%), Juncus balticus var. montanus (1-6%), Vicia americana (1-5%), Mertensia ciliata (1-5%), Galium triflorum (1-4%), Thalictrum fendleri (1-5%), Geum macrophyllum var. perincisum (1-6%), Geranium richardsonii (1-5%), Fragaria virginiana ssp. glauca (1-5%), Chamerion angustifolium ssp. circumvagum (1-3%), Galium boreale (1-3%), Mentha arvensis (1-4%), Symphoricarpos oreophilus (1-3%), Galium trifidum ssp. subbiflorum (1-3%), Actaea rubra ssp. arguta (0.1-3%), Phleum pratense (1%), Equisetum laevigatum (0.1-1%).

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

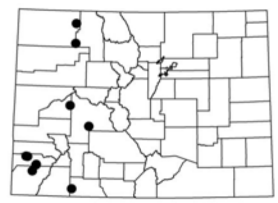
Narrowleaf cottonwood / River hawthorn Woodland

Populus angustifolia / Crataegus rivularis

Global rank/State rank:
G2? / S2

HGM subclass: R3/4

Colorado elevation range:
6,900-8,000 ft (2,100-2,400 m)



General Description

The *Populus angustifolia/Crataegus rivularis* (narrowleaf cottonwood/river hawthorn) plant association is characterized by having dense to sparse canopy cover of mature *Populus angustifolia* (narrowleaf cottonwood) trees. The understory is typically very dense and consists of *Crataegus rivularis* (river hawthorn) and other shrub species including *Cornus sericea* (red-osier dogwood) and various tall *Salix* (willow) species. Graminoid and forb cover is minimal. This association generally occurs away from the immediate stream bank in moderately wide valleys. It also occurs along dry backchannels or ephemeral streams.

Stream channels are wide and moderately to highly sinuous. The soils are sandy clays and highly stratified alluvium.

Vegetation Description

Populus angustifolia (narrowleaf cottonwood) forms an open to dense overstory canopy with 4-63% cover. *Crataegus rivularis* (river hawthorn) forms a dense shrub canopy with 10-70% cover, and *Rosa woodsii* (Woods rose) forms a sub-shrub canopy. These three species were present in every stand sampled. Other tree species may be present, including *Pinus ponderosa* (ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir). Shrub species may include *Symphoricarpos oreophilus* (mountain snowberry), *Quercus gambelii* (Gambel oak), *Dasiphora floribunda* (shrubby cinqefoil), *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), and *Salix monticola* (mountain willow).

Graminoid and forb cover is typically low due to dry soil conditions. *Taraxacum officinale* (dandelion) and *Iris missouriensis* (wild iris) are present in nearly all sampled stands. Other herbaceous species present include *Maianthemum stellatum* (starry false Solomon seal), *Poa pratensis* (Kentucky bluegrass), *Thermopsis montana* (mountain goldenbanner), *Thalictrum fendleri* (Fendler meadowrue), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex praegracilis* (clustered field sedge), and *Delphinium nuttallianum* (Nuttal larkspur).

Ecological Processes
An abundance of *Crataegus rivularis* (river hawthorn) may indicate a late seral stage of the cottonwood stand. *Crataegus* occupies the driest part of the riparian habitat, and may indicate the surface is no longer flooded. In Montana, thickets of *Crataegus* are considered a grazing disclimax. Cattle will browse *Crataegus* and heavy pressure can cause thickets to become open and increaser species such as *Rosa woodsii* (Woods rose), *Symphoricarpos* (snowberry) and *Poa pratensis* (Kentucky bluegrass) become established and abundant.

A Potential Conservation Area supporting this community type is Devil Creek State Wildlife Area PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
44	(4-63%)	Populus angustifolia	10
35	(1-100%)	Ribes inerme	3
25	(10-70%)	Crataegus rivularis	10
14	(1-30%)	Cornus sericea	5
14	(3-40%)	Symphoricarpos oreophilus	6
10	(1-20%)	Salix monticola	3
10	(1-30%)	Rosa woodsii	10
10	(3-20%)	Pinus ponderosa var. scopulorum	4
8	(1-50%)	Maianthemum stellatum	9
6	(1-15%)	Quercus gambelii	5
6	(1-20%)	Amelanchier alnifolia	6

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (1-10%), Dasiphora floribunda (1-10%), Poa pratensis (1-10%), Osmorhiza depauperata (1-6%), Melilotus officinalis (1-10%), Thalictrum fendleri (1-9%), Geranium richardsonii (1-6%), Thermopsis montana (1-3%), Juncus balticus var. montanus (1-3%), Phleum pratense (1-3%), Fragaria virginiana ssp. glauca (1-3%), Vicia americana (1-5%), Bromus inermis (1-3%), Taraxacum officinale (1-3%), Achillea millefolium var. occidentalis (1%), Iris missouriensis (1%), Galium triflorum (1%), Pseudocymopterus montanus (1%), Trifolium longipes (1%).

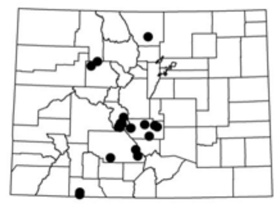
Narrowleaf cottonwood / Rocky Mountain juniper Woodland

Populus angustifolia - Juniperus scopulorum

Global rank/State rank:
G2G3 / S2S3

HGM subclass: R3/4

Colorado elevation range:
6,000-8,600 ft (1,800-2,600 m)



General Description
Populus angustifolia (narrowleaf cottonwood) and *Juniperus scopulorum* (Rocky Mountain juniper) dominated riparian areas are uncommon. The community occurs along lower foothill streams with perennial to intermittent stream flows. Total biomass and canopy cover are often low. The association is characterized by an open canopy of *Populus angustifolia* (narrowleaf cottonwood) and *Juniperus scopulorum* (Rocky Mountain juniper), often with little else growing in the understory. The species composition and percent cover is variable and depends on aspect, elevation, and stream flow, in addition to the degree of disturbance by recreational use and livestock grazing.

Stream channels are steep and narrow with rocky to sandy bottoms. This association can also occur on upper terraces and elevated islands of wide, meandering river reaches such as those found along the Arkansas and Colorado Rivers. Valley widths are typically 700 ft (200 m) or less and stream gradients are generally low to moderate (0.5-2.5%). *Juniperus scopulorum* (Rocky Mountain juniper) is situated at the high water line and above, while the *Populus angustifolia* (narrowleaf cottonwood) grades into the active floodplain area. Soils of this plant association are derived from alluvial deposits. The surface soils consist of loamy sand, clay loams, silty clays or organic matter. Subsurface layers range from sandy loams and loamy sands to clay loams and sandy clay loams with 20-50% gravel and cobbles. Soil depth ranges from 15-25 inches (40 to 65 cm).

Vegetation Description
This plant association is characterized by an open to closed canopy of 20-100% cover of *Populus angustifolia* (narrowleaf cottonwood) and scattered to abundant *Juniperus scopulorum* (Rocky Mountain juniper) with 5-85% cover. Stands with northern aspects may include *Pseudotsuga menziesii* (Douglas-fir) or *Populus tremuloides* (quaking aspen). Two stands in the lower San Juan watershed with *Juniperus osteosperma* (Utah juniper), rather than *J. scopulorum* (Rocky Mountain juniper), are included in this type.

There is very little shrub canopy and little to no herbaceous undergrowth due to dry conditions. If present, the shrub canopy may include a wide variety of species, although none is present in every stand. Shrub species may include *Clematis ligusticifolia* (western white clematis), *Acer glabrum* (Rocky Mountain maple), *Rhus trilobata* (skunkbush sumac), *Symphoricarpos oreophilus* (mountain snowberry), *Quercus gambelii* (Gambel oak), and *Berberis fendleri* (Colorado barberry).

Non-native species are some of the more commonly encountered herbaceous components of this association, and generally occur in disturbed stands. Species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Agrostis stolonifera* (creeping bentgrass), and *Melilotus officinalis* (sweet clover).

Ecological Processes
As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Potential Conservation Areas supporting this community type are Ignacio Creek PCA, Lower Piedra River PCA, Round Meadow Creek PCA, Sambrito Creek Headwaters PCA, San Juan River at Carracas PCA, San Juan River at Juanita PCA, and Spring Creek North PCA[1].

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
51	(12-97%)	Populus angustifolia	20
29	(3-86%)	Juniperus scopulorum	18
12	(6-22%)	Quercus gambelii	3
11	(3-24%)	Carex utriculata	3
10	(1-29%)	Poa pratensis	13
9	(0.1-30%)	Maianthemum stellatum	6
9	(6-12%)	Pseudotsuga menziesii	3
9	(1-23%)	Alnus incana ssp. tenuifolia	3
8	(1-18%)	Acer glabrum	4
7	(1-17%)	Agrostis stolonifera	6
6	(1-27%)	Clematis ligusticifolia	10
6	(1-12%)	Melilotus officinalis	6

Other species with < 5% average cover present in at least 10% of plots:
Leymus cinereus (1-10%), Medicago lupulina (1-8%), Equisetum arvense (1-8%), Thermopsis divaricarpa (2-7%), Trifolium repens (1-7%), Thalictrum fendleri (1-4%), Juncus balticus var. montanus (1-6%), Rhus trilobata var. trilobata (1-6%), Equisetum hyemale var. affine (1-6%), Rosa woodsii (0.1-5%), Salix exigua (1-3%), Achillea millefolium var. occidentalis (1-3%), Symphoricarpos oreophilus (1-2%), Taraxacum officinale (1-3%), Artemisia ludoviciana (1-2%), Bromus tectorum (1%), Pascopyrum smithii (1%), Tragopogon dubius (1%).

[1]For information on this PCA please refer to CNHP's associated report, *Survey of Critical Wetland and Riparian Areas in La Plata County* (2004).

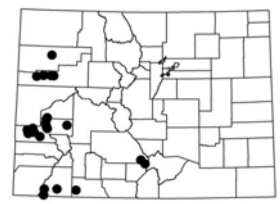
Narrowleaf cottonwood / Skunkbush sumac Woodland

Populus angustifolia / Rhus trilobata

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
5,000-8,000 ft (1,500-2,440 m)



General Description

The *Populus angustifolia*/*Rhus trilobata* (narrowleaf cottonwood/skunkbush sumac) plant association is characterized by a scattered overstory of *Populus angustifolia* with an occasional *P.* x *acuminata* (lanceleaf cottonwood) or *P. deltoides* ssp. *wislizeni* (Rio Grande cottonwood). The shrub understory is a dense layer of *Rhus trilobata*. It occurs in sandstone canyons and on streams adjacent to sand dunes.

This plant association occurs on immediate river banks, floodplain meanders, and narrow benches in narrow to wide, 65-500 ft (20-150 m), sandstone canyons. Stands generally occur within 3 ft (1 m) of the high water mark, but can also occur on higher terraces, up to 10 ft (3 m) above the channel. In the western portion of the Colorado River drainage, this association occurs on small streams in shale canyon areas. Stream channels are wide and highly sinuous or wide and moderately sinuous. Occasionally, stream channels are narrow and steep. The soils associated with this plant association are often alkaline and of a calcareous parent material. The soil textures are fine sandy loams, clay loams, silty clay loams, and silty clay.

Vegetation Description

This plant association is characterized by the presence and abundance of *Rhus trilobata* (skunkbush sumac) with *Populus angustifolia* (narrowleaf cottonwood), or *P.* x *acuminata* (lanceleaf cottonwood). The cottonwoods may be young or mature trees. Other trees that may be present in the overstory include *Acer negundo* (boxelder), *Juniperus osteosperma* (Utah juniper), *Juniperus scopulorum* (Rocky Mountain juniper), *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas-fir), *Pinus edulis* (pinyon pine), and *Ulmus pumila* (Siberian elm), an introduced species found in a single plot.

The shrub layer is dominated by *Rhus trilobata* (skunkbush sumac). Other shrubs that may be present include *Clematis ligusticifolia* (western white clematis), *Rosa woodsii* (Woods rose), *Quercus gambelii* (Gambel oak), *Salix exigua* (sandbar willow), *Amelanchier utahensis* (Utah serviceberry), *Cornus sericea* (red-osier dogwood), *Forestiera pubescens* (wild privet), *Prunus virginiana* (chokecherry), *Berberis fendleri* (Colorado barberry), *Shepherdia argentea* (silver buffaloberry), and *Acer glabrum* (Rocky Mountain maple). The herbaceous undergrowth is usually sparse.

Ecological Processes
In southwestern Colorado, *Rhus trilobata* is present in both young and old cottonwood stands. As the stand matures, *Rhus trilobata* becomes denser and excludes other shrubs. On higher terraces that are less frequently flooded, *Populus angustifolia* does not reproduce. This indicates succession to an upland community. The presence of *Quercus gambelii* (Gambel oak) in some stands may indicate a trend toward an upland oak shrub community.

As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being “re-set” by flooding disturbance. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

A Potential Conservation Area supporting this community type is Turkey Creek at Stollsteimer PCA[1].

Avg. Cover %	(Range)	Species Name	# Plots (N=34)
37	(1-99%)	Rhus trilobata var. trilobata	32*
33	(1-80%)	Populus angustifolia	32*
20	(1-50%)	Mahonia repens	5
20	(1-60%)	Populus x acuminata	6
19	(3-40%)	Forestiera pubescens	6
18	(1-40%)	Acer negundo var. interius	8
17	(3-31%)	Prunus virginiana var. melanocarpa	5
16	(1-26%)	Berberis fendleri	5
11	(1-30%)	Shepherdia argentea	4
10	(1-21%)	Maianthemum stellatum	9
9	(1-30%)	Salix exigua	11
9	(1-20%)	Crataegus rivularis	4
8	(1-56%)	Clematis ligusticifolia	22
8	(1-20%)	Quercus gambelii	13
7	(1-30%)	Poa pratensis	19
7	(1-21%)	Pascopyrum smithii	5
6	(1-10%)	Cornus sericea	7
6	(0.1-30%)	Rosa woodsii	18
6	(1-10%)	Artemisia tridentata	8
5	(1-10%)	Juniperus scopulorum	6
5	(1-20%)	Symphoricarpos oreophilus	9
5	(1-10%)	Toxicodendron rydbergii	6

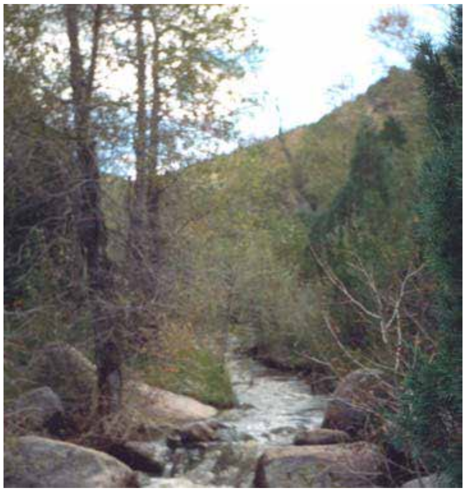
Other species with < 5% average cover present in at least 10% of plots:
Ericameria nauseosa ssp. nauseosa var. glabrata (0.1-10%), Amelanchier utahensis (1-10%), Melilotus officinalis (0.1-10%), Equisetum arvense (1-5%), Glycyrrhiza lepidota (1-5%), Taraxacum officinale (1-5%), Vicia americana (1-5%), Artemisia ludoviciana (1-3%), Bromus tectorum (1-3%), Heterotheca villosa (1%), Eleocharis palustris (1%), Achillea millefolium var. occidentalis (0.1-1%), Equisetum laevigatum (0.1-1%).

* Populus angustifolia and Rhus trilobata occurred in all stands, but were not captured in every sample plot.

[1]For information on this PCA please refer to CNHP’s associated report, *Upper San Juan Basin Biological Assessment* (2003).

Narrowleaf cottonwood / Sandbar willow Woodland

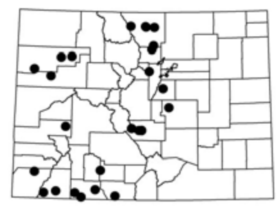
Populus angustifolia / Salix exigua



Global rank/State rank:
G4 / S4

HGM subclass: R3/4, R5

Colorado elevation range:
5,200-8,500 ft (1,580-2,600 m)



General Description

This is a very common plant association of young seedling and sapling *Populus angustifolia* (narrowleaf cottonwood) intermixed with *Salix exigua* (sandbar willow). The association occupies point bars, gravel bars, benches and low areas that are flooded annually.

This plant association occurs on recently flooded point bars, low terraces, and stream benches. It is usually well within the active channel and immediate floodplain of the stream and does not occur more than 3-6 ft (1-2 m) above the high-water mark. Stream channels are wide and slightly sinuous, or wide and moderately sinuous. Soils are skeletal (40% gravel and 10-20% cobbles) and shallow, 15 in (35 cm) deep, sands, sandy loams, sandy clay loams, or silty clays over coarse alluvial material.

Vegetation Description

This plant association represents the early, successional stage of nearly all *Populus angustifolia* (narrowleaf cottonwood) dominated plant associations, and is characterized by an open to dense stand of *Populus angustifolia* (narrowleaf cottonwood) young trees, seedlings and saplings with *Salix exigua* (sandbar willow). *Populus* x *acuminata* (lanceleaf cottonwood) may also be present in similar age classes. Other more widely scattered trees occurring in fewer than 20% of sampled stands include *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce), *Pinus ponderosa* (ponderosa pine), and *Picea pungens* (blue spruce).

The shrub canopy is typically at the same height of the seedling and sapling cottonwood trees, although older, transitional, stands will have taller, more mature trees with *Salix exigua* as an understory. Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Salix lucida* ssp. *caudata* or ssp. *lasiandra* (shining willow), *Salix ligulifolia* (strapleaf willow), *Salix drummondiana* (Drummond willow), and *Salix bebbiana* (Bebb willow).

The herbaceous undergrowth is generally invasive, non-native and sparse from frequent flooding disturbance. Non-native species include *Poa pratensis* (Kentucky bluegrass), *Trifolium repens* (white clover), *Agrostis stolonifera* (creeping bentgrass), *Linaria vulgaris* (butter and eggs), *Taraxacum officinale* (dandelion), *Medicago lupulina* (black medick), *Phleum pratense* (timothy), *Melilotus officinalis* (yellow sweetclover), *Dactylis glomerata* (orchardgrass), and *Elymus repens* (quackgrass). Native herbaceous species that can be present include *Equisetum arvense* (field horsetail), *Achillea millefolium* var. *occidentalis* (western yarrow), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex microptera* (big head sedge), *Carex pellita* (woolly sedge), and *Mentha arvensis* (wild mint).

Ecological Processes
Populus angustifolia/Salix exigua (narrowleaf cottonwood/sandbar willow) is one of the earliest successional stages of a cottonwood-dominated plant association. *Populus angustifolia* and *Salix exigua* seeds often germinate together on freshly deposited sandbars. If the site becomes more stable and less frequently flooded (i.e., the stream channel migrates away from the site), the *Populus angustifolia* saplings mature, but the *Salix exigua* population eventually declines. The association can become one of several mid- or late-seral floodplain types including *Populus angustifolia/Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) and *Populus angustifolia/ Cornus sericea* (narrowleaf cottonwood/red-osier dogwood).

A Potential Conservation Area supporting this community type is Lower Piedra River PCA.

Avg. Cover %	**(Range)**	**Species Name**	**# Plots (N=27)**
38	(15-80%)	Populus angustifolia	27
22	(1-64%)	Salix exigua	24*
17	(0.1-40%)	Agrostis gigantea	5
13	(1-70%)	Poa pratensis	19
11	(1-40%)	Trifolium pratense	5
10	(1-88%)	Equisetum arvense	11
8	(1-20%)	Salix lucida ssp. caudata, lasiandra	6
6	(1-30%)	Melilotus officinalis	10
6	(1-38%)	Trifolium repens	12
6	(1-20%)	Medicago lupulina	9
5	(1-12%)	Salix ligulifolia	5
5	(1-19%)	Bromus inermis	6
5	(2-10%)	Alnus incana ssp. tenuifolia	7
5	(1-10%)	Dactylis glomerata	4

Other species with < 5% average cover present in at least 10% of plots:
Phleum pratense (1-10%), Poa compressa (1-15%), Heterotheca villosa (1-10%), Juncus balticus var. montanus (0.1-10%), Juniperus scopulorum (1-8%), Eleocharis palustris (1-5%), Taraxacum officinale (0.1-20%), Rudbeckia laciniata var. ampla (0.1-5%), Clematis ligusticifolia (0.1-6%), Mentha arvensis (1-5%), Rosa woodsii (0.1-5%), Achillea millefolium var. occidentalis (1-3%), Carex microptera (1%),.

*Salix exigua was present in all stands, but was not captured in every sample plot.

Narrowleaf cottonwood / Bluestem willow Woodland

Populus angustifolia / Salix irrorata

Global rank/State rank:
G2 / S2

HGM subclass: R3/4

Colorado elevation range:
5,600-7,300 ft (1,700-2,200 m)

General Description

The *Populus angustifolia/Salix irrorata* (narrowleaf cottonwood/bluestem willow) plant association is a provisional type representing young, early-seral stands of *Populus angustifolia*. Some stands of this association in the upper South Platte River Basin have significant cover of *Populus deltoides* ssp. *monilifera* (plains cottonwood). These stands are in the transition zone where *Populus deltoides*, typically a low elevation species, and *Populus angustifolia* occur together.

This plant association occupies immediate stream banks and point bars of meandering rivers. It is located very close to, or well within, the high-water line of a stream. Stream channels can be moderately steep (8-9% gradient) and sinuous with a narrow floodplain, or less steep (1-2% gradient) and highly sinuous, or braided. Soils are shallow and skeletal, 30-50% cobbles at 6 inches (15 cm) depth, sandy clay loams alternating with loamy sands and silty clay loams.

Vegetation Description

This plant association is characterized by 4-75% cover of all age classes of *Populus angustifolia* (narrowleaf cottonwood). Other trees that may be present include *Populus deltoides* ssp. *monilifera* (plains cottonwood), *Populus* x *acuminata* (lanceleaf cottonwood), and *Salix amygdaloides* (peachleaf willow).

The shrub canopy consists of *Salix irrorata* (bluestem willow) creating a thick band along the streambank. In fact, some stands would be dense *Salix irrorata* (bluestem willow) shrublands if it were not for the nearby *Populus angustifolia* (narrowleaf cottonwood) that overhang the bank. Other shrubs that may be present include *Salix exigua* (sandbar willow), *Salix monticola* (mountain willow), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

Herbaceous undergrowth is sparse due to frequent flooding. However, non-native species can be abundant, including *Agrostis stolonifera* (creeping bentgrass), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome). Herbaceous natives can also be present, and include *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex nebrascensis* (Nebraska sedge), *Glyceria grandis* (American mannagrass), *Schoenoplectus acutus* (hardstem bulrush), and *Epilobium* spp. (willowherb).

Ecological Processes

The *Populus angustifolia/Salix irrorata* (narrowleaf cottonwood/bluestem willow) plant association is considered an early-seral community following the establishment of *Populus angustifolia*. A dense cover of *Salix irrorata* or *Salix exigua* (sandbar willow) indicates frequent flooding. With time, the vegetation traps sediment and the land surface aggrades. With continued flooding and sediment deposition, this plant association will shift to a more mature floodplain community.

Potential Conservation Areas supporting this community type are Devil Creek at Middle Mountain PCA and Middle Fourmile Creek PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
43	(7-90%)	Salix irrorata	7
29	(4-75%)	Populus angustifolia	7
26	(13-37%)	Agrostis stolonifera	3
14	(13-14%)	Populus deltoides	2
13	(1-22%)	Salix exigua	3
13	(1-25%)	Mertensia ciliata	2
11	(9-17%)	Poa pratensis	5
8	(1-15%)	Poa compressa	2
8	(1-15%)	Agrostis gigantea	2
7	(1-20%)	Clematis ligusticifolia	3
7	(2-11%)	Elymus lanceolatus	3
5	(0.1-10%)	Acer glabrum	2
5	(5-5%)	Alnus incana ssp. tenuifolia	2

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (2-6%), Trifolium repens (1-7%), Epilobium ciliatum ssp. glandulosum (2-6%), Salix amygdaloides (1-7%), Elymus trachycaulus ssp. trachycaulus (2-5%), Lolium pratense (2-5%), Cirsium arvense (1-5%), Betula occidentalis (1-3%), Rosa woodsii (1-2%), Stellaria crassifolia (1%), Taraxacum officinale (1%), Oxalis stricta (1%), Mentha arvensis (1%), Centaurea diffusa (1%), Arctium minus (1%).

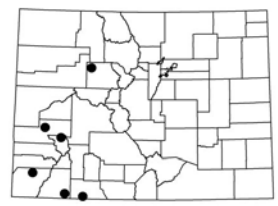
Narrowleaf cottonwood / Strapleaf willow – Silver buffaloberry Woodland

Populus angustifolia / Salix ligulifolia - Shepherdia argentea

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
6,000-7,100 ft (1,800-2,200 m)



General Description

Populus angustifolia/Salix ligulifolia-Shepherdia argentea (narrowleaf cottonwood/strapleaf willow-silver buffaloberry) is an extremely limited plant association in western Colorado. Historically, it was more widespread and common in broad river valleys. Intense, long-term use by livestock and alterations in the river flow regime have caused a decline in its distribution.

This plant association occurs in narrow to broad, 1,000 ft (300 m) wide, alluvial valleys. Mature stands occur on terraces up to 10 ft (2.5 m) above the active channel. Mature stands spread out across wide floodplains, but also occur on narrow floodplains of constricted reaches. Stream channels are wide and sinuous with low to moderate gradients (1-5%). The soils are deep, sandy loams.

Vegetation Description

This plant association is characterized by an overstory canopy of *Populus angustifolia* (narrowleaf cottonwood) and the presence of *Shepherdia argentea* (silver buffaloberry). The tree canopy consists of mature *Populus angustifolia* (narrowleaf cottonwood), with seeding and sapling sized *P. angustifolia* that can occur in bands close to the river's edge. Other trees that may be present include *Pinus edulis* (pinyon pine) and *Populus* x *acuminata* (lanceleaf cottonwood).

The shrub layer is diverse and widely spaced. *Shepherdia argentea* (silver buffaloberry) is the key characteristic shrub for this association. Low abundance may indicate a degraded occurrence. *Salix ligulifolia* (strapleaf willow) is so widely spaced that it may not be sampled. Other shrub species which may be present include *Rhus trilobata* (skunkbush sumac), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Woods rose), *Crataegus rivularis* (river hawthorne), *Quercus gambelii* (Gambel oak), *Salix exigua* (sandbar willow), *Salix irrorata* (bluestem willow), and *Betula occidentalis* (river birch).

The herbaceous undergrowth is typically dominated by introduced hay grasses including *Agrostis stolonifera* (creeping bentgrass), *Poa pratensis* (Kentucky bluegrass), and *Dactylis glomerata* (orchardgrass). A few native species also occur, including *Maianthemum stellatum* (starry false Solomon seal), *Equisetum arvense* (field horsetail), *Glycyrrhiza lepidota* (American licorice), *Thlaspi montanum* (alpine pennycress), and *Pascopyrum smithii* (western wheatgrass).

Ecological Processes

No undisturbed stands of the *Populus angustifolia/Salix ligulifolia-Shepherdia argentea* (narrowleaf cottonwood/strapleaf willow-silver buffaloberry) plant association are known in Colorado. The predominance of non-native grasses in the undergrowth and widely spaced shrubs indicate heavy utilization by cattle.

Potential Conservation Areas supporting this community type are Devil Creek State Wildlife Area PCA, Lower Piedra River PCA, San Juan River at Carracas PCA, San Juan River at Juanita PCA, and San Juan River at Trujillo PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
34	(1-85%)	Populus angustifolia	7
33	(3-59%)	Shepherdia argentea	7
28	—	Salix irrorata	1
26	—	Salix lucida ssp. caudata, lasiandra	1
20	—	Agrostis stolonifera	1
18	(1-69%)	Poa pratensis	6
18	—	Populus x acuminata	1
16	(1-30%)	Clematis ligusticifolia	5
11	(1-28%)	Rosa woodsii	4
10	—	Crataegus rivularis	1
10	—	Thlaspi montanum	1
10	—	Quercus gambelii	1
10	—	Salix ligulifolia	1
10	—	Symphoricarpos oreophilus	1
9	(1-40%)	Rhus trilobata var. trilobata	5
9	(1-22%)	Alnus incana ssp. tenuifolia	4
9	—	Deschampsia caespitosa	1
9	(3-14%)	Betula occidentalis	2
8	(1-27%)	Salix exigua	4
4	(1-11%)	Trifolium repens	3

Other species with < 5% average cover present in at least 10% of plots:
Melilotus officinalis (3-5%), Poa compressa (4-4%), Dactylis glomerata (3-3%), Symphyotrichum laeve var. geyeri (3-3%), Thalictrum fendleri (3-3%), Chamerion angustifolium ssp. circumvagum (3-3%), Amelanchier alnifolia (3-3%), Salix monticola (3-3%), Pinus edulis (3-3%), Heterotheca villosa (3-3%), Prunella vulgaris (3-3%), Cornus sericea ssp. sericea (1-3%), Taraxacum officinale (1-3%), Pascopyrum smithii (1-3%), Glycyrrhiza lepidota (1-3%), Elymus lanceolatus (2%), Hedysarum boreale (2%), Equisetum arvense (1-3%), Maianthemum stellatum (1-3%), Cirsium arvense (1-2%), Phleum pratense (1%), Juncus balticus var. montanus (1%), Carduus nutans ssp. macrolepis (1%), Elymus trachycaulus ssp. trachycaulus (1%), Dasiphora floribunda (1%), Symphyotrichum spathulatum (1%), Mahonia repens (1%), Equisetum laevigatum (1%), Calamagrostis canadensis (1%), Toxicodendron rydbergii (1%), Asparagus officinalis (1%), Arctium minus (1%), Apocynum cannabinum (1%), Trifolium pratense (1%), Poa reflexa (1%), Ribes cereum (1%), Equisetum hyemale var. affine (1%), Achillea millefolium var. occidentalis (1%), Solidago canadensis (1%), Ipomopsis aggregata (1%), Streptopus amplexifolius var. chalazatus (1%), Galium triflorum (1%), Galium boreale (1%), Oxypolis fendleri (1%).

Narrowleaf cottonwood / Mixed willow Woodland

Populus angustifolia / Salix (monticola, drummondiana, lucida)

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
7,900-8,900 ft (2,400-2,700 m)

General Description
The *Populus angustifolia*/*Salix (monticola, drummondiana, lucida)* (narrowleaf cottonwood/mixed willow) plant association is an early to mid-seral stage of more mature *Populus angustifolia* dominated plant associations. The cottonwoods are fairly young trees (5-15 in, 12-38 cm dbh), with a diverse mix of willows and other shrubs in the understory canopy.

This community occurs on active floodplains, stream benches and low terraces, generally within 1-4.5 ft (0.3-1.4 m) of the active channel elevation. Stream channels range from steep and narrow to broad, moderate gradient and more sinuous. Sites show signs of active flooding. One stand occurs on an overflow or back channel. Soils are somewhat deep (about 3 ft, 1 m), loamy to clay sands over very coarse alluvial layers with at least 25% gravel and other coarse fragments present in all layers.

Vegetation Description
The upper canopy is dominated by young (sapling, pole and medium-sized 5-15 in, 12-35 cm in diameter) *Populus angustifolia* (narrowleaf cottonwood) trees with 25-90% cover. The understory has a consistent mixture of two or more willow species, which can include *Salix exigua* (sandbar willow), *S. ligulifolia* (strapleaf willow), *S. monticola* (mountain willow), *S. lucida* ssp. *caudata* (shining willow), *S. drummondiana* (Drummond willow), and *S. geyeriana* (Geyer willow). Total cover of the shrub layer is between 15-70%. Other, non-willow shrubs are usually present as well, and include *Rosa woodsii* (Woods rose), *Ribes* spp. (gooseberry), *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Crataegus rivularis* (river hawthorn), *Dasiphora floribunda* (shrubby cinquefoil), and *Symphoricarpos* spp. (snowberry).

The herbaceous undergrowth is generally low in total cover, with 10-40% forbs and 5-15% graminoids. Common species include *Maianthemum stellatum* (starry false Solomon seal), *Trifolium* spp. (clover), *Erigeron* spp. (fleabane), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome).

Ecological Processes
As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats.

Potential Conservation Areas supporting this community type are Sand Creek PCA[1] and Upper Indian Creek PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=4)
57	(23-89%)	Populus angustifolia	4
17	(6-36%)	Salix monticola	3
13	(10-16%)	Alnus incana ssp. tenuifolia	2
12	—	Salix drummondiana	1
11	—	Juniperus monosperma	1
7	—	Ribes cereum	1
6	(1-13%)	Poa pratensis	4
5	(1-9%)	Ribes inerme	2
5	(4-6%)	Salix exigua	2
5	(3-7%)	Salix lucida ssp. caudata, lasiandra	2
5	—	Maianthemum stellatum	1

Other species with < 5% average cover present in at least 10% of plots:
Symphyotrichum foliaceum (4%), Symphoricarpos albus (4%), Rosa woodsii (1-8%), Lonicera involucrata (3%), Equisetum arvense (3%), Heracleum maximum (3%), Bromus ciliatus var. ciliatus (3%), Galium triflorum (3%), Equisetum pratense (3%), Crataegus rivularis (3%), Cornus sericea ssp. sericea (3%), Trifolium pratense (3%), Thermopsis montana (3%), Symphoricarpos oreophilus (3%), Salix geyeriana (3%), Rudbeckia laciniata var. ampla (3%), Pseudocymopterus montanus (3%), Phleum pratense (3%), Pedicularis procera (3%), Medicago lupulina (3%), Salix ligulifolia (2-3%), Taraxacum officinale (2-3%), Achillea millefolium var. occidentalis (1-2%), Juncus balticus var. montanus (1%), Glyceria striata (1%), Fragaria virginiana ssp. glauca (1%), Dasiphora floribunda (1%), Iris missouriensis (1%), Thalictrum fendleri (1%), Dactylis glomerata (1%), Amelanchier alnifolia (1%), Angelica pinnata (1%), Geranium richardsonii (1%), Bromus inermis (1%), Chamerion angustifolium ssp. circumvagum (1%), Calamagrostis canadensis (1%), Carex pellita (1%), Cardamine cordifolia (1%), Carex microptera (1%), Mertensia ciliata (1%), Castilleja sulphurea (1%), Castilleja miniata (1%), Carex utriculata (1%), Elymus glaucus (1%), Vicia americana (1%), Trifolium repens (1%), Solidago canadensis (1%), Ribes lacustre (1%), Heterotheca villosa (1%), Limnorchis ensifolia (1%), Pinus ponderosa var. scopulorum (1%), Oxypolis fendleri (1%), Mimulus guttatus (1%), Zigadenus elegans ssp. elegans (1%), Maianthemum racemosum ssp. amplexicaule (1%), Rubus idaeus ssp. strigosus (1%).

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

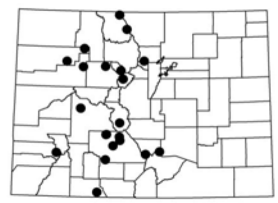
Quaking aspen / Thinleaf alder Forest

Populus tremuloides / Alnus incana* ssp. *tenuifolia

Global rank/State rank:
G3 / S3

HGM subclass: R3/4

Colorado elevation range:
7,850-9,700 ft (2,400-2,950 m)



General Description

The *Populus tremuloides/Alnus incana* ssp. *tenuifolia* (quaking aspen/thinleaf alder) plant association is located in narrow ravines and along first- and second-order streams where upland *Populus tremuloides* forests intermix with riparian shrub vegetation and at lower elevations where *Populus tremuloides* persists only in the riparian zone. The presence of obligate riparian species distinguish this association from upland *Populus tremuloides* communities. This plant association is known from throughout the Western Slope.

This plant association occurs in narrow, 25-225 ft (10-70 m) wide, valleys along stream banks of first- and second-order streams. Stream channels are steep and narrow and occasionally, of moderate gradient and width. Stream gradients range from 1-30%. Soils are generally skeletal, shallow, sandy and sandy clay loams or deeper sandy clay loams.

Vegetation Description

This plant association has a tall, 20-40 ft (6-12 m), overstory of *Populus tremuloides* (quaking aspen). Several conifer species can occur, but aspen is clearly the dominant canopy tree, at least along the streambanks. Other tree species that may be present include *Pinus contorta* (lodgepole pine), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Pseudotsuga menziesii* (Douglas-fir).

The shrub and forb canopy along the immediate stream bank distinguish this riparian plant association from the adjacent forests. The shrub layer is dominated by *Alnus incana* ssp. *tenuifolia* (thinleaf alder). Other shrubs that may be present in this association include *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), and *Cornus sericea* (red-osier dogwood). The forb undergrowth can be dense and includes *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells), *Osmorhiza depauperata* (bluntseed sweetroot) and *Senecio triangularis* (arrowleaf ragwort). Graminoid cover includes *Calamagrostis canadensis* (bluejoint reedgrass), *Equisetum arvense* (field horsetail) and *Carex disperma* (softleaf sedge).

Ecological Processes

Populus tremuloides (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* (quaking aspen) is a non-obligate riparian species and often occurs in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes. *Alnus incana* ssp. *tenuifolia* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining. After establishment, young stands of *Alnus incana* ssp.*tenuifolia* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop.

A Potential Conservation Area supporting this community type is Tributary to Little Navajo River PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=22)
44	(3-100%)	Populus tremuloides	22
37	(5-89%)	Alnus incana ssp. tenuifolia	22
14	(3-22%)	Salix drummondiana	3
13	(3-20%)	Picea pungens	4
11	(1-20%)	Picea engelmannii	6
10	(1-52%)	Abies lasiocarpa	9
8	(1-40%)	Mertensia ciliata	18
8	(3-10%)	Rudbeckia laciniata var. ampla	5
8	(1-30%)	Heracleum maximum	14
8	(3-10%)	Pseudotsuga menziesii	3
7	(1-20%)	Carex utriculata	3
7	(1-10%)	Corydalis caseana ssp. brandegeei	3
6	(3-12%)	Actaea rubra ssp. arguta	3
6	(1-11%)	Ribes montigenum	3
6	(1-20%)	Calamagrostis canadensis	13
6	(1-20%)	Equisetum arvense	11
6	(1-25%)	Bromus inermis	5
6	(1-15%)	Arnica cordifolia	5
6	(1-20%)	Salix bebbiana	4
6	(1-13%)	Acer glabrum	4
5	(1-30%)	Cardamine cordifolia	16

Other species with < 5% average cover present in at least 10% of plots:
Senecio triangularis (1-16%), Poa compressa (1-9%), Geranium richardsonii (1-25%), Taraxacum officinale (1-15%), Lonicera involucrata (1-10%), Ribes inerme (1-13%), Orthilia secunda (1-10%), Oxypolis fendleri (1-8%), Aconitum columbianum (1-15%), Galium triflorum (1-8%), Osmorhiza depauperata (1-10%), Rosa woodsii (1-10%), Streptopus amplexifolius var. chalazatus (1-9%), Chamerion angustifolium ssp. circumvagum (1-9%), Fragaria virginiana ssp. glauca (1-7%), Carex microptera (1-5%), Poa pratensis (1-5%), Hydrophyllum fendleri (1-4%), Glyceria striata (1-5%), Geum macrophyllum var. perincisum (1-5%), Bromus ciliatus var. ciliatus (1-3%), Conioselinum scopulorum (1-9%), Maianthemum stellatum (1-4%), Saxifraga odontoloma (1-4%), Trifolium repens (1-3%), Viola canadensis var. scopulorum (1-3%), Achillea millefolium var. occidentalis (1-3%), Urtica dioica ssp. gracilis (1-3%), Galium boreale (1-3%), Rubus parviflorus (1-2%), Poa palustris (1%), Mahonia repens (1%), Sambucus racemosa var. racemosa (1%), Veronica americana (0.1-1%).

Quaking aspen / Red-osier dogwood Forest

Populus tremuloides / Cornus sericea

Global rank/State rank:
G4 / S2S3

HGM subclass: R3/4

Colorado elevation range:
6,600-8,200 ft (2,000-2,500)

General Description
The *Populus tremuloides/Cornus sericea* (quaking aspen/red-osier dogwood) plant association is located in narrow ravines where upland *Populus tremuloides* (quaking aspen) forests intermix with the riparian shrub vegetation. Obligate riparian shrub species distinguish this association from upland *Populus tremuloides* communities. This association occurs in the Colorado River Basin and the San Juan National Forest.

This plant association occurs in deep, narrow (6-20 m) valleys along banks of first-order streams. Stands are located 1-3 ft (0.25-1 m) above the channel bankfull level. Stream channels are narrow and have relatively steep gradients (5-40%). Occasionally stream channels are somewhat wider and more gradual. Soils range from skeletal, shallow, sandy and sandy clay loams to deeper sandy and silty clay loams.

Vegetation Description
This association is characterized by an overstory canopy of *Populus tremuloides* (quaking aspen), with an abundance of *Cornus sericea* (red-osier dogwood) in the shrub canopy. Several other tree species may be present, but none as consistently or in as high abundance as *Populus tremuloides* (quaking aspen). Other tree species include *Abies concolor* (white fir) and *Pseudotsuga menziesii* (Douglas-fir). Other shrub species include *Lonicera involucrata* (twinberry honeysuckle), *Salix drummondiana* (Drummond willow), *Salix boothii* (Booth willow), *Salix ligulifolia* (strapleaf willow), *Symphoricarpos oreophilus* (mountain snowberry), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder).

The herbaceous undergrowth is relatively sparse, but diverse, with *Osmorhiza depauperata* (bluntseed sweetroot), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Aconitum columbianum* (Columbian monkshood), *Mertensia franciscana* (Franciscan bluebells), and *Equisetum arvense* (field horsetail).

Ecological Processes

Populus tremuloides (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs in upland settings. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes. Mesic shrub understories composed of *Alnus incana* ssp. *tenuifolia* (thinleaf alder) or *Cornus sericea* (red-osier dogwood) can become dominated by *Symphoricarpos* spp. (snowberry) with heavy grazing. This is likely to occur in valley bottom stands where grazing has dried the soil and dropped the water table.

This plant association is not documented within a designated PCA in Archuleta County; however, it can be found along Ute Creek.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
49	(23-90%)	Cornus sericea	3
37	(20-59%)	Populus tremuloides	3
29	(25-32%)	Lonicera involucrata	2
22	(12-31%)	Rudbeckia laciniata var. ampla	2
18	(5-30%)	Maianthemum stellatum	2
14	—	Salix drummondiana	1
14	—	Abies concolor	1
13	—	Heracleum maximum	1
11	—	Salix boothii	1
10	(2-18%)	Pseudotsuga menziesii	2
10	—	Salix ligulifolia	1
10	—	Mertensia franciscana	1
9	—	Equisetum arvense	1
6	(5-7%)	Aconitum columbianum	2
6	—	Elymus glaucus	1
5	—	Geranium richardsonii	1

Other species with < 5% average cover present in at least 10% of plots:
Chamerion angustifolium ssp. circumvagum (4%), Alnus incana ssp. tenuifolia (4%), Equisetum pratense (1-6%), Sorbus scopulina (3%), Salix geyeriana (3%), Oxypolis fendleri (3%), Ligusticum porteri (3%), Quercus gambelii (3%), Carex geyeri (2%), Carex capillaris (2%), Osmorhiza depauperata (1-3%), Viola canadensis var. scopulorum (1-2%), Taraxacum officinale (1%), Galium trifidum ssp. subbiflorum (1%), Galium boreale (1%), Abies lasiocarpa (1%), Acer glabrum (1%), Actaea rubra ssp. arguta (1%), Amelanchier utahensis (1%), Angelica grayi (1%), Poa pratensis (1%), Symphoricarpos oreophilus (1%), Rubus idaeus ssp. strigosus (1%), Juncus balticus var. montanus (1%), Pseudostellaria jamesiana (1%), Glyceria striata (1%), Paxistima myrsinites (1%), Mertensia brevistyla (1%).

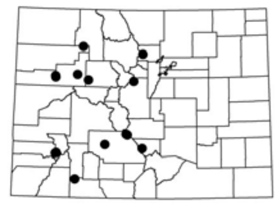
Quaking aspen / Tall forbs Forest

***Populus tremuloides* / Tall forbs**

Global rank/State rank:
G5 / S5

HGM subclass: R2, R3/4

Colorado elevation range:
7,000-10,200 ft (2,100-3,100 m)



General Description
This community is common on the uplands and in riparian areas of the Colorado Western Slope. *Populus tremuloides* (quaking aspen) forests are abundant in the Rocky Mountains. The *Populus tremuloides/*Tall forbs plant association is found on steep hill sides and often along narrow riparian areas. The undergrowth is characterized by a thick carpet of 1-3 foot (<1 m) tall forbs with no one species dominant. Forb species along stream bank stands can be different from hillside stands.

This plant association occurs on broad, gently sloping hillsides and valley bottoms. Stream channels are high-gradient and very narrow, moderately wide and moderately sinuous, or wide and sinuous. The soils are derived from alluvial deposition of a variety of parent materials. The soils are deep, well-drained loams, sandy loams to clay loams.

Vegetation Description
The *Populus tremuloides*/Tall forbs (quaking aspen/tall forbs) association is not restricted to riparian habitats. It is often found on very steep slopes on mesic hillsides throughout the Southern Rocky Mountains. *Populus tremuloides* (quaking aspen) is the dominant tree species in this plant association. Other tree species, usually coming in from the upland, include *Abies concolor* (white fir), *Pinus ponderosa* (ponderosa pine), *Picea pungens* (blue spruce), and *Abies lasiocarpa* (subalpine fir).

Shrub cover is typically minor. A few low-stature shrubs that may be present include *Juniperus communis* (common juniper), *Symphoricarpos oreophilus* (mountain snowberry), *Lonicera involucrata* (twinberry honeysuckle), *Ribes inerme* (whitestem gooseberry), *Sambucus racemosa* (scarlet elderberry), and *Vaccinium* spp. (blueberry). Taller shrubs, typically lining the stream channel, include *Salix bebbiana* (Bebb willow), *S. monticola* (mountain willow), and *Ribes montigenum* (gooseberry currant).

The undergrowth is characterized by the presence of many species of mesic forbs, some of which can be quite tall. Forb species include *Mertensia ciliata* (tall fringed bluebells), *Geranium* *richardsonii* (Richardson geranium), *Heracleum maximum* (common cowparsnip), *Osmorhiza occidentalis* (western sweetroot), *Hydrophyllum fendleri* (Fendler waterleaf) *Delphinium barbeyi* (tall larkspur), *Senecio triangularis* (arrowleaf ragwort), *Aconitum columbianum* (Columbian monkshood), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Achillea millefolium* var. *occidentalis* (western yarrow), *Galium boreale* (northern bedstraw), *Galium triflorum* (fragrant bedstraw), *Maianthemum stellatum* (starry false Solomon seal), *Thalictrum fendleri* (Fendler meadowrue), and *Viola* spp. (violet). Graminoid species include *Equisetum arvense* (field horsetail), *Calamagrostis canadensis* (bluejoint reedgrass), *Carex* spp. (sedge), *Elymus glaucus* (blue wildrye), and the ever present *Poa pratensis* (Kentucky bluegrass).

Ecological Processes

Populus tremuloides (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes.

A Potential Conservation Area supporting this community type is Coldwater Creek at Skunk Creek PCA[1].

Avg. Cover %	(Range)	Species Name	# Plots (N=20)*
44	(10-80%)	Populus tremuloides	19*
22	(1-50%)	Hydrophyllum fendleri	4
18	(1-50%)	Heracleum maximum	12
14	(4-30%)	Thalictrum fendleri	5
12	(1-30%)	Bromus ciliatus var. ciliatus	5
11	(2-32%)	Equisetum arvense	6
9	(2-20%)	Senecio triangularis	4
9	(1-27%)	Rosa woodsii	8
8	(3-14%)	Juncus compressus	5
8	(3-20%)	Elymus glaucus	6
8	(3-10%)	Mertensia franciscana	4
8	(1-18%)	Conioselinum scopulorum	5
8	(0.1-24%)	Picea pungens	4
7	(1-20%)	Poa pratensis	12
7	(3-10%)	Salix monticola	4
7	(1-15%)	Poa palustris	5
6	(1-14%)	Fragaria virginiana ssp. glauca	7
6	(1-15%)	Senecio serra var. serra	5
5	(0.1-19%)	Chamerion angustifolium ssp. circumvagum	4
5	(0.1-10%)	Lonicera involucrata	6

Other species with < 5% average cover present in at least 10% of plots:
Ribes inerme (2-10%), Galium boreale (1-7%), Mertensia ciliata (1-15%), Oxypolis fendleri (1-14%), Aconitum columbianum (1-10%), Glyceria striata (1-6%), Geranium richardsonii (0.1-15%), Vicia americana (1-9%), Geum macrophyllum var. perincisum (1-5%), Prunus virginiana var. melanocarpa (1-6%), Taraxacum officinale (1-7%), Calamagrostis canadensis (1-4%), Achillea millefolium var. occidentalis (1-5%), Maianthemum stellatum (1-5%), Symphoricarpos oreophilus (1-3%), Urtica dioica ssp. gracilis (1-3%), Cardamine cordifolia (1%).

*Populus tremuloides occurred in all stands, but was not captured in every sample plot.

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Douglas-fir / Rocky Mountain maple Forest

Pseudotsuga menziesii / Acer glabrum

Global rank/State rank:
G4? / S1

There is no stand data compiled for *Pseudotsuga menziesii / Acer glabrum* Forest in Colorado. This association is not included within *Field Guide to the Wetland and Riparian Plant Associations of Colorado* (Carsey *et al.* 2003a).

The following information is summarized from NatureServe Explorer (2005):

General Description
Pseudotsuga menziesii/Acer glabrum (Douglas-fir/Rocky Mountain maple) forest is a montane plant association that can be found across the Rocky Mountains at elevations ranging from 1465 to 2,654 m (4,800-8,700 feet). It typically occurs in ravines and stream bottoms where cold-air drainage is a factor. Overstory and shrub layers vary from dense to open, and the herbaceous layer is generally sparse. Soils are variable from clays to sands to gravels.

Vegetation Description
Vegetation is characterized by a *Pseudotsuga menziesii*-dominated tree canopy with *Acer glabrum* dominating or codominating the understory. The evergreen needle-leaved tree canopy is generally moderately dense to dense (50-80% cover), although occasionally the cover will be as low as 15%. Mature seral tree species like *Pinus ponderosa* (ponderosa pine), *Populus angustifolia* (narrowleaf cottonwood), or *Populus tremuloides* (quaking aspen) may be present to codominant. The tall-shrub layer is open (patchy) to moderately dense and dominated or codominated by *Acer glabrum* with other tall shrubs such as *Amelanchier alnifolia* (Saskatoon serviceberry), or *Cornus sericea* (red-osier dogwood). An open to moderately dense short-shrub layer is usually present and often containing species such as *Lonicera involucrata* (twinflower honeysuckle)*, or Rosa woodsii* (Woods' rose). In some stands the tall- and short-shrub layers are not distinct. The herbaceous layer is generally sparse and is composed of diverse forbs and graminoids. Species may include *Calamagrostis canadensis* (bluejoint reedgrass), *Galium septentrionale* (northern bedstraw), and *Thalictrum fendleri* (Fendler's meadowrue).

Ecological Processes
Pseudotsuga menziesii/Acer glabrum (Douglas-fir / Rocky Mountain maple) forest occurs on cool and moist sites, generally on northern or eastern aspects, on steep, mid to lower slopes, and

ravines or stream bottoms where cold-air drainage is a factor. Substrates are variable and may be gravelly or not, with soil texture ranging from sandy loam to clay derived from colluvium. The ground surface typically has high cover of litter, sometimes with significant amounts of larger rock and boulders, with patches of bare soil infrequent.

This plant association occurs within the Hunter Campground PCA in Archuleta County.

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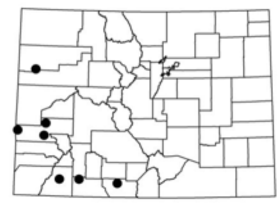
Douglas-fir / Red-osier Dogwood Woodland

Pseudotsuga menziesii / Cornus sericea

Global rank/State rank:
G4 / S2

HGM subclass: R3/4

Colorado elevation range:
5,600-8,500 ft (1,700-2,400 m)



General Description
In Colorado, this is an uncommon association that naturally occurs in small patches. It occurs in the San Juan and Rio Grande National Forests, the San Miguel and Dolores River Basins, Gunnison River Basin, and White River Basin.

This plant association occurs in narrow valleys with variable stream gradients (5-25%) on narrow floodplains and elevated benches. Stands occur well above the stream channel bankfull height, 1-10 ft (0.16-3 m). Stream channels are steep and narrow. The soils are generally well-drained, well-developed colluvial clay loams to sandy loams. Coarse fragments range from 0 to 25%. The water table is at least one meter below the surface.

Vegetation Description
Pseudotsuga menziesii (Douglas-fir) dominates the overstory with 10-60% cover. Other tree species that may be present include *Populus angustifolia* (narrowleaf cottonwood), *Populus tremuloides* (quaking aspen), *Abies concolor* (white fir), *Acer negundo* (boxelder), and *Picea pungens* (blue spruce). *Cornus sericea* (red-osier dogwood) forms a dense shrub layer with 20-75% cover. Other shrub species that may be present include *Acer glabrum* (mountain maple), *Quercus gambelii* (Gambel oak), *Alnus incana* ssp.*tenuifolia* (thinleaf alder), *Ribes* (currant), and *Prunus virginiana* (chokecherry). The ground is covered with a thick layer of duff and few herbaceous plants. This association is often the only type within a narrow valley profile. Adjacent riparian areas may have *Cornus sericea* (red-osier dogwood) and *Acer glabrum* (Rocky Mountain maple) shrubland communities.

Ecological Processes
Pseudotsuga menziesii (Douglas-fir) is a non-obligate riparian species. This plant association is limited to narrow canyon bottoms where upland *Pseudotsuga menziesii* forests on north-facing slopes grade into riparian corridors. Narrow canyons with steep slopes create pockets of moist,

cool air by funneling cold-air drainage and providing a microsite for *Pseudotsuga menziesii*. *Cornus sericea* (red-osier dogwood) is more abundant on level sites where water tables are periodically high. At lower elevations, *Pseudotsuga menziesi* can occur in cool valley bottoms where it cannot survive on warmer and drier valley slopes. Well drained colluvial soils also favor *Pseudotsuga menziesii* establishment.

Potential Conservation Areas supporting this community type are Elk Creek at Piedra River PCA and Hurt Canyon PCA.

Avg. Cover %	**(Range)**	**Species Name**	**# Plots (N=7)**
35	(20-74%)	Cornus sericea	7
34	(10-66%)	Pseudotsuga menziesii	7
30	(3-70%)	Acer glabrum	4
14	(5-32%)	Alnus incana ssp. tenuifolia	4
12	(5-19%)	Populus tremuloides	2
11	(1-30%)	Rosa woodsii	4
11	(4-18%)	Picea pungens	2
10	(10-10%)	Rhus trilobata var. trilobata	2
9	(5-13%)	Ribes inerme	2
7	(1-20%)	Populus angustifolia	4
7	(3-10%)	Salix exigua	2
6	(1-16%)	Prunus virginiana var. melanocarpa	3
6	(3-10%)	Amelanchier utahensis	3
5	(1-10%)	Equisetum hyemale var. affine	3
5	(2-11%)	Abies concolor	3
5	(1-10%)	Paxistima myrsinites	3
Other species with < 5% average cover present in at least 10% of plots:			
Actaea rubra ssp. arguta (2-5%), Geranium richardsonii (1-5%), Fragaria vesca ssp. bracteata (1-4%), Equisetum arvense (1-5%), Maianthemum racemosum ssp. amplexicaule (1-5%), Quercus gambelii (1-6%), Heracleum maximum (1-3%), Rubus parviflorus (1-2%), Maianthemum stellatum (1-2%), Osmorhiza depauperata (1-2%), Symphoricarpos oreophilus (1-2%), Poa pratensis (1%), Vicia americana (1%), Galium triflorum (1%).			

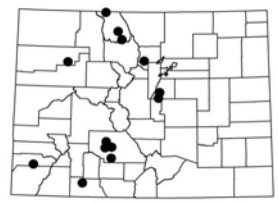
Bebb willow Shrubland

Salix bebbiana

Global rank/State rank:
G3? / S2

HGM subclass: R2, R3/4

Colorado elevation range:
7,300-9,400 ft (2,225-2,870 m)



General Description
This association occurs in canyon country at lower elevations in the San Juan National Forest, the Rio Grande River Basin and in foothill canyons of the South Platte River Basin. The *Salix bebbiana* (Bebb willow) plant association is a minor type in Colorado. It is a tall (5-15 ft, 1.5-3 m), deciduous, shrubland with an open to closed canopy, generally forming small thickets within larger riparian mosaics or long and thin continuous thickets in narrow tributary canyons.

This plant association occurs on briefly flooded, low-gradient streams or along narrow alluvial terraces of canyons. It can also occur on broad, seep-fed meadows. Stream channels are steep and narrow, wider, less steep, and moderately sinuous, or moderately wide and sinuous.

Soils are highly stratified layers of sandy loams, clay loams, and silty clay with mottling near the surface. Soils can also be deep, dark-colored silty clay loams with high organic content and mottling or they can be shallow, becoming skeletal at about 10 inches (25 cm) depth. In the spring and early summer, soils are saturated for several days to weeks and then slowly dry out over the rest of the growing season.

Vegetation Description
Salix bebbiana (Bebb willow) rarely forms large willow shrublands in Colorado and commonly appears in small patches within other plant associations. On occasion, however, it will form a small and dense shrubland with an overstory. Other shrubs that may be present include *Alnus incana* ssp. *tenuifolia* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Dasiphora floribunda* (shrubby cinqfoil), *Ribes montigenum* (gooseberry currant), and *Salix ligulifolia* (strapleaf willow).

The herbaceous undergrowth is characterized by a sparse to moderately dense forb layer on raised, better-drained hummocks and ridges beneath the willow canopy. Herbaceous species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Poa pratensis* (Kentucky bluegrass), *Calamagrostis canadensis* (bluejoint reedgrass), *Geranium richardsonii* (Richardson geranium), *Juncus balticus* var. *montanus* (mountain rush), and *Heracleum maximum* (common cowparsnip).

Ecological Processes
In Colorado, stands of *Salix bebbiana* (Bebb willow) do not frequently occur. *Salix bebbiana* appears to be very sensitive to grazing, and forms the classic "mushroom" shape with overgrazing. *Salix bebbiana* rarely forms large willow carrs and is limited to small patches within larger riparian mosaics or in protected, narrow canyon bottoms that preclude livestock grazing.

Potential Conservation Areas supporting this community type are Porcupine Creek Meadow PCA and Spring Creek Lakes PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=14)
35	(10-69%)	Salix bebbiana	14
27	(1-80%)	Poa compressa	3
22	(6-36%)	Ribes montigenum	3
16	(1-70%)	Calamagrostis canadensis	8
13	(10-18%)	Salix monticola	3
11	(2-36%)	Dasiphora floribunda	6
11	(1-30%)	Juncus balticus var. montanus	5
10	(1-22%)	Populus tremuloides	3
10	(2-21%)	Carex utriculata	6
8	(3-17%)	Ribes inerme	4
8	(1-20%)	Poa pratensis	9
6	(2-13%)	Carex aquatilis	3
6	(2-10%)	Agrostis gigantea	3
5	(1-10%)	Geum macrophyllum var. perincisum	3

Other species with < 5% average cover present in at least 10% of plots:
Rudbeckia laciniata var. ampla (2-6%), Geranium richardsonii (1-7%), Conioselinum scopulorum (1-10%), Thermopsis divaricarpa (1-8%), Lonicera involucrata (2-5%), Fragaria virginiana ssp. glauca (1-8%), Mertensia ciliata (1-5%), Chamerion angustifolium ssp. circumvagum (1-5%), Equisetum arvense (1-5%), Galium boreale (1-7%), Glyceria striata (1-5%), Taraxacum officinale (1-5%), Pedicularis groenlandica (1-5%), Potentilla pulcherrima X hippiana (1-3%), Thalictrum fendleri (1-5%), Trifolium repens (1-5%), Maianthemum stellatum (1-4%), Equisetum pratense (1-3%), Achillea millefolium var. occidentalis (0.1-3%), Rubus idaeus ssp. strigosus (1-2%), Mentha arvensis (1-2%), Dodecatheon pulchellum (1-2%), Phleum pratense (1%).

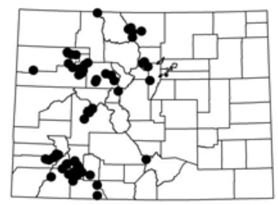
Drummond's willow / Mesic forbs Shrubland

***Salix drummondiana /* Mesic forbs**

Global rank/State rank:
G4 / S4

HGM subclass: S3/4, R2, R3/4

Colorado elevation range:
7,500-11,300 ft (2,400-3,500 m)



General Description

The *Salix drummondiana*/mesic forbs (Drummond willow/mesic forbs) plant association most commonly occurs on relatively steep streams and rarely forms more than a narrow, 5-25 ft (1.5-7.5 m) wide, band along streambanks. The closed to partially open canopy of *Salix drummondiana* and a thick carpet of many forb species characterize this plant association. This plant association occurs throughout the Western Slope and in montane regions along the Colorado Front Range.

The association occurs as a narrow band along high gradient streams in narrow, V-shaped valleys and as large willow carrs in the broad valleys of low gradient (1-3%), moderately sinuous streams. It is also located along broad, highly sinuous streams and broad, actively downcutting channels. This association also occurs near seeps. Soils range from deep sandy loams and sandy clay loams with no coarse fragments to shallow silty clay loams and sandy clay loams over coarse, angular cobbles.

Vegetation Description

Salix drummondiana (Drummond willow) forms an open to closed, narrow canopy of tall shrubs lining the stream bank. Other shrub species may be present with cover equal to but not exceeding that of *Salix drummondiana*. Mature trees may be present as a few individuals scattered through the shrubland or as canopy from an adjacent forested association. Stands with an overstory canopy of aspen are currently included in this association, although a *Populus tremuloides/Salix drummondiana* type may be separated at a later date. The herbaceous undergrowth may be sparse or richly diverse. In general, total forb cover exceeds that of graminoid cover, and no single species is dominant.

Ecological Processes

The *Salix drummondiana*/mesic forb (Drummond willow/mesic forb) association is often an early colonizer of first-order, boulder-strewn, steep streams. This association could be an early-seral stage of the *Abies lasiocarpa-Picea engelmannii* (subalpine fir-Engelmann spruce) plant association which also occurs along steep streams and alternates with the willow carrs. In wider valleys, this association occurs as a broad willow carr on well-developed soils near seeps or downstream from beaver dams. It appears to be a stable community in these environments.

A Potential Conservation Area supporting this community type is Hondo Creek PCA[1].

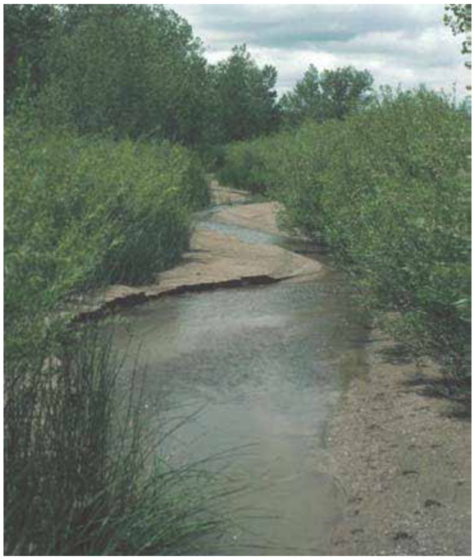
Avg. Cover %	(Range)	Species Name	# Plots (N=60)
55	(20-98%)	Salix drummondiana	60
15	(2-37%)	Salix planifolia	7
13	(1-75%)	Populus tremuloides	10
12	(1-21%)	Alnus incana ssp. tenuifolia	17
11	(0.1-40%)	Salix monticola	33
10	(0.1-44%)	Mertensia ciliata	41
9	(1-29%)	Carex utriculata	12
8	(1-40%)	Heracleum maximum	39
8	(1-26%)	Mertensia franciscana	9
8	(1-34%)	Picea engelmannii	21
8	(1-30%)	Delphinium barbeyi	8
8	(1-60%)	Equisetum arvense	30
7	(1-20%)	Carex aquatilis	7
6	(0.1-30%)	Lonicera involucrata	36
6	(1-40%)	Cardamine cordifolia	44
6	(1-24%)	Ligusticum porteri	12
6	(0.1-30%)	Calamagrostis canadensis	31
6	(1-30%)	Oxypolis fendleri	24
5	(1-20%)	Ribes inerme	14
5	(1-20%)	Agrostis gigantea	7
5	(1-21%)	Arnica cordifolia	8
5	(1-13%)	Picea pungens	10
5	(1-34%)	Saxifraga odontoloma	19

Other species with < 5% average cover present in at least 10% of plots:
Hydrophyllum fendleri (1-17%), Rudbeckia laciniata var. ampla (1-14%), Dasiphora floribunda (1-19%), Senecio triangularis (1-24%), Abies lasiocarpa (1-12%), Geranium richardsonii (1-20%), Aconitum columbianum (1-20%), Elymus glaucus (1-10%), Osmorhiza depauperata (1-10%), Sambucus racemosa var. racemosa (1-10%), Chamerion angustifolium ssp. circumvagum (1-12%), Maianthemum stellatum (1-10%), Poa pratensis (1-20%), Conioselinum scopulorum (1-8%), Bromus ciliatus var. ciliatus (1-5%), Carex microptera (1-10%), Deschampsia caespitosa (1-7%), Thalictrum fendleri (1-5%), Veratrum tenuipetalum (1-5%), Viola canadensis var. scopulorum (1-10%), Geum macrophyllum var. perincisum (1-10%), Taraxacum officinale (0.1-8%), Galium triflorum (1-5%), Fragaria virginiana ssp. glauca (1-6%), Phleum pratense (1-5%), Urtica dioica ssp. gracilis (1-5%), Achillea millefolium var. occidentalis (0.1-5%), Streptopus amplexifolius var. chalazatus (1-5%), Rubus idaeus ssp. strigosus (1-5%), Mitella pentandra (1-4%), Symphoricarpos oreophilus (1-5%), Mimulus guttatus (1-3%), Glyceria striata (1-4%), Thlaspi montanum (1%), Pedicularis groenlandica (1%), Descurainia incana (1%).

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Sandbar willow / Mesic graminoids Shrubland

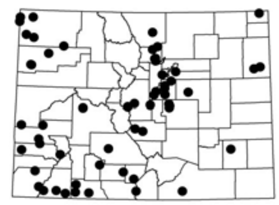
***Salix exigua /* Mesic graminoids**



Global rank/State rank:
G5 / S5

HGM subclass: R3/4, R5

Colorado elevation range:
3,400-9,600 ft (1,040-2,930 m)



General Description

Salix exigua (sandbar willow) is one of the most common willow species in Colorado, and is characteristic of two associations, the *Salix exigua*/mesic graminoids and the *Salix exigua*/barren ground. Both may be nearly pure stands of the willow, with few other species present. An undergrowth of dense grasses and forbs covering at least 30% of the ground falls into the mesic graminoid type, while an undergrowth of a few, widely scattered forbs and grasses, where exposed cobbles or sand characterizes the ground cover, constitutes the *Salix exigua*/barren ground association. The *Salix exigua*/mesic graminoid association generally occurs along backwater channels and other perennially wet, but less scoured sites, such as floodplain swales and irrigation ditches while the *Salix exigua*/barren ground association occurs within the annual flood zone of a river on point bars, islands, sand or cobble bars and stream banks.

This plant association usually occurs within 3 feet (1 m) vertical distance of the stream channel on point bars, low floodplains, terraces and along overflow channels. It can also occur away from the stream channel in mesic swales or along the margins of beaver ponds. Stream channels are broad to narrow and meandering with sand or cobble beds. Soils are typically somewhat more developed than the *Salix exigua*/barren ground plant association due to a slightly more stable environment and greater input of organic matter. Textures are typically loamy sands interspersed with layers of silty clays and alternating with coarse sands. Upper layers (10-30 cm) often have 25-30% organic matter.

Vegetation Description

Salix exigua (sandbar willow) dominates the canopy of this association, giving the association its characteristic grayish-green color. Other shrub species can also be present including *Rosa woodsii* (Woods rose), *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*) (shining willow), *Salix planifolia* (planeleaf willow), *Salix geyeriana* (Geyer willow), and *Alnus incana* ssp. *tenuifolia* (thinleaf alder). The undergrowth has at least 20-35% cover of various graminoid (and sometimes forb) species, although no single species is consistently present. Species include *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Cirsium* spp. (thistle), *Carex pellita* (woolly sedge), and *Eleocharis palustris* (common spikerush). Forb cover is generally low, but can include a high percentage of non-native species such as *Medicago lupulina* (black medick) and *Melilotus officinalis* (yellow sweetclover).

Ecological Processes
This plant association is typical of recent floodplains and highly disturbed, low, wet areas and is considered early-seral. The amount of herbaceous growth in the understory is an indication of the amount of time since the last scouring (or depositional) flood event. *Salix exigua* (sandbar willow) is an excellent soil stabilizer with a deep root system and flexible stems that can withstand flooding. *Salix exigua* reduces erosion potential by increasing the friction of stream flow, trapping sediments and building a protected seed bed for a number of tree and shrub species. The presence of cottonwood seedlings within this association indicates succession to a cottonwood stand (and may represent the *Populus angustifolia* or *Populus deltoides/Salix exigua* plant associations), if seedlings survive subsequent flooding events.

This plant association is not documented within a designated PCA in Archuleta County; however, it can be found along the Piedra River near its confluence with Turkey Creek.

Avg. Cover %	(Range)	Species Name	# Plots (N=118)
64	(5-100%)	Salix exigua	118
22	(1-88%)	Agrostis gigantea	48
21	(0.1-63%)	Elymus lanceolatus	16
17	(2-38%)	Agrostis stolonifera	14
16	(0.1-100%)	Poa pratensis	58
16	(0.1-60%)	Carex pellita	28
14	(0.1-63%)	Juncus balticus var. montanus	33
12	(0.1-85%)	Bromus inermis	22
12	(0.1-38%)	Tamarix ramosissima	12
10	(0.1-38%)	Schoenoplectus pungens	23
10	(1-80%)	Rosa woodsii	22
9	(0.1-31%)	Melilotus officinalis	27
8	(0.1-40%)	Eleocharis palustris	29
7	(1-20%)	Salix monticola	14
7	(1-38%)	Equisetum arvense	34
7	(1-15%)	Symphyotrichum lanceolatum ssp. hesperium var. hesperium	17
7	(1-38%)	Glycyrrhiza lepidota	16
6	(0.1-38%)	Cirsium arvense	28
6	(0.1-23%)	Salix ligulifolia	15
5	(1-18%)	Trifolium repens	13
5	(0.1-38%)	Populus deltoides	22

Other species with < 5% average cover present in at least 10% of plots:
Plantago major (0.1-24%), Hordeum jubatum ssp. jubatum (1-22%), Achillea millefolium var. occidentalis (0.1-38%), Mentha arvensis (0.1-30%), Taraxacum officinale (0.1-10%), Epilobium ciliatum ssp. glandulosum (0.1-5%), Elymus canadensis (0.1-10%), Verbascum thapsus (0.1-16%), Equisetum laevigatum (0.1-5%).

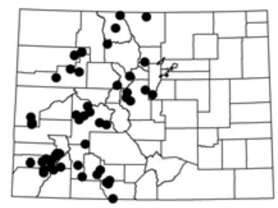
Mountain willow / Mesic forb Shrubland

***Salix monticola /* Mesic forbs**

Global rank/State rank:
G4 / S3

HGM subclass: S1/2, R2, R3/4

Colorado elevation range:
6,800-10,700 ft (2,070-3,260 m)



General Description

The *Salix monticola/*mesic forbs (mountain willow/mesic forbs) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland with a dense or open canopy and an herbaceous layer dominated by a variety of forbs and grasses. While no single herbaceous species is a clear dominant, total forb cover is generally greater than 30% and exceeds total graminoid cover.

This association occurs along broad, swift-moving streams and active floodplains in narrow to moderately wide valleys. The ground surface is usually undulating, from past flooding or beaver activity. Stands form narrow bands at the stream edge, ranging from 1-6 ft (0.1-2 m) above the channel elevation. In wider valley bottoms, stands occur further from the bank, but never more than 2.5 ft (0.75 m) above the annual high water mark. Most stands occur adjacent to straight, wide, and shallow channels ranging from bedrock to silty-bottomed reaches. A few stands occur on meandering, cobble-bottomed reaches or streams braided by beaver activity. Soils are fine textured sandy clays to silty and sandy clay loams.

Vegetation Description

Salix monticola (mountain willow) forms a dense to open canopy, and if not the clear dominant, then it is the matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrub species that may be present include *Ribes inerme* (whitestem gooseberry), *Salix drummondiana* (Drummond willow), *S. planifolia* (planeleaf willow), *S. bebbiana* (Bebb willow), *S. geyeriana* (Geyer willow), *S. brachycarpa* (barrenground willow), *S. wolfii* (Wolf willow), *S. lucida* ssp. *caudata* or *lasiandra* (shining willow), *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Lonicera involucrata* (twinberry honeysuckle).

Total forb cover ranges from 10-70%. No one forb species is noticeably more abundant than any other, nor is any species consistently present in all stands. Forb species that may be present include *Heracleum maximum* (common cowparsnip), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Mertensia ciliata* (tall fringed bluebells), and *Fragaria virginiana* (strawberry). Graminoid cover may be absent or up to 50% cover; in general it does not exceed the total forb cover. Graminoid species that may be present include *Calamagrostis canadensis* (bluejoint reedgrass) and *Carex utriculata* (beaked sedge). Generally, forbs are dominant under shrubs on hummocks and ridges while graminoids dominate the undergrowth in low-lying, wetter swales. Exotic graminoid and forb species include *Poa pratensis* (Kentucky bluegrass), *Trifolium repens* (white clover), and *Taraxacum officinale* (dandelion).

Ecological Processes
Salix monticola (mountain willow) dominated plant associations appear to be long-lived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils, and it is likely that succession to other associations is slow. This plant association occurs on mesic sites and supports a rich diversity of forbs. On broad, hummocky floodplains stands can form extensive willow carrs. Sites with a higher abundance of exotic forbs and graminoids may be grazing-induced. At higher elevations, this association grades into the *Salix planifolia*/mesic forb (planeleaf willow/mesic forb) association.

A Potential Conservation Area supporting this community type is Porcupine Creek Meadow PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=93)
58	(1-100%)	Salix monticola	93
17	(1-40%)	Ribes lacustre	26
16	(0.1-60%)	Salix drummondiana	31
16	(1-75%)	Heracleum maximum	49
12	(1-70%)	Ribes inerme	23
11	(1-40%)	Alnus incana ssp. tenuifolia	16
10	(1-30%)	Salix geyeriana	15
9	(1-50%)	Poa pratensis	42
9	(0.1-30%)	Salix bebbiana	15
9	(1-20%)	Salix brachycarpa	11
9	(0.1-60%)	Mertensia ciliata	55
9	(1-30%)	Salix planifolia	18
8	(1-28%)	Rudbeckia laciniata var. ampla	13
8	(0.1-30%)	Calamagrostis canadensis	31
7	(1-60%)	Juncus balticus var. montanus	10
7	(1-22%)	Trifolium repens	10
6	(1-14%)	Picea pungens	14
6	(0.1-30%)	Cardamine cordifolia	22
6	(1-20%)	Lonicera involucrata	43
6	(1-25%)	Urtica dioica ssp. gracilis	21
5	(0.1-20%)	Equisetum arvense	44
5	(1-16%)	Aconitum columbianum	18
5	(1-20%)	Carex utriculata	13

Other species with < 5% average cover present in at least 10% of plots:
Picea engelmannii (1-13%), Bromus ciliatus var. ciliatus (0.1-20%), Conioselinum scopulorum (0.1-15%), Hydrophyllum fendleri (1-10%), Carex aquatilis (1-10%), Dasiphora floribunda (0.1-13%), Fragaria virginiana ssp. glauca (0.1-10%), Geranium richardsonii (0.1-10%), Senecio triangularis (1-10%), Taraxacum officinale (0.1-12%), Maianthemum stellatum (0.1-12%), Achillea millefolium var. occidentalis (1-10%), Chamerion angustifolium ssp. circumvagum (0.1-11%), Thalictrum fendleri (0.1-9%), Ligusticum porteri (0.1-10%), Geum macrophyllum var. perincisum (1-5%), Rosa woodsii (0.1-5%), Oxypolis fendleri (1-5%), Vicia americana (0.1-5%).

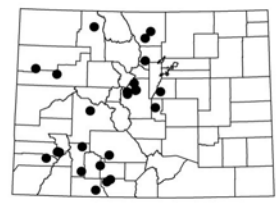
Mountain willow / Mesic graminoid Shrubland

***Salix monticola /* Mesic graminoids**

Global rank/State rank:
G3 / S3

HGM subclass: S1/2, S3/4, R2

Colorado elevation range:
6,600-11,000 ft (2,000-3,350 m)



General Description

The *Salix monticola*/mesic graminoids (mountain willow/mesic graminoids) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland, with an open to closed canopy of willows on broad, gentle floodplains, or in narrow canyon bottoms. The herbaceous undergrowth is diverse, with a variety of graminoid and forb species. This association is distinguished from the *Salix monticola*/mesic forb association by having a higher cover of graminoid species. Stands with predominantly non-native graminoid species in the undergrowth are considered grazing-induced. Stands are considered high quality when their undergrowth is predominantly native graminoid species.

The *Salix monticola*/mesic graminoids (mountain willow/mesic graminoids) plant association dominates stream reaches in narrow to wide valleys, 65-400 ft (20-120 m) wide, with active floodplains and broad, swift-moving streams. Stands usually occur > 2 ft (0.5 m) above the bankfull channel along the stream edge or away from the channel up to 50 ft (15 m). The ground surface is usually undulating due to past flooding or beaver activity. Stream channels can be fairly steep and narrow with cobble beds, moderately wide and sinuous with cobble beds or broad, meandering rivers with a developed floodplain. Some stands also occur along channels that are braided due to beaver activity. Soils are fine textured clay loams and sandy clay loams of varying depths, 4-18 inches (10-45 cm). Mottling and gleyed layers often occur within 5 inches (12 cm) of the ground surface.

Vegetation Description

Salix monticola (mountain willow) forms a dense to open canopy. If it is not the clear dominant, then it is the matrix willow. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrubs that may be present at higher elevations include *Salix planifolia* (planeleaf willow), *S. geyeriana* (Geyer willow), and *S. brachycarpa* (barrenground willow). At lower elevations, other shrubs that may be present include *Salix irrorata* (bluestem willow), *S. lucida* ssp. *caudata* (shining willow), *Alnus incana* ssp. *tenuifolia* (thinleaf alder) and *Dasiphora floribunda* (shrubby cinquefoil).

Total graminoid cover ranges from 10-55% and exceeds that of total forb cover. No single species is particularly dominant over the others, and no one species is present in every stand. Graminoid species that may be present include *Poa pratensis* (Kentucky bluegrass), *Juncus balticus* var. *montanus* (mountain rush), *Carex aquatilis* (water sedge), and *Equisetum arvense* (field horsetail). Forb cover ranges from 5-20% and forbs generally are not as abundant as graminoids. Forb species that may be present include *Heracleum maximum* (common cowparsnip), *Fragaria virginiana* (strawberry) and *Achillea millefolium* var. *occidentalis* (western yarrow). In stands with pronounced hummock micro-topography underneath the willow canopy, graminoids will typically dominate the low-lying swales, while forbs will dominate the better drained hummocks and ridge tops.

Ecological Processes

The *Salix monticola/*mesic graminoids (mountain willow/mesic graminoids) plant association appears to be a stable, long-lived community. Stands with an abundance of *Poa pratensis* (Kentucky bluegrass) or *Agrostis stolonifera* (creeping bentgrass) may be a grazing-induced disclimax. Stands with abundant *Salix planifolia* (planeleaf willow) may indicate a transition between higher elevational sites dominated by *Salix planifolia* and lower elevational sites where *Salix monticola* is more abundant.

Potential Conservation Areas supporting this community type are Buckles Lake PCA and Rio Chama PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=31)
52	(7-90%)	Salix monticola	31
25	(5-48%)	Salix drummondiana	5
22	(2-40%)	Salix planifolia	6
18	(0.1-60%)	Juncus balticus var. montanus	13
17	(1-50%)	Carex aquatilis	11
15	(4-20%)	Alnus incana ssp. tenuifolia	4
14	(1-40%)	Poa pratensis	18
12	(0.1-40%)	Carex utriculata	13
11	(1-30%)	Salix geyeriana	8
8	(1-20%)	Calamagrostis canadensis	10
7	(0.1-21%)	Dasiphora floribunda	11
7	(1-30%)	Deschampsia caespitosa	6
6	(0.1-25%)	Salix lucida ssp. caudata, lasiandra	7
6	(1-15%)	Phleum pratense	4
5	(0.1-22%)	Taraxacum officinale	19
5	(1-15%)	Picea pungens	5
5	(0.1-16%)	Salix bebbiana	7

Other species with < 5% average cover present in at least 10% of plots:
Equisetum arvense (0.1-20%), Lonicera involucrata (1-10%), Carex microptera (1-10%), Trifolium repens (0.1-6%), Dodecatheon pulchellum (0.1-10%), Achillea millefolium var. occidentalis (0.1-8%), Mertensia ciliata (0.1-10%), Ribes inerme (1-5%), Salix brachycarpa (1-5%), Geranium richardsonii (1-4%), Conioselinum scopulorum (1-5%), Fragaria virginiana ssp. glauca (1-3%), Heracleum maximum (1-3%), Geum macrophyllum var. perincisum (0.1-3%), Equisetum pratense (1-3%), Cardamine cordifolia (0.1-3%).

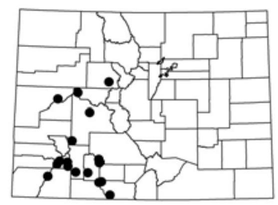
Planeleaf willow / Mesic forbs Shrubland

***Salix planifolia* / Mesic forb**

Global rank/State rank:
G4 / S4

HGM subclass: S1/2, R2

Colorado elevation range:
8,900-12,100 ft (2,700-3,700 m)



General Description

The *Salix planifolia/*mesic forb (planeleaf willow/mesic forbs) plant association is a low stature (<2 ft, 0.5 m) shrubland with abundant and diverse forbs under the willow canopy. It is a common community of the sublapine and lower alpine areas. It occurs on mesic soils. This plant association typically occurs in wide, glaciated valleys adjacent to streams. It occurs in swales, depressions and on slopes where snow melt runoff saturates soils for much of the growing season. The ground may be flat or uneven with raised hummocks. Stream gradients range from <1% in broad floodplains to 14% in steep snowmelt basins. Stream channels vary. Channels may be steep and narrow, first-order streams in snow melt basins, relatively wide and straight, narrow, relatively deep, and meandering in broad, glaciated valleys or braided, multiple channels below beaver dams.

Soil textures are highly variable. Mineral soils vary along a moisture gradient. Wet sites have soil textures of silty clays and silt loams, while slightly drier sites have loamy sands and sandy loams overlying gravelly alluvium. Some stands occur on well-drained, mineral soils with well-oxygenated water and no mottled or gleyed layers. Other sites have a shallow organic layer overlying a gravel or cobble layer within 10-20 inches (20-50 cm) of the surface. The water table at these sites is usually near the surface throughout the growing season and may be perched by a clay horizon. Still other stands occur on deep, dark clay loams with high organic content or a fibric or hemic layer on top.

Vegetation Description

Salix planifolia (planeleaf willow) often forms nearly pure stands. Other willows that may be present include *Salix monticola* (mountain willow), *S. brachycarpa* (barrenground willow), *S. boothii* (Booth willow), *S. drummondiana* (Drummond willow), and *S. wolfii* (Wolf willow). *Picea engelmannii* (Engelmann spruce) can occur along the outer edges of the stand.

Typically, the willow canopy is nearly closed and an herbaceous undergrowth occurs only in openings between willow patches. The undergrowth is characterized by an abundance of forbs with few graminoids. Forb species include *Achillea millefolium* var. *occidentalis* (western yarrow), *Mertensia ciliata* (tall fringed bluebells), and *Senecio triangularis* (arrowleaf ragwort).

Ecological Processes
Salix planifolia (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is more often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. In montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations.

The *Salix planifolia*/mesic forb (planeleaf willow/mesic forb) plant association occurs in wet swales that are saturated throughout most or all of the growing season. It is a long-lived, stable association that changes with fluctuations in the water table and degree of soil saturation. The *Salix planifolia/*mesic forb association may be a grazing-induced phase of the *Salix planifolia/Caltha leptosepala* (planeleaf willow/marsh marigold) association. Many stands in the Routt National Forest are heavily grazed and contain a high number of exotic and increaser species such as *Taraxacum officinale* (dandelion) and *Fragaria virginiana* (strawberry). Other stands in Colorado, however, do not show an increase in non-native species.

A Potential Conservation Area supporting this community type is Quartz Creek at East Fork San Juan River PCA.

Avg. Cover %	**(Range)**	**Species Name**	**# Plots (N=17)**
59	(14-90%)	Salix planifolia	17
17	(9-28%)	Salix brachycarpa	7
16	(1-34%)	Picea engelmannii	6
14	(1-35%)	Mertensia ciliata	11
8	(1-12%)	Caltha leptosepala	6
8	(1-18%)	Oxypolis fendleri	8
8	(1-30%)	Salix monticola	5
6	(0.1-22%)	Senecio triangularis	10
5	(1-13%)	Conioselinum scopulorum	5
5	(1-16%)	Deschampsia caespitosa	8
5	(1-10%)	Pseudocymopterus montanus	4

Other species with < 5% average cover present in at least 10% of plots:
Carex aquatilis (1-9%), Primula parryi (1-10%), Calamagrostis canadensis (1-10%), Saxifraga odontoloma (1-9%), Hymenoxys hoopesii (1-9%), Achillea millefolium var. occidentalis (1-13%), Cardamine cordifolia (1-9%), Dasiphora floribunda (1-7%), Pedicularis groenlandica (1-11%), Geranium richardsonii (1-7%), Rhodiola integrifolia (1-7%), Aconitum columbianum (1-5%), Geum macrophyllum var. perincisum (1-5%), Bromus ciliatus var. ciliatus (1-4%), Polygonum viviparum (1-4%), Rhodiola rhodantha (1-4%), Taraxacum officinale (1-4%), Veronica wormskjoldii (1-2%), Phleum alpinum (1-2%), Polygonum bistortoides (1-2%), Castilleja rhexiifolia (1%), Luzula parviflora (1%), Potentilla pulcherrima (1%).

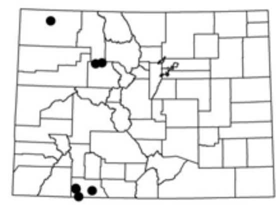
Silver buffaloberry Shrubland

Shepherdia argentea

Global rank/State rank:
G3G4 / S1

HGM subclass: R3/4

Colorado elevation range:
5,600-7,200 ft (1,700-2,200 m)



General Description

The *Shepherdia argentea* (silver buffaloberry) plant association is a medium-tall (4-6 ft, 1.2-2 m) shrubland. It occurs within a mosaic of deciduous tree and willow plant associations in the riparian corridor on broad floodplains of larger rivers on the Western Slope. Most stands in Colorado are severely degraded by improper grazing and stream flow alterations. Stands generally occur in wide valleys.

This plant association occurs on moderate to wide floodplains, 250-1000 ft (80-300 m) wide, with gravel and cobble streambed materials. Stream channels are low gradient, 0.3-4%, and moderately sinuous or highly sinuous. Some stream channels are heavily entrenched. Soils are deep, fine, silty and sandy clay loams over stratified alluvial material.

Vegetation Description

Shepherdia argentea (silver buffaloberry) dominates the dense, but patchy, tall-shrub layer of this plant association. Other shrubs that may be present include *Rosa woodsii* (woods rose), *Salix exigua* (sandbar willow) and *Rhus trilobata* (skunkbush sumac). *Artemisia tridentata* (big sagebrush), and *Chrysothamnus linifolius* (spearleaf rabbitbrush) may also be present.

The herbaceous undergrowth varies from a sparse to dense cover. Forb species that may be present include *Solidago canadensis* (Canada goldenrod), *Maianthemum stellatum* (starry false Solomon seal), *Clematis ligusticifolia* (western white clematis), and *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower). Some stands have a thick litter layer between clumps of the native bunchgrass *Leymus cinereus* (basin wild-rye). Non-native grasses, including *Poa pratensis* (Kentucky bluegrass), *Bromus tectorum* (cheatgrass), and *Bromus inermis* (smooth brome) are present in disturbed stands.

Ecological Processes

In Colorado, *Shepherdia argentea* (silver buffaloberry) was probably once more widespread, but is on the decline with the loss of lower elevation riparian habitats. *Shepherdia argentea* is now an uncommon riparian shrub and is being replaced by *Elaeagnus angustifolia* (Russian olive). A few stands of the *Shepherdia argentea* association have *Populus angustifolia* (narrowleaf cottonwood) present. Historically, the *Shepherdia argentea* plant association may have been part of a riparian woodland dominated by *Populus angustifolia*. More information is needed about the historical range, regeneration requirements, and drought tolerance of *Shepherdia argentea*.

Potential Conservation Areas supporting this community type are Rio Blanco at Deadman Canyon PCA and San Juan River at Carracas PCA.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
56	(25-73%)	Shepherdia argentea	7
22	(1-47%)	Rosa woodsii	5
16	(1-31%)	Prunus virginiana var. melanocarpa	2
13	(1-24%)	Solidago canadensis	2
11	(1-20%)	Leymus cinereus	2
11	(1-20%)	Clematis ligusticifolia	2
10	(1-31%)	Salix exigua	5
10	(1-36%)	Poa pratensis	5
9	(1-22%)	Maianthemum stellatum	4
8	(1-22%)	Rhus trilobata var. trilobata	3
8	(1-14%)	Salix ligulifolia	2
6	(1-16%)	Elymus trachycaulus ssp. trachycaulus	3
6	(1-10%)	Rudbeckia laciniata var. ampla	2
Other species with < 5% average cover present in at least 10% of plots:			
Cirsium arvense (1-7%), Berberis fendleri (1-5%), Symphoricarpos oreophilus (2-3%), Bromus inermis (1-5%), Taraxacum officinale (1-3%), Ribes inerme (1-2%), Juncus balticus var. montanus (1%), Equisetum arvense (1%), Erigeron flagellaris (1%), Equisetum laevigatum (1%).			

NATURAL HISTORY INFORMATION FOR PLANT SPECIES ASSOCIATED WITH WETLAND / RIPARIAN AREAS OF ARCHULETA COUNTY

Retrorse sedge
Carex retrorsa

Carex retrorsa. Photo © CNHP by K. Freeman

Taxonomy:
Class: Monocotyledoneae
Order: Cyperales
Family: Cyperaceae
Genus: *Carex*

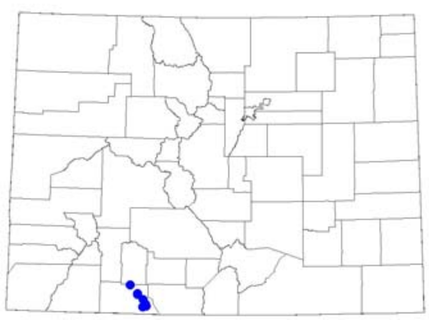
Taxonomic Comments: *Carex retrorsa* Schweinitz has also been reported as *C. lupulina*. The type specimen is from Durango, CO.

CNHP Ranking: G5 / S1

State/Federal Status: None.

Phenology: *C. retrorsa* is a tall, perennial sedge with short rhizomes and staminate and pistillate flowers on separate spikes. Perigynia are widely spreading to reflexed.

Habitat Comments: *C. retrorsa* is uncommon in scattered marshes, wet meadows, or sloughs, in the foothill and montane zones.



Colorado

Global Range: *C. retrorsa* is known from northern Canada, south to Nevada, Utah, and Colorado, and east to Maine.

State Range: In Colorado, *C. retrorsa* is reported to occur in the northwest and southwest portions of the state (Harrington 1979).

Distribution/Abundance: Retrorse sedge is common globally, but rare or possibly overlooked in Colorado. Since it has recently been added to the tracked species list for CNHP, there is little data available as to its abundance in the state.

Known Threats and Management Issues: Threats to *Carex retrorsa* include human activities (recreation, road and trail maintenance activities, selection of grazing areas) and invasion by exotic plant species. Changes in hydrology could negatively affect populations.

Potential Conservation Areas that support *Carex retrorsa*: East Side Chalk Mountains, Navajo Peak Trail, Opal Lake, Sparks Creek, Tributary to Rito Blanco, and Turkey Creek at Snowball Creek PCAs.

Marsh cinquefoil
Comarum palustre

Comarum palustre. Photo © CNHP by K. Freeman

Taxonomy
Class: Dicotyledoneae
Order: Rosales
Family: Rosaceae
Genus: *Comarum*

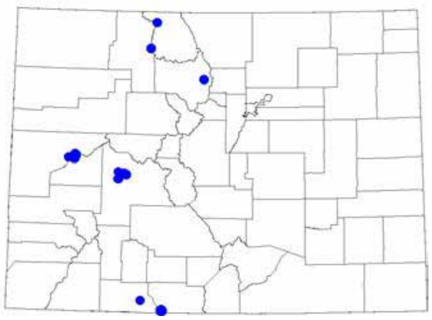
Taxonomic Comments: *Comarum palustre* (L.) is also known as *Potentilla palustris* (L.) Scop., *Potentilla palustris* (L.) Scop. var. *parvifolia* (Raf.) Fern. & Long, and *Potentilla palustris* (L.) Scop. var. *villosa* (Pers.) Lehm.

CNHP Ranking: G5 / S1S2

State/Federal Status: None.

Phenology: *C. palustre* is a perennial, cespitose herbaceous plant with rhizomatous. Leaves are pinnately compound but are often so close together to appear digitate. Flowering occurs from June to August.

Habitat Comments: *C. palustre* grows in wet meadows, fens, and around ponds in the montane or subalpine zones between 8,000 and 10,200 feet (2440 and 3100m) and is often found in association with peatlands. Associated species may include *Pedicularis groenlandica* (elephant head), *Carex aquatilis* (water sedge), and *Menyanthes trifoliata* (buckbean).



Colorado

Global Range: *C. palustre* has a broad range in North America, across Canada from Greenland to Alaska, and southward in the east to Illinois and New Jersey and in the west to Colorado and California. It is also native to northern Europe and Asia.

State Range: *C. palustre* is known from the west slope of Colorado, from Jackson County in the north to Archuleta and Conejos Counties at the south border.

Distribution/Abundance: *C. palustre* is common globally, but not frequently documented in Colorado. Its full distribution across the state is not known due to limited available data.

Known Threats and Management Issues: Threats to *Comarum palustre* include human activities, particularly activities resulting in changes in hydrology. This includes impacts from grazing including trampling and soil erosion and compaction which may result in the alteration or drying of the hydrology supporting the fen. Its limited habitat and dependence on moist conditions also make it susceptible to random events such as drought and disease.

Potential Conservation Areas that support *Comarum palustre*:
- Harris Lake PCA

Slender rock-brake
Cryptogramma stelleri

Cryptogramma stelleri
Photo © CNHP

Taxonomy
Class: Filicopsida
Order: Filicales
Family: Pteridaceae
Genus: *Cryptogramma*

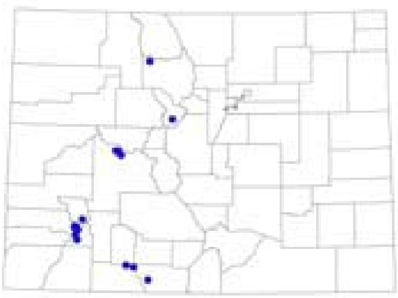
Taxonomic Comments: *C. stelleri* (S. G. Gmelin) Prantl. Synonyms include *Pteris stelleri* S. G. Gmelin; *Allosorus stelleri* Rupr. Beitr. Glanzenk; *Pellaea gracilis* Hooker

CNHP Ranking: G5 / S2

State/Federal Status: BLM Sensitive Species.

Phenology: This delicate slender perennial fern has two kinds of fronds, sterile and fertile. New growth is produced in spring and may dry up by late summer.

Habitat Comments: *C. stelleri* grows in horizontal crevices of moist, shaded cliffs, often associated with waterfalls and under shallow rock overhangs. These habitats tend to be mossy, and support other ferns such as brittle bladderfern (*Cystopteris fragilis*) and American rockbrake (*Cryptogramma acrostichoides*).



Colorado

Global Range: *Cryptogramma stelleri* is extremely widespread, with a nearly circumpolar distribution.

State Range: *C. stelleri* is known only from 19 locations in Colorado and only two locations in Archuleta County.

Distribution/Abundance: *C. stelleri* is extremely widespread, although its habitat requirements are very specific and its abundance may not be great at any single location. *C. stelleri* was found along the East Fork of the San Juan River, and at a location on cliffs above Quartz Creek.

Known Threats and Management Issues: Changes in the hydrologic regime may negatively impact this species. Direct disturbance is not likely on steep cliff habitats.

Potential Conservation Areas that support *Cryptogramma stelleri*:
- East Fork San Juan River PCA[1]
- Quartz Creek at East Fork San Juan River PCA

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Smith whitlow-grass
Draba smithii

Draba smithii
Photo © CNHP

Taxonomy
Class: Dicotyledoneae
Order: Capparales
Family: Brassicaceae
Genus: *Draba*

Taxonomic Comments: *D. smithii* Gilg *ex* O.E. Schulz. Type specimen from Mt. Baldy, 1891.

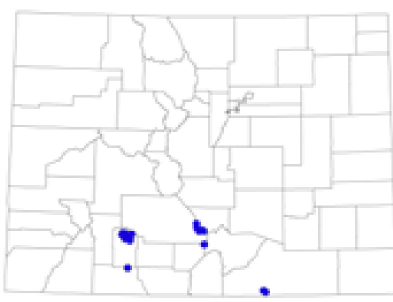
CNHP Ranking: G2 / S2

State/Federal Status: USFS Sensitive Species.

Phenology: A perennial mustard with white flowers, *Draba smithii* flowers in late spring and fruits in late summer.

Habitat Comments: *D. smithii* commonly occurs at seeps and springs in cliff faces and on talus slopes at moderate to high elevation.

Global Range: Endemic to Colorado, in six southern counties.



Colorado

State Range: *D. smithii* is known only from six southern Colorado counties (Alamosa, Archuleta, Custer, Las Animas, Mineral, and Saguache).

Distribution/Abundance: A Colorado endemic, the species is known from six southern Colorado counties. It was first located in Archuleta County along the East Fork of the San Juan River in 2000 by Ken Heil. The boundaries of this population were mapped in 2001 and were found to extend both upstream and downstream from the original location.

Known Threats and Management Issues: Threats to *Draba smithii* include changes in hydrology and direct disturbance, although this is not likely at the location in Archuleta County.

Potential Conservation Areas that support *Draba smithii*:

- East Fork San Juan River PCA[1]

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Giant helleborine
Epipactis gigantea

Epipactis gigantea. Photo © CNHP by K. Freeman

Taxonomy
Class: Monocotyledoneae
Order: Orchidales
Family: Orchidaceae
Genus: *Epipactis*

Taxonomic Comments: Stream orchid, *Epipactis gigantea* Douglas ex Hooker. Synonyms include *Limodorum giganteum* Kuntze; *Peramium giganteum* J. Coulter; *Helleborine gigantea* Druce. There are 20 species of *Epipactis* across the temperate regions of Europe and North America (Luer 1975).

CNHP Ranking: G3G4 / S2

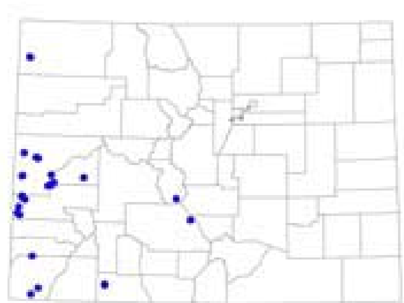
State/Federal Status: USFS Sensitive Species.

Description and Phenology: *E. gigantea* is a tall (3-7 dm) bog orchid with several leafy stems. The greenish-purple flowers of the giant helleborine orchid have the familiar orchid shape, are about 1” across, and flower in a raceme. Flowers appear in June and July, and fruit is produced in August and September.

Habitat Comments: *E. gigantea* is found in wet habitats, including seeps, around springs, and occasionally along stream banks and near hot springs. It is also often associated with hanging gardens in sandstone canyons.

Global Range: *E. gigantea* has a wide geographic distribution in western North America, and is known from fifteen western U. S. states and British Columbia.

State Range: The species occurs in eight western Colorado counties (Archuleta, Chaffee, Delta, Mesa, Moffat, Montezuma, Montrose, and Saguache).



Colorado

Distribution/Abundance: There are 37 occurrences in the CNHP database. Abundance data are scarce for this species, and the data that do exist are based upon casual field estimates. Based on the available EOR and herbarium label data, it is estimated that approximately 4,000 or more individuals make up the known abundance of this species. This number is based on general field observations and not on actual counts. The precision of the estimate may over or underestimate the actual population number by thousands. No population trend data or inferences of population trend are known (Moore and Friedley 2004).

Known Threats and Management Issues: Threats to the plants include diversion of the water feeding the seeps, and trampling. Its limited habitat and dependence on moist conditions make it susceptible to random events such as drought and disease.

Potential Conservation Areas that support *Epipactis gigantea*:

- Piedra PCA

Variegated scouring rush
Equisetum variegatum

Taxonomy
Class: Equisetopsida
Order: Equisetales
Family: Equisetaceae
Genus: *Equisetum*

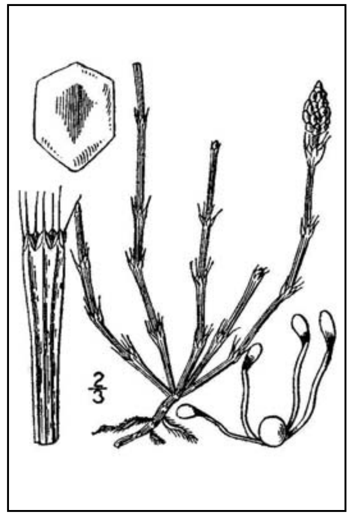


Image courtesy USDA-NRCS PLANTS Database / Britton, N.L. and A. Brown. 1913. *Illustrated flora of the northern states and Canada.* Vol. 1: 42.

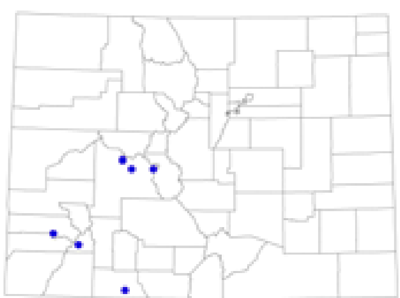
Taxonomic Comments: *E. variegatum* Schelich. *ex* Weber & Mohr is also known as *Hippochaete variegatum* var. *variegatum* and *Equisetum hyemale* var. *variegatum.*

CNHP Ranking: G5 / S1

State/Federal Status: None.

Phenology: *E. variegatum* is a perennial herbaceous plant with rough-surfaced evergreen stems. Its cones can mature in late summer, or they can overwinter and shed spores in spring. It is distinguished from the more common *E. hyemale* var. *affine* by its smaller and more slender stems.

Habitat Comments: *E. variegatum* is found at lakeshores, riverbanks, ditches and in wet woods. In Archuleta County it was found at the margin of a stock pond.



Colorado

Global Range: The range of *Equisetum variegatum* is circumpolar in the north temperate zone, extending into the Arctic.

State Range: There are five records of the species in the CNHP database, in Archuleta, Gunnison, San Juan and San Miguel counties. Specimens at the University of Colorado Herbarium represent seven additional counties.

Distribution/Abundance: This species may be more common than believed, and merely overlooked.

Known Threats and Management Issues: Threats to *Equisetum variegatum* include human activities (recreation, road and trail maintenance activities, selection of grazing areas), invasion by exotic plant species, and changes in hydrology.

Potential Conservation Areas that support *Equisetum variegatum*:

- Kenney Flats PCA[1]

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Philadelphia fleabane
Erigeron philadelphicus

Erigeron philadelphicus
Photo copyright © 1989 by R. H. Mehlonbrock, courtesy US Department of Agriculture

Taxonomy
Class: Dicotyledoneae
Order: Asterales
Family: Asteraceae
Genus: *Erigeron*

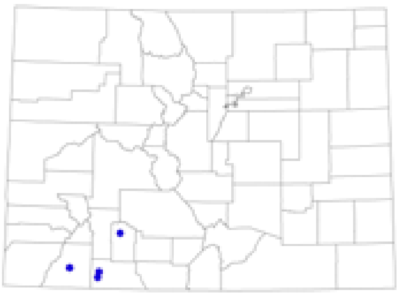
Taxonomic Comments: *E. philadelphicus* L.
Weber and Wittman (2001) note that generic segregation of the group to which *E. philadelphicus* belongs may be warranted.

CNHP Ranking: G5 / S1

State/Federal Status: None.

Phenology: An annual daisy with broad, coarsely toothed basal leaves and numerous slender rays, *Erigeron philadelphicus* flowers from April through June.

Habitat Comments: *E. philadelphicus* grows in moist to very wet conditions and is found in meadows, at seeps, along streams, roads, and ditches.



Colorado

Global Range: *E. philadelphicus* is widespread and common in Canada and occurs over much of the United States.

State Range: There are occurrences of *E. philadelphicus* in La Plata and Archuleta Counties, and a 1990 specimen collection at the University of Colorado Herbarium from Mineral County The population in Archuleta County brings the total number of populations for Colorado to four.

Distribution/Abundance: This species is very common and abundant in most of North America, but rare in Colorado and Wyoming.

Known Threats and Management Issues: Threats to *E. philadelphicus* include human activities, particularly activities resulting in changes in hydrology that cause decreased soil moisture content.

Potential Conservation Areas that support *Erigeron philadelphicus*:
- Piedra PCA

Canyon bog orchid
Limnorchis ensifolia

Limnorchis ensifolia. Photo © CNHP K. Freeman

Taxonomy
Class: Monocotyledoneae
Order: Orhidales
Family: Orhidaceae
Genus: *Limnorchis*

Taxonomic Comments: *Limnorchis ensifolia* (Rydb.) Luer. The genus is also classified by some botanists as *Habenaria* or *Platanthera.* The species has been known as *Habenaria sparsiflora, Platanthera sparsiflora,* and *Platanthera sparsiflora* var. *ensifolia.*

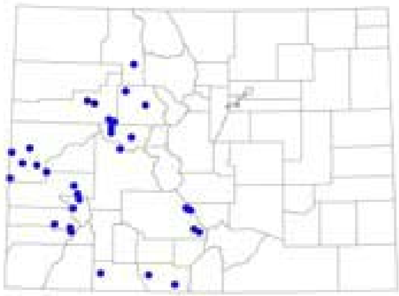
CNHP Ranking: G4G5T4? / S3

State/Federal Status: None.

Phenology: *Limnorchis ensifolia* is a glabrous plant, 3 to 6 dm tall, growing from a fascicle of fleshy roots. Its flower stalk is slender, with greenish flowers spaced farther apart than on other related bog orchids. Plants flower in May or June, and set fruit by August or September.

Habitat Comments: *Limnorchis ensifolia* grows in moist or wet soil in mountain meadows, marshes, swamps, fens, open or dense forests, on stream banks and open seeps, and frequently near springs.

Global Range: *Limnorchis ensifolia* has a wide range, from Oregon to Mexico, but food habitat is limited.



Colorado

State Range: *Limnorchis ensifolia* is widespread throughout western Colorado. There are 36 known populations in 12 Colorado counties.

Distribution/Abundance: *Limnorchis ensifolia* is widespread occurring wherever suitable habitat is found. Because good habitat is limited, the species - although widespread - is not abundant anywhere within its range. In Archuleta County its local population is sparse, and grows with two other rare plants, *Epipactis gigantea* (giant helleborine) and *Erigeron philadelphicus* (Philadelphia fleabane).

Known Threats and Management Issues: Threats to *Limnorchis ensifolia* include human activities, particularly activities resulting in changes in hydrology that cause decreased soil moisture content. The orchid's survival depends on a reliable year-round supply of moisture. The combination of grazing and trampling by livestock in the mucky areas where the orchid grows may eradicate the plant. Removal of overstory vegetation may cause sites to become too dry for the orchids.

Potential Conservation Areas that support *Limnorchis ensifolia*:
- Piedra PCA

NATURAL HISTORY INFORMATION FOR ANIMAL SPECIES ASSOCIATED WITH WETLAND / RIPARIAN AREAS OF ARCHULETA COUNTY

BIRDS

Black Swift
Cypseloides niger

Black Swift nest under an overhang on a cliff face.

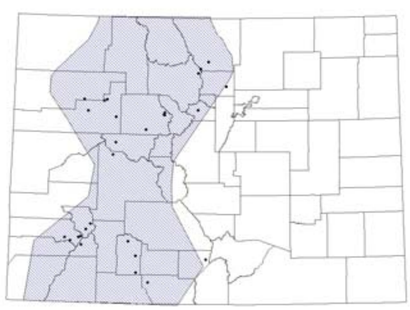
Taxonomy:
Class: Aves
Order: Apodiformes
Family: Apodidae
Genus: *Cypseloides*

Taxonomic Comments:
Subfamily Cypseloidinae

CNHP Ranking: G4 / S3B

State/Federal Status: USFS Sensitive.

Habitat Comments: Black Swifts nest on vertical rock faces, near waterfalls or in dripping caves (Lack 1956). Beyond that requirement, they inhabit a variety of landscapes, from seacoasts to the high elevations of the Rocky Mountains (Kingery 1998).



Colorado Distribution

Distribution: Black swifts breed in scattered colonies in western North America, from southeast Alaska to central Mexico, and migrate to the Neotropics in the winter (Stiles and Negret 1994). In Colorado, black swifts breed most commonly in the San Juan mountains, with scattered colonies in four other mountain ranges -- Sangre de Cristo, Flat Tops, Gore, and Front (Kingery 1998).

Important Life History Characteristics: After arriving in Colorado in June, black swifts take all summer to raise a single nestling (Kingery 1998). The cool microclimates they select for nesting presumably slows the developmental metabolism of the nestlings. Since nestlings are typically fed only once per day after the adults return from a day of foraging, slower development rates would help the survival.

Known Threats and Management Issues: There are few obvious threats to this species, except where development alters nesting habitat. The Colorado Breeding Bird Atlas (Kingery 1998) hypothesizes that at least 20% of all black swifts breed in Colorado.

Potential Conservation Areas supporting *Cypseloides niger*:
- Quartz Creek at East Fork San Juan River PCA

Bald Eagle
Haliaeetus leucocephalus

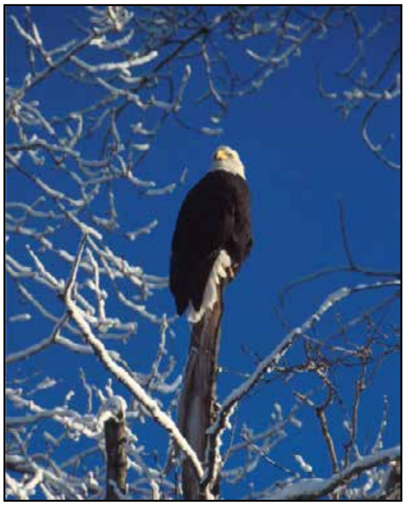


Photo © by Mary Kiesling

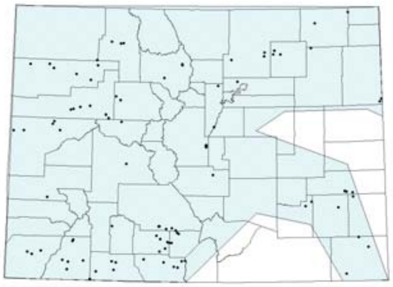
Taxonomy:
Class: Aves
Order: Falconiformes
Family: Accipitridae
Genus: *Haliaeetus*

Taxonomic Comments: none.

CNHP Ranking: G4 / S1B, S3N

State/Federal Status: Federally threatened.

Habitat Comments: Bald Eagles that nest in Colorado use large, mature cottonwoods or pines, often along rivers, to hold their heavy nests (Kingery 1998). Wintering populations will use major rivers, reservoirs, and prairie dog towns (MBW).


Colorado Distribution

Distribution: Bald Eagles live throughout North America - from Alaska to Newfoundland, and from the tip of Florida to southern California, and nest across Colorado (Kingery 1998).

Important Life History Characteristics: Bald Eagles begin nesting in late February, and can often be observed feeding their young into late June (Kingery 1998).

Known Threats and Management Issues: Continued threats to this species include high pesticide use, poisoning, poaching, and loss of nesting habitat due to the enduring popularity of waterfront development (CNHP 1997).

Potential Conservation Areas supporting *Haliaeetus leucocephalus*:
No PCAs were created for the Bald Eagle in Archuleta County, however, there are documented occurrences throughout the county, including on Lake Pagosa, along Stollsteimer Creek, and along the Piedra River.

FISH

Colorado River Cutthroat Trout
Oncorhynchus clarkii pleuriticus

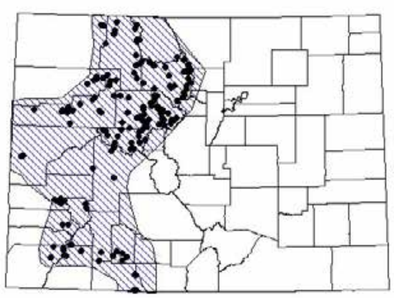
Taxonomy:
Class: Actinopterygii
Order: Salmoniformes
Family: Salmonidae
Genus: *Oncorhynchus*

Taxonomic Comments:
Subclass - Neopterygii

CNHP Ranking: G4T3 / S3

State/Federal Status: USFS sensitive, BLM sensitive, State species of special concern.

Habitat Comments: The historical habitat included most clearwater streams and rivers of western Colorado (Behnke 1992). The trout remains only in smaller order streams and a few high elevation lakes of the mountainous country.



Colorado Distribution

Distribution: This subspecies is the only trout native to the upper Colorado River basin. Its native range extends southward to the Escalante River on the west and San Juan drainage on the east sides of the basin, including the Green, Yampa, Gunnison, Dolores, and San Juan river systems (CDOW 1986, CDOW 1987, Proebstel 1994, Young *et al.* 1996). Currently, remnant populations remain in Colorado, Wyoming, and Utah.

Important Life History Characteristics: Competition and hybridization with non-native salmonids occurs. This trait has contributed to the current preferences of this native trout for lakes, beaver ponds, and small streams. Clean, cold water running over a boulder-cobble substrate marks the preferred habitat of this trout (Trotter 1987).

Known Threats and Management Issues: The Colorado River cutthroat trout is heavily managed and studied. Presently, there are 42 populations in Colorado judged to be genetically pure (Proebstel 1994). However, the primary reasons for conservation concern at the global and state levels are long-term trend prognoses and threats. Populations continue to decline in many streams (Young *et al.* 1996); hybridization between this species and non-native trout species (Rainbow trout *Onchorhynchus mykiss*) poses the greatest threat to the elimination of pure populations. Competition with non-native trout species and exotic fish diseases also pose threats, and declines have been hastened by loss of habitat to grazing, clearcutting, water diversions, and stream channelization (Trotter 1987).

Potential Conservation Areas supporting *Oncorhynchus clarki pleuriticus*:

- Navajo River at Banded Peak PCA

Rio Grande cutthroat trout
Oncorhynchus clarkii virginalis

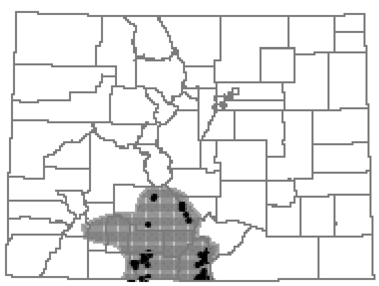
Taxonomy:
Class: Actinopterygii
Order: Salmoniformes
Family: Salmonidae
Genus: *Oncorhynchus*

Taxonomic Comments:
Readily hybridizes (or introgresses) with other spring spawning trout such as introduced rainbow trout or other subspecies of cutthroat (Sublette *et al*. 1990). See Behnke (1992) for a discussion of taxonomic history.

CNHP Ranking: G4T3 / S3

State/Federal Status: USFS sensitive, BLM sensitive, State species of special concern.

Habitat Comments: Most populations are restricted to small headwater streams (Behnke 1992) where allochthonous materials are the primary energy input (Sublette *et al*. 1990). As with other subspecies, the native habitat included lakes and higher order streams.



Colorado Distribution

Distribution: Historic range is not definitely known, but probably encompassed all "trout waters" in the Rio Grande drainage, including the Chama, Jemez, and Rio San Jose drainages (Sublette *et al*. 1990). Present range includes New Mexico and Colorado (Rinne 1995), as far north as the headwater tributaries in the Rio Grande and San Juan National Forests in southwestern Colorado. There are few lake and introduced populations.

Known Threats and Management Issues: Habitat degradation or loss and threats from fish diseases are believed to be important threats to this subspecies (Sue Swift, pers. comm.). Other threats include hybridization (or introgression) and competition with introduced salmonids. Breeding stock for reintroduction and other management purposes is being developed at Mescalero National Fish Hatchery (Sublette *et al*. 1990). It is estimated that the Rio Grande cutthroat trout occupies less than 1% of its original habitat in Colorado (Alves 1996). Genetically pure populations tend to be found only in small, isolated headwater streams (Propst and McInnis 1975). To help manage and conserve this subspecies in Colorado, remaining habitat should be protected and non-native fishes removed and kept out.

Potential Conservation Areas supporting *Oncorhynchus clarki virginalis*:
- Adams Fork of the Conejos River PCA[1]

[1]For information on this PCA please refer to CNHP's associated report, *Upper San Juan Basin Biological Assessment* (2003).

Rio Grande chub
Gila pandora

Taxonomy:
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Gila*

Gila pandora photo by J. Woodling courtesy Colorado Div. of Wildlife

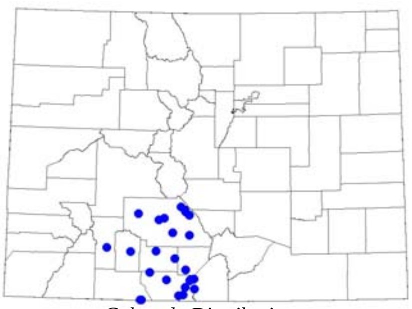
Taxonomic Comments: Morphological variation among populations in Canadian River, Pecos River, and Rio Grande are believed to represent ecophenotypic variation (Sublette *et al.* 1990).

CNHP Ranking: G3 / S1?

State/Federal Status: BLM sensitive, USFS sensitive, State species of special concern.

Habitat Comments: The Rio Grande chub occurs in low- to moderate-gradient small and large streams and rivers, as well as in large reservoirs in the upper Colorado River watershed. (NatureServe 2005). It is often found near undercut banks and areas of overhanging vegetation (Woodling 1985).

Distribution: The Rio Grande Chub is endemic to the Pecos River and Rio Grande River basins (NatureServe 2005). In Colorado, this species occurs only in the Rio Grande River mainstem and its tributaries (CNHP 2005).



Colorado Distribution

Important Life History Characteristics: Rio Grande chub is commonly found in flowing pools of creeks and small rivers, often near inflow of riffles and in association with cover such as undercut banks and plant debris (Lee *et al.* 1980, Page and Burr 1991). It is frequently associated with aquatic vegetation (Sublette *et al.* 1990).

Known Threats and Management Issues: Primary threats are stream dewatering and habitat modification due to channelization (New Mexico Department of Game and Fish 1996).

Potential Conservation Areas supporting *Gila pandora*:
No PCAs were created for the roundtail chub in Archuleta County; however, there are documented occurrences in the County in the Rio Chamita and in Sexto Creek.

Roundtail Chub
Gila robusta

Adult male Gila robusta in breeding colors. Photo by J. Woodling courtesy Colorado Div. of Wildlife

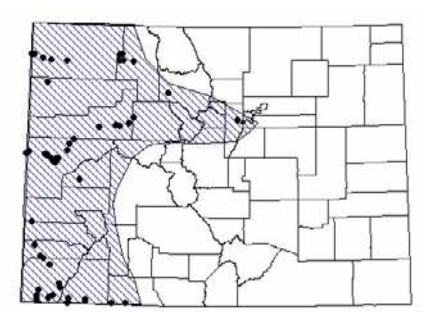
Taxonomy:
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Gila*

Taxonomic Comments: Subclass Neopterygii

CNHP Ranking: G2G3 / S2

State/Federal Status: BLM sensitive, USFS sensitive, State species of special concern.

Habitat Comments: The Roundtail chub occurs in large streams and intermediate sized rivers (Page and Burr 1991).


Colorado Distribution

Distribution: The Roundtail Chub is endemic to the Colorado River basin (Page and Burr 1991). In Colorado, this species occurs in the Colorado River mainstem and its larger tributaries, including the White, Yampa, Dolores, San Juan, and Gunnison rivers (CNHP 1997).

Important Life History Characteristics: Roundtail chub occupies slow moving water adjacent to areas of faster water. Gravel substrates are required for spawning (Woodling 1985).

Known Threats and Management Issues: The main threats to this species are habitat degradation and its restricted range (CNHP 1997). Warm water temperatures are required during the summer for breeding, and the release of cold water from dam facilities during the summer may contribute to the decline of this species (Woodling 1985).

Potential Conservation Areas supporting *Gila robusta*:
No PCAs were created for the roundtail chub in Archuleta County; however, there are documented occurrences in the county in the San Juan River between Trujillo and Navajo Reservoir.

REPTILES

Painted turtle
Chrysemys picta

Public domain photo by Gary M. Stolz, courtesy USFWS Digital Media Library.

Taxonomy:
Class: Reptilia
Order: Squamata
Family: Testudines
Genus: *Chrysemys*

Taxonomic Comments: The species in Colorado is recognized as the distinct subspecies *Chrysemys picta belli* (Gray 1831).

CNHP Ranking: G5 / S5

State/Federal Status: None.

Phenology: In Colorado painted turtles emerge from hibernation in March or April and remain active through at least mid-November. Courtship and mating occur in spring and more rarely in summer in fall with nesting taking place from mid-May to mid-July (Hammerson 1999). Turtles hibernate in water and are reported to burrow into anoxic bottom mud.

Global Range: *Chrysemys picta* is widespread throughout southern Canada, south through Oregon, northern Idaho, Colorado and the rest of the central and eastern United States, but not in Florida (Hammerson 1999). There is a disjunct population occupying southwestern Colorado, New Mexico, Texas and Chihuahua, Mexico.

State Range: *Chrysemys picta* occurs below 6,000 feet in the plains of eastern Colorado and at elevations of 6,000 to 8,500 feet in southwestern Colorado (Hammerson 1999). However, a previous inventory noted one individual at over 8,500 feet at Price Lakes north of Chromo.

Habitat Comments: Typical habitat includes permanent ponds, reservoirs, marshes, river backwaters and slow moving portions of streams.

Distribution/Abundance: *Chrysemys picta* is numerous throughout its range in North America and within northeastern Colorado, but is extremely local and less common in southwestern Colorado. The regional population of painted turtles likely will remain stable and secure for the foreseeable future (Hammerson 1999).

Known Threats and Management Issues: Human created ponds and reservoirs have augmented native habitat throughout the range of the painted turtle. Various local populations, however, have suffered from habitat alteration associated with residential, commercial and agricultural development. Availability of suitable nesting habitat may be more of a problem for a shallow nesting turtle like *Chrysemys picta* in the dry climate of Colorado (Hammerson 1999). Nesting painted turtles are sensitive to human disturbance such as fishing, and management of recreational use at known populations of turtles during nesting (mid- May to mid-July) would benefit painted turtle populations.

Potential Conservation Areas supporting *Chrysemys picta*:
Although no PCAs were created for this species, it was previously observed at Price Lakes north of Chromo and near Lake Capote, and during this survey was seen in ponds near the Piedra River.

AMPHIBIANS

Photo © CNHP

Northern leopard frog
Rana pipiens

Taxonomy:
Class: Amphibia
Order: Anura
Family: Ranidae
Genus: *Rana*

Taxonomic Comments: Much published information on *Rana pipiens* actually pertains to other species that been described or recognized since the early 1970s.

CNHP Ranking: G5 / S3

State/Federal Status: BLM sensitive, USFS sensitive, State species of special concern.

Phenology: *Rana pipiens* emerges from winter retreats in March and activity continues until October or November. Breeding commences in March or April and eggs are layed from mid-April through May (Hammerson 1999).

Global Range: *Rana pipiens* ranges from southern Canada and the northern United States south to Maryland, West Virginia, Kentucky, northern Illinois, Missouri, Nebraska, New Mexico, Arizona, and eastern California (Hammerson 1999).

State Range: *Rana pipiens* ranges throughout Colorado except for the southeastern portion of the state.

Habitat Comments: Northern leopard frogs are found in a variety of temporary and permanent aquatic habitats, including streams, rivers, ponds, lakes, ditches, and marshes (Degenhardt *et al.* 1996). Mass movements away from breeding ponds are sometimes undertaken by adults and young after summer rains (Fitch 1958).

Distribution/Abundance: The formerly abundant northern leopard frog has become scarce in many areas of its range due in part to changes in habitat. In some areas the decline in northern leopard frogs are associated with the presence of increasingly abundant bullfrogs, which may eat Northern leopard frogs.

Known Threats and Management Issues: *Rana pipiens* has become scarce or absent at some locations where non-native bullfrogs have been introduced (Hammerson 1999). Bullfrog larvae that overwinter readily eat *Rana pipiens* eggs (Ehrlich 1979), and could greatly reduce reproductive success of northern leopard frogs (Hammerson 1999). Flood control measures and diversion of water for irrigation has reduced the availability of breeding habitat (Hammerson 1999).

Potential Conservation Areas supporting *Rana pipiens*: Buckles Lake, Devil Creek State Wildlife Area, Harris Lake, Porcupine Creek Meadows, Rio Blanco at Deadman Canyon, and San Juan at Trujillo PCAs.

Nokomis fritillary
Speyeria nokomis nokomis

Photo © Paul A. Opler, courtesy USGS-Northern Prairie Wildlife Research Center. www.npwrc.usgs.gov

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Nymphalidae
Genus: *Speyeria*

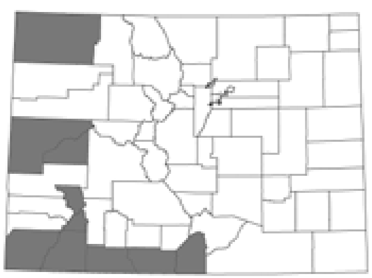
Taxonomic Comments: *Speyeria nokomis nokomis* is synonymized with *S. nokomis* in Miller (1992). Otherwise the subspecies of this species seem unusually clear-cut for a *Speyeria*.

CNHP Ranking: G3T1 / S1

State/Federal Status: USFS sensitive, BLM sensitive.

Phenology: One brood emerging in mid-July through late September in Colorado (Opler and Bartlet-Wright 1999). Males patrol all day about the seeps and meadows in search of females (Scott 1986).

Larval Hostplant: The hostplant is the violet, *Viola nephrophylla*.



Colorado Distribution

Global Range: This species is widespread throughout the southern Rocky Mountains, into the Great Basin and south into northern Mexico.

State Range: In Colorado the Nokomis fritillary is widespread across the west slope and into the south-central Rocky Mountains of the state. It is known from 11 Colorado counties ranging from Moffat County in the northwest to Costilla County, which borders New Mexico in south-central Colorado.

Habitat Comments: *Speyeria nokomis nokomis* inhabits wet alpine meadows and seeps and springs and associated marshes with flowing water at lower elevation where adults will nectar avidly at thistles (Opler and Bartlet-Wright 1999).

Distribution/Abundance: The Nokomis fritillary, although widespread is extremely local, restricted habitat and decidedly rare over the major portion of its range (Ferris and Brown 1981).

Known Threats and Management Issues: Habitat loss is a major problem for *S. n. nokomis*. Many populations have disappeared because of capping of springs, lowering of water tables by pumping and habitat modification (Opler and Bartlet-Wright 1999).

Potential Conservation Areas supporting *Speyeria nokomis nokomis*:

The Nokomis fritillary does not inhabit any PCAs, but it is recorded from a spring along Highway 84 south of Chromo, and from along Round Meadow Creek near Round Meadow Creek PCA.

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