

WETLAND CLASSIFICATION OF BLANCA WETLANDS, SAN LUIS VALLEY, COLORADO



**Colorado Natural Heritage Program
College of Natural Resources, 8002 Campus Delivery
Colorado State University
Fort Collins, Colorado 80523-8002**



**Colorado
State**
University
Knowledge to Go Places

Wetland Classification of Blanca Wetlands, San Luis Valley, Colorado.

Prepared for:

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Cover photograph: Pond dominated by common spikerush (*Eleocharis palustris*) in the center and cattail (*Typha latifolia*) in foreground/background.

Photo taken by: Joe Rocchio

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INTRODUCTION

The goal of this project is to classify approximately 200 ponds on the Bureau of Land Management's Blanca Wetlands complex, according to CNHP's *Comprehensive Statewide Wetlands Classification and Characterization: Wetland Plant Associations of Colorado* (Carsey et al. 2001). The information may be helpful to wetland managers in understanding vegetation dynamics and its correlation to management actions and wildlife use of the ponds. The data are summarized in this report and data forms and ArcView shape files are on the included CD-Rom. Community characterization abstracts for most of the plant associations found during the project are also found in this report.

METHODS

Project Area

This project was conducted at the Blanca Wetlands complex in the San Luis Valley. The area is managed by the Bureau of Land Management's La Jara Field Office, La Jara, CO. The Blanca Wetlands complex is a network of marshes, wet meadows, ponds, and playas managed for recreation and wildlife habitat. Some of the ponds may have been natural prior to current management, however most are now managed as specific wetland types to optimize habitat conditions. The ponds have been previously classified into five Pond Types: (1) fish ponds; (2) fresh marsh; (3) wet meadow; (4) salt marsh; and (5) salt playa.

Sampling Method

Plant associations at each of the 202 ponds visited were identified using the *Field Guide to the Wetland and Riparian Plant Associations of Colorado* (Carsey et al. 2003). Pond sizes vary tremendously, thus it was felt that an ocular estimate of % cover for each plant association would inherit too much error between ponds. CNHP decided, given time/money, it was much easier to differentiate with more consistent "accuracy", the relative dominance of each plant association in each pond. Thus, the plant associations were ranked according to their relative dominance at each pond. The communities were ranked from 1 (most dominant) to 5 (least dominant) and only the five most dominant types were considered, meaning a pond could have more than five types, but only five were ranked.

As is often the case in wetlands, multiple plant associations occur in a complex, which are defined by some gradient (i.e. concentric rings of a playa), or are interspersed amongst each other as small patches. In the latter scenario, the visual concept of a plant association may not be readily apparent, however when considered as a whole one may notice a pattern of vegetation types co-occurring as a complex.

The presence of slender spiderflower (*Cleome multicaulis*) was noted at each pond. Canada thistle (*Cirsium arvense*) and whitetop (*Lepidium latifolium*) were also noted. However, the intent of this project was not an exhaustive search for these species.

Data Analysis

Dominant plant associations in each Pond Type --fish pond, fresh marsh, wet meadow, salt marsh, salt playa—were compared to show patterns of dominance distribution among the plant

associations. For example, which plant associations commonly dominate each Pond Type? Which plant associations occur in multiple Pond Types?

Colorado Natural Heritage Program Ranks

Although no potential conservation areas are presented in this report, nor are any new element occurrences, the section on Natural Heritage Methodology was included to explain the importance of the Global Ranks of each plant associations and how they influence conservation actions in Colorado and worldwide.

THE NATURAL HERITAGE NETWORK AND BIOLOGICAL DIVERSITY

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

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

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

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

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

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as their biology and known threats. By ranking the relative rarity or

imperilment of a species, the quality of its populations, and the importance of associated conservation PCAs, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community realized that plant associations are equally important as individual species, this methodology has been applied to ranking and preserving rare plant associations, as well as the best examples of common associations.

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

What is Biological Diversity

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

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

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

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

Community Diversity — the variety of plant associations or associations within an area that represent the range of species relationships and inter-dependence. These associations may be diagnostic or even restricted to an area. Although the terms plant association and community have been described by numerous ecologists, no general consensus of their meaning has developed. The terms are similar, somewhat overlapping, and are often used more or less interchangeably. The U.S. National Vegetation Classification (USNVC) (Anderson et al. 1998), the accepted national standard for vegetation, defines a community as an "assemblage of species that co-occur in defined areas at certain times and that have the potential to interact with one another" (The Nature Conservancy 1999), and a plant association as a type of plant community with "definite floristic composition, uniform habitat conditions, and uniform physiognomy" (Flahault and Schroter 1910). The term plant "association" is hereafter used in lieu of "community" except when referring to a broader definition of community (e.g. natural community). Identifying and protecting representative examples of plant associations ensures

conservation of multiple number of species, biotic interactions, and ecological process. Using associations as a "coarse-filter" enables conservation efforts to work toward protecting a more complete spectrum of biological diversity.

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

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

Colorado Natural Heritage Program

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

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

The Biological and Conservation Data System (BCD) developed by The Nature Conservancy is used by all Natural Heritage Programs to house data about imperiled species. This database includes taxonomic group, global and state rarity rank, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. The Colorado Natural Heritage Program also uses the Biodiversity Tracking and Conservation System (BioTiCS) for digitizing and mapping occurrences of rare plants, animals, and plant associations. These rare species and plant associations are referred to as "elements of natural diversity" or simply "elements."

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

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

- What species and ecological associations exist in the area of interest?
- Which are at greatest risk of extinction or are otherwise significant from a conservation perspective?
- What are their biological and ecological characteristics, and where are these priority species or associations found?
- What is the species' condition at these locations, and what processes or activities are sustaining or threatening them?
- Where are the most important PCAs to protect?
- Who owns or manages those places deemed most important to protect, and what is threatening those places?
- What actions are needed for the protection of those PCAs 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 associations according to their imperilment status provides guidance for where Natural Heritage Programs should focus their information-gathering activities. For species deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, the more common and secure species constitute the majority of most groups of organisms. On the other hand, for those species that are by their nature rare, more detailed information is needed. Because of these species' rarity, gathering comprehensive and detailed population data can be less daunting than gathering similarly comprehensive information on more abundant species.

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

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than five current locations in Colorado, is ranked G5 S1 (globally-secure, but critically imperiled in this state). The Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3 S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1 S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 3.

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

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

Table 1. Definition of Natural Heritage Imperilment Ranks.

G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
G/S4	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
G/SX	Presumed extinct globally, or extirpated within the state.
G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
G/SH	Historically known, but usually not verified for an extended period of time.
G#T#	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
S#B	Refers to the breeding season imperilment of elements that are not residents.
S#N	Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SZ	Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SA	Accidental in the state.
SR	Reported to occur in the state but unverified.
S?	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.

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

Legal Designations for Rare Species

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

Candidate species for listing as endangered or threatened under the Endangered Species Act are indicated with a “C.” While obsolete legal status codes (Category 2 and 3) are no longer used, CNHP continues to maintain them in its Biological and Conservation Data system for reference.

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

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
E (S/A)	Endangered: treated as endangered due to similarity of appearance with listed species.
LT	Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
P	Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
C	Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as "S")	
FS	Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: 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 associations, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. To prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences whenever sufficient

information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

Size – a measure of the area or abundance of the element’s occurrence, relative to other known, and/or presumed viable, examples. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance).

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

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

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

Table 3. Element Occurrence Ranks and their Definitions.

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

Potential Conservation Areas and Their Ranking

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

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

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

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

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

Off-PCA 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 are necessary as well, which will involve regional efforts in addition to coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Potential Conservation Areas

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

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

B1	<p>Outstanding Significance (indispensable):</p> <p>Only known occurrence of an element</p> <p>A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence)</p> <p>Concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)</p>
B2	<p>Very High Significance:</p> <p>B- or C-ranked occurrence of a G1 element</p> <p>A- or B-ranked occurrence of a G2 element</p> <p>One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element.</p> <p>Concentration of A- or B-ranked G3 elements (four or more)</p> <p>Concentration of C-ranked G2 elements (four or more)</p>
B3	<p>High Significance:</p> <p>C-ranked occurrence of a G2 element</p> <p>A- or B-ranked occurrence of a G3 element</p> <p>D-ranked occurrence of a G1 element (if best available occurrence)</p> <p>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)</p>
B4	<p>Moderate Significance:</p> <p>Other A- or B-ranked occurrences of a G4 or G5 community</p> <p>C-ranked occurrence of a G3 element</p> <p>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)</p> <p>Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more)</p> <p>D-ranked occurrence of a G2 element</p> <p>At least C-ranked occurrence of a disjunct G4 or G5 element</p> <p>Concentration of excellent or good occurrences (A- or B-ranked) of G4 S1 or G5 S1 elements (four or more)</p>
B5	<p>General or State-wide Biological Diversity Significance: good or marginal occurrence of common community types and globally secure S1 or S2 species.</p>

Protection Urgency Ranks

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

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

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

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

Situations that may require a protection action are as follows:

- Forces that threaten the existence of one or more element occurrences at a PCA. For example, development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; or timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- The inability to undertake a management action in the absence of a protection action; for example, obtaining a management agreement;
- In extraordinary circumstances, a prospective change in ownership or management that will make future protection actions more difficult.

Management Urgency Ranks

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

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

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

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

RESULTS

Pond Number Inconsistencies

During the course of the project, inconsistencies with Pond Numbers were found between hardcopy maps and the ArcView coverage provided by the Bureau of Land Management. Unless otherwise noted, when “data collected” is indicated in parentheses, it means data exists on the MS Excel spreadsheet but not on the ArcView coverage,. The inconsistencies and other notes are as follows:

1. Pond 11 has two ponds on map and only one on ArcView coverage. Data from “north” pond was entered into ArcView table (data collected).
2. Pond 35 is labeled as Pond 26 on ArcView (data collected);
3. Pond 52 is on ArcView coverage but not on maps (no data);
4. Pond 68 is on ArcView coverage but not on maps (no data);
5. Pond 189 is outside Project Boundary (no data);
6. Pond 204 is on ArcView coverage but not on maps (no data);
7. Pond 205 is on ArcView coverage but not on maps (no data);
8. Pond 38 is lumped with Pond 39 on ArcView (data collected - used Pond 39 data on ArcView coverage);
9. Pond 57 is listed as Pond 56 on ArcView coverage (data collected – entered into Pond 56 on ArcView coverage);
10. Pond 81 is not on ArcView coverage (data collected);
11. Pond 98 is listed as Pond 96 on ArcView (data collected - entered into Pond 96 on ArcView coverage);
12. Pond 145 (south) is not on ArcView (data collected);
13. Pond 176 is not listed on ArcView (data collected);
14. Pond 191 on hardcopy map does not match the Pond 191 on ArcView (data collected); and
15. Pond 206 has multiple ponds on hardcopy map but only one on ArcView (data collected – used “south” pond data for ArcView coverage).

In addition, a few ponds were missed during the survey: Pond 85, 122, 123, 172, 177, and 178. Most of these ponds occur on the east side of the Closed Basin canal, which was mistaken for the Project Boundary.

Plant Associations Present

Twenty-two plant associations recognized in CNHP's Comprehensive Statewide Wetlands Classification and Characterization were found at the ponds visited (Table 7). There were four plant assemblages not recognized as plant associations but found as dominants in some of the ponds (Table 8).

Three abiotic dominance types were also found at the ponds: (1) open water; (2) bare ground; and (3) salt crust.

Table 7. Plant Associations, recognized in CNHP's Comprehensive Statewide Wetlands Classification and Characterization, which were found in ponds:

Code on Data Form/ArcView	Plant Association	Common name	Global/State Rank
Amp nev	<i>Amphiscirpus nevadensis</i> (= <i>Scirpus nevadensis</i>)	Nevada bulrush Herbaceous Vegetation	G4/S2
Cal str	<i>Calamagrostis stricta</i>	Slimstem reedgrass Herbaceous Vegetation	GU/S1?
Car neb	<i>Carex nebrascensis</i>	Nebraska sedge Herbaceous Vegetation	G4/S3
Car pel	<i>Carex pellita</i>	Wooly sedge Herbaceous Vegetation	G3/S3
Car pra	<i>Carex praeegracilis</i>	Clustered field sedge Herbaceous Vegetation	G3G4/S2
Car sim	<i>Carex simulata</i>	Analogue sedge Herbaceous Vegetation	G4/S3
Dis spi	<i>Distichlis spicata</i>	Inland saltgrass Herbaceous Vegetation	G5/S3
Ele aci	<i>Eleocharis acicularis</i>	Needle spikerush Herbaceous Vegetation	G4?/S3
Ele pal	<i>Eleocharis palustris</i>	Common spikerush Herbaceous Vegetation	G5/S4
Hor jub	<i>Hordeum jubatum</i>	Foxtail barley Herbaceous Vegetation	G4/S4
Jun bal	<i>Juncus balticus</i>	Mountain rush Herbaceous Vegetation	G5/S5
Muh asp	<i>Muhlenbergia asperifolia</i>	Alkali muhly Herbaceous Vegetation	G3?/S3?
Pol spp	<i>Polygonum</i> spp. – Mesic graminoid	Knotweed spp. – Mesic Graminoid Herbaceous Vegetation	N/A (non-native)
Puc nut	<i>Puccinellia nuttalliana</i>	Nuttall alkaligrass Herbaceous Vegetation	G3?/S3
Sal rub	<i>Salicornia rubra</i>	Red saltwort Herbaceous Vegetation	G2G3/S1?
Sar ver/bare ground	<i>Sarcobatus vermiculatus</i> /barren ground	Black greasewood / Barren ground Shrubland	GU/S2
Sar ver/Dis spi	<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i>	Black greasewood / Inland saltgrass Shrubland	G4/S2
Sch lac	<i>Schoenoplectus acutus</i> var. <i>acutus</i>	Hardstem bulrush Herbaceous Vegetation	G5/S4
Sch mar	<i>Schoenoplectus maritimus</i>	Alkali bulrush Herbaceous Vegetation	G4/S2
Sch pun	<i>Schoenoplectus pungens</i>	Common threesquare Herbaceous Vegetation	G3G4/S3
Sua cal	<i>Suaeda calceoliformis</i>	Pursh seepweed Herbaceous Vegetation	GU/S2
Typ lat	<i>Typha angustifolia</i> - <i>Typha latifolia</i> -(<i>Typha domingensis</i>)	Cattail Herbaceous Vegetation	G5/S4

Table 8. Plant Assemblages not recognized as Plant Associations but found as Dominants in Ponds.

Code on Data Form/ArcView	Plant Assemblage	Common name
Bas hys	<i>Bassia hyssop</i>	Ironweed (non-native)
Che gla	<i>Chenopodium glaucum</i>	Goosefoot
Chr nau	<i>Chrysothamnus nauseosus</i>	Rabbitbrush
Lep lat	<i>Lepidium latifolium</i>	Whitetop (non-native)

Plant Association Patterns

As shown in Table 9, of the 22 plant associations only nine were commonly dominant. Thus, there is not a large diversity of plant associations that dominate the Ponds at Blanca. However, a large diversity of types were documented at the ponds visited. *Distichlis spicata* (Dis spi) as well as Open Water were each the most dominant (Dominant 1) types in two Pond Types and *Distichlis spicata* was a common dominant (Dominant 2, 3, 4, and 5) in all five Pond Types. *Schoenoplectus acutus* (Sch lac) was a common dominant (Dominant 2, 3, 4, and 5) in four Pond Types. *Typha latifolia* (Typ lat) and *Eleocharis palustris* (Ele pal) were common dominants (Dominant 2, 3, 4, and 5) in three Pond Types.

Table 9. Most common plant associations within each Pond Type.

	Fish Pond	Fresh Marsh	Wet Meadow	Salt Marsh	Salt Playa
Dominant 1	Open water	Typ lat	Dis spi & Ele pal	Dis spi	Open water & salt crust
Dominant 2	Typ lat	Typ lat	Dis spi	Salt crust	Dis spi
Dominant 3	Sch lac	Ele pal & Sch lac	Jun bal	Amp nev	Salt crust
Dominant 4	Ele pal	Dis spi	Jun bal & Sch lac	Sch mar	Sar ver/Dis spi
Dominant 5	Cal str, Dis spi, Ele pal, and Jun bal	Jun bal	Typ lat & open water	Open water	Sch lac

Of the 202 ponds visited, slender spiderflower (*Cleome multicaulis*), a G2G3 plant species, was found at 36 ponds (18% of Ponds visited). Canada thistle (*Cirsium arvense*), an aggressive non-native species, was located at 48 ponds (24% of Ponds visited) while whitetop (*Lepidium latifolium*), another aggressive non-native species, was found at 62 ponds (31% of Ponds visited).

CD-ROM Data

Included in this report are a CD-Rom with the amended ArcView coverage of the ponds and an MS Excel spreadsheet with the raw field data.

The ArcView coverage has 339 ponds, however only 202 were visited for this project. Ten ponds within the Project Boundary were not visited. The remaining 127 ponds are outside the Project Boundary.

Plant Community Characterization Abstracts

Community Characterization Abstracts have not been completed for all of the plant associations found at Blanca Wetlands. Those which are completed are included below.

Nevada bulrush Herbaceous Vegetation

Scirpus nevadensis (= *Amphiscirpus nevadensis*)



Global rank/State rank:

G4 / S2

HGM subclass: F1

Colorado elevation range:

7,500-9,000 ft (2,280-2,740 m)

General Description

Scirpus nevadensis (= *Amphiscirpus nevadensis*, Nevada bulrush) is an association of moist to seasonally flooded alkaline flats in desert and semidesert regions in Canada and northwestern United States. In Colorado, this association occurs in intermountain valleys and parks, typically with low rainfall and alkaline water sources. Although these areas may not look like typical deserts, they can qualify as desert or semidesert based on annual precipitation amounts of about 10 inches. *Scirpus nevadensis* is superficially similar to *Schoenoplectus pungens* (threesquare bulrush), but the arrangement of the spikes and the achenes of each are distinctive.

Vegetation Description

In North and South Park sites, the *Scirpus nevadensis* association tends to be monotypic (3-40% cover) with sparse coverage by other species such as *Hordeum jubatum* (foxtail barley), *Distichlis spicata* (inland saltgrass), *Puccinellia nuttalliana* (= *Puccinellia airoides*) (Nuttall alkaligrass), and *Glaux maritima* (sea milkwort).

Species diversity in the San Luis Valley sites is higher. *Scirpus nevadensis* provides 10 to 80% cover; other species include *Juncus balticus* var. *montanus* (mountain rush), *Spartina gracilis* (alkali cordgrass), *Schoenoplectus pungens* (threesquare bulrush) and *Hordeum jubatum* (foxtail barley). Forb cover is minimal.

Ecological Processes

The *Scirpus nevadensis* association always occurs on saline soils and can tolerate a range of moisture conditions. Stands in the San Luis Valley tend to occur on drier sites than those in South Park. In the San Luis Valley this association is typically found above the zone of *Juncus balticus* var. *montanus* (mountain rush) where soils are periodically saturated, but flooding is rare; in South Park stands have seasonal standing water. Soils in South Park stands have extremely high salinity and low species diversity.

Avg. Cover %	(Range)	Species Name	# Plots (N=15)
21	(3-40%)	Scirpus nevadensis	15
9	(2-15%)	Spartina gracilis	6
6	(2-10%)	Juncus balticus var. montanus	5
6	(0.1-25%)	Triglochin maritimum	5
5	(2-10%)	Hordeum jubatum ssp. jubatum	3
Other species with < 5% average cover present in at least 10% of plots:			
Ranunculus cymbalaria (0.1-7%), Distichlis spicata (2.5-5%), Glaux maritima (0.1-10%), Schoenoplectus pungens (2-3%), Pyrrocoma lanceolata (1-2%), Cleome multicaulis (1-2%), Puccinellia nuttalliana (0.1-3%), Almutaster pauciflorus (1%).			

Nebraska sedge Herbaceous Vegetation

Carex nebrascensis



Global rank/State rank:

G4 / S3

HGM subclass: D2/3, S3/4

Colorado elevation range:

4,000-9,600 ft (1,220-2,930
m)

General Description

Carex nebrascensis (Nebraska sedge) is a widespread species and generally forms small- to medium-size meadows. It forms an open wetland meadow occurring along the margins of stream banks, lakes and seeps from the plains to the lower subalpine. The soils are generally saturated for much of the growing season and are subject to compaction by livestock.

This plant association appears to be restricted to saturated soils of flat floodplains bordering ponds or pools adjacent to stream channels. It can also occur along flat, marshy areas surrounding springs. Stream channels are low-gradient, moderately narrow, and sinuous or very narrow and sinuous. Soils are heavy clays and silty clay loams with high organic matter content. Anoxic conditions often occur within 8 inches (20 cm) of the surface either in the form of a gleyed layer or abundant mottling.

Vegetation Description

Carex nebrascensis (Nebraska sedge) forms the dominant cover and is the diagnostic species for this type. A wide variety of other graminoids and forbs may be present, depending on the elevation and moisture level of the site. Other graminoid species that can be abundant include *Eleocharis palustris* (common spikerush), *Carex praegracilis* (clustered field sedge), and *Schoenoplectus tabernaemontani* (softstem bulrush). Forb cover is generally low, but can be high in moist locations. Common forb species include *Ranunculus cymbalaria* (alkali buttercup), *Mentha arvensis* (wild mint), *Mimulus glabratus* (roundleaf monkeyflower), and *Melilotus officinalis* (yellow sweetclover).

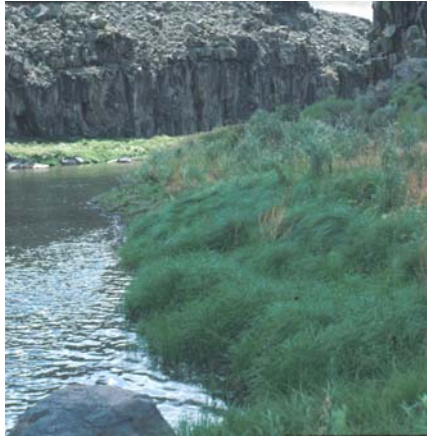
Ecological Processes

In Montana, the *Carex nebrascensis* (Nebraska sedge) type is considered a grazing-disclimax. Under season-long grazing, *Carex nebrascensis* increases in abundance, replacing former dominant species. However, under extreme grazing conditions and a resulting drop in the water table, *Juncus balticus* var. *montanus* (mountain rush) or *Poa pratensis* (Kentucky bluegrass) can eventually replace *Carex nebrascensis*. In Nevada, sites dominated by *Carex nebrascensis* are

considered the Potential Natural Community, which appears to be the case in undisturbed stands in Colorado.

Avg. Cover %	(Range)	Species Name	# Plots (N=74)
69	(5-100%)	Carex nebrascensis	74
12	(0.1-43%)	Eleocharis palustris	23
7	(0.1-60%)	Juncus balticus var. montanus	26
6	(0.1-15%)	Epilobium leptophyllum	7
5	(0.1-20%)	Veronica anagallis-aquatica	9
5	(1-15%)	Carex pellita	7
Other species with < 5% average cover present in at least 10% of plots:			
Epilobium ciliatum ssp. glandulosum (0.1-15%), Mentha arvensis (0.1-20%), Poa pratensis (0.1-15%), Agrostis gigantea (0.1-15%).			

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/wooly 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 lanuginosa* (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.

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%).			

Clustered field sedge Herbaceous Vegetation
Carex praeegracilis



Global rank/State rank:
G3G4 / S2

HGM subclass: S3/4

Colorado elevation range:
4,900-12,000 ft (1,500-3,650 m)

General Description

The *Carex praeegracilis* (clustered sedge) plant association forms small meadows in swales and along stream channels from the shortgrass prairie in eastern Colorado to alpine areas throughout the state.

This plant association occurs along small, shallow drainages, usually no more than 7-17 ft (2-5 m) wide. The stream banks are gentle and flat. Stream channels are wide and flat, with little sinuosity, low gradient (0.5-1%), and little to no floodplain development. Soils are deep and range from heavy clays to sandy clay loams with mottling.

Vegetation Description

In this plant association the vegetation completely covers the ground in narrow bands following the stream bed and is dominated by *Carex praeegracilis* (clustered sedge), with associated *Carex nebrascensis* (Nebraska sedge), *Eleocharis palustris* (common spikerush), and *Equisetum laevigatum* (smooth horsetail). Tree or shrub cover is minimal.

The *Carex praeegracilis* (clustered field sedge) plant association often occurs as the only vegetation type along small streams. It can occur with patches of *Carex nebrascensis* (Nebraska sedge) and *Pascopyrum smithii* (western wheatgrass) or patches of *Schoenoplectus pungens* (threesquare bulrush) and *Schoenoplectus acutus* (hardstem bulrush) in adjacent pools within the channel.

Ecological Processes

Little is known about the successional pattern of *Carex praeegracilis* (clustered sedge) dominated areas.

Avg. Cover %	(Range)	Species Name	# Plots (N=7)
55	(20-85%)	Carex praegracilis	7
30	(30-30%)	Spartina pectinata	2
15	(10-20%)	Carex utriculata	2
10	(10-10%)	Juncus longistylis	2
8	(5-11.9%)	Deschampsia caespitosa	4
8	(5-10%)	Cicuta douglasii	2
6	(1-15%)	Juncus balticus var. montanus	4
5	(1-10%)	Carex aquatilis	3
5	(5-5%)	Eleocharis palustris	2
Other species with < 5% average cover present in at least 10% of plots:			
Schoenoplectus acutus\tabernaemontani (1-3%), Poa pratensis (0.1-1%), Senecio hydrophilus (0.1-1%).			

Analogue sedge Herbaceous Vegetation
Carex simulata



Global rank/State rank:
G4 / S3

HGM subclass: S1/2

Colorado elevation range:
5,600-11,700 ft (1,700-3,560
m)

General Description

Carex simulata (analogue sedge) is found only on quaking fens in Colorado (occasionally may persist on drying fens). It is commonly found with many other sedge species, but its presence is associated with deep organic soils and a perennially high water table. *Carex simulata* (analogue sedge) fens are known from Larimer County south to the San Luis Valley, and are more or less restricted to the high mountain valleys in the central part of the state.

This community is located on saturated organic soils in moderate to wide valleys. The surface of the ground is hummocky, and “quakes” when walked or jumped on. Streams are low gradient and highly sinuous to broader and slightly steeper. Soils are deep, dark brown to black, 100% peat, saturated to the surface.

Vegetation Description

Graminoids dominate this meadow association with 90-100% vegetative cover. *Carex simulata* (analogue sedge) may not be the most abundant species, but it is always present, and serves as the indicator species for this association. A variety of other *Carex* (sedge) species may be present, and even more abundant, including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Carex nebrascensis* (Nebraska sedge). *Juncus balticus* var. *montanus* (mountain rush) and other graminoids may also be present. A variety of forbs may be inconspicuously present (total cover <10%). A few scattered shrubs, usually in stunted form, contribute little cover when present. They may include *Salix geyeriana* (Geyer willow), *Salix monticola* (mountain willow), and *Dasiphora floribunda* (shrubby cinquefoil).

Concentric rings or a mosaic of patches of other herbaceous wetland types can be adjacent and intermixed with *Carex simulata* (analogue sedge) fens. Herbaceous wetland plants include *Carex nebrascensis* (Nebraska sedge), *Carex utriculata* (beaked sedge) and *Juncus balticus* var. *montanus* (mountain rush).

Ecological Processes

Little is known about the successional processes of this plant association. Deep accumulations of peat suggest long-term stability. Changes in the natural hydrological regime have the potential to greatly affect the composition of this association.

Avg. Cover %	(Range)	Species Name	# Plots (N=33)
67	(5-90%)	Carex simulata	33
21	(1-45%)	Carex utriculata	4
16	(1-47%)	Carex aquatilis	10
11	(1-30%)	Carex nebrascensis	5
11	(1-28%)	Juncus balticus var. montanus	9
Other species with < 5% average cover present in at least 10% of plots:			
Deschampsia caespitosa (1-10%), Triglochin maritimum (1-10%), Eleocharis palustris (1-7%), Ranunculus cymbalaria (1-5%), Poa pratensis (1-5%), Pedicularis groenlandica (1-2%), Calamagrostis stricta (1-3%), Dodecatheon pulchellum (0.1-1%), Epilobium lactiflorum (0.1-1%).			

Inland saltgrass Herbaceous Vegetation
Distichlis spicata



Global rank/State rank:
G5 / S3

HGM subclass: F1

Colorado elevation range:
3,800-8,900 ft (1,150-2,700
m)

General Description

This plant association is characterized by sparse to thick stands of pure *Distichlis spicata* (inland saltgrass) growing on alkaline or saline soils in shallow basins, swales or on pond margins. This is a common association in Colorado, however, it has declined in abundance since European settlement. Large, pristine stands are virtually unknown. This association is threatened by agricultural conversion and groundwater development.

This plant association occurs on alkaline or saline soils (soils that have been formed from the accumulation of bases and soluble salts in poorly drained areas). This association occurs along narrow streams or the margins of playa lakes. Soil textures include sandy clay, sandy loam, or sandy clay loam with gravel and cobbles. The soils may be heavily gleyed and can have fine, distinct mottles at a depth of about 20 inches (50 cm).

Vegetation Description

This plant association is characterized by almost pure stands of *Distichlis spicata* (inland saltgrass) with up to 95% cover. Occasionally several clumps of *Ericameria nauseosa* ssp. *nauseosa* var. *glabrata* (rubber rabbitbrush) or *Sarcobatus vermiculatus* (black greasewood) can be present. In degraded stands, *Iva axillaris* (povertyweed) or *Bromus tectorum* (cheatgrass) can be present.

Ecological Processes

Distichlis spicata (inland saltgrass) is a warm season grass and grows from early summer until fall primarily from rhizomes. *Distichlis spicata* can tolerate low to moderately alkaline soils and is resistant to trampling by livestock. Cover of *Distichlis spicata* increases when grazing reduces competition from other plants, but eventually *Hordeum jubatum* (foxtail barley) or weedy species will take over if heavy grazing persists.

Avg. Cover %	(Range)	Species Name	# Plots (N=37)
45	(2-95%)	<i>Distichlis spicata</i>	37
13	(5-30%)	<i>Suaeda calceoliformis</i>	5
9	(5-10%)	<i>Puccinellia nuttalliana</i>	4
8	(2-10%)	<i>Iva axillaris</i>	6
5	(0.1-15%)	<i>Sporobolus airoides</i>	5
Other species with < 5% average cover present in at least 10% of plots:			
Schoenoplectus pungens (1-11.1%), Pascopyrum smithii (1-5%), Muhlenbergia asperifolia (0.1-6%), Juncus balticus var. montanus (1-8%), Hordeum jubatum ssp. jubatum (0.1-10%), Triglochin maritimum (0.1-5%), Cirsium arvense (0.1-5%).			

Needle spikerush Herbaceous Vegetation
Eleocharis acicularis

Global rank/State rank:
G4? / S3

HGM subclass: D2/3, D4/5

Colorado elevation range:
4,800-11,000 ft (1,460-3,350 m)

General Description

This association is characterized by diminutive, rhizomatous, very slender perennial graminoids that form dense tufts. The canopy cover can range from open (10%) to closed (85%). The association may be found on the edges of marshes, on muddy shores, and other wet places from the lowlands to high elevations in the western United States. Stands typically occur in wet basins, exposed pond bottoms, or concave areas in meadows or grasslands. Sites generally have a high water table throughout the growing season but are only occasionally or seasonally inundated. Widely fluctuating water tables are typical.

This plant association occurs in shallow playas on the northeastern plains of Colorado, and may also be found in intermittently flooded areas of the foothills, montane, and subalpine. Soils vary from fine to coarse, alluvial to colluvial; in the playa lakes they are often fine textured mineral soils with thick dark profiles.

Vegetation Description

Species diversity and vegetation cover are generally low in this association. *Eleocharis acicularis* (needle spikerush) usually provides more cover than other species (4-85%). Other species that may occur include *Eleocharis palustris* (common spikerush), *Pascopyrum smithii* (western wheatgrass), *Rorippa sinuata* (spreading yellowcress), *Marsilea vestita ssp. vestita* (hairy watercress), and *Ambrosia tomentosa* (skeletonleaf burr ragweed). Non-native graminoids include *Bromus japonicus* (Japanese brome) and *Echinochloa crus-galli* (barnyard grass).

Ecological Processes

Vegetation in this type is highly dependent on the hydrologic regime. Changing hydrologic conditions may result in changes to a more xeric or hydric vegetation type.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
36	(4-85%)	<i>Eleocharis acicularis</i>	10
19	(1-38%)	<i>Bromus japonicus</i>	2

Other species with < 5% average cover present in at least 10% of plots:
Buchloe dactyloides (1-7 %), *Ambrosia tomentosa* (2-4%), *Echinochloa crus-galli* (2-3%), *Pascopyrum smithii* (0.1-8%), *Marsilea vestita ssp. vestita* (0.1-3%), *Oenothera canescens* (0.1-2%), *Eleocharis palustris* (0.1-2%), *Rorippa sinuata* (0.1%), *Ratibida columnifera* (0.1%).

Common spikerush Herbaceous Vegetation
Eleocharis palustris



Global rank/State rank:
G5 / S4

HGM subclass: D2/3, D4/5,
S1/2

Colorado elevation range:
3,800-11,400 ft (1,150-3,500
m)

General Description

The *Eleocharis palustris* (common spikerush) plant association is a conspicuous, if small, common emergent association that occurs in shallow, mostly still water. Most of the sites where it occurs experience water levels that fluctuate to some degree throughout the growing season. It is recognized by the clear dominance, although sometimes sparse cover, of *Eleocharis palustris*. The largest known occurrence consists of broad concentric rings around a series of playa lakes at The Nature Conservancy's Mishak Lake Preserve in the San Luis Valley in south central Colorado.

This association occurs on wet sand bars and on finer substrates in backwater areas within the stream channel at low elevations and in shallow waters of ponds in montane and subalpine regions. This association often occurs along narrow, sinuous headwater rivulets where groundwater flow is lateral, primarily fed from toeslope seeps. High elevation stands consistently occur on organic soils, or on a thick organic horizon that overlies fine to coarse alluvial material. Lower elevation stands occur on fresh alluvial deposits of fine-textured loamy sands, clays, clay loams, and sandy clays.

Vegetation Description

This community can be very sparse to quite dense, but *Eleocharis palustris* (common spikerush) is always the dominant species, and the only species always present. Because the *Eleocharis palustris* (common spikerush) plant association occurs within a wide elevational range, the species composition can be quite variable, but this community is easily recognized by its single, low herbaceous canopy cover of bright green, nearly pure stands of *Eleocharis palustris* (common spikerush). Other species, when present, can contribute as much as 40% cover, but never exceed that of the *Eleocharis palustris*. On the Colorado Western Slope in low elevation stands, co-occurring species can include *Phalaris arundinacea* (reed canarygrass) and *Juncus balticus* var. *montanus* (mountain rush) as well as the introduced *Melilotus officinalis* (yellow sweetclover) and *Bromus inermis* (smooth brome). Other species may include *Sparganium angustifolium* (narrowleaf burreed), *Lemna* spp. (duckweed) and *Potamogeton* spp. (pondweed). On the eastern plains, co-occurring species can include *Leersia oryzoides* (rice cutgrass), *Schoenoplectus pungens* (threesquare bulrush), *Panicum virgatum* (switchgrass), *Carex pellita* (woolly sedge), and *Spartina pectinata* (prairie cordgrass).

At higher, montane elevations other graminoids present include *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), and *Deschampsia caespitosa* (tufted hairgrass). Forb cover is typically

low, but can occasionally be abundant in some stands. Common forb species include *Pedicularis groenlandica* (elephanthead lousewort), *Rhodiola integrifolia* (ledge stonecrop), and *Caltha leptosepala* (marsh marigold).

Ecological Processes

At lower elevations the *Eleocharis palustris* (common spikerush) plant association occurs well within the active channel and is inundated annually. This early seral community colonizes backwater eddies and shallow edges of slow moving reaches of small and larger rivers. It is probably an ephemeral community, scoured out each year during high spring flows. At montane elevations, this association occurs in ponded sites on faster moving streams. If siltation occurs, sites may become dominated by *Carex utriculata* (beaked sedge). At higher elevations, this association appears to be stable. It occurs near seeps on soils with deep organic layers, often sapric, and saturated throughout the growing season.

Avg. Cover %	(Range)	Species Name	# Plots (N=142)
47	(3-100%)	<i>Eleocharis palustris</i>	142
14	(0.1-63%)	<i>Agrostis gigantea</i>	12
8	(0.1-88%)	<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	32
6	(0.1-29%)	<i>Schoenoplectus pungens</i>	25
5	(1-15%)	<i>Beckmannia syzigachne</i>	11
5	(0.1-40%)	<i>Polygonum amphibium</i> var. <i>emersum</i>	12
Other species with < 5% average cover present in at least 10% of plots:			
Juncus balticus var. montanus (0.1-15%), Xanthium strumarium (0.1-15%), Schoenoplectus acutus/tabernaemontani (0.1-23%), Epilobium ciliatum ssp. glandulosum (0.1-15%), Argentina anserina (0.1-10%), Mentha arvensis (0.1-5%), Salix exigua (0.1-5%).			

Foxtail barley Herbaceous Vegetation
Hordeum (=Critesion) jubatum



Global rank/State rank:
G4 / S4

HGM subclass: D2/3, D4/5

Colorado elevation range:
5,400-7,700 ft (1,650-2,350
m)

General Description

Hordeum jubatum (foxtail barley) is a short-lived perennial native grass of wet meadows. Stands are common in Colorado but are rarely reported in the literature. Documented stands include a playa on the eastern plains, Cherry Creek near Denver and sites in La Plata, Alamosa and Saguache counties. These documented sites are low elevation shallow basins that may be either seasonally to permanently flooded (the D2/3 HGM subclass) or intermittently to temporarily flooded (D4/5). Intermittently flooded basins tend to be nearly flat; seasonally and permanently flooded basins typically are deeper and *Hordeum jubatum* occurs on pond edges, or in the drawdown zone. Soils are fine to coarse and poorly to very poorly drained. Soil salinity is variable. The soil surface may be covered with white salt crusts with moderately to strongly saline soils.

Vegetation Description

Vegetation in *Hordeum jubatum* meadows is sparse to dense with *Hordeum jubatum* making up 5 to 85% cover of documented stands. Associated species rarely contribute more than 15% cover. Species composition is highly variable between stands, reflecting the moisture and soil differences between sites. *Eleocharis palustris* (common spikerush) is present in about half the stands.

Stands may have an assortment of weedy annual or perennial forbs and graminoids, including *Polygonum* (knotweed) spp., *Echinochloa crus-galli* (barnyard grass), *Xanthium strumarium* (rough cocklebur), *Plantago major* (common plantain), *Erodium cicutarium* (redstem storksbill), *Convolvulus arvensis* (field bindweed), *Bromus japonicus* (Japanese brome), *Chenopodium album* (lambsquarters) and numerous others.

Wetter sites adjacent to *Hordeum jubatum* stands are often open water. Surrounding uplands can be dominated by a variety of grasslands or shrublands.

Ecological Processes

Hordeum jubatum is a common, short-lived pioneer species. It may represent a seral stage that will be taken over by more permanent grasses as conditions change. It is moderately salt tolerant and can densely colonize areas disturbed by flooding along drainages, around playas, and more permanent ponds. Often around playas, this association occupies a zone of intermediate salinity

between halophytic vegetation dominated by *Distichlis spicata* (inland saltgrass), *Puccinellia nuttalliana* (= *airoides*) (Nuttall alkaligrass), or *Salicornia rubra* (red swampfire), and non-saline mesic prairie vegetation dominated by *Pascopyrum smithii* (western wheatgrass), *Poa* spp. (bluegrass), or *Elymus* spp (wild rye). Vegetation cover, species composition, and soil salinity, as well as the direction of succession of this type, depend on the amount and timing of precipitation and flooding.

Avg. Cover %	(Range)	Species Name	# Plots (N=13)
37	(5-85%)	<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	13
20	(2-37%)	<i>Polygonum douglasii</i>	2
9	(2-15%)	<i>Scirpus pallidus</i>	2
9	(2-15%)	<i>Alopecurus aequalis</i>	2
6	(2-15%)	<i>Echinochloa crus-galli</i>	5
5	(2-15%)	<i>Eleocharis palustris</i>	6
Other species with < 5% average cover present in at least 10% of plots:			
<i>Polygonum arenastrum</i> (2%), <i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i> (2%), <i>Veronica anagallis-aquatica</i> (2%), <i>Xanthium strumarium</i> (1-2%), <i>Plantago major</i> (1-2%), <i>Conyza canadensis</i> (0.1-2%), <i>Salix amygdaloides</i> (0.1-2%), <i>Rumex salicifolius</i> var. <i>mexicanus</i> (0.1%).			

Mountain rush Herbaceous Vegetation

Juncus balticus var. *montanus*



Global rank/State rank:

G5 / S5

HGM subclass: D2/3,

D4/5, S3/4, R3/4

Colorado elevation range:

4,900-10,000 ft (1,500-
3,050 m)

General Description

This plant association occurs as small, dense patches on flat stream benches, along overflow channels, near springs, and around ponds. It is characterized by a dense sward of *Juncus balticus* var. *montanus* (mountain rush) and often minor cover of *Carex* (sedge) species. Forb cover is generally low. This association is often considered to be a grazing-induced community since it is not palatable to livestock and increases with grazing.

Adjacent stream channels are highly variable and can be narrow and deeply entrenched, moderately wide and moderately sinuous, moderately wide and very sinuous, narrow and very sinuous, or braided. Soil textures are also variable. They range from sandy and well drained, to silty clay loams, to pure organic matter, however most stands occur on coarse-textured sandy loams with a high percentage of cobbles and gravel. Mottles or gleyed horizons are often present.

Vegetation Description

This plant association is very easy to recognize with its band of dark green following the channel path or surrounding depressions. *Juncus balticus* var. *montanus* (mountain rush) is the dominant and indicator species for this community. Because it occurs over a broad elevational and latitudinal range in Colorado, associated species are variable. Some of the more frequently encountered species include *Carex aquatilis* (water sedge), *Carex praegracilis* (clustered field sedge), *Carex utriculata* (beaked sedge), *Glyceria striata* (fowl mannagrass), *Distichlis spicata* (inland saltgrass) and *Eleocharis palustris* (common spikerush).

Forb cover is usually minor, and may include *Argentina anserina* (silverweed cinquefoil), *Achillea millefolium* var. *occidentalis* (western yarrow), *Mentha arvensis* (wild mint) or *Trifolium* spp. (clover). Degraded stands and grazing-induced stands of *Juncus balticus* var. *montanus* (mountain rush) can have high abundance of *Agrostis gigantea* (redtop), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), and *Taraxacum officinale* (dandelion). Occasionally, a few tree or shrub seedlings may be present with 3-15% cover, including *Populus angustifolia* (narrowleaf cottonwood), *Dasiphora floribunda* (shrubby cinquefoil), and *Salix exigua* (sandbar willow).

Ecological Processes

In low-disturbance areas, this plant association appears to be a stable, climax community, often persisting in the absence of wetland conditions. It occupies frequently inundated swales and wet, low- to mid-elevation sites. However, in some areas, this association is considered to be grazing-induced. *Juncus balticus* var. *montanus* (mountain rush) is considered an increaser due to its low

forage value and high tolerance to grazing. It usually increases in abundance on sites formerly dominated by *Deschampsia caespitosa* (tufted hairgrass) or *Calamagrostis canadensis* (bluejoint reedgrass). Nearly pure stands of *Juncus balticus* var. *montanus* (mountain rush) indicate that the site may have been heavily grazed in the past.

Avg. Cover %	(Range)	Species Name	# Plots (N=178)
54	(1-100%)	<i>Juncus balticus</i> var. <i>montanus</i>	178
19	(0.1-63%)	<i>Agrostis gigantea</i>	24
17	(1-55%)	<i>Argentina anserina</i>	67
16	(0.1-85%)	<i>Poa pratensis</i>	60
9	(0.1-40%)	<i>Carex praegracilis</i>	34
9	(1-25%)	<i>Carex simulata</i>	20
8	(0.1-30%)	<i>Deschampsia caespitosa</i>	67
8	(0.1-45%)	<i>Phleum pratense</i>	27
7	(0.1-30%)	<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	40
6	(0.1-20%)	<i>Plantago eriopoda</i>	24
6	(0.1-15%)	<i>Dasiphora floribunda</i>	18
5	(0.1-30%)	<i>Iris missouriensis</i>	28
5	(0.1-30%)	<i>Taraxacum officinale</i>	48

Other species with < 5% average cover present in at least 10% of plots:
Poa secunda (0.1-10%), *Potentilla gracilis* (0.1-10%), *Juncus longistylis* (1-15%), *Elymus trachycaulus* ssp. *trachycaulus* (0.1-25%), *Mentha arvensis* (0.1-25%), *Triglochin maritimum* (0.1-15%), *Pedicularis crenulata* (0.1-15%), *Calamagrostis stricta* (0.1-15%), *Achillea millefolium* var. *occidentalis* (0.1-15%), *Crepis runcinata* ssp. *runcinata* (0.1-10%).

Alkali muhly Herbaceous Vegetation
Muhlenbergia asperifolia

Global rank/State rank:
G3? / S3?

HGM subclass: F1, R5

Colorado elevation range:
3,450-5,950 ft (1,050-1,800
m)

General Description

The *Muhlenbergia asperifolia* (alkali muhly) plant association occurs as small, patchy meadows or strips of grass along stream courses and low-lying swales associated with alkaline soils. It occurs in nearly pure stands in saline or alkaline bottomlands where the water table is high.

Associated stream channels were sandy braided systems or meandering, low gradient, broad rivers. This association also occurs in low swales away from riparian areas, and can be found in brackish marshes and roadside ditches. Soils are deep (20-24 in, 50-60 cm) silty clays and sand over sandy loams.

Vegetation Description

Stands of this grassland are small and open, with a generally patchy nature. *Muhlenbergia asperifolia* (alkali muhly) is the dominant graminoid. Other graminoids that may be present include *Spartina gracilis* (alkali cordgrass), *Eleocharis palustris* (common spikerush), *Elymus canadensis* (Canada wildrye). *Bromus tectorum* (cheatgrass) and *Iva axillaris* (povertyweed) may also be present, indicating the site has been disturbed in the recent past.

The surrounding riparian area may include *Scirpus* (bulrush) marshes, *Salix exigua* (sandbar willow) or *Tamarix ramosissima* (saltcedar) shrublands, young *Populus deltoides* (cottonwood) thickets on lower terraces and streambanks, and older, widely spaced, mature cottonwoods on upper terraces.

Ecological Processes

Little information is available on the successional status of this plant association. *Muhlenbergia asperifolia* (alkali muhly) is an indicator of saline or alkaline soil conditions. It appears to be an early-seral community as it occurs in moist alkaline meadows, margins of playa lakes and streams. It invades newly disturbed roadsides and alluvial deposits.

Avg. Cover %	(Range)	Species Name	# Plots (N=10)
44	(10-88%)	Muhlenbergia asperifolia	9*
31	(15-63%)	Eleocharis palustris	3
17	(0.1-38%)	Distichlis spicata	4
6	(1-10%)	Iva axillaris	2
5	(0.1-15%)	Cirsium arvense	3
5	(1-15%)	Schoenoplectus pungens	4
5	(2-7%)	Elymus canadensis	2

Other species with < 5% average cover present in at least 10% of plots:

Glycyrrhiza lepidota (1-5%), Artemisia tridentata (1-5%), Castilleja miniata (0.1-5%), Polypogon monspeliensis (1-5%), Helianthus annuus (1-4%), Hordeum jubatum ssp. jubatum (1-5%), Melilotus officinalis (1-2%), Medicago sativa (0.1-3%), Tamarix ramosissima (1%), Chenopodium album (1%), Equisetum laevigatum (1%), Epilobium ciliatum ssp. glandulosum (0.1-1%), Sonchus asper (0.1-1%), Asclepias speciosa (0.1-1%), Rumex crispus (0.1-1%).

* Muhlenbergia asperifolia occurred in all stands, but was not captured in every sample plot.

Knotweed spp. - Mesic Graminoid Herbaceous Vegetation
***Polygonum* spp. - Mesic Graminoid**



Global rank/State rank:
Not Applicable

HGM subclass: D4/5

Colorado elevation range:
5,280-6000 ft (1,610-1830 m)

General Description

This is a small patch type at lower elevations along the edges of reservoirs, lakes, ponds, marshes, swales, and other low areas. This ephemeral pond community type occurs widely throughout the Midwestern region of the United States. Stands occur in shallow depressions that may flood for several weeks in the spring, then draw down during the summer. The community may be found in low spots on the plains or in depressions on floodplains.

Soils include most textures from fine clays to sandy loams. The dominant plants of the association are usually intolerant of alkaline or saline conditions.

Vegetation Description

One or two species of *Polygonum* (knotweed), usually introduced species, typically dominate this type with sparse to dense cover (15-98%). Dominants are usually *Polygonum lapathifolium* or *Polygonum arenastrum*, and other knotweed species including *Polygonum hydropiper* and *Polygonum douglasii* may also be present in minor amounts.

Associated species are often introduced and are highly variable from stand to stand. Graminoids tend to be more common than forbs. The most commonly occurring graminoid species include *Echinochloa crus-galli* (barnyard grass), *Hordeum jubatum* (foxtail barley), *Alopecurus aequalis* (shortawn foxtail) and *Eleocharis palustris* (common spikerush). Common forbs include *Xanthium strumarium* (rough cocklebur) and *Rumex salicifolius* var. *mexicanus* (willow dock).

Ecological Processes

Polygonum (knotweed) species are aggressive invaders of shallow water and exposed mud flats. Shore vegetation tends to be a mosaic or bands of short-lived plant communities that survive or disappear depending on water depth in the basin. The vegetation is composed of mostly early successional species that become established when water levels are low. When the shore is inundated for longer periods, some species may be eliminated, but the *Polygonum* species are usually tolerant of longer periods of flooding.

In some areas of the Midwest this association supports rare marsh vegetation. Associated ephemeral ponds may be very important for certain amphibians and invertebrates.

Avg. Cover %	(Range)	Species Name	# Plots (N=16)
64	(2-97%)	Polygonum lapathifolium	9
26	(15-37%)	Polygonum arenastrum	8
13	(2-37%)	Hordeum jubatum ssp. jubatum	6
9	(2-37%)	Echinochloa crus-galli	9
Other species with < 5% average cover present in at least 10% of plots:			
Xanthium strumarium (2%), Alopecurus aequalis (1-2%), Rumex salicifolius var. mexicanus (1-2%), Eleocharis palustris (0.1-2%).			

Nuttall alkaligrass Herbaceous Vegetation
Puccinellia nuttalliana (=airoides)



Global rank/State rank:
G3? / S3

HGM subclass: F1

Colorado elevation range:
4,950-9,500 ft (1,510-2,900
m)

General Description

Puccinellia nuttalliana (Nuttall alkaligrass) forms a short grassland (15-30 in, 4-8 dm) with small amounts of forbs and other grasses present. *Puccinellia nuttalliana* needs moist soils of intermediate salinity in seasonally wet meadows. The topography of the area is generally flat, with poor drainage. Much of the ground surface may be bare.

This association is generally found on flat, seasonally wet meadows with fine soil. These moist soils are saline and alkaline and in South Park, Colorado are derived from calcareous shales. The soils usually dry out during the growing season. Soils are generally fine colluvial material and range in moisture from dry to permanently wet.

Vegetation Description

Puccinellia nuttalliana (Nuttall alkaligrass) is the characteristic and diagnostic species of this association, and is always present. Cover values range from 5-100%. It is usually the dominant species, but in a few plots was secondary to *Spergularia maritima* (media sandspurry) or *Trifolium pratense* (red clover). Associated species are usually herbaceous, and commonly include *Hordeum jubatum* ssp. *jubatum* (foxtail barley), *Triglochin maritimum* (seaside arrowgrass) and *Spergularia maritima* (media sandspurry).

Ecological Processes

In playas, salt flats and saline lakes this community forms a ring around concentrated stands of species that are more tolerant of inundation. In this type of community it is common for *Puccinellia nuttalliana* (Nuttall alkaligrass) to dominate the graminoid layer. *Distichlis spicata* (inland saltgrass) or *Hordeum jubatum* (foxtail barley) can co-dominate some stands. *Hordeum jubatum* can replace *Puccinellia nuttalliana* if a stand receives prolonged disturbance.

Avg. Cover %	(Range)	Species Name	# Plots (N=20)
50	(5-100%)	Puccinellia nuttalliana	20
46	(10-90%)	Spergularia maritima	4
9	(3-25%)	Hordeum jubatum ssp. jubatum	10
9	(0.1-20%)	Triglochin maritimum	4
8	(5-10%)	Distichlis spicata	2
8	(5-10%)	Iva axillaris	2
Other species with < 5% average cover present in at least 10% of plots:			
Suaeda calceoliformis (2-7%), Muhlenbergia asperifolia (2-3%), Ranunculus cymbalaria (0.1-1%).			

Black greasewood / Barren ground Shrubland
***Sarcobatus vermiculatus* / Barren ground**



Global rank/State rank:
GU / S2

HGM subclass: F1

Colorado elevation range:
7,500-7,700 ft (2,280-2,350
m)

General Description

Sarcobatus vermiculatus (black greasewood) forms expansive shrublands on alkaline soils with a perennially high water table in southern and western Colorado. Stands of this long-lived deciduous shrub are patchy in western Colorado and are extensive in the San Luis Valley. This association of almost pure greasewood with very little understory has been documented only from the San Luis Valley and North Park. The community typically has an open canopy and extensive bare ground with a hard crusty surface and a deposit of salts during the dry season.

The *Sarcobatus vermiculatus* (black greasewood) plant association occurs where the water table is close to the surface of the soil for a large portion of the growing season and where the soil salinity is high. *Sarcobatus vermiculatus* is an indicator of saline-sodic or relatively moist soils, and grows on clay-loam, silt-loam, or deep, fine sandy loam soils with high salinity or alkalinity.

Vegetation Description

Sarcobatus vermiculatus (black greasewood) typically forms an open shrubland community with 20-60% cover. The understory is primarily bare ground, although sparse cover of *Suaeda calceoliformis* (Pursh seepweed) or *Spartina gracilis* (alkali cordgrass) may be present. One stand also had 3% cover of the rare *Cleome multicaulis* (slender spiderflower).

Ecological Processes

Sarcobatus vermiculatus (black greasewood) shrublands are long-lived and self-perpetuating. Seedlings can survive under parent shrubs, despite high levels of salinity. Seeds germinate during spring runoff when surface moisture dilutes salinity.

Sarcobatus vermiculatus may occur as a band of vegetation around a salt flat or depression. This visible zonation is caused by the relative tolerances to soil salinity and depth to groundwater of the dominant species. Soil characteristics may also play a role in the mosaic of shrub species on the landscape.

In the San Luis Valley, the effects of groundwater pumping and surface water diversions have the potential to be detrimental to the persistence of this association.

Avg. Cover		Species Name	# Plots (N=4)
%	(Range)		
36	(20-62.5%)	Sarcobatus vermiculatus	4
26	(15-37.5%)	Suaeda calceoliformis	2
Other species with < 5% average cover present in at least 10% of plots:			
Spartina gracilis (2-5%), Cleome multicaulis (3%).			

Black greasewood / Inland saltgrass Shrubland
Sarcobatus vermiculatus / *Distichlis spicata*



Global rank/State rank:
G4 / S2

HGM subclass: F1

Colorado elevation range:
5,500-7,650 ft (1,700-2,300
m)

General Description

Sarcobatus vermiculatus (black greasewood) forms expansive shrublands on alkaline soils with a perennial high water table in southern and western Colorado. In the San Luis valley, it grows between playa lakes on sandy hummocks. The shrubs are 2-4 ft (0.6-1.2 m) tall and usually have non-overlapping canopies. The understory is sparse, open herbaceous cover of *Distichlis spicata* (inland saltgrass) and other salt tolerant species.

This community occurs on the highest ground between salt flat depressions called playa lakes in the northern part of the San Luis Valley. The shrubs occur on hummocks, approximately 4 ft (1.2 m) above the lake bed. Soils are deep, fine-textured sandy loams to clay loams. The surface soil is very hard when dry, but the subsurface soils, below 12 in (30 cm), are of a friable loamy texture.

Vegetation Description

The shrub canopy is fairly open with 18-30% cover of *Sarcobatus vermiculatus* (black greasewood). *Ericameria nauseosa* ssp. *nauseosa* var. *glabrata* (rubber rabbitbrush) may also occur. The herbaceous understory is a dry carpet of *Distichlis spicata* (inland saltgrass) with up to 40% cover. Other graminoid species which may be present are *Juncus balticus* var. *montanus* (mountain rush) and *Spartina gracilis* (alkali cordgrass). Forb cover is minimal.

Ecological Processes

Sarcobatus vermiculatus (black greasewood) and other salt flat vegetation often occur as bands or rings of species around a salt flat or depression. This visible zonation is caused by the change in dominant species and their relative tolerances to soil salinity and depth to groundwater. Soil characteristics may also play a role in the mosaic of shrub species on the landscape.

In the San Luis Valley, a large playa lake ecosystem supports the largest and most pristine example of *Sarcobatus vermiculatus* (black greasewood) shrublands in the state. The playas are ephemeral to perennial shallow lakes, depending on the variation in the annual precipitation.

Sarcobatus vermiculatus (black greasewood) shrublands are long-lived, self-perpetuating communities. Seedlings can survive under parent shrubs, where salinity is the highest. Seeds

germinate in spring when surface soils are wet with spring runoff, and the salinity is most diluted. Although characteristic of desert climates, greasewood cannot tolerate droughts and grows only at the edges of lakes or arroyos or in sites with at high water table. Greasewood has salt glands adapted for excreting excess salts, often increasing the soil salinity over time.

Avg. Cover		Species Name	# Plots (N=7)
%	(Range)		
25	(18-30%)	<i>Sarcobatus vermiculatus</i>	7
25	(10-40%)	<i>Distichlis spicata</i>	7
11	(1-20%)	<i>Spartina gracilis</i>	2
8	(5-10%)	<i>Ericameria nauseosa</i> ssp. <i>nauseosa</i> var. <i>glabrata</i>	2
6	(3-8%)	<i>Juncus balticus</i> var. <i>montanus</i>	2
Other species with < 5% average cover present in at least 10% of plots:			
<i>Suaeda calceoliformis</i> (2%), <i>Lepidium latifolium</i> (1%), <i>Almutaster pauciflorus</i> (1%), <i>Lepidium alyssoides</i> (0.1-2%).			

Hardstem bulrush Herbaceous Vegetation
Schoenoplectus acutus var. *acutus*



Global rank/State rank:
G5 / S4

HGM subclass: D2/3, D4/5?

Colorado elevation range:
4,300-10,000 ft (1,300-3,050
m)

General Description

The *Schoenoplectus acutus* var. *acutus* (hardstem bulrush) plant association occurs in marshes, along the margins of lakes and ponds, and in backwater areas of rivers in water up to 3 ft (1 m) deep. This association occurs in small patches, below 10,000 ft (3,050 m). It is highly threatened by development, agricultural conversion, stream flow alterations, and wetland filling activities.

The *Schoenoplectus acutus* var. *acutus* (hardstem bulrush) plant association occurs in wet swales and overflow channels with standing water. It also occurs at the edges of beaver ponds, ditches, and railroad embankments. One stand occurred on a saturated floodplain where a perched water table emerged from the surrounding bedrock. Streams are large and slightly meandering. Soils of this association are deep heavy clays and silty loams with a high organic matter content. Soils remain saturated for most of the growing season and often have an anoxic gleyed layer within 20 inches (50 cm) of the soil surface, although the water table can drop as far as 3 ft (1 m) below the surface.

Vegetation Description

This association is characterized by nearly pure stands of *Schoenoplectus acutus* var. *acutus* (= *Scirpus acutus*) (hardstem bulrush) and/or *Schoenoplectus tabernaemontani* (= *Scirpus tabernaemontani*) (softstem bulrush), with a few other wetland species that may include *Eleocharis palustris* (common spikerush), *E. rostellata* (beaked spikerush), *Mimulus guttatus* (seep monkeyflower), *Sagittaria* spp. (arrowhead), *Carex* spp. (sedge), and *Nuphar lutea* ssp. *polysepala* (Rocky Mountain pondlily).

Other emergent wetland vegetation is commonly found with this plant association, such as stands of *Typha* spp. (cattail) and other *Scirpus* or *Schoenoplectus* spp. (bulrush species). Within the riparian zone, *Populus deltoides* (cottonwood) and *Salix amygdaloides* (peachleaf willow) may be present on the floodplain. On the open prairies along small streams, adjacent riparian vegetation types include stands of *Carex nebrascensis* (Nebraska sedge).

Ecological Processes

Schoenoplectus spp. (bulrush) stands are generally considered permanent wetland communities. They will remain in place unless the hydrologic regime is severely altered. Stands of *Schoenoplectus* are important to wildlife species, especially birds, for cover and nesting habitat.

Avg. Cover %	(Range)	Species Name	# Plots (N=29)
77	(5-100%)	Schoenoplectus acutus\tabernaemontani	29
12	(1-38%)	Typha latifolia	8
9	(1-30%)	Eleocharis palustris	10
8	(0.1-38%)	Rorippa palustris ssp. hispida	5
7	(1-15%)	Rorippa nasturtium-aquaticum	3
6	(0.1-15%)	Lemna minor	4
5	(0.1-15%)	Epilobium ciliatum ssp. glandulosum	7
Other species with < 5% average cover present in at least 10% of plots:			
Hippuris vulgaris (1-5%), Mentha arvensis (1%), Ranunculus cymbalaria (1%).			

Cosmopolitan bulrush Herbaceous Vegetation
Schoenoplectus maritimus (= *Bolboschoenus maritimus*)



Global rank/State rank:
 G4 / S2

HGM subclass: F1

Colorado elevation range:
 3,800-8,950 ft (1,150-2,700 m)

General Description

This wetland plant association often occurs in standing water. The vegetation is characterized by a sparse cover of *Schoenoplectus maritimus* (cosmopolitan bulrush), few associated species and mostly open water. Livestock grazing is limited in this association due to the wet conditions.

This plant association occurs in wet swales and along narrow channels, spring-fed creeks, and back-water eddies of larger rivers.

Vegetation Description

Schoenoplectus maritimus dominates this sparsely vegetated wetland with 15-60% cover. Associated species can include *Salix exigua* (sandbar willow) and *Muhlenbergia asperifolia* (alkali muhly).

Adjacent riparian areas may support *Juncus balticus* var. *montanus* (mountain rush) wetlands, *Salix exigua* (sandbar willow) shrublands, and *Populus deltoides* (cottonwood) forests

Ecological Processes

Schoenoplectus maritimus (cosmopolitan bulrush) is an early colonizer and is able to persist under wet conditions. The wet conditions limit most forms of disturbance to this plant association.

Schoenoplectus maritimus helps filter sediments to build stream banks. This species is a prolific seed producer. Its rhizomes spread quickly into exposed areas and colonize mudflats and drawdown areas.

Avg. Cover %	(Range)	Species Name	# Plots (N=3)
32	(14-60%)	<i>Schoenoplectus maritimus</i>	3
25	—	<i>Melilotus officinalis</i>	1
20	—	<i>Salix exigua</i>	1
20	—	<i>Argentina anserina</i>	1
6	(1-10%)	<i>Muhlenbergia asperifolia</i>	2
5	—	<i>Puccinellia nuttalliana</i>	1
5	—	<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	1
5	—	<i>Equisetum arvense</i>	1
Other species with < 5% average cover present in at least 10% of plots:			
<i>Suaeda calceoliformis</i> (3%).			

Common threesquare Herbaceous Vegetation
Schoenoplectus pungens



Global rank/State rank:
G3G4 / S3

HGM subclass: D2/3

Colorado elevation range:
3,800-7,800 ft (1,050-2,400
m)

General Description

The *Schoenoplectus pungens* (= *Scirpus pungens*) (threesquare bulrush) plant association forms small low stature (1-3 ft, 0.3-1 m) marshes in low-lying swales, abandoned channels, and overflow channels where soils remain saturated. This association is characterized by pure stands of *Schoenoplectus pungens*, occasionally associated with a few other graminoid species.

This association also occurs on silt and sand bars within the active channel where the water velocity is lowest. Soils from the Colorado River Basin are black, anoxic, organic soils and gleyed, clay-loam, alkaline soils.

Vegetation Description

This plant association can be pure stands of *Schoenoplectus pungens* (threesquare bulrush). Some stands include other graminoids such as *Juncus balticus* var. *montanus* (mountain rush), *Hordeum jubatum* (foxtail barley), *Phragmites australis* (common reed), *Spartina gracilis* (alkali cordgrass), *Muhlenbergia asperifolia* (alkali muhly), and *Eleocharis palustris* (common spikerush). On alkaline soils, *Distichlis spicata* (inland saltgrass) is a common associate.

Ecological Processes

Schoenoplectus pungens (threesquare bulrush) is an early colonizer and is adapted to saturated conditions on streamsides, sandy shores, marshes, and reservoir margins. Because of the wet soil conditions and aggressive growth of *Schoenoplectus pungens*, most other species are precluded from the sites. Disturbance can cause the establishment of increaser species such as *Juncus balticus* var. *montanus* (mountain rush) and *Hordeum jubatum* (foxtail barley). Lowering the water table may dry the site and result in decreased cover of *Schoenoplectus pungens*. An increase in salinity may increase alkaline tolerant species.

Avg. Cover %	(Range)	Species Name	# Plots (N=94)
59	(6.5-100%)	Schoenoplectus pungens	94
19	(1-62%)	Agrostis gigantea	26
19	(0.1-90%)	Eleocharis palustris	34
14	(1-38%)	Juncus balticus var. montanus	21
9	(0.1-80%)	Mentha arvensis	17
5	(0.1-37%)	Hordeum jubatum ssp. jubatum	31
5	(1-15%)	Polygonum douglasii	9
Other species with < 5% average cover present in at least 10% of plots:			
Schoenoplectus acutus\tabernaemontani (0.1-10%), Lycopodium americanus (0.1-15%), Cirsium arvense (0.1-25%), Epilobium ciliatum ssp. glandulosum (0.1-15%), Muhlenbergia asperifolia (0.1-10%), Typha latifolia (1-5%).			

Pursh seepweed Herbaceous Vegetation
Suaeda calceoliformis

Global rank/State rank:
GU / S2

HGM subclass: F1

Colorado elevation range:
5,600-9,400 ft (1,700-2,870
m)

General Description

This plant association has been described from seasonally flooded, alkaline or saline mud flats near Antero Reservoir in South Park, the San Luis Valley, and Arapahoe County. In Montana, the association has been described as also occurring in seeps, basins, swales, and on pond and lake margins. The association is characterized by dominance of the annual forb *Suaeda calceoliformis* (Pursh seepweed) and bare soil often covered with white salt crusts. Other species may occur, but the seasonally deep water and the high salinity limit the species that can occur.

This plant association occurs in nearly level, seasonally flooded sites. Soils are generally poorly drained, ranging from fine clay soils to silt loams. The association tolerates highly alkaline and saline conditions.

Vegetation Description

Suaeda calceoliformis (Pursh seepweed) may occur as a near monoculture or with other species. *Suaeda calceoliformis* cover values range from 25 to 70%. Other species that may be present include *Puccinellia airoides* (Nuttall alkaligrass), *Hordeum jubatum* (foxtail barley), *Triglochin maritima* (seaside arrowgrass), and *Salicornia rubra* (red swampfire). The rare plant, *Thellungiella salsuginea* (salt-lick mustard) may be associated with these sites.

Ecological Processes

Suaeda calceoliformis (Pursh seepweed) is an annual species and may be much more abundant in some years than in others, depending mainly on moisture conditions. Associations occupying these sites may change as salinity and alkalinity and hydrologic regime change.

Avg. Cover			# Plots
%	(Range)	Species Name	(N=4)
54	(25-70%)	<i>Suaeda calceoliformis</i>	4
15	(10-20%)	<i>Salicornia rubra</i>	2
10	—	<i>Triglochin maritimum</i>	1
6	(1-10%)	<i>Puccinellia nuttalliana</i>	2
5	—	<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	1
Other species with < 5% average cover present in at least 10% of plots:			
<i>Schoenoplectus pungens</i> (3%).			

Cattail Herbaceous Vegetation

Typha angustifolia - *Typha latifolia* - (*Typha domingensis*)



Global rank/State rank:

G5 / S4

HGM subclass: D2/3, D4/5?

Colorado elevation range:

3,900-8,900 ft (1,530-3,500 m)

General Description

The *Typha angustifolia*-*Typha latifolia*-(*Typha domingensis*) (cattail) plant association is a commonly seen tall, dark green community growing in 2-4 feet of standing water. It is found in the shallow edges of ponds and lakes, and can occur in backwaters of larger river floodplains. This association is a common wetland community occurring throughout the western and midwestern states.

This plant association occurs in standing water at least 1 foot (0.3 m) in depth, although it will persist during drier periods. It is found along the margins of beaver ponds, overflow channels, backwater sloughs, floodplain swales, drainage ditches, behind railroad embankments, and any place where water collects and remains for two-thirds of the growing season. This association can be found on nearly every type of stream channel, but typically along meandering, low gradient streams. Soils are deep, heavy silty clay loam and organic mucks. Some profiles have 10-30% coarse material and are fairly well drained, others remain anoxic throughout most of the year.

Vegetation Description

Typha angustifolia (narrowleaf cattail) and/or *Typha latifolia* (broadleaf cattail) forms near-monotypic (70-85%) stands between 3 and 6 feet tall (1-2 m). *Typha domingensis* (southern cattail) is much less common than the other two species. It may or may not be present and is restricted to Western Slope stands. *Schoenoplectus acutus* and *Schoenoplectus tabernaemontani* are common associates. Other species which may be present include *Potamogeton* (pondweed) spp., *Spartina pectinata* (prairie cordgrass), and *Veronica* (speedwell) spp.

Ecological Processes

Typha angustifolia (narrowleaf cattail) occupies inundated and disturbed grounds and can tolerate deeper water and higher alkalinity levels than *T. latifolia* (broadleaf cattail). *Typha* species are prolific seed producers, spreading rapidly to become the early colonizers of wet mineral soil, and will persist under wet conditions. The roots and lower stems are well adapted to prolonged submergence but germination and establishment require periods of drawdown to expose bare soil.

This association may be declining in Colorado. It is threatened by development, wetland draining, and stream flow alterations. However it is also a natural invader to newly created wetlands, and will appear in newly ponded areas on its own.

Avg. Cover %	(Range)	Species Name	# Plots (N=107)
75	(0.1-100%)	Typha latifolia	97
55	(2 -99%)	Typha angustifolia	18
36	(0.1-85%)	Lemna minor	23
17	(1-88%)	Eleocharis palustris	22
9	(0.1-37%)	Schoenoplectus acutus\tabernaemontani	36
7	(0.1-62%)	Polygonum lapathifolium	12
6	(0.1-37%)	Epilobium ciliatum ssp. glandulosum	27
5	(0.1-20%)	Schoenoplectus pungens	12
Other species with < 5% average cover present in at least 10% of plots:			
Scirpus pallidus (0.1-10%).			

Raw Field Data

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
1		Typ lat	Jun bal	Che gla	Dis spi	Ele pal			
2	north	Dis spi	Sch pun	Jun bal					
2	south	Ele pal	Typ lat	open water	Jun bal	Dis spi			
3		open water	Typ lat	Sch lac					
4		Typ lat	Jun bal	Sar ver/Dis spi	Ele aci	Cal str			Yes
5	north	Jun bal	Typ lat	Cal str					
5	south	Jun bal	Dis spi	Amp nev	Sar ver/Dis spi				Yes
6		Typ lat	Jun bal	open water	Dis spi	Ele pal			
7		Sch lac	Jun bal	open water	Typ lat	Car sim	Yes		
8		open water	Jun bal	Typ lat	Ele pal				
9		Typ lat	open water	Sch lac	Jun bal	Sar ver/Dis spi		Yes	
10		Typ lat	open water	Ele pal	Sch lac	Cal str			Yes
11	south	Dis spi	Lep lat	Sar ver/Dis spi	Jun bal			Yes	Yes
11	north	Ele pal	Jun bal	Pol spp.	Sch lac	Hor jub		Yes	Yes
12		open water	Typ lat	Sch lac	Ele pal	Car sim	Yes	Yes	
13		open water	Typ lat	Ele pal	Jun bal	Sch lac		Yes	
14		open water	Typ lat	Car neb	Jun bal	Ele pal		Yes	
15		Typ lat	open water	Jun bal	Dis spi	Ele pal			
16		open water	Amp nev	salt crust	Dis spi	Sch lac			
17		open water	Typ lat	Cal str	Sch lac				
18		Typ lat	open water	Ele pal	Amp nev	Sar ver/Dis spi	Yes		
19		Ele pal	Typ lat	Sch lac	open water	Cal str		Yes	
20		salt crust	open water	Sch mar	Dis spi	Ele pal			
21		Sch mar	Dis spi	salt crust	open water	Sar ver/Dis spi			
22		salt crust	Sch mar	Dis spi	Sch lac	open water			
23		open water	Typ lat	Sch lac	Ele pal	Jun bal	Yes	Yes	Yes
24		Ele pal	Sch lac	Hor jub	Dis spi	Jun bal			

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
25		bare ground	Dis spi	Chr nau	Jun bal				Yes
26		salt crust	Dis spi	Sch mar	Sal rub	open water	Yes		
27		Dis spi	salt crust	Amp nev	Sch mar	open water		Yes	Yes
28		Typ lat	Jun bal	Ele pal					Yes
29		Ele pal	Sch lac	Muh asp	Typ lat	Hor jub			
30		Typ lat	Ele pal	Jun bal	Cal str				Yes
31		Dis spi	Car sim	Jun bal	Sch lac	Typ lat			
32		open water							
33		Muh asp	Jun bal	Chr nau				Yes	
34		Typ lat	open water	Sch lac	Car sim				
35		Lep lat	Muh asp	Dis spi	Jun bal			Yes	
36		Typ lat	Ele pal	Sch lac	open water	Muh asp		Yes	Yes
37		Chr nau	Dis spi					Yes	
38		Dis spi	Jun bal	bare ground					
39		Dis spi	Pas smi	Jun bal	bare ground			Yes	Yes
40		Dis spi	Muh asp	Cir arv	Jun bal	bare ground		Yes	Yes
41		Dis spi	Ele pal	Sch lac	Hor jub	Typ lat		Yes	Yes
42		Dis spi	Ele pal	Hor jub	Sch mar	Sar ver/Dis spi		Yes	
43		Dis spi	Muh asp	Ele pal	Jun bal			Yes	Yes
44		Ele pal	Typ lat	Sch mar	Sch lac	Hor jub			
45		salt crust	Dis spi	Sar ver/Dis spi					
46		open water	salt crust	Dis spi	Sar ver/Dis spi	Sch mar			
47		Typ lat	Jun bal	Sar ver/Dis spi	Lep lat			Yes	
48		open water	Typ lat	Jun bal	Ele pal		Yes		Yes
49		Typ lat	Jun bal	Dis spi	Lep lat	Car pra		Yes	
50		Typ lat	Sch lac	Ele pal	Jun bal	Sar ver/Dis spi		Yes	
51		Dis spi	Amp nev	salt crust	Sar ver/Dis spi	Puc nut			
53		Ele pal	Dis spi	bare ground	Jun bal			Yes	
54		open water	Typ lat	Car sim					Yes
55		Sar ver/Dis spi							

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
56		Sar ver/Dis spi	salt crust						
57		Sar ver/bare ground							
58		Dis spi	Chr nau	Sar ver/bare ground					
59		Typ lat	open water	Ele pal	Muh asp	Dis spi			Yes
60		Sar ver/bare ground	Chr nau						
61		Chr nau	bare ground						
62		Dis spi	Ele pal	Sar ver/Dis spi	Typ lat	Jun bal			
63		open water	Typ lat	Sch lac	Ele pal	Jun bal			
64		Ele pal	Jun bal	Typ lat	Dis spi				
65		Ele pal	Dis spi	Chr nau	Jun bal	open water			
66		Dis spi	Ele pal	Sar ver/Dis spi	open water			Yes	
67		Dis spi	Sar ver/Dis spi	Typ lat	Jun bal	Hor jub			
69		open water	Typ lat	Ele pal	Sch lac	Jun bal			
70		open water	Typ lat	Cal str					
71		Dis spi	Chr nau						
72		Sar ver/bare ground							
73		bare ground	Dis spi	Sua cal	open water				
74		Sar ver/bare ground							
75		open water	Typ lat	Sch lac	Ele pal	Dis spi			
76		Sar ver/bare ground							
77		open water	Typ lat	Dis spi					
78		open water	Sar ver/bare gro	Typ lat					
79		Typ lat	Sua cal						
80		Dis spi	Typ lat	salt crust	Sua cal				
81		Typ lat	Sar ver/Dis spi	Dis spi	salt crust				
82		Typ lat	Sch mar	Dis spi	Muh asp	salt crust		Yes	
83		Sch lac	Ele pal	Che gla	Typ lat	salt crust		Yes	
84		Typ lat	Dis spi	Jun bal					
86		salt crust	Dis spi	Typ lat	Sch mar	Puc nut			
87		open water	Ele pal	Sch lac	Typ lat	Jun bal	Yes		

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
88		open water	Typ lat						
89		open water	Ele pal	Sch lac	Muh asp	Jun bal			
90		Ele pal	Typ lat	Sch lac	Typ lat	Jun bal			
91		Sch lac	Typ lat	Dis spi	open water	Amp nev	Yes	Yes	
92		open water	Ele pal	Typ lat					
93		Typ lat	open water	Sch lac	Dis spi	Jun bal	Yes		
94		Ele pal	Jun bal	Typ lat	Dis spi	Sch lac			
95		salt crust	Dis spi	Sal rub	Sar ver/Dis spi				
96		Sch lac	Ele pal	Typ lat	Puc nut	Jun bal			
97		Ele pal	Muh asp	Typ lat	Dis spi	Jun bal		Yes	Yes
98		salt crust	Dis spi	Sch mar	Sar ver/Dis spi	Sal rub			Yes
99		open water	Ele pal	Typ lat	Cal str	Hor jub		Yes	
100		open water	Typ lat	Car sim	Jun bal	Cal str			Yes
101		open water	Typ lat	Ele pal	Puc nut	Sch mar		Yes	
102		Ely gla	Dis spi	Muh asp	Jun bal				
103		Typ lat	Jun bal	Sch lac	Cal str				
104		open water	Sch mar	Dis spi	salt crust	Sch lac		Yes	
105		Typ lat	Cal str	Dis spi	Jun bal	open water			
106		open water	Typ lat	Cal str	Car neb	Sch lac			
107		open water	Dis spi	Ele pal	Typ lat	Sch lac	Yes		Yes
108		open water	salt crust	Sch mar	Dis spi			Yes	
109		Ele pal	Typ lat	Hor jub	Sch lac	Jun bal			
110		bare ground	Typ lat	Che gla				Yes	Yes
111		open water	Typ lat	Sch lac	Ele pal	Sch pun		Yes	Yes
112		open water	Typ lat	Sch lac	Ele pal	Sar ver/Dis spi		Yes	Yes
113		Dis spi	salt crust						
114		salt crust	open water	Dis spi	Sar ver/Dis spi	Sua cal			
115		open water	Dis spi	salt crust	Sch mar	Sch lac	Yes		
116		Lep lat	Dis spi	bare ground	Typ lat	Sch lac			
117		open water	Dis spi	Sch lac	Sch mar	Jun bal	Yes		

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
118		Sch lac	Typ lat	bare ground	Dis spi	Muh asp		Yes	Yes
119		Sch lac	Typ lat	Ele pal	Jun bal	Hor jub	Yes	Yes	
120		Typ lat	Ele pal	Sch lac	Jun bal	Dis spi	Yes		
121		Typ lat	open water	Jun bal	Ele pal	Sch lac		Yes	Yes
124		Sch lac	Che gla	Typ lat	Jun bal	Hor jub			Yes
125		Dis spi	salt crust	Sch lac	Muh asp	Jun bal			
126		open water	Sch lac	Sch mar	Sch pun	Dis spi			
127		open water	Typ lat	Jun bal				Yes	Yes
128		open water	Typ lat	Jun bal	Sch lac		Yes		
129		open water	Sch lac	Jun bal	Sch mar	Typ lat	Yes		
130		open water	Typ lat	Sch lac	Dis spi		Yes		
131		open water	Typ lat						
132		open water	Typ lat	Sch lac	Ele pal				
133		open water	Sch lac	Typ lat	Dis spi	Amp nev	Yes		
134		open water	Amp nev	salt crust	Dis spi	Sch pun	Yes		
135		Che gla	Typ lat	Ele pal	bare ground	Sch lac			Yes
136		Sar ver/Dis spi	salt crust						
137		open water							
138		Dis spi	bare ground	Jun bal	Ele pal			Yes	
139		Sch lac	Che gla	Jun bal				Yes	Yes
140		Ele pal	open water	Sch lac					
141		open water	Sch pun	Dis spi	salt crust	Sch mar	Yes		Yes
142		open water	Typ lat						
143		Hor jub	Ele pal	Sch mar	Dis spi	Jun bal			
144		Typ lat	Sch mar	Ele pal	open water	Sch lac	Yes		
145	south	Dis spi	bare ground	Hor jub	Ele pal	Typ lat			
145	north	Dis spi	salt crust						
146		open water	Sch lac	Ele pal	Hor jub	Dis spi			
147		open water	Typ lat	Sch lac					
148		open water	Sch pun	Amp nev	Sch mar	Sch lac	Yes		

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
149		open water	Sch mar	Sch lac	Amp nev	Dis spi	Yes		
150		Typ lat	Sch lac	Ele pal	Jun bal	Sch pun	Yes		
151		Typ lat	Sch lac	Amp nev	Dis spi	open water	Yes		
152		Sch lac	Typ lat	bare ground	Sch mar			Yes	
153		open water	Typ lat	Sch lac	Cal str	Jun bal	Yes		
154		Sch lac	Dis spi	Ele pal	bare ground		Yes	Yes	
155		Ele pal	Typ lat	Jun bal					
156		bare ground	Dis spi	Sch mar	Amp nev				
157		salt crust	Sar ver/Dis spi	Dis spi			Yes		
158		salt crust	Sar ver/Dis spi	Dis spi	Sua cal			Yes	
159		Sch lac	Typ lat	Ele pal	Puc nut	open water			
160		open water	Typ lat	Sch lac	Ele pal	Jun bal	Yes		
161		bare ground	Dis spi	Lep lat	Sch lac			Yes	
162		Ele pal	Muh asp	Jun bal	Dis spi	Sch lac		Yes	
163		open water	Typ lat	Sch pun	Sch lac			Yes	Yes
164		Typ lat	Lep lat	Muh asp	Dis spi			Yes	Yes
165		open water	Typ lat	Jun bal	Dis spi				
166		open water	Jun bal	Typ lat	Sch lac				Yes
167		Typ lat	Jun bal	Dis spi	Sch lac	bare ground			
168		Dis spi	salt crust	Hor jub	Sch lac	Typ lat	Yes		
169		Dis spi	Sar ver/Dis spi	salt crust	Jun bal				Yes
170		Sch lac	Dis spi	Ele pal	Jun bal	Muh asp	Yes		Yes
171		open water	Sch lac	Typ lat	Car sim	Jun bal	Yes		
173		open water	Typ lat	Cal str					
174		Dis spi	Jun bal	Ele pal	Sch lac	Muh asp	Yes	Yes	
175		open water	Typ lat	Jun bal	Car sim	Cal str	Yes		Yes
176		open water	Dis spi	Sch lac	Hor jub	Typ lat			
179		Ele pal	open water	Typ lat	Sch lac	Jun bal			
180		open water	Sch lac	Typ lat	Hor jub	Dis spi	Yes		
181		Sch mar	Ele pal	Sch lac	Typ lat	open water	Yes	Yes	

Pond #	Modifier	1st Dominant	2nd Dominant	3rd Dominant	4th Dominant	5th Dominant	Cleome multicaulis?	Whitetop?	Canada thistle?
182		Ele pal	bare ground	Sch mar	Dis spi	Sch lac			
183		open water	Dis spi	salt crust	Sar ver/Dis spi				
184		salt crust	Dis spi	Sch mar					
185		Sar ver/Dis spi	Sch mar	Sch lac	Ele pal	open water			
186		Jun bal	Car sim						Yes
187		Dis spi	bare ground	Ele pal	Hor jub				
188		Dis spi	Sar ver/Dis spi	Amp nev					
190		Ele pal	Jun bal	Dis spi	Muh asp	Sch mar		Yes	
191	2	Sar ver/Dis spi	Dis spi	salt crust					
191	1	Dis spi	bare ground	Hor jub					
192		open water	Ele pal	Typ lat	Lep lat			Yes	
193		Ele pal	open water	Hor jub	Sch mar	Dis spi	Yes	Yes	
194		Ele pal	Dis spi	open water	Sch lac	Sua cal			
195		Dis spi	Sua cal	salt crust	Sar ver/Dis spi				
196		Dis spi	salt crust	Sar ver/Dis spi	Sua cal				
197		Bas hys	Sua cal	salt crust	Dis spi	open water			
198		Dis spi	Bas hys	salt crust	Sua cal	Sar ver/Dis spi			
199		salt crust	Sar ver/Dis spi	Sua cal					
200		Dis spi	Sar ver/Dis spi	salt crust	Sua cal				
201		Dis spi	salt crust	Sar ver/Dis spi					
202		Sar ver/Dis spi	Dis spi						
203		Sar ver/Dis spi	Dis spi						
206	north	Cal str	Typ lat	Jun bal	Sch lac	Muh asp			
206	south	Ele pal	Dis spi	Jun bal	Sch lac	Typ lat		Yes	
207		Ele pal	Jun bal	Lep lat	Dis spi			Yes	