

# Ouray National Wildlife Refuge, Utah

## 2000-2001 VEGETATION MAPPING PROJECT

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FINAL REPORT MARCH 31, 2002



Technical Memorandum 8260-02-03  
Remote Sensing and GIS Group  
Technical Service Center  
Bureau of Reclamation  
Denver, CO

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This report was prepared for the U.S. Fish and Wildlife Service's Mountain-Prairie Region (Region 6) and the U.S. Geological Survey's Center for Biological Informatics by the Remote Sensing and GIS Group of the Bureau of Reclamation's Technical Service Center, Denver, CO as Technical Memorandum No. 8260-02-03.

USGS-USFWS VEGETATION MAPPING PROGRAM  
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- The entire staff of BOR RSGIS (both past and present) for so many things.

**LIST OF ABBREVIATIONS AND ACRONYMS**

<b>AA</b>	Accuracy Assessment
<b>AML</b>	Arc Macro Language
<b>BOR</b>	Bureau of Reclamation (also USBR)
<b>BRD</b>	Biological Resource Division (of the USGS)
<b>CBI</b>	Center for Biological Informatics (of the USGS/BRD)
<b>CIR</b>	Color Infrared Photography
<b>DEM</b>	Digital Elevation Model
<b>DLG</b>	Digital Line Graph
<b>DRG</b>	Digital Raster Graphic
<b>DOP</b>	Digital Orthophoto
<b>FGDC</b>	Federal Geographic Data Committee
<b>USFWS</b>	Fish And Wildlife Service
<b>GIS</b>	Geographic Information System(s)
<b>GPS</b>	Global Positioning System
<b>MMU</b>	Minimum Mapping Unit
<b>NPS</b>	U.S. National Park Service
<b>NAD</b>	North American Datum
<b>NBII</b>	National Biological Information Infrastructure
<b>NRCS</b>	Natural Resources Conservation Service (formerly the Soil Conservation Service)
<b>NVCS</b>	National Vegetation Classification System
<b>ONWR</b>	Ouray National Wildlife Refuge
<b>PLGR</b>	Precision Light-Weight GPS Receiver
<b>RSGIS</b>	Remote Sensing And Geographic Information Group
<b>TNC</b>	The Nature Conservancy
<b>USBR</b>	United States Bureau Of Reclamation (also BOR)
<b>USDA-SCS</b>	U.S. Dept. Of Agriculture – Soil Conservation Service
<b>USFS</b>	United States Forest Service
<b>USGS</b>	United States Geological Survey
<b>UTM</b>	Universal Transverse Mercator

## **EXECUTIVE SUMMARY**

The Ouray National Wildlife Refuge (ONWR) was established in 1960 as an inviolate sanctuary for migratory birds and any other management purpose. In 2000, the Refuge published a Comprehensive Conservation Plan in accordance with the 1997 National Wildlife Refuge Improvement Act. The plan shifted the Refuge's emphasis toward ecosystem-based management of all resident and migratory species. Refuge and Regional staff asked that a detailed and accurate vegetation map be developed for planning and for managing the Refuge effectively. The Bureau of Reclamation's Remote Sensing and Geographic Information Group (RSGIS) was contracted by US Fish and Wildlife Service to map vegetation and land-use classes at ONWR using remote sensing and GIS technologies originally developed for the National Park Service's Vegetation Mapping Program.

The diverse vegetation and complicated land-use history of Ouray National Wildlife Refuge presented a unique challenge to mapping vegetation at the plant association level of the US National Vegetation Classification. To meet this challenge, the project consisted of two linked phases: (1) vegetation classification and (2) digital vegetation map production. To classify the vegetation, we sampled representative plots located throughout the 14,025-acre (5676 ha) project area. Analysis of the plot data using ordination and clustering techniques yielded 58 distinct plant associations. To produce the digital map, we used a combination of new color-infrared aerial photography and fieldwork to interpret the complex patterns of vegetation and land-use at ONWR. Eighty-one map units were developed and the vegetation units matched to the corresponding plant associations. The interpreted map data were converted to a GIS database using ArcInfo<sup>®</sup>. Draft maps created from the vegetation classification were field-tested and revised before an independent ecologist conducted an assessment of the map's accuracy. The accuracy assessment revealed an overall database accuracy of 75.2%.

Products developed for the Ouray National Wildlife Refuge Vegetation Mapping Project include

- the final report, vegetation key, map accuracy assessment results and contingency table, and photo interpretation key;
- spatial database coverages of the vegetation map, vegetation plots, accuracy assessment sites, and flight line index;
- digital photos (scanned from 35mm slides) of each vegetation type;
- graphics of all spatial database coverages;
- Federal Geographic Data Committee-compliant metadata for all spatial database coverages and field data.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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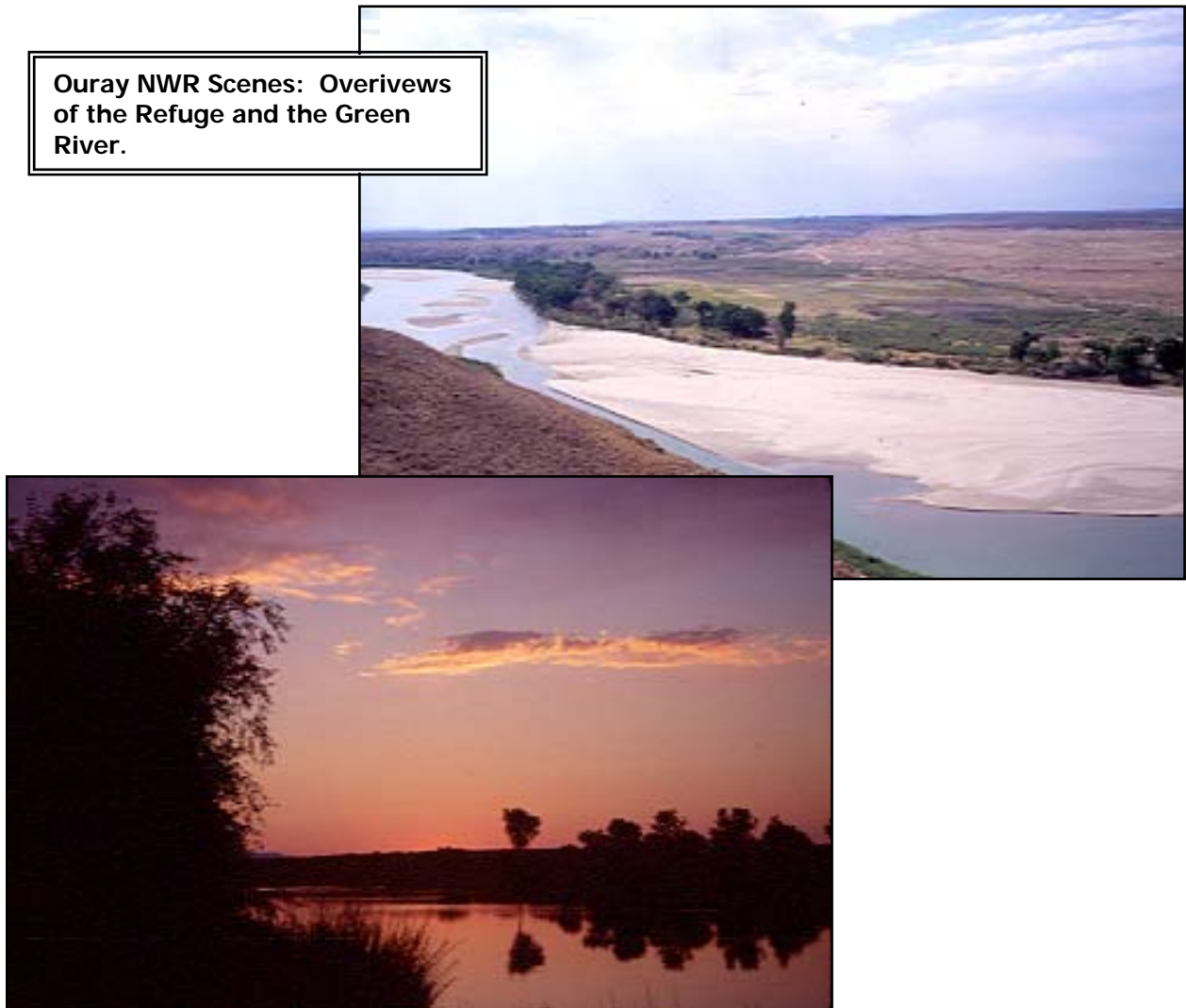
In addition, the Refuge and USFWS copies of this report contain

- original aerial photographs of the project area;
- digital data files and hard copy data sheets of the observation points, vegetation field plots, and accuracy assessment sites;
- original slides of each vegetation type.

A CD-ROM attached to this report contains text and metadata files, keys, lists, field data, spatial data, the vegetation map, graphics, and ground photos. The USGS will post this project on its website: [http://biology.usgs.gov/cbi/bio-char/fws\\_veg.html](http://biology.usgs.gov/cbi/bio-char/fws_veg.html). For information on other projects completed by the RSGIS, visit <http://www.usbr.gov/pmts/rsgis/>.

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**Ouray NWR Scenes: Overviews of the Refuge and the Green River.**



## 1. INTRODUCTION

This report describes the creation of a vegetation classification and a spatial vegetation database for Ouray National Wildlife Refuge (ONWR) by the Remote Sensing and GIS Group of the Bureau of Reclamation (RSGIS). The objectives of this project were to:

- collect and analyze vegetation data;
- create vegetation and map unit classifications based on the National Vegetation Classification System (NVCS) and Refuge-specific requirements;
- develop a spatial database of ONWR's vegetation, using remote sensing and Geographic Information System (GIS) techniques;
- produce digital and hard copy vegetation maps with a minimum 80% accuracy

### 1.1 BACKGROUND

The Prairie-Mountain Region of the USFWS has made a priority of obtaining accurate vegetation data in order to improve Refuge capacity for inventory, planning and management. The USGS-NPS Vegetation Mapping Program (URL: <http://biology.usgs.gov/npsveg>) was selected as the operating model and ONWR was one of two refuges chosen to test the applicability of the model. The USGS-NPS Vegetation Mapping Program uses standard methods and protocols to classify, describe, and map vegetation, but they were developed for use at relatively pristine National Parks. At the beginning of this project no one knew how well USGS-NPS methods would work on the modified and managed vegetation of a National Wildlife Refuge.

In March 2000, the U.S. Fish and Wildlife Service (USFWS) asked the U.S. Bureau of Reclamation's Remote Sensing and Geographic Information Group (RSGIS) to undertake the classification and mapping of vegetation at Ouray National Wildlife Refuge. The USFWS requested that the U.S. Geological Survey's Biological Resources Division, Center for Biological Informatics (CBI) be responsible for overall project coordination and ensuring that the mapping was performed in accordance with USGS-NPS Vegetation Mapping Program protocols and standards (**Appendix A**). The RSGIS submitted a work proposal (**Appendix B**) to CBI and in June 2000, an Interagency Agreement was established between the USFWS, CBI, and RSGIS for this project.

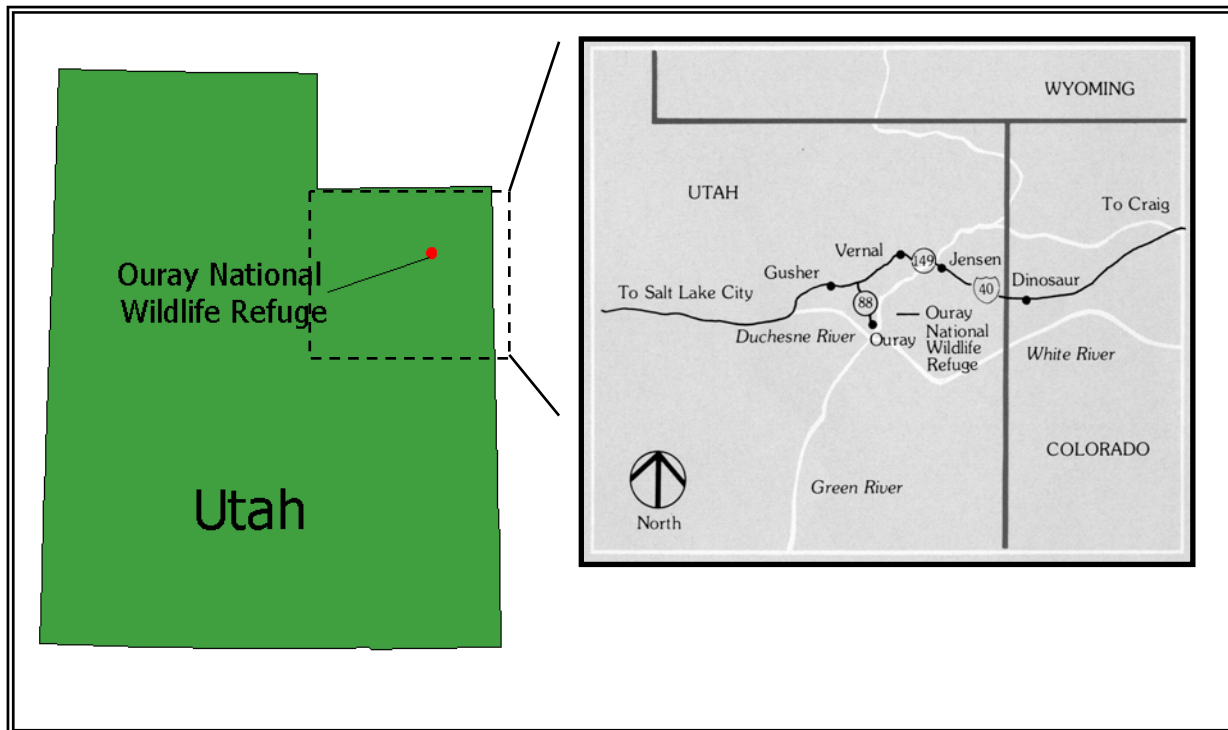
### 1.2 SCOPE OF WORK

The goal of this project was to describe the vegetation within the executive boundary for Ouray National Wildlife Refuge, including leased lands owned by other entities. Project goals centered around the following products: digital files of the vegetation map and field data, descriptions of and keys to the plant associations, metadata, map accuracy summaries, and aerial photographs. The RSGIS created most of the products and provided day-to-day project coordination. CBI was responsible for general oversight and adherence to the standards and protocols of the USGS-NPS Vegetation Mapping Program. NatureServe was responsible for producing a preliminary vegetation classification and providing global descriptions for the final plant associations.

### **1.3 OURAY NATIONAL WILDLIFE REFUGE**

ONWR executive boundary occupies 14,029 acres (5678 ha) in northeastern Utah, approximately 30 miles south-southwest of Vernal in Uintah County. To access the Refuge, travel west 14 miles (23 km) from Vernal on US Highway 40, then turn south on State Highway 88 and go 17 miles (**Figure 1**). The Refuge includes State and leased Tribal lands as well as private inholdings. Other Federal agencies have minor holdings within the Refuge (**Figure 2**). (U.S. Dept. of Interior 1999)

Climate: ONWR's semiarid climate is characteristic of a cold desert steppe; annual precipitation is 7.09 inches at the Refuge and 8.5 inches (22 cm) in the surrounding Uinta Basin (USDA 1997). The average relative humidity is likewise low. Peak precipitation events typically occur in April-May and September-October, while February is the driest month. Strong winds can occur in the late spring and early summer, while temperature extremes range from a low of -45° F in January to 110° F in July. The growing season extends from May to September for an average of 113 frost-free days (USDA 1959).



**Figure 1.** Location of Ouray National Wildlife Refuge in Northeastern Utah.



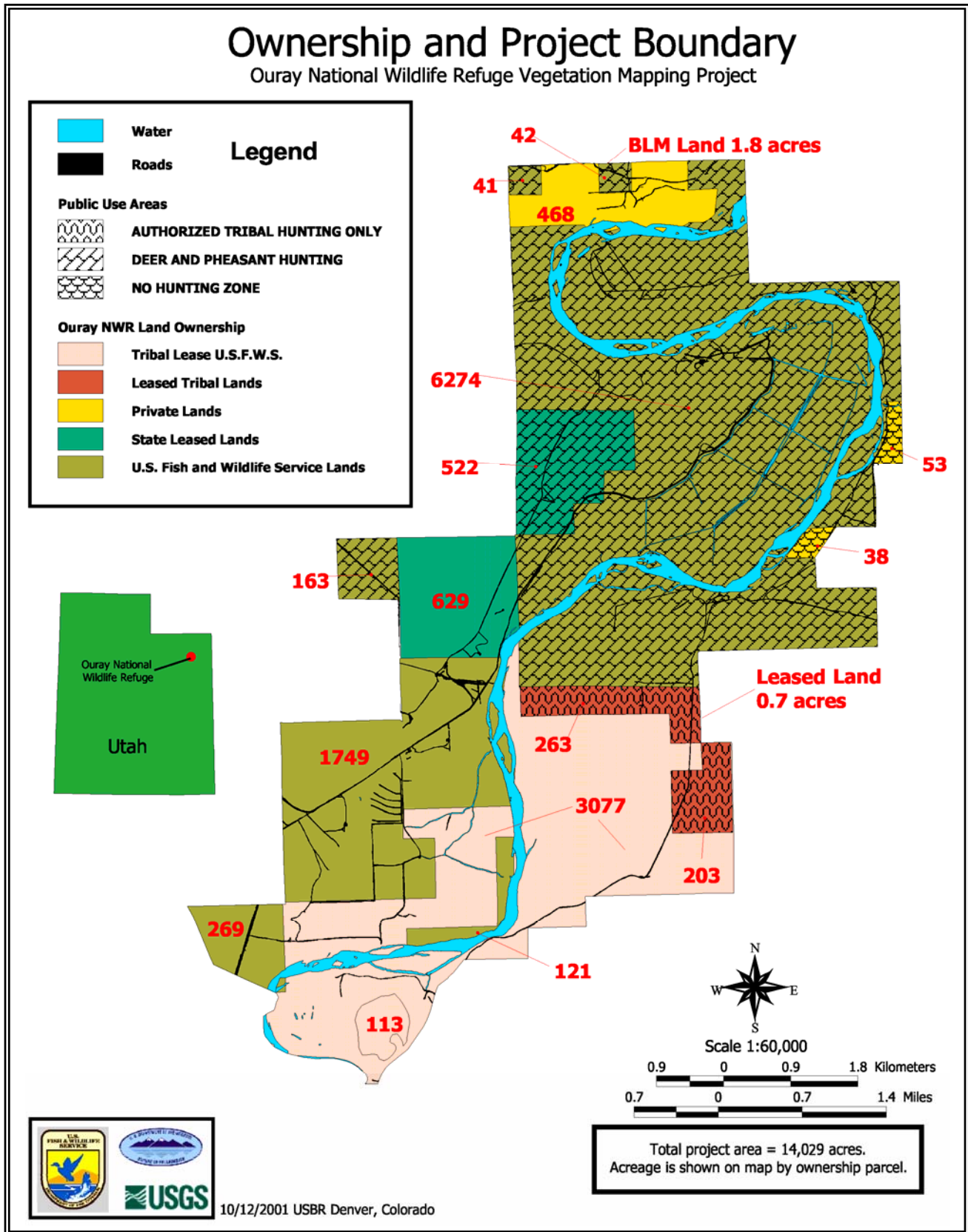
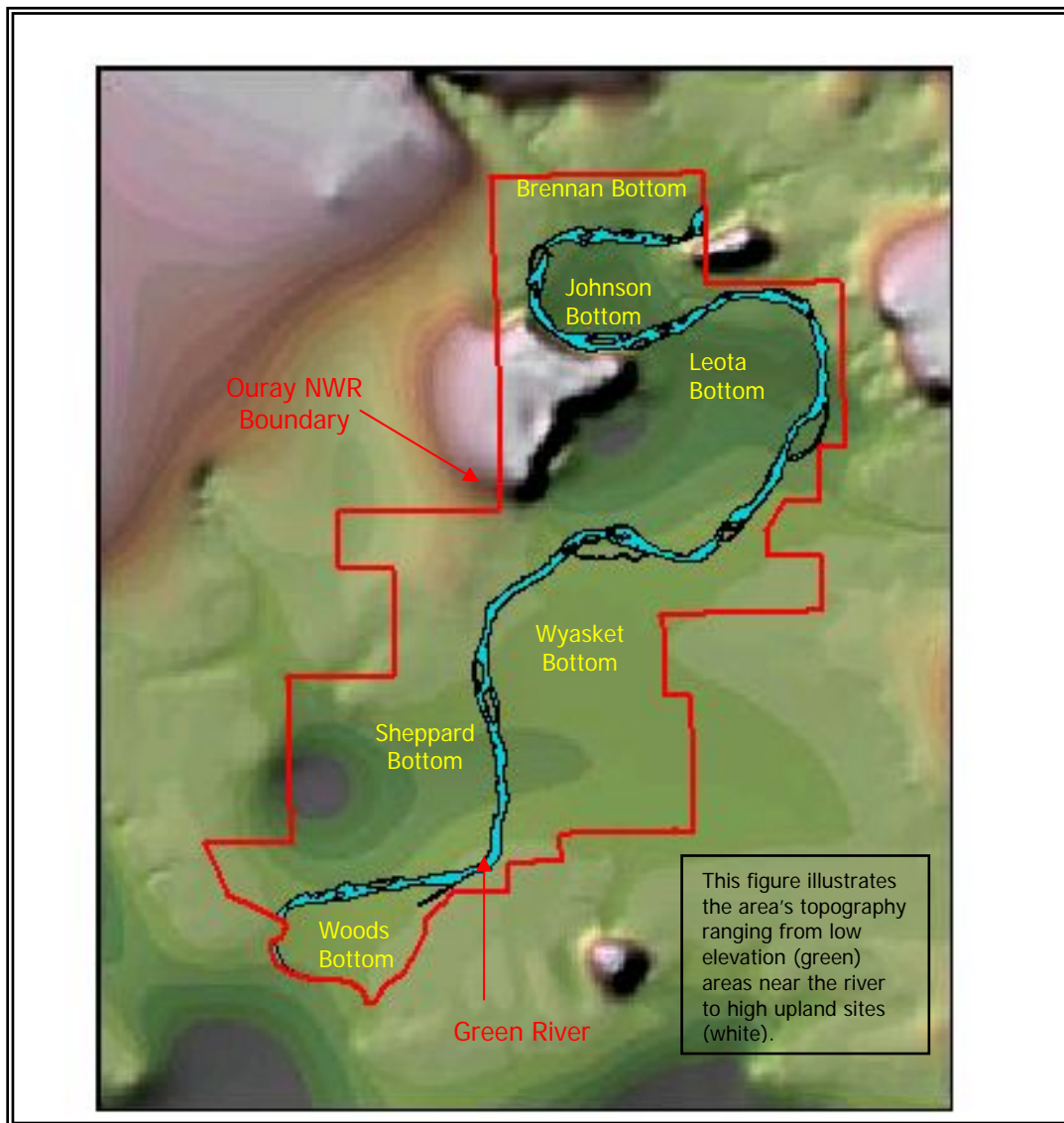


Figure 2. Land Ownership Map for the Ouray National Wildlife Refuge Project Area.



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**Topography:** Ouray National Wildlife Refuge is in the Uinta Basin, which is situated at the northern extreme of the Colorado Plateau physiographic province. To the north lie the Uinta Mountains, the longest east west oriented mountain chain in the Western Hemisphere. To the south lie the bluffs of the East and West Tavaputs plateaus. The Refuge is situated in a broad valley and is bounded by shale bluffs and hills that are the highest points in the Refuge. These high points rise 200 to 300 feet above the surrounding Green River floodplain. The highest point within the Refuge is Leota Bluff (5072 ft/1546 m). The lowest points in the Refuge are associated with the Green River (4670 ft/1423 m at the northern boundary and 4650 ft/1420 m at the southern boundary) (U.S. Dept. of Interior 2000). ONWR topography can be visualized using the shaded relief map in **Figure 3**.



**Figure 3.** Shaded Relief Map of the Ouray National Wildlife Refuge Project Area.

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**Hydrology:** Ouray National Wildlife Refuge includes 16 miles of the Green River and lies approximately 120 river miles below Flaming Gorge Dam. The river meanders through the Refuge (six 'bottoms' are situated along the river in the Refuge - see **Figure 3**) and runs in a generally southerly direction. The floodplain through the Refuge is more than one mile wide. The Refuge has no natural surface tributaries or groundwater inputs (David Cooper *et al.* 1994).

**Vegetation:** Much botanical work has been done in the area in and around ONWR yielding a thorough understanding of species composition (Cronquist *et al.* 1972, Folks 1963, and Goodrich and Neese 1986). Based on this knowledge, ONWR's vegetation can ecologically be divided based on plant species common to wetland, riparian, and upland habitats in the Uinta Basin subdivision of the Colorado Plateau physiographic province. The wetlands can further be separated into lacustrine and palustrine systems and uplands split into semi-desert shrubland, grassland, and clay bluff categories. (U.S. Dept. of Interior 2000)

Lacustrine wetlands at ONWR typically contain annual forbs resulting from dam operation or seasonal drawdowns of backwater pools along the Green River. Species composition varies greatly and stands typically have low diversity. Representative species include smartweeds (*Polygonum* spp.), pondweeds (*Potamogeton* spp.), dock (*Rumex* spp.), beggarticks (*Bidens* spp.), red orache (*Atriplex rosea*), and kochia (*Kochia scoparia*).

Palustrine wetlands contain greater species diversity and range from small potholes to oxbow lakes. Emergent species in saturated areas include cattails (*Typha* spp.), spikerushes (*Eleocharis* spp.), bulrushes (*Schoenoplectus* spp.), and rushes (*Juncus* spp.). Herbaceous species occupying adjacent floodplains include witchgrass (*Panicum capillare*), dogbane (*Apocynum cannabinum*), and inland saltgrass (*Distichlis spicata*).

Riparian areas support shrubs and trees as well as rich and diverse herbaceous communities. Shrubland species vary with soil moisture, ranging from willows (*Salix* spp.) and skunkbush sumac (*Rhus trilobata*) on mesic floodplains and point bars to sagebrush (*Artemisia* spp.) and greasewood (*Sarcobatus vermiculatus*) on drier terraces. Riparian trees include Fremont cottonwood (*Populus fremontii*) and peach-leaf willow (*Salix amygdaloides*).

Semi-desert uplands are scattered throughout the Refuge and total approximately 2669 acres (1080 ha). Common species include greasewood, rubber rabbitbrush (*Ericameria nauseosa*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), spiny hopsage (*Grayia spinosa*), shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), winterfat (*Krascheninnikovia lanata*), and sagebrush. Graminoids are usually present and include Indian ricegrass (*Achnatherum hymenoides*), needle-and-thread (*Hesperostipa comata*), sand dropseed (*Sporobolus cryptandrus*), and cheatgrass (*Bromus tectorum*).

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Grasslands are widely distributed throughout the project area and total about 1520 acres (615 ha). Typical grasses are alkali sacaton (*Sporobolus airoides*), western wheatgrass (*Pascopyrum smithii*), wildryes (*Elymus* spp.), and galleta (*Pleuraphis jamesii*).

Grasslands typically occur on benches above clay bluffs. Clay bluffs define the outer limits of the Green River floodplain and consist of about 1935 acres (783 ha) of barren slopes. Few plants grow on this harsh terrain; however, scattered individuals of broom snakeweed (*Gutierrezia sarothrae*) and shadscale (*Atriplex confertifolia*) can be found.

Several problematic non-native and invasive plant species are found within the Refuge. These include salt cedar (*Tamarix* spp.), giant whitetop (*Lepidium latifolium*), Russian-olive (*Elaeagnus angustifolia*), and Russian knapweed (*Acroptilon repens*).

Agricultural or semi-natural lands total about 150 acres (61 ha) at ONWR. A cooperative agreement with an adjacent landowner allows for limited production of alfalfa and small grains. These lands provide additional forage for migratory birds and other resident wildlife.

Wildlife: Located along the Green River, Ouray National Wildlife Refuge provides habitat for migrating water birds, and resident fish, mammal, amphibian, and reptile populations. During different times of the year Canada geese, snow geese, mallard, gadwall, northern pintail, American widgeon, green-winged teal, and common merganser all use ONWR as a primary roost. Shorebirds also benefit from the large areas of shallow water along the Green River. These include yellowlegs, willet, and killdeer. Elk, mule deer, moose, and black bear all use the Refuge as a watering site. Common smaller mammals include beaver, river otter, and muskrat. Threatened and endangered fish resident in the Green River include Colorado pikeminnow, razorback sucker, and humpback chub. Non-native fish found in the river include smallmouth bass, channel catfish, and black bullhead (U.S. Dept. of Interior 1999).

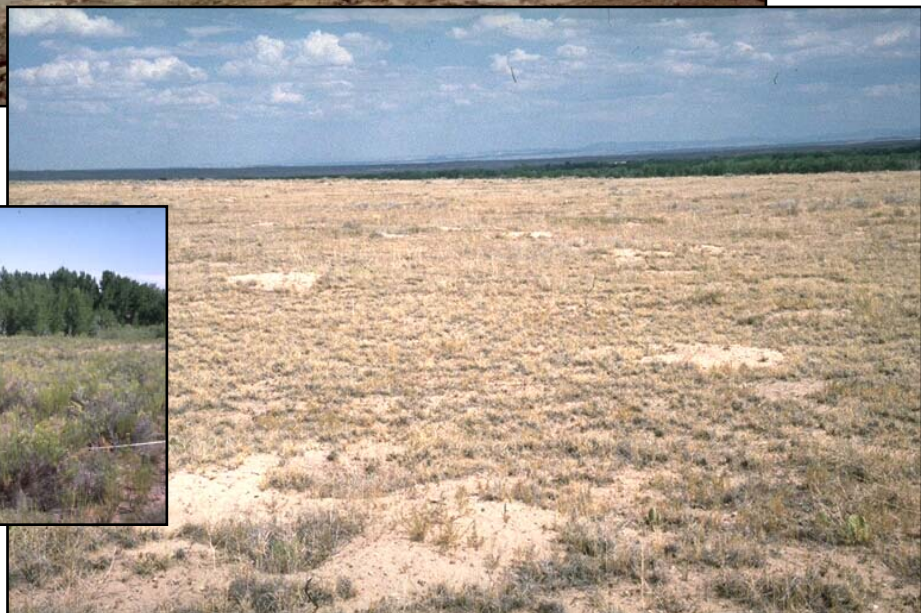


Pronghorn antelope at Ouray National Wildlife Refuge.



## Ouray National Wildlife Refuge Vegetation Mapping Project

**Ouray NWR:** Palustrine wetlands in a shallow pool (right); the Green River with floodplains and shale bluffs (center); semi-desert shrub herbaceous vegetation (bottom); and greasewood shrubland on an upper floodplain terrace (inset).



## **2. MATERIALS AND METHODS**

Based on the overall project scope and the assignment of responsibilities the project was divided into six major steps following the USGS flowchart (**Appendix A**):

1. Plan, gather data and coordinate tasks
2. Conduct a field survey of ONWR to understand and sample the vegetation
3. Classify the vegetation using field data to NVCS standards and crosswalk it to recognizable map units
4. Acquire aerial photography and interpret the photographs using the classification scheme and crosswalk
5. Transfer the interpreted data to a digital form
6. Ground-truth and assess the accuracy of the final map product.

**All protocols for this project as outlined in the following sections can be found in documents produced by The Nature Conservancy (1994a, 1994b, and 1994c) for the USGS-NPS Vegetation Mapping Program and found at this website: <http://biology.usgs.gov/npsveg>.**

### **2.1 PLANNING, DATA GATHERING AND COORDINATION**

A scoping meeting was held in July 2000 and attended by RSGIS, USFWS (Region 6 and ONWR), NatureServe, and CBI staff. The goals of this meeting were to (1) determine the project boundary, (2) assess the availability of aerial photography, base maps and other data, (3) plan the logistics of doing fieldwork at ONWR, and (4) assign specific tasks to the organizations involved.

The meeting resulted in two guiding decisions:

1. The project extent was defined as the 'executive' boundary of the Refuge (approximately 14,029 acres).
2. New aerial photography would be required as well as a new orthophoto base map since USGS DOQQ base maps for ONWR were not yet available.

Work responsibilities were assigned to the participants:

#### ***USBR Responsibilities***

- Provide overall project facilitation and coordination.
- Acquire new 1:12,000 scale color infrared aerial photography and ortho-rectified imagery.
- Verify vegetation and land use/land cover signatures on the aerial photographs.
- Collect data for the vegetation classification and local NVCS descriptions.
- Develop map units linked to the NVCS.
- Provide NatureServe with information regarding the distribution and characteristics of vegetation types within ONWR.

## Ouray National Wildlife Refuge Vegetation Mapping Project

- Interpret and delineate vegetation and land use types using aerial photographs.
- Transfer and automate interpreted photographs to produce a digital spatial database and hard copy vegetation maps.
- Produce spatial coverages of plot and accuracy assessment site locations.
- Provide an analysis of the accuracy assessment.
- Provide a final report describing all aspects of the project.
- Provide a visual guide to the photo signatures of each map unit.
- Document FGDC-compliant metadata for all vegetation data.
- Create a CD-ROM with reports, metadata, guides, vegetation classification, plot data, spatial data, the vegetation database (map), graphics, and ground photos.

### ***USFWS Responsibilities***

- Provide program oversight in conjunction with CBI.
- Supply RSGIS with the ONWR boundary in digital format.

### ***NatureServe Responsibilities***

- Develop a vegetation classification for the study area based on the NVCS, using field data provided by RSGIS.
- Provide guidance to the photo interpreters regarding the ecology and floristic composition of each vegetation type.
- Provide global vegetation descriptions and assist with keys to the vegetation.

RSGIS obtained copies of maps, soil surveys, reports, and other documents describing the Refuge and its environmental setting. ONWR provided species lists, annual reports, and their draft comprehensive conservation plan. Two documents were obtained from the Upper Colorado Endangered Fish Recovery Program (Cooper *et al.* 1994, and Hansen 1994) regarding studies done at ONWR as well a report from the USGS regarding USFWS refuges along the Green River (Laubhan 1997). The Region 6 office of the USFWS provided a digital copy of the project area boundary. NatureServe provided a list of potential plant associations (Reid *et al.* 2000).

## **2.2 FIELD SURVEY**

RSGIS conducted a field survey during the summer of 2000, during which both observation point data and plot data were collected. Observation points allowed the field team to become generally familiar with the vegetation while field checking NatureServe's list of potential plant associations. Data collected at each observation point included a general description of the vegetation, UTM coordinates, estimates of foliar cover for the dominant species, and a brief description of the environmental characteristics (**Appendix C**). We collected data at 129 observation points during the September field survey (**Figure 4**).

We also sampled 130 vegetation plots during the August 2000 field survey (**Figure 5**). These plots differed from the observation points in two important ways. First, plot boundaries were formally defined, and second, the data we collected were quantitative

# Observation Point Locations

Ouray National Wildlife Refuge Vegetation Mapping Project

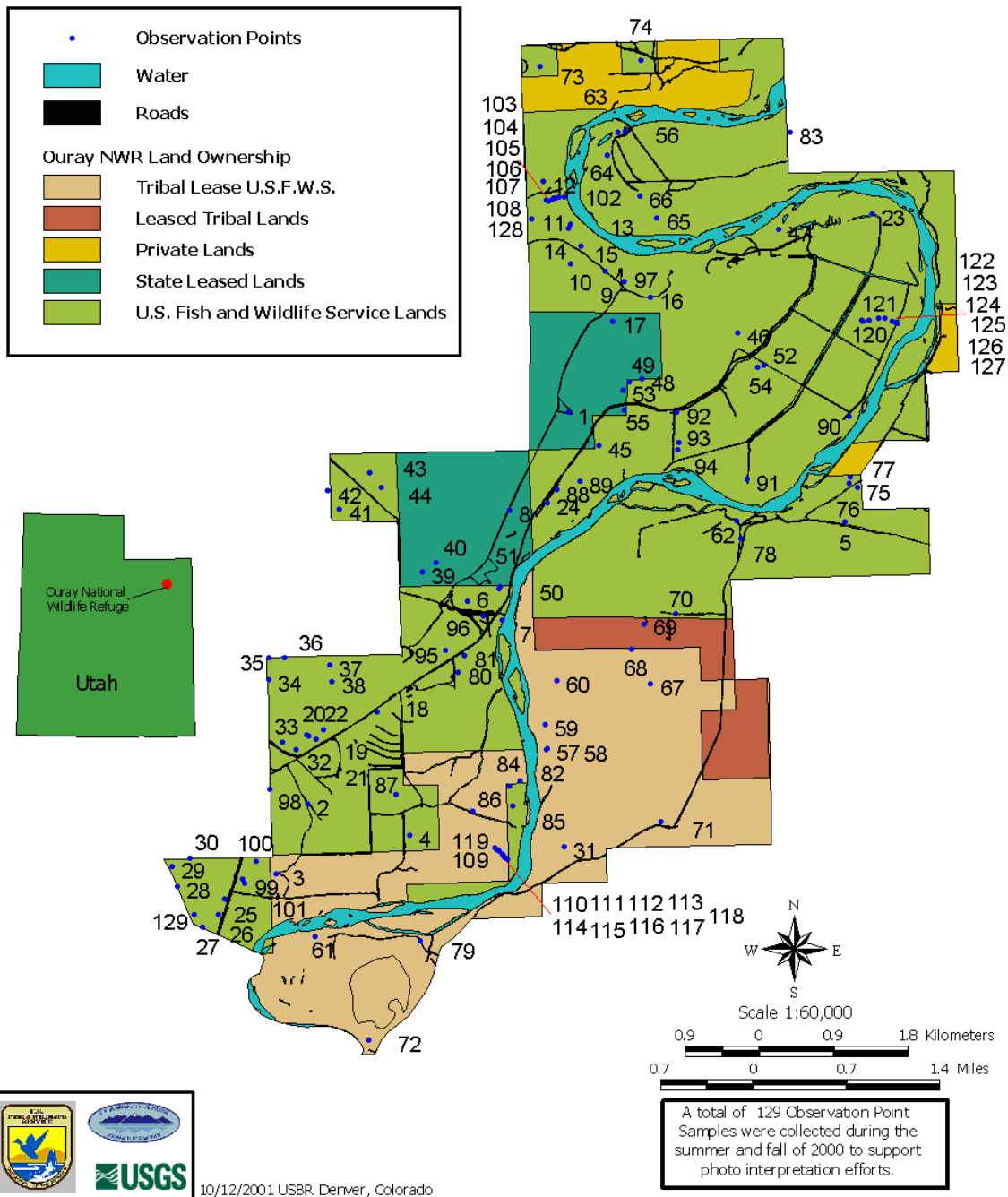


Figure 4. Location of Observation Points at Ouray National Wildlife Refuge.

and much more detailed. The plots were placed subjectively in vegetation that was judged to be "representative" and relatively homogeneous over at least 0.5 ha (the size of the minimum mapping unit). Ecotones were not sampled, and smaller areas were only sampled if they represented unique or distinctive vegetation types. We used 20 x 20 m square plots to sample forest and woodland communities, while shrubland and herbaceous communities were sampled using 10 x 10 m plots. We made an effort to sample three plots per vegetation type with more plots in types not previously documented by the NVCS. The plots were spread across the Refuge to capture the full range of variation.

The descriptive information we collected in each plot included slope, aspect, elevation, soil characteristics, and evidence of wildlife and human disturbance (**Appendix C**). To characterize the vegetation in a plot, we estimated the cover of all vascular plant species (Daubenmire 1959) by layer (herb, shrub, tall shrub, subcanopy, canopy, etc.). The UTM coordinates and elevation of all plots were logged using a Garmin™ 12XL GPS receiver. We took photographs (35 mm format) of each plot and scanned them as digital images. Representative slides for all plots are included in **Appendix G** and all scanned images can be found on the CD\_ROM attached to this report. Data collected for each plot was entered into TNC's PLOTS (MS Access®) database and analyzed by NatureServe ecologists using the procedures described in **Section 2.3**.

### **2.3 NVCS CLASSIFICATION AT OURAY NWR**

The National Vegetation Classification System (NVCS) for the United States was selected as the vegetation classification standard for this project for several reasons. First, the NVCS is the system mandated by the USGS-NPS Vegetation Mapping Program model we adopted for this project. Second, the Federal Geographic Data Committee (FGDC) (FGDC 1997) has adopted the NVCS to the formation level as a standard for federal agencies. Finally, a national (as opposed to regional, state, or local) vegetation classification system facilitates resource stewardship by ensuring that the same plant associations get the same names throughout the National Refuge System. The strengths of the NVCS are that it:

- is vegetation based
- uses a systematic approach to classify a continuum
- emphasizes natural and existing vegetation
- uses a combined physiognomic-floristic hierarchy
- identifies vegetation units based on both qualitative and quantitative data
- is appropriate for mapping at multiple scales.



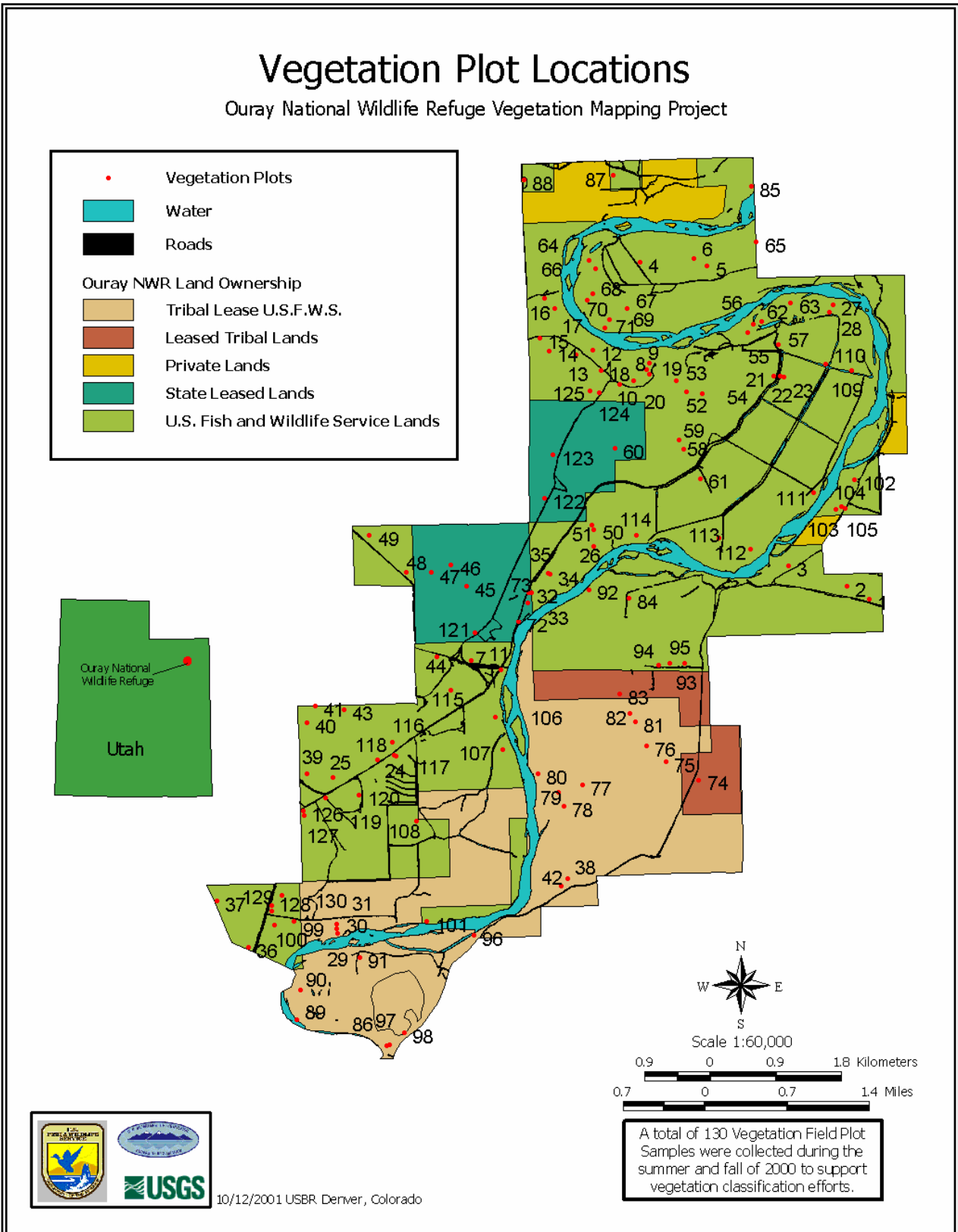


Figure 5. Location of Vegetation Sample Plots at Ouray National Wildlife Refuge.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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The NVCS was established primarily by The Nature Conservancy (TNC) and is being implemented and updated by NatureServe in support of the network of Natural Heritage Programs (Grossman *et al.* 1998). Development and refinement of the classification is an ongoing process, and proposed revisions are reviewed both locally and nationally. TNC published two volumes describing the classification of US vegetation as of April 1997 (Grossman *et al.* 1998). This publication can be found on the Internet (URL: <http://www.natureserve.org/publications/icec/index.html>). NatureServe also posts regular updates to the list of plant associations in the United States and Canada on their online database server: <http://www.natureserve.org>.

The procedure for classifying vegetation followed guidelines described in the Vegetation Classification Standard (FGDC 1997), which was derived from the NVCS. The NVCS is a species-based, hierarchical system with seven levels (Grossman *et al.* 1998). The highest (i.e., coarse) levels of the hierarchy have a broad geographic perspective and use physiognomic features to distinguish among groups of plant communities. The lower levels (i.e., finest) have a local and site-specific perspective and are based on floristics (**Table 1**). The two lowest levels (alliance and association) were used in the ONWR project.

**Table 1.** An example of the NVCS's physiognomic-floristic classification hierarchy.

Level	Primary Basis For Classification	Example
Class	Growth form and structure of vegetation	Woodland
Subclass	Growth form characteristics, e.g., leaf phenology	Deciduous Woodland
Group	Leaf types, corresponding to climate	Cold-deciduous Woodland
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/Semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Temporarily Flooded Cold-deciduous Woodland
Alliance	Dominant/diagnostic species of uppermost or dominant stratum	<i>Salix amygdaloides</i> Temporarily Flooded Woodland Alliance
Association	Additional dominant/diagnostic species from any stratum	<i>Salix amygdaloides</i> / <i>Salix exigua</i> Woodland

The NVCS defines an association as “a plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy” (see Flahault and Schroter 1910 in Moravec 1993). Associations are separated from alliances through the use of total floristic composition and are named by the most dominant and/or indicator species. If two or more dominant species occur in the same stratum a dash symbol is used between the names. If the species occur in different strata then a slash is used. Parentheses indicate that a diagnostic species is not always present. Alliances are physiognomically uniform groups of plant associations that share dominant or diagnostic species, usually found in the uppermost stratum of the vegetation. For forested types, the alliance is roughly equivalent to the “cover type” of the Society of American Foresters. NVCS alliances also include non-forested types.

Unlike classifications based on habitat types or potential vegetation, the NVCS strives to describe existing vegetation. This includes both natural and cultural vegetation. However, due in part to the conservation focus of TNC and NatureServe, the classification of natural vegetation types is often better developed than that of cultural or modified types. The NVCS is also unique in that the association is the basic unit, with broader levels of the hierarchy representing aggregations of lower units (*i.e.*, from the bottom up). This differs from other classifications that recognize plant communities as refinements of broader units (*i.e.*, from the top down).

### ***Preparing the Data for Analysis***

The vegetation classification for ONWR began with RSGIS and NatureServe ecologists manually sorting observation point and plot data into groups based on vegetation structure and composition. Most of the plots could be evaluated qualitatively and assigned to an existing NVCS alliance or association. In a few instances, new NVCS units were defined from quantitative analysis of the plot data using ordination techniques described below. The results of the numerical analyses were compared to the subjective classification so that discrepancies between the two could be reconciled.

Data from the 130 ONWR vegetation plots were entered into the PLOTS database following procedures outlined by the NVCS (Grossman *et al.* 1998). The cover values for species in each plot were used to create a plots-by-species data matrix. Prior to analysis, all species with total cover values (summed over all plots) of 1% or less were removed from the data matrix. This prevented minor species from influencing the classification. The resulting matrix was then run through a number of computer analyses to organize and summarize the compositional and structural characteristics of the vegetation and assess patterns related to environmental gradients.

Classification and ordination procedures work best on relatively uniform data sets. Therefore before the data matrix was analyzed, plots with exceptionally low similarity to the remaining plots (outliers) were identified and removed. Outliers are common in large data sets and occur because of disturbed, heterogeneous, or otherwise unusual sites, or because of gaps in sampling (Gauch 1982). Plots sampled within prairie dog towns were the first outlier group to be identified and removed from the data matrix. The remaining plots were then placed subjectively into a floodplain or upland group to further reduce heterogeneity. Floodplain plots were on active and abandoned terraces of the Green River containing wetland or riparian species. Upland plots were on badlands, bluffs, ridges and erosional fans, as well as the driest floodplain soils.

### ***Data Analysis***

Following procedures described by Grossman *et al.* (1998) and McCune and Mefford (1999), the floodplain and upland groups were analyzed separately using TWINSpan (a classification program) and DECORANA (an ordination program). The TWINSpan analyses were conducted using relative cover values, while raw cover values were used in the DECORANA ordination procedures. TWINSpan recognizes distinct ecological

groups of plots such as wetlands, riparian woodlands, shrublands, and grasslands. DECORANA clarifies these patterns of classification and places the plots along a two-dimensional gradient that can be related inferentially to environmental gradients.

TWINSpan analysis of the floodplain plots identified two additional groups of outliers. The larger group was characterized by exotic and/or early successional species, the smaller by aquatic species. These groups were removed from the data matrix. Another group of plots with very similar composition were combined into one composite plot. The refined floodplain data matrix was then analyzed using DECORANA, which identified a third group of outliers that was removed prior to the final ordination. Removing the outliers had the effect of spreading out the remaining plots in a two-dimensional space that represents significant environmental gradients.

Classification and ordination of the upland plots was simpler than the floodplain group. After removing outlier plots (cheatgrass and some greasewood types) and after combining similar plots into composite samples, the upland plots were run through the same series of classification and ordination analyses as the floodplain plots.

A classification of ONWR's vegetation was the end product of this process. RSGIS ecologists, photo interpreters, and Refuge staff field-reviewed the classification. RSGIS and NatureServe prepared a dichotomous map unit key for ONWR (**Appendix F**). The key was tested during the accuracy assessment process. An illustrated guide to the map units (**Appendix H**) was also developed to assist managers and field researchers in identifying plant associations in the field.

## **2.4 AERIAL PHOTOGRAPH ACQUISITION AND PHOTO-INTERPRETATION**

Horizons, Inc. (Rapid City, SD) flew color-infrared (CIR) aerial photography for ONWR at scales of 1:12,000 and 1:40,000 on July 5, 2000. We chose CIR film because of its ability to highlight subtle differences in vegetation, especially among wetland types. Frame overlap on the 1:12,000-scale photography was between 50% and 60% along the flight lines and 20% to 30% between the flight lines (**Figure 6**). The 1:40,000-scale photography was draped over a 30m digital elevation model (DEM) to produce a color digital orthophoto base map (see **Title Page**) while RSGIS photo interpreters used 9" X 9" prints of the 1:12,000-scale photography (**Figure 7**) to map the Refuge's vegetation.

RSGIS interpreted the aerial photographs twice. The first interpretation identified patches of homogenous vegetation (areas on the photos with similar tone, texture, color and landscape position) to identify the best sites to place sample plots. The final interpretation used NVCS-derived map units, field notes, observation point and vegetation plot data to prepare the GIS vegetation database.



**Stereoscopic photo interpretation**

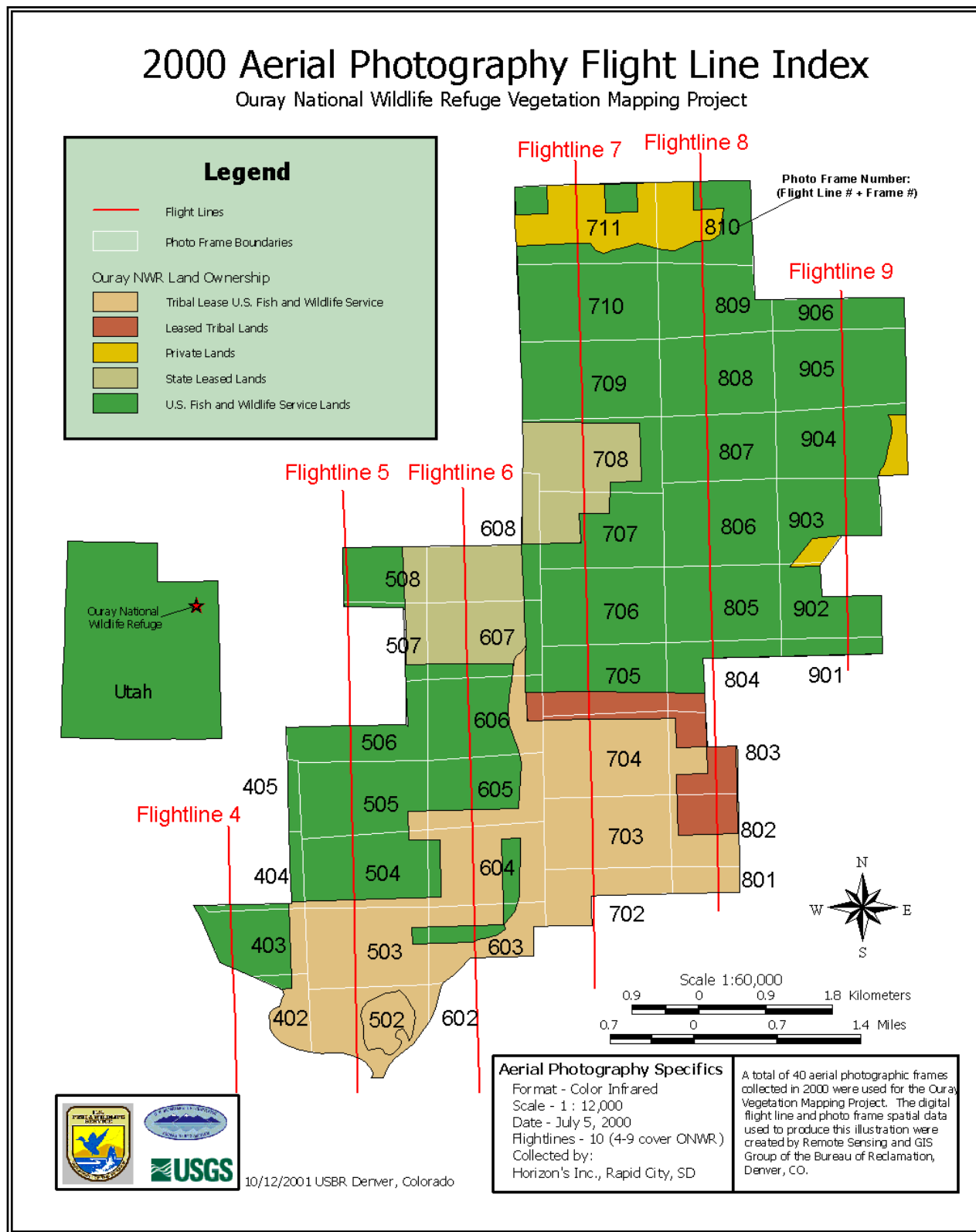
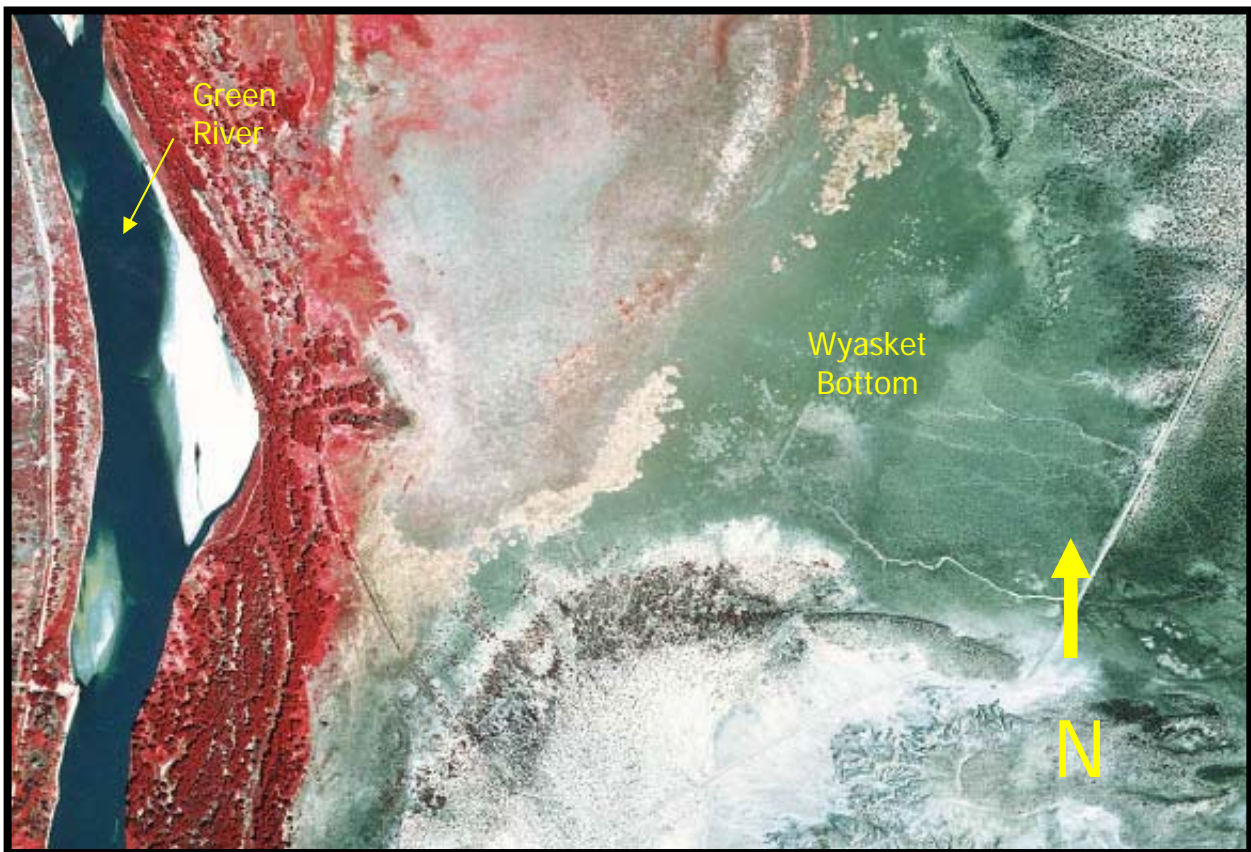


Figure 6. 2000 Aerial Photo Flight Line Index Map for Ouray National Wildlife Refuge.



## Ouray National Wildlife Refuge Vegetation Mapping Project

For both levels of interpretation, we covered each 9"x 9" aerial photograph with sheets of translucent (semi-frosted) Mylar. The aerial photos and their overlays were backlit on a light table and a stereoscope was used to help recognize photo signatures and three-dimensional features. Corner and side tics, photograph and flight line numbers were marked on each Mylar sheet. Polygons were delineated using a 0.5 mm lead pencil. Only the center portion of each aerial photograph was interpreted to minimize the effects of edge distortion. In order to insure completeness and accuracy, digital transfer specialists reviewed all of the interpreted photos for consistency and recommended changes where necessary.



**Figure 7.** Example of an Aerial Photograph from the ONWR Vegetation Mapping Project (example is not to scale).

The map units delineated on the photos were derived from the NVCS classification as constrained by the limitations of the photography. Photo interpreters applied the preliminary NVCS classification to aerial photo signatures to see how many plant associations could be recognized on the photos. In most instances, one NVCS association corresponded to one map unit. However, sometimes a plant association could not be recognized consistently on the photos or the photo interpreter could see more detail than was recognized by the vegetation classification. These problems were overcome by using two separate but related classifications: (1) a NVCS classification for the plot data and (2) a map unit classification for the GIS database.

The two were related or “crosswalked” by noting where plant associations were lumped into single map units and where other associations were split into multiple map units.

We created map units for land-use types based on the system developed by Anderson (1976) to classify remotely sensed cover types. This includes unvegetated lands not included in the NVCS, such as roads, facilities, and agricultural fields. A third class of map units was defined especially for ONWR to cover vegetation types that were easily mapped but were not included in either the NVCS or Anderson, such as white-tailed prairie dog towns. A list of the final map units appears in **Table 3**.

### **2.5 DIGITAL TRANSFER OF PHOTO INTERPRETED DATA**

The transfer process removes much of an aerial photograph's inherent distortion and ties the interpreted data to real-world coordinates so it can be digitally automated. To accomplish this for ONWR, an ArcInfo<sup>®</sup> GIS database was created using in-house protocols. The protocols consist of a shell (master file) of Arc Macro Language (AML) scripts and menus (nearly 100 files) that automate the transfer process, thus insuring that all spatial and attribute data are consistent and stored properly (**Figure 8**). The actual transfer of information from the interpreted aerial photographs to a digital, geo-referenced format involves two basic techniques: (1) scanning the interpreted line work and (2) on-screen digitizing. Both techniques require a background image or basemap. For ONWR, we used nine digital orthophoto sheets created under contract by Horizons, Inc. as the base maps for this project (**Figure 9**).

The scanning technique used for ONWR involved a multi-step process whereby the Mylar overlay sheets produced by the photo interpreters were scanned into a digital form. The digital image file (tagged image format .tif) created from the scanned sheet was then converted from a raster image to a vector file using RSGIS-developed AMLs in ArcInfo<sup>®</sup>. The vector file or ‘line coverage’ was then geo-referenced to the orthophoto base map. The essential principle of geo-referencing is to match the scale and position of features on the photographs with the scale and position of the same features on the orthophotos. Technicians accomplished this by adjusting the scale of the scanned Mylar between known control points using computer program routines until the adjustment was considered a good fit.



**Large Format Scanning**

## Ouray National Wildlife Refuge Vegetation Mapping Project

Any remaining land use classes not already scanned (such as roads) were transferred by means of on-screen digitizing. This process entered data into GIS format by manually tracing digital lines (using a mouse) on a computer monitor screen with the orthophoto as a background image. The completed line work for each photo was then edge matched. Finally, polygon topology was built and attribute information added to produce digital vector or polygon coverages (one per photo) that were combined into a final coverage for the entire Refuge.



On-screen Digitizing

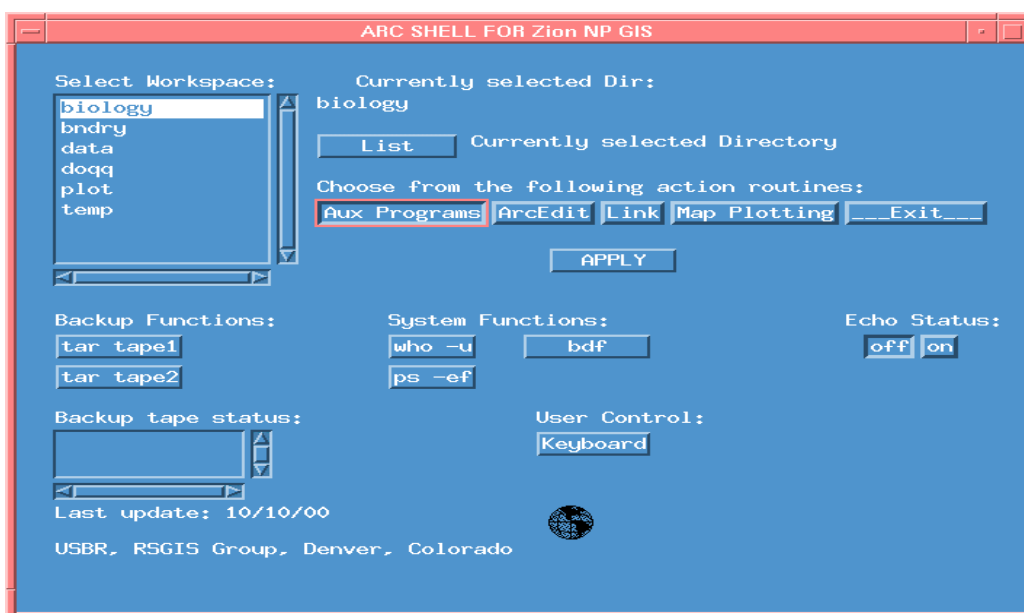


Figure 8. Example of UNIX ArcInfo® Shell Menu Interface.

We attributed, or labeled, each vegetation polygon for ONWR with information pertaining to map units, NVCS units, Anderson land-use classes, Refuge-special units, and other relevant data. The attribute items are listed in **Table 2** and are referenced in the ONWR vegetation look-up table included on the accompanying CD-ROM. Attribute items include standard GIS categories (area, perimeter), NVCS types mandated by the program (Association, Alliance), and USFWS specific modifiers (mod and eco).



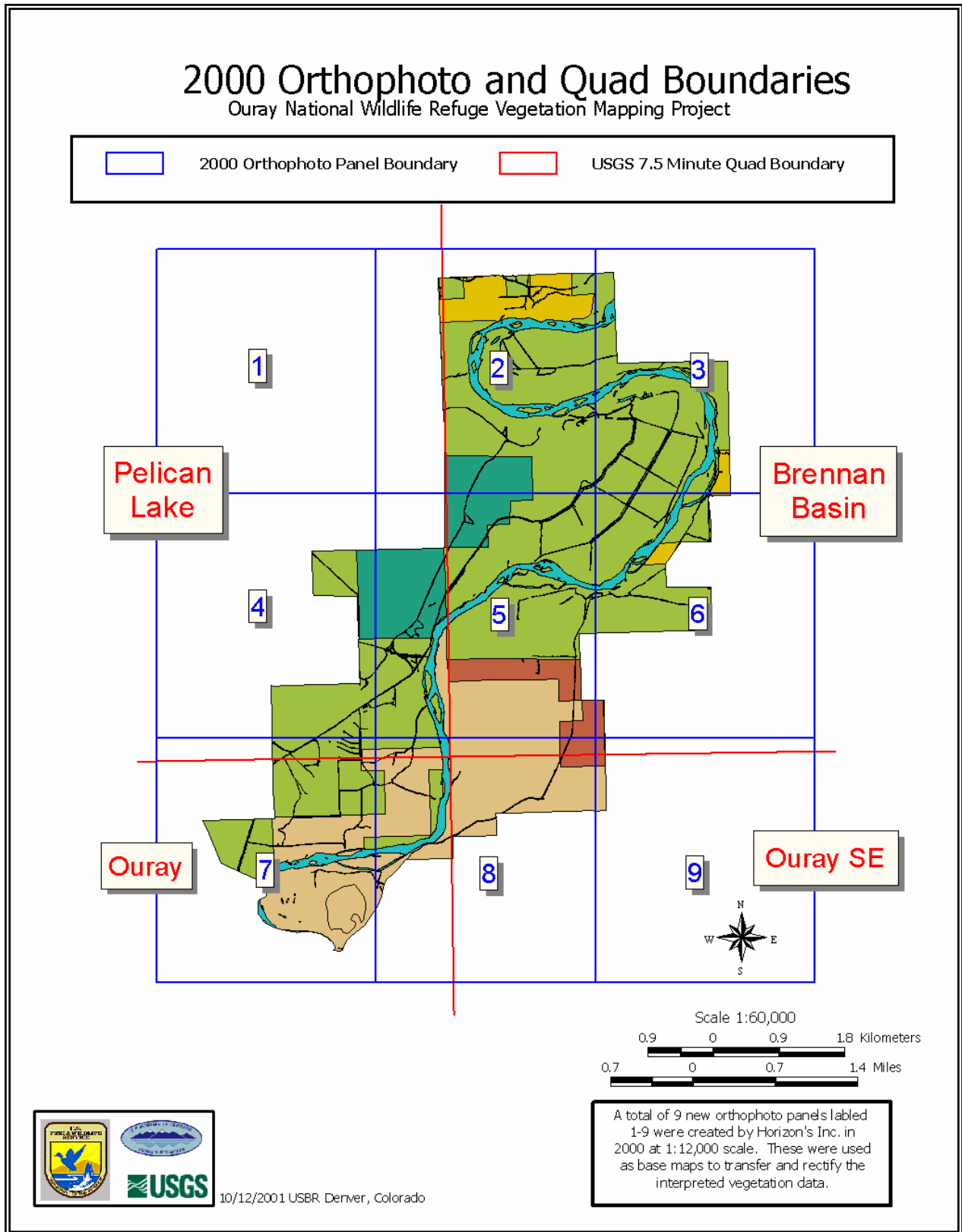


Figure 9. Color Orthophoto and USGS Quadrangle Reference Map for ONWR.

**Ouray National Wildlife Refuge Vegetation Mapping Project**

**Table 2.** Polygon attribute items and descriptions used in the ONWR spatial database (GIS coverage).

<b>ATTRIBUTE</b>	<b>DESCRIPTION</b>
AREA*	Surface area of the polygon in meters squared
PERIMETER*	Perimeter of the polygon in meters
ONWR_VEG#*	Unique internal polygon coding
ONWR_VEG-ID*	Unique internal polygon coding
VEG_CODE	Map unit code - project derived, project specific
VEG_NAME	Map unit name - project derived, project specific
ECO	Ecological description of the polygon
PHYS	Physiographic description of the polygon
ASSN_NAME	Community name - NVCS plant association used by the project
ASSN_CNAME	Community common name used by the project
SYNONYM	Other common name of plant association
ASSN_C EGL	Community element global code - TNC element code link to NVCS plant association
ALL_NAME	NVCS alliance name
ALL_CNAME	Translated common name of the NVCS alliance
NVCS_CODE	NVCS code (formation level)
CLASS	NVCS class name (code)
SUBCLASS	NVCS subclass name (code)
GROUP	NVCS group name (code)
SUBGROUP	NVCS subgroup name (code)
FORMATION	NVCS formation name
LUC_II	Land use and land cover classification system (USGS, Anderson <i>et al.</i> 1976)
COMMENT1	General description of the map unit
COMMENT2	General comment describing how the map unit relates to other map units
PDOG	Evidence of prairie dog activity in the polygon (1=yes or 0=no)
(*ArcInfo <sup>®</sup> default items)	

**2.6 MAP VERIFICATION AND ACCURACY ASSESSMENT**

Once the aerial photo interpretation transfer and digitization was complete, we printed draft 1:12,000-scale hard copy vegetation maps. Photo interpreters checked the map against the interpreted aerial photographs to ensure that the polygons were labeled properly and to locate any extra or missing lines. They also compared the map labels to the observation and plot data. Copies of the revised draft map were then sent to the Refuge for review and taken into field by the photo interpreters for ground-truthing. During the ground-truthing process, we collected additional observation points and verified aerial photograph signatures using landmarks and GPS waypoints. The map and map units were then modified to correct any mistakes.

RSGIS conducted an assessment of the vegetation map's thematic accuracy in the summer of 2001. Accuracy assessment (AA) sample sites were selected by following the protocols defined by the USGS-NPS Vegetation Mapping Program (TNC 1994a). AA points were selected using a 100-meter grid overlaid on the ONWR vegetation coverage in ArcInfo<sup>®</sup>. The origin of the grid was selected using a random number

table and the intersections of the gridlines became the pool of potential sample points. Sample points were removed from the pool if they fell within 10 meters of a vegetation polygon line or fell on a non-vegetated site. The remaining points were attributed by vegetation type. Between five and 30 points were randomly selected for each vegetation type using a random number generator in ArcInfo<sup>®</sup>. More AA sample points were selected for common map units and fewer selected for rare map units. Some extremely rare map units had fewer than five AA sample points due to their small size (all potential AA points fell within 10m of a polygon boundary). A total of 421 sample points were selected for the ONWR accuracy assessment (**Figure 10**).

AA logistics involved plotting AA points and polygon boundaries on hard copy 1:12,000-scale topographic quadrangle maps. Each point's UTM coordinates were uploaded into a Garmin GPS unit to help find the field location of the AA points. Armed with the vegetation key, the digital AA point coordinates, and the map, an RSGIS ecologist (who had not previously been involved with the project) collected AA data at ONWR. The ecologist walked to each AA point and used the vegetation key (**Appendix D**) to identify the plant association within a 40m radius. Data recorded for each point included the community name(s), dominant species, environmental conditions, and rationale for the identification (**Appendix C**).

Upon completion of the fieldwork, the AA data were entered into the PLOTS database and reviewed for data entry errors. Incomplete data on the field sheets, including missing GPS coordinates, were corrected if possible. Final AA points were viewed in ArcView in relation to the vegetation map coverage. Actual assessment consisted of comparing the determination made in the field for each AA point to the polygon map label. These comparisons were made at an AA meeting held in September 2001 by a panel of USFWS and BOR staff. Each point was reviewed for accuracy and for errors made by the AA ecologist. In this manner, "false" errors or mismatches between a polygon and an accuracy assessment were separated from true errors. False errors were generally recognized as resulting from one of three problems:

- **GPS errors:** The point was located incorrectly (wrong polygon) due to GPS limitations (+/- error). Usually the point was too close to a polygon boundary.
- **Ecotone errors:** A point occurred in a zone of transition between two types.
- **Intuitive errors:** A point was classified differently than the polygon label but was overruled by USFWS staff. These errors probably resulted either from assessing areas too small to map or assessing too small an area around the point. Some of these points were removed from the assessment entirely.

The assessments for each point was recorded in an error matrix (*i.e.*, contingency table) after final approval by the ONWR biologist and USFWS regional planner.

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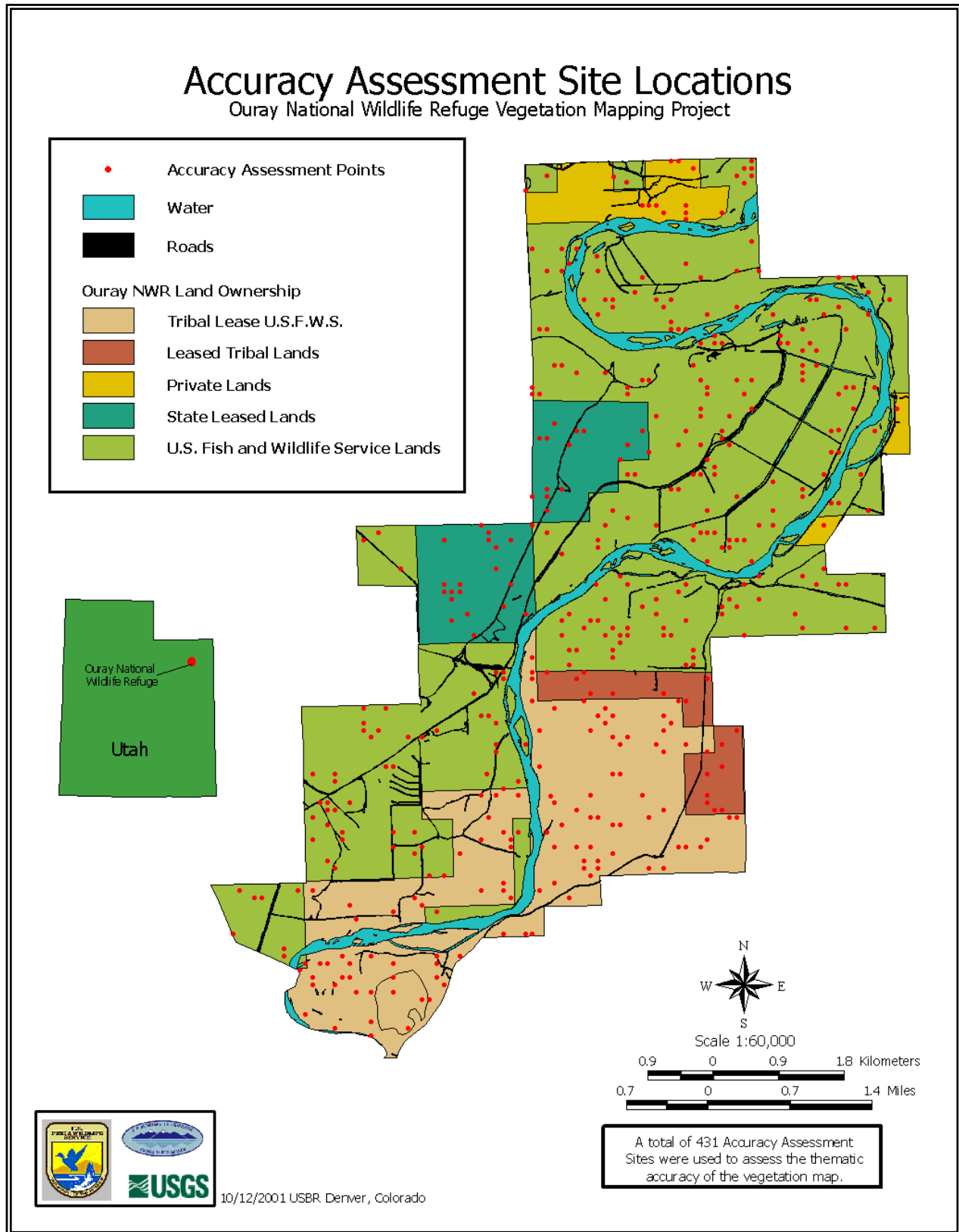


Figure 10. Locations of Accuracy Assessment Points Sampled at ONWR.

### **3. RESULTS AND DISCUSSION**

#### **3.1 NVCS CLASSIFICATION AT OURAY NWR**

Visual inspection, classification and ordination of the 130 plots sampled at ONWR resulted in 58 plant associations (**Figures 11-15**). The floodplain plant associations appeared to segregate primarily on the basis of soil moisture and/or depth to water table. For example, willow-dominated and annual forb (*e.g.* smartweed) plots adjacent to the Green River occurred at the mesic end of the environmental gradient (**Figure 14**) and big sagebrush and greasewood plots (found on the higher (drier) alluvial terraces) at the dry end. The middle of the gradient contained an intricate mixture of riparian woodland, shrubland, and herbaceous plant associations such as Russian-olive, salt cedar, and cattail types. Spread throughout the middle of the gradient were grassland sites dominated by western wheatgrass, alkali sacaton and inland saltgrass occurring on a variety of upper terraces, shallow draws, and tributary drainages.

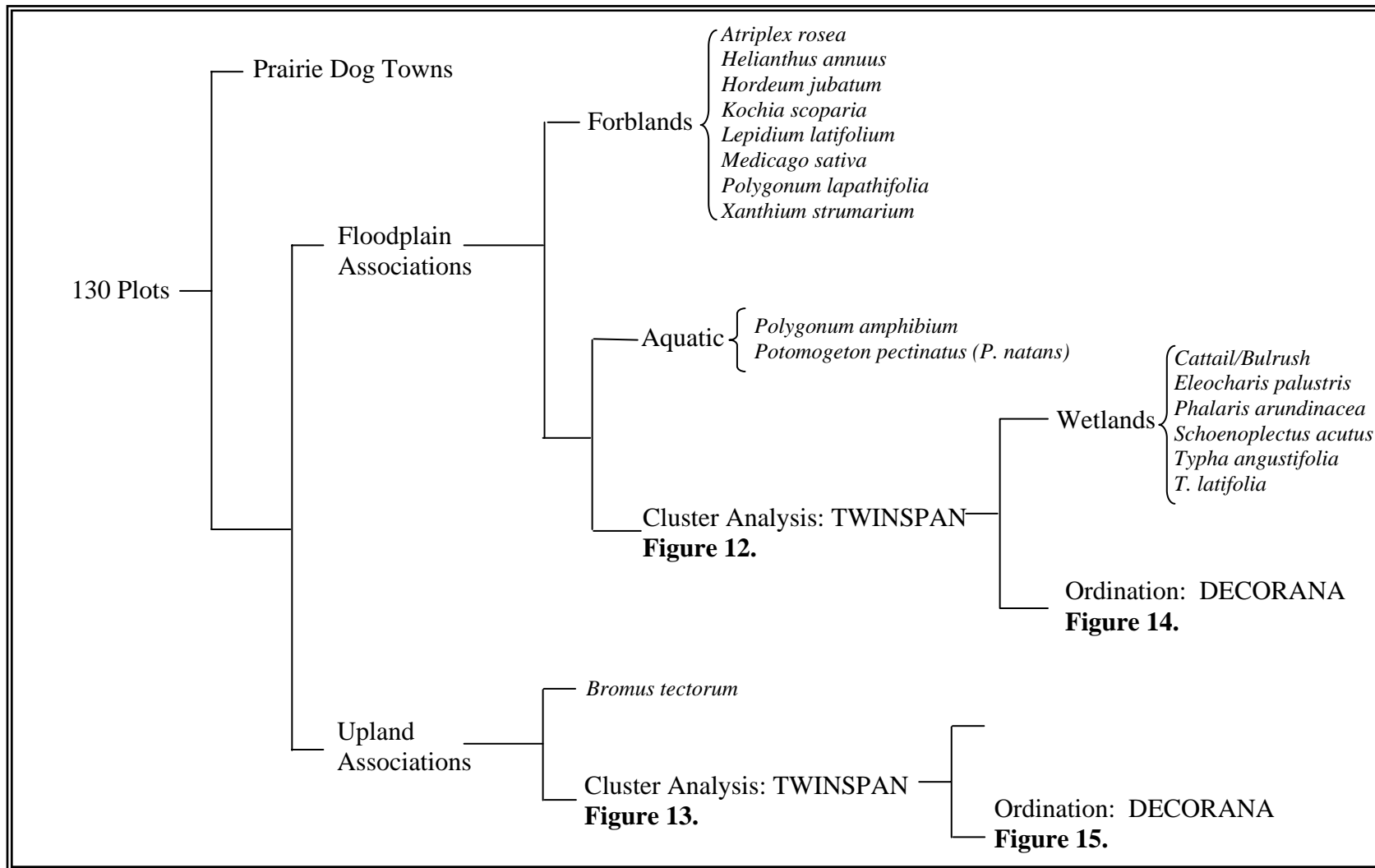
The upland plant associations appeared to segregate on the basis of soil texture and depth, and to a lesser extent, on fire and grazing history (**Figure 15**). Classification revealed three major subgroups of upland plots: Dwarf-shrubland, Shrubland and Grassland. Plots dominated by snakeweed were unique in that they were often grouped with other kinds of shrublands and grasslands. Plots dominated by sand dropseed, Indian ricegrass and rubber rabbitbrush occur at one end of the gradient, representing somewhat disturbed, deep sandy soils. The one plot representing the black sagebrush plant association (Plot 10) occurs on coarse cobble soils at the other extreme. Finally, the plots located toward the bottom of the ordination space represent plant associations found on fine textured, silty clay soils.

The final NVCS classification summary and detailed plant association descriptions appear in **Appendix E**.

#### **3.2 PHOTO-INTERPRETATION AND MAP UNITS**

We recognized and delineated 82 map units on the color infrared aerial photographs for ONWR. This included 59 vegetation units and 22 Anderson Level II (1976) and sub-level II (more detailed units than Level II) land-use units (Table 4). All map units were developed from a combination of an initial NVCS vegetation classification provided by the NatureServe with input from Refuge biologists and BOR ecologists, fieldwork, and preliminary photo-interpretation.

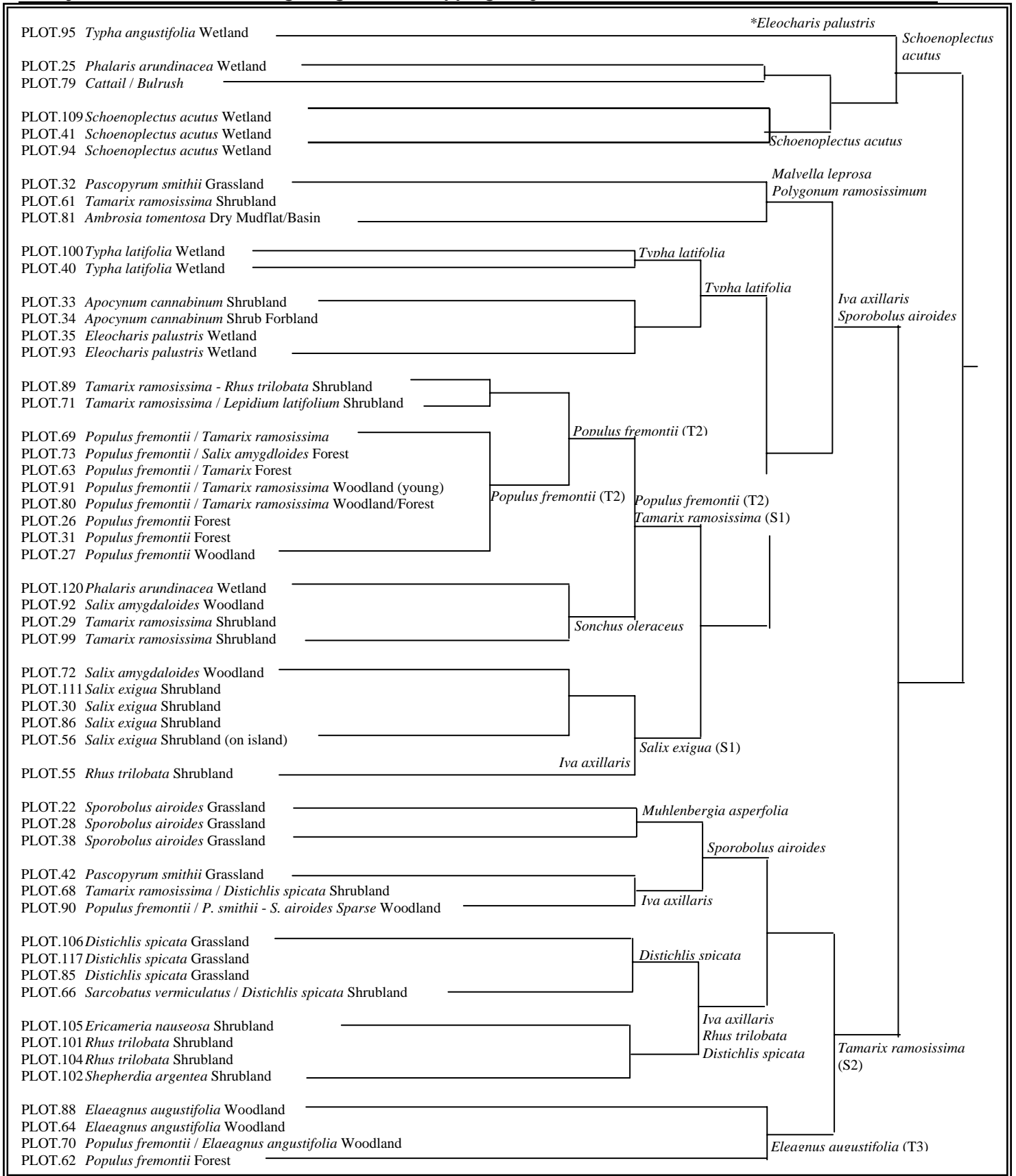
Please reference **Appendix G** for detailed descriptions and representative photos for all vegetation map units.



**Figure 11.** Dendrogram illustrating subjective classification of all 130 plots.

- Illustration represents subjective groupings prior to multivariate analysis using TWINSpan and DECORANA (McCune and Mefford 1999).
- Dominant species for each outlier association are indicated in italics.

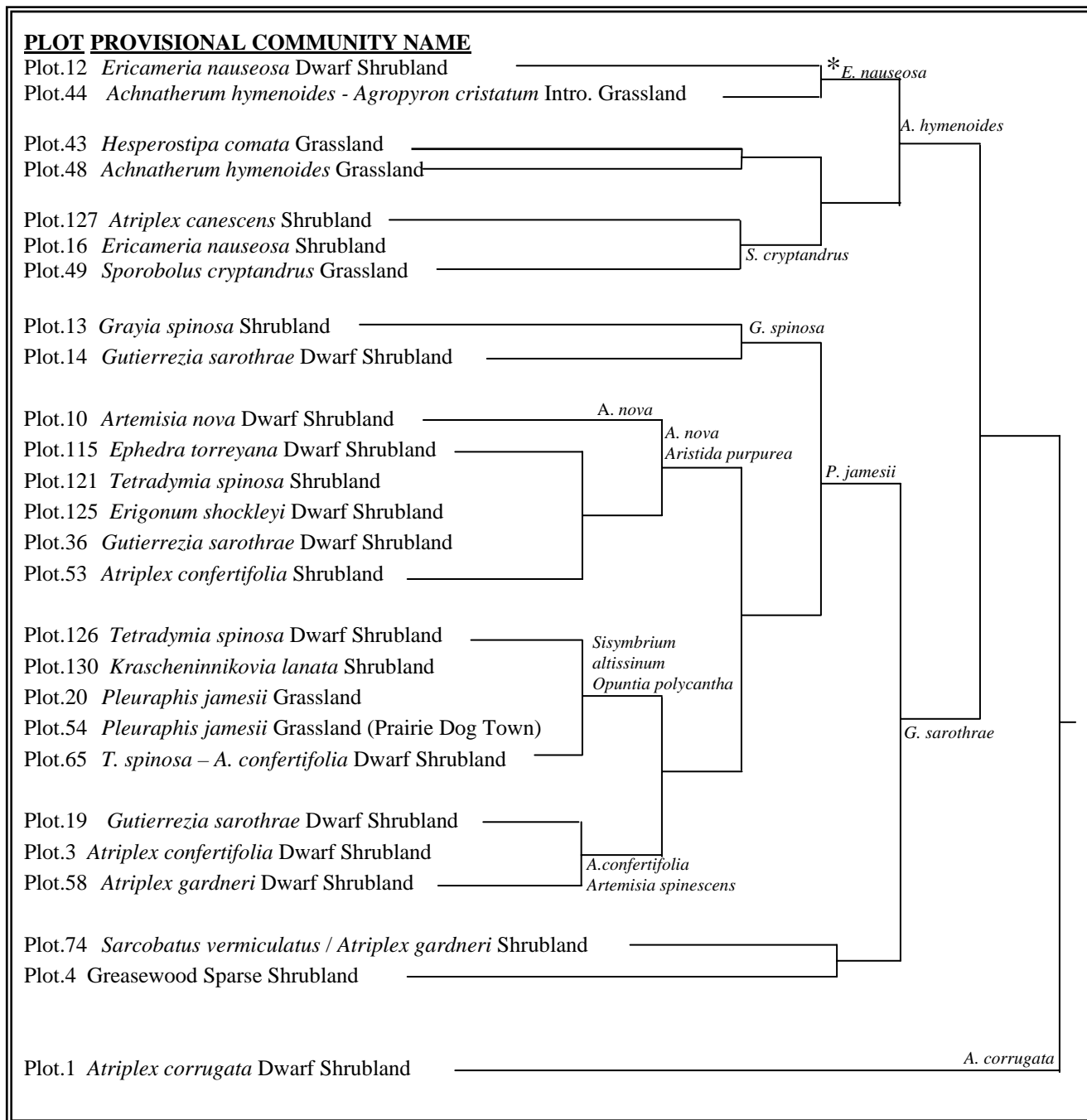
# Ouray National Wildlife Refuge Vegetation Mapping Project



**Figure 12.** TWINSpan Dendrogram of 53 Floodplain Plots Sampled at ONWR.

\* = Indicator species. Strata: **T2**=canopy layer, **T3**=sub-canopy, **S1**=shrub layer 1, **S2**=shrub layer 2, **S3**=shrub layer 3.

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**Figure 13.** TWINSpan Dendrogram of 26 Upland Plots Sampled at ONWR.

\* = Indicator species



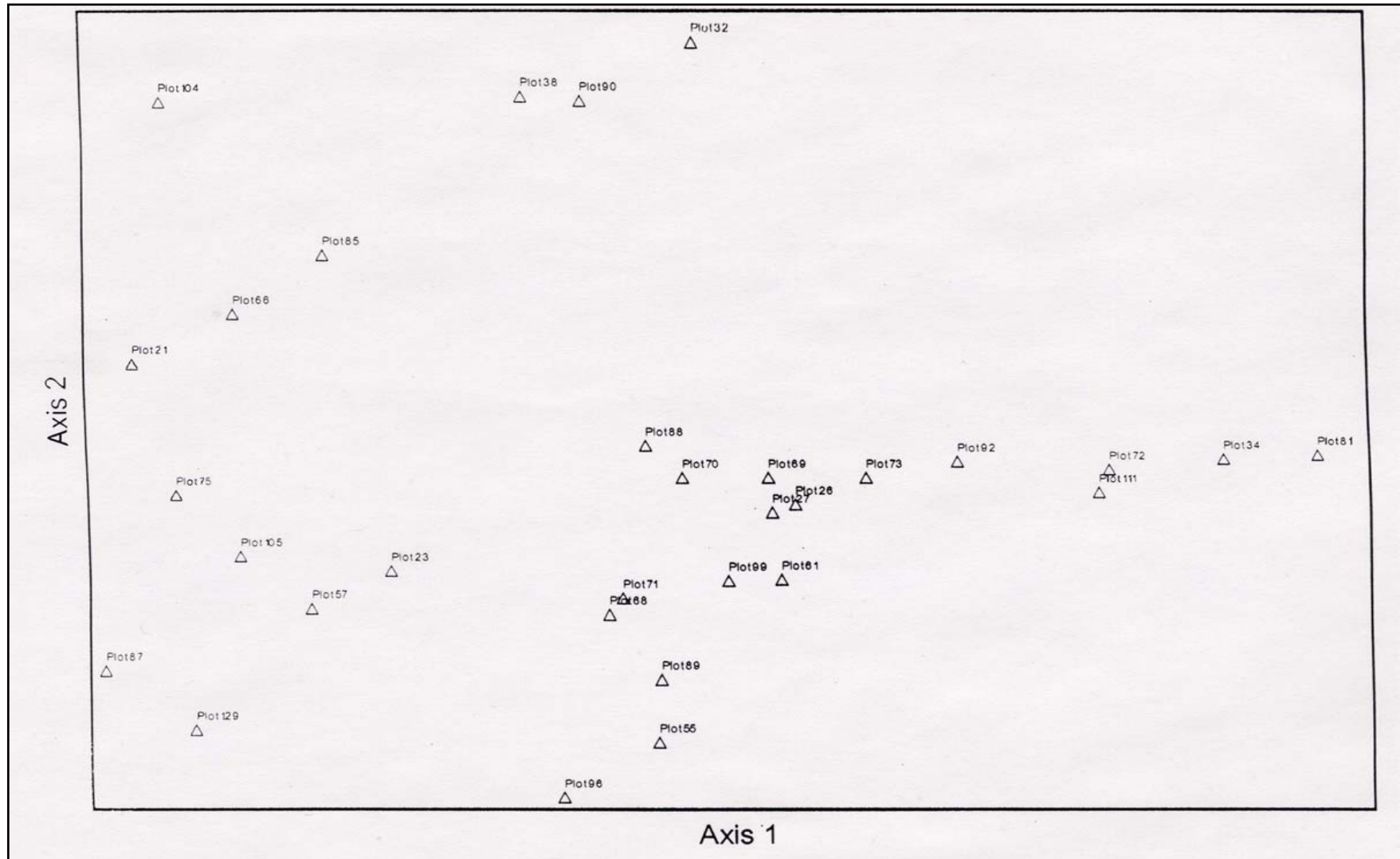


Figure 14. DECORANA Ordination of 34 Floodplain Vegetation Plots.

-See Figure 10 for provisional community names for each plot.

Ouray National Wildlife Refuge Vegetation Mapping Project

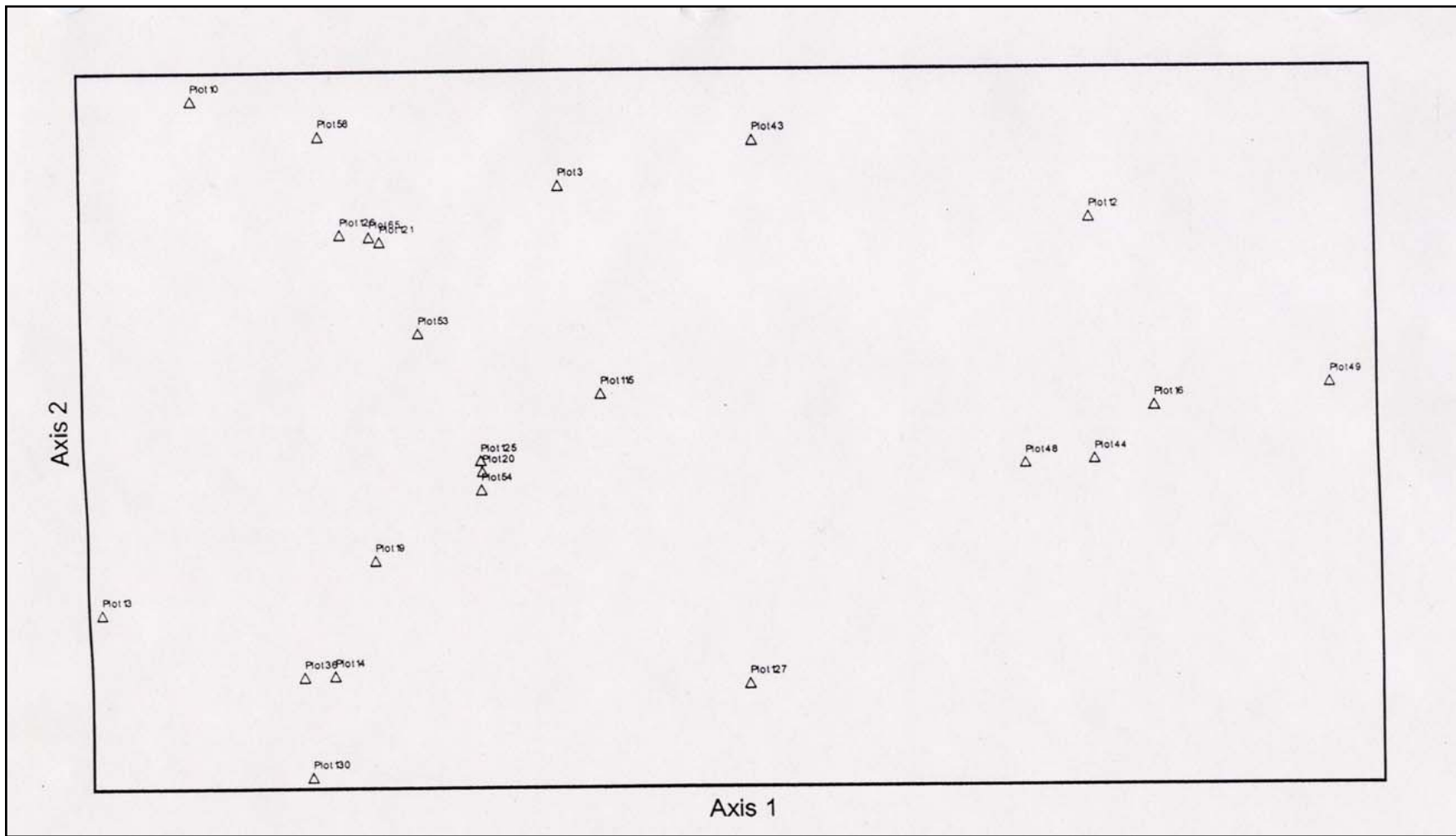


Figure 15. DECORANA Ordination of 23 Upland Plots Sampled at ONWR.

-See Figure 11 for provisional community names for each plot.

**Table 3.** Established and provisional NVCS plant associations and alliances at Ouray NWR.

Plant Association Name	Common Name	Elcode*
<b>Floodplain Plant Associations – Forests and Woodlands</b>		
<i>Elaeagnus angustifolia</i> Semi-natural Woodland	Russian-olive Semi-natural Woodland	CEGL005269
<i>Populus fremontii</i> Temporarily Flooded Forest	Fremont Cottonwood Temporarily Flooded Forest	A.313
<i>Populus fremontii</i> Temporarily Flooded Woodland	Fremont Cottonwood Temporarily Flooded Woodland	A.644
<i>Salix amygdaloides</i> / <i>Salix exigua</i> Woodland	Peachleaf Willow / Coyote Willow Woodland	CEGL000948
<b>Floodplain Plant Associations - Shrublands</b>		
<i>Ericameria parryi</i> - <i>Sarcobatus vermiculatus</i> Shrubland [Provisional]	Parry rabbitbrush-Black Greasewood Shrubland [Provisional]	Local Community
<i>Rhus trilobata</i> - <i>Salix exigua</i> Shrubland	Ill-scented Sumac - Coyote Willow Shrubland	CEGL001121
<i>Salix exigua</i> / Barren Shrubland	Coyote Willow / Barren Shrubland	CEGL001200
<i>Sarcobatus vermiculatus</i> / <i>Atriplex gardneri</i> Shrubland	Black Greasewood / Gardner's Saltbush Shrubland	CEGL001360
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland	Black Greasewood / Saltgrass Shrubland	CEGL001363
<i>Sherpherdia argentea</i> Great Basin Shrubland	Silver Buffaloberry Great Basin Shrubland	New NVCS Association
<i>Tamarix</i> spp. Temporarily Flooded Shrubland	Tamarisk species Temporarily Flooded Shrubland	CEGL003114
<b>Floodplain Plant Associations – Forlands and Grasslands</b>		
Annual Weedy Forbs Mudflat Complex	Annual Weedy Forbs Mudflat Complex	CECX Mudflat Complex
<i>Distichlis spicata</i> Herbaceous Vegetation	Saltgrass Herbaceous Vegetation	CEGL001770
<i>Eleocharis palustris</i> Herbaceous Vegetation	Marsh Spikerush Herbaceous Vegetation	CEGL001833
<i>Hordeum jubatum</i> Herbaceous Vegetation	Foxtail Barley Herbaceous Vegetation	CEGL001798
<i>Juncus balticus</i> Herbaceous Vegetation	Baltic Rush Herbaceous Vegetation	CEGL001838
<i>Pascopyrum smithii</i> Herbaceous Vegetation	Western Wheatgrass Herbaceous Vegetation	CEGL001577
<i>Phalaris arundinacea</i> Western Herbaceous Vegetation	Reed Canary Grass Western Herbaceous Vegetation	CEGL001474

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<i>Phragmites australis</i> Western North America Temperate Semi-natural Herbaceous Vegetation	Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation	CEGL001475
<i>Polygonum amphibium</i> Permanently Flooded Herbaceous Alliance	Water Smartweed Permanently Flooded Herbaceous Alliance	CEGL002002
<i>Potamogeton natans</i> Herbaceous Vegetation	Floating Pondweed Herbaceous Vegetation	New NVCS Association
<i>Schoenoplectus acutus</i> Herbaceous Vegetation	Hardstem Bulrush Herbaceous Vegetation	CEGL001840
<i>Schoenoplectus pungens</i> Herbaceous Vegetation	Threesquare Herbaceous Vegetation	CEGL001587
<i>Sporobolus airoides</i> Southern Plains Herbaceous Vegetation	Alkali Sacaton Southern Plains Herbaceous Vegetation	CEGL001685
<i>Typha domingensis</i> Western Herbaceous Vegetation	Southern Cattail Western Herbaceous Vegetation	CEGL001845
<i>Typha latifolia</i> Western Herbaceous Vegetation	Broadleaf Cattail Western Herbaceous Vegetation	CEGL002010
<b>Upland Plant Associations - Shrublands</b>		
<i>Artemisia nova</i> Dwarf-shrubland	Black Sagebrush Dwarf-shrubland	CEGL001417
<i>Artemisia tridentata</i> Shrubland	Big Sagebrush Shrubland	CEGL000991
<i>Atriplex canescens</i> / <i>Pleuraphis jamesii</i> Shrubland	Fourwing Saltbush / James' Galleta Shrubland	CEGL001288
<i>Atriplex confertifolia</i> / <i>Pleuraphis jamesii</i> Shrubland	Shadscale / James' Galleta Shrubland	CEGL001304
<i>Atriplex corrugata</i> Dwarf-shrubland	Mat Saltbush Dwarf-shrubland	CEGL001437
<i>Atriplex gardneri</i> Dwarf-shrubland	Gardner's Saltbush Dwarf-shrubland	CEGL001438
<i>Ephedra torreyana</i> – ( <i>Atriplex canescens</i> , <i>confertifolia</i> ) Sparse Vegetation [Provisional]	Torrey's Joint-fir – (Fourwing Saltbush, Shadscale) Sparse Vegetation [Provisional]	Local Community
<i>Ericameria nauseosa</i> Sand Deposit Sparse Vegetation	Rubber Rabbitbrush Sand Deposit Sparse Vegetation	New NVCS Association
<i>Ericameria parryi</i> – <i>Sarcobatus vermiculatus</i> Shrubland [Provisional]	Parry Rabbitbrush – Black Greasewood Shrubland [Provisional]	Local Community
<i>Eriogonum schockleyi</i> Badlands Sparse Vegetation [Provisional]	Schockley's Buckwheat Badlands Sparse Vegetation [Provisional]	Local Community
<i>Grayia spinosa</i> / <i>Pleuraphis jamesii</i> Shrubland	Spiny Hopsage / James' Galleta Shrubland	New NVCS Association
<i>Gutierrezia sarothrae</i> - ( <i>Opuntia</i> spp.) / <i>Pleuraphis jamesii</i> Dwarf-shrubland	Snakeweed - (Prickly-pear species) / James' Galleta Dwarf Shrubland	CEGL002690
<i>Krascheninnikovia lanata</i> / <i>Pleuraphis jamesii</i> Dwarf-shrubland	Winter-fat / James' Galleta Dwarf Shrubland	CEGL001322

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<i>Tetradymia spinosa</i> / <i>Pleuraphis jamesii</i> Dwarf-shrubland	Short-spine Horsebrush / James' Galleta Dwarf Shrubland	New NVCS Association
<b>Upland Plant Associations – Forblands and Grasslands</b>		
<i>Achnatherum hymenoides</i> Herbaceous Alliance	Indian Ricegrass Herbaceous Alliance	A.1262
<i>Bromus tectorum</i> Semi-natural Herbaceous Alliance	Cheatgrass Herbaceous Semi-natural Alliance	CEGL003019
<i>Hesperostipa comata</i> Great Basin Herbaceous Vegetation	Needle-and-Thread Great Basin Herbaceous Vegetation	CEGL001705
<i>Lepidium latifolium</i> Semi-natural Herbaceous Vegetation [Provisional]	Broadleaved Pepperweed Semi-natural Herbaceous Vegetation [Provisional]	Local Community
<i>Pleuraphis jamesii</i> Herbaceous Vegetation	James' Galleta Herbaceous Vegetation	CEGL001777
<i>Sporobolus cryptandrus</i> Great Basin Herbaceous Vegetation	Sand Dropseed Great Basin Herbaceous Vegetation	CEGL002691

\*ELCODE represents NatureServe's internal database tracking code for each recognized plant association. Local communities have not been described outside of ONWR by NatureServe but have been recognized as provisional NVCS associations by NatureServe. New NVCS associations have not yet been assigned an Elcode number.

**Table 4.** Map units used for Ouray National Wildlife Refuge.

The units are organized into ecological groups. "Level" refers to whether the map unit represents a NVCS plant association or alliance (NVCS unless otherwise noted), local plant community/plant population, or a land use class. Anderson Land Use Classes are identified by Roman numerals.

Map Code	Map Unit Name	Map Unit Common Name	Level
<b>Floodplain Units – Forests and Woodlands</b>			
1	<i>Populus fremontii</i> Temporarily Flooded Forest Alliance	Fremont Cottonwood Temporarily Flooded Forest Alliance	Alliance
2	<i>Populus fremontii</i> Temporarily Flooded Woodland Alliance	Fremont Cottonwood Temporarily Flooded Woodland Alliance	Alliance
3	<i>Salix amygdaloides</i> / <i>Salix exigua</i> Woodland	Peachleaf Willow / Coyote Willow Woodland	Association
4	<i>Elaeagnus angustifolia</i> Semi-Natural Woodland	Russian-olive Semi-natural Woodland	Association
<b>Floodplain Units – Shrublands</b>			
5	<i>Salix exigua</i> / Barren Shrubland	Coyote Willow / Barren Shrubland	Association
6	<i>Tamarix</i> spp. Temporarily Flooded Shrubland	Tamarisk spp. Temporarily Flooded Shrubland	Association
7	<i>Tamarix</i> spp. / <i>Sporobolus airoides</i> Shrubland	Tamarisk spp. / Alkali Sacaton Shrubland	Local Plant Community
8	<i>Rhus trilobata</i> – <i>Salix exigua</i> Shrubland	Ill-scented Sumac – Coyote Willow Shrubland	Association
9	<i>Shepherdia argentea</i> Great Basin Shrubland	Silver Buffaloberry Great Basin Shrubland	New NVCS Association
10	* <i>Symphoricarpos occidentalis</i> Shrubland	Snowberry Shrubland	Local Plant Population
11	<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland	Black Greasewood / Saltgrass Shrubland	Association
12	<i>Sarcobatus vermiculatus</i> / <i>Atriplex gardneri</i> Shrubland	Black Greasewood / Gardner's Saltbush Shrubland	Association
14	<i>Ericameria parryi</i> - <i>Sarcobatus vermiculatus</i> Shrubland [Provisional]	Parryi Rabbitbrush – Black Greasewood Shrubland [Provisional]	Association (NVCS Provisional)
<b>Floodplain Units – Herbaceous Wetland</b>			
27	<i>Potamogeton natans</i> Herbaceous Vegetation	Floating Pondweed Herbaceous Vegetation	New NVCS Association
28	<i>Polygonum amphibium</i> Permanently Flooded Herbaceous Alliance	Water Smartweed Permanently Flooded Herbaceous Alliance	Alliance
29	<i>Polygonum lapathifolium</i> Permanently Flooded Herbaceous Vegetation	Pale Smartweed Permanently Flooded Herbaceous Vegetation	Local Plant Community

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30	<i>Schoenoplectus acutus</i> Herbaceous Vegetation	Hardstem Bulrush Herbaceous Vegetation	Association
31	<i>Typha domingensis</i> ( <i>Typha angustifolia</i> , <i>latifolia</i> ) Herbaceous Vegetation	Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation	Complex <sup>1</sup>
32	* <i>Schoenoplectus pungens</i> Herbaceous Vegetation	Threesquare Herbaceous Vegetation	Association
33	<i>Juncus balticus</i> Herbaceous Vegetation	Baltic Rush Herbaceous Vegetation	Association
34	<i>Eleocharis palustris</i> Herbaceous Vegetation	Common Spikerush Herbaceous Vegetation	Association
35	<i>Phragmites australis</i> Western North America Temperate Semi-natural Herbaceous Vegetation	Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation	Association
36	<i>Phalaris arundinacea</i> Western Herbaceous Vegetation	Reed Canary Grass Western Herbaceous Vegetation	Association
<b>Floodplain Units – Herbaceous Non-wetland</b>			
37	<i>Hordeum jubatum</i> Herbaceous Vegetation	Foxtail Barley Herbaceous Vegetation	Association
40	<i>Distichlis spicata</i> Herbaceous Vegetation	Saltgrass Herbaceous Vegetation	Association
41	<i>Sporobolus airoides</i> Southern Plains Herbaceous Vegetation	Alkali Sacaton Southern Plains Herbaceous Vegetation	Association
42	<i>Pascopyrum smithii</i> Herbaceous Vegetation	Western Wheatgrass Herbaceous Vegetation	Association
50	<i>Apocynum cannabinum</i> Herbaceous Vegetation	Hemp Dogbane Herbaceous Vegetation	Local Plant Community
60	<i>Ambrosia tomentosa</i> - <i>Helianthus annuus</i> Herbaceous Vegetation	Bur Ragweed - Wild Sunflower Herbaceous Vegetation	Floristic Sub-association
61	<i>Atriplex rosea</i> Semi-natural Herbaceous Vegetation	Red Orache Semi-natural Herbaceous Vegetation	Floristic Sub-association
62	<i>Xanthium strumarium</i> Herbaceous Vegetation	Cocklebur Herbaceous Vegetation	Floristic Sub-association
63	<i>Iva axillaris</i> Herbaceous Vegetation	Poverty Sumpweed Herbaceous Vegetation	Local Plant Community
64	<i>Kochia scoparia</i> Semi-natural Herbaceous Vegetation	Kochia Semi-natural Herbaceous Vegetation	Floristic Sub-association
66	<i>Lepidium latifolium</i> Semi-natural Herbaceous Vegetation [Provisional]	Pepperweed Semi-natural Herbaceous Vegetation [Provisional]	Association (NVCS Provisional)
68	<i>Glycyrrhiza lepidota</i> Herbaceous Vegetation	Wild Licorice Herbaceous Vegetation	Local Plant Community

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Upland Units - Shrubland			
13	<i>Artemisia tridentata</i> Shrubland	Big Sagebrush Shrubland	Association
15	<i>Ericameria nauseosa</i> Sand Deposit Sparse Vegetation	Rubber Rabbitbrush Sand Deposit Sparse Vegetation	New NVCS Association
16	<i>Atriplex canescens</i> / <i>Pleuraphis jamesii</i> Shrubland	Fourwing Saltbush / James' Galleta Shrubland	Association
17	<i>Grayia spinosa</i> / <i>Pleuraphis jamesii</i> Shrubland	Spiny Hopsage / James' Galleta Shrubland	New NVCS Association
18	<i>Tetradymia spinosa</i> / <i>Pleuraphis jamesii</i> Dwarf-shrubland	Short-spine Horsebrush / James' Galleta Dwarf-shrubland	New NVCS Association
19	<i>Gutierrezia sarothrae</i> – ( <i>Opunita</i> spp.) / <i>Pleuraphis jamesii</i> Dwarf-shrubland	Snakeweed - (Prickly-pear spp.) / James' Galleta Dwarf Shrubland	Association
20	<i>Artemisia dracuncululus</i> Dwarf-shrubland	Tarragon Dwarf-shrubland	Local Plant Community
21	<i>Ephedra torreyana</i> – ( <i>Atriplex canescens</i> , <i>confertifolia</i> ) Sparse Vegetation [Provisional]	Torrey's Joint-fir – (Fourwing Saltbush, Shadscale) Sparse Vegetation [Provisional]	Local Plant Community
22	<i>Artemisia nova</i> Dwarf-shrubland	Black Sagebrush Dwarf-shrubland	Association
23	<i>Atriplex confertifolia</i> / <i>Pleuraphis jamesii</i> Shrubland	Shadscale / James' Galleta Shrubland	Association
24	<i>Atriplex corrugata</i> Dwarf-shrubland	Mat Saltbush Dwarf-shrubland	Association
25	<i>Atriplex gardneri</i> Dwarf-shrubland	Gardner's Saltbush Dwarf-shrubland	Association
26	<i>Eriogonum schockleyi</i> Badlands Sparse Vegetation [Provisional]	Schockley's Buckwheat Badlands Sparse Vegetation [Provisional]	Association (NVCS Provisional)
51	<i>Krascheninnikovia lanata</i> / <i>Pleuraphis jamesii</i> Dwarf-shrubland	Winter-fat / James' Galleta Dwarf-shrubland	Association
Upland Units - Herbaceous			
43	<i>Achnatherum hymenoides</i> Herbaceous Alliance	Indian Ricegrass Herbaceous Alliance	Alliance
44	<i>Achnatherum hymenoides</i> - <i>Agropyron cristatum</i> Herbaceous Vegetation	Indian Ricegrass - Crested Wheatgrass Herbaceous Vegetation	Local Plant Community
45	<i>Sporobolus cryptandrus</i> Great Basin Herbaceous Vegetation	Sand Dropseed Great Basin Herbaceous Vegetation	Association
46	<i>Hesperostipa comata</i> Great Basin Herbaceous Vegetation	Needle-and-Thread Great Basin Herbaceous Vegetation	Association
47	<i>Pleuraphis jamesii</i> Herbaceous Vegetation	James' Galleta Herbaceous Vegetation	Association
48	<i>Bromus tectorum</i> Semi-natural Herbaceous Alliance	Cheatgrass Semi-natural Herbaceous Alliance	Alliance



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Modified Vegetation			
49	<i>Bouteloua gracilis</i> Introduced Grassland	Blue Grama Introduced Grassland	Local Plant Community
65	<i>Medicago sativa</i> / <i>Populus fremontii</i> Herbaceous Vegetation	Alfalfa / Fremont Cottonwood Herbaceous Vegetation	Local Plant Community
67	<i>Opuntia polyacantha</i> - <i>Gutierrezia sarothrae</i> / <i>Halogeton glomeratus</i> - <i>Bromus tectorum</i> Disturbed Vegetation	Prairie Dog Town Disturbed Vegetation	Local Plant Community
101	<i>Schoenoplectus acutus</i> Herbaceous Vegetation - Burned	Hardstem Bulrush Herbaceous Vegetation - Burned	Management Association
103	<i>Typha domingensis</i> ( <i>Typha angustifolia</i> , <i>latifolia</i> ) Herbaceous Vegetation - Burned	Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation - Burned	Management Complex <sup>1</sup>
104	<i>Typha domingensis</i> ( <i>Typha angustifolia</i> , <i>latifolia</i> ) Herbaceous Vegetation - Disked	Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation - Disked	Management Complex <sup>1</sup>
Barren Units			
73	Clay Bluffs - Barren	Clay Bluffs - Barren	II
74	Mud Flats - Barren	Mud Flats - Barren	II
76	Point Bars - Dry Sand	Point Bars - Dry Sand	Sub-Level II
77	Point Bars - Wet Sand	Point Bars - Wet Sand	Sub-Level II
78	Islands - Dry Sand	Islands - Dry Sand	Sub-Level II
79	Islands - Wet Sand	Islands - Wet Sand	Sub-Level II
Land Use Units			
70	Agricultural Crop - Alfalfa	Agricultural Crop - Alfalfa	Sub-Level II
71	Agricultural Crop - Barley	Agricultural Crop - Barley	Sub-Level II
72	Agricultural Crop - Fallow Land	Agricultural Crop - Fallow Land	Sub-Level II
75	Constructed Waterfowl Nesting Islands	Constructed Waterfowl Nesting Islands	Sub-Level II
80	Utah Highway 88 ROW	Utah Highway 88 ROW	Sub-Level II
81	Uintah County Road	Uintah County Road	Sub-Level II
82	Hatchery Road	Hatchery Road	Sub-Level II

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83	Auto Tour Route	Auto Tour Route	Sub-Level II
84	Service Roads and Trails	Service Roads and Trails	II
85	Levee (Flood Control)	Levee (Flood Control)	Sub-Level II
86	Dike (Separate Impoundment)	Dike (Separate Impoundment)	Sub-Level II
89	Refuge Facility	Refuge Facility	Sub-Level II
90	Oil and Gas Facility	Oil and Gas Facility	Sub-Level II
91	Green River - Main Channel	Green River - Main Channel	Sub-Level II
92	Green River - Backwater	Green River - Backwater	Sub-Level II
93	Canal	Canal	II
95	Pond - Fish Hatchery	Pond - Fish Hatchery	Sub-Level II
96	Pond - Impoundment	Pond - Impoundment	Sub-Level II
97	Pond - Moist Soil	Pond - Moist Soil	Sub-Level II
98	Pond - Pot hole, Dugout, Livestock	Pond - Pot hole, Dugout, Livestock	Sub-Level II
99	Gravel Pit	Gravel Pit	II
100	Levee Removal Site	Levee Removal Site	Sub-Level II

<sup>1</sup> **COMPLEX:** A group of plant associations that cannot be mapped individually on the aerial photographs but occur together predictably on the landscape. Complexes typically are composed of communities with similar physiognomies, thus are more difficult to tell apart on the photos.

\*These associations and map units occurred in the Refuge but were not of sufficient size to map.

### 3.3 RELATIONSHIP BETWEEN MAP UNITS AND PLANT ASSOCIATIONS

The ONWR map units represent a compromise among the detail of the NVCS classification, the needs of the Refuge and the limitations of the photography. As a result, the ONWR mapping scheme does not exactly match the NVCS. The vegetation map units are linked (“crosswalked”) to the NVCS plant associations. When a plant association has a unique photo signature, the map unit and the plant association are the same. When plant associations occur in complexes of stands too small to map or when related plant associations share the same signature, several plant associations are lumped into a single map unit. When more than one phase of a single plant association could be recognized on the photos, a plant association is split among several map classes. Finally, non-vegetated areas and vegetation types not recognized by the NVCS receive special map unit designations. The crosswalking of the NVCS associations to the map units for ONWR are listed below.

#### ***Map Units Representing Single NVCS Units (either existing or new)***

The following map units were created from the NVCS and represent established or provisional plant associations or alliances that could be discerned and delineated on the aerial photography.

Map Code	Map Unit NVCS Plant Association
1	<i>Populus fremontii</i> Temporarily Flooded Forest Alliance <i>Populus fremontii</i> Temporarily Flooded Forest Alliance
2	<i>Populus fremontii</i> Temporarily Flooded Woodland Alliance <i>Populus fremontii</i> Temporarily Flooded Woodland Alliance
3	<i>Salix amygdaloides</i> / <i>Salix exigua</i> Woodland <i>Salix amygdaloides</i> / <i>Salix exigua</i> Woodland
4	<i>Elaeagnus angustifolia</i> Semi-natural Woodland <i>Elaeagnus angustifolia</i> Semi-natural Woodland
5	<i>Salix exigua</i> /Barren Shrubland <i>Salix exigua</i> /Barren Shrubland
6	<i>Tamarix</i> spp. Temporarily Flooded Shrubland <i>Tamarix</i> spp. Temporarily Flooded Shrubland
8	<i>Rhus trilobata</i> - Coyote Willow Shrubland <i>Rhus trilobata</i> - <i>Salix exigua</i> Shrubland
9	<i>Shepherdia argentea</i> Great Basin Shrubland <i>Shepherdia argentea</i> Great Basin Shrubland
11	<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland <i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland

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- 12    *Sarcobatus vermiculatus* / *Atriplex gardneri* Shrubland  
      *Sarcobatus vermiculatus* / *Atriplex gardneri* Shrubland
- 13    *Artemisia tridentata* Shrubland  
      *Artemisia tridentata* Shrubland
- 14    *Ericameria parryi* – *Sarcobatus vermiculatus* Shrubland [Provisional]  
      *Ericameria parryi*-*Sarcobatus vermiculatus* Shrubland [Provisional]
- 15    *Ericameria nauseosa* Sand Deposit Sparse Vegetation  
      *Ericameria nauseosa* Sand Deposit Sparse Vegetation
- 16    *Atriplex canescens* / *Pleuraphis jamesii* Shrubland  
      *Atriplex canescens* / *Pleuraphis jamesii* Shrubland
- 17    *Grayia spinosa* / *Pleuraphis jamesii* Shrubland  
      *Grayia spinosa* / *Pleuraphis jamesii* Shrubland
- 18    *Tetradymia spinosa* / *Pleuraphis jamesii* Dwarf-shrubland  
      *Tetradymia spinosa* / *Pleuraphis jamesii* Dwarf-shrubland
- 19    *Gutierrezia sarothrae* - (*Opuntia* spp.) / *Pleuraphis jamesii* Dwarf-shrubland  
      *Gutierrezia sarothrae* - (*Opuntia* spp.) / *Pleuraphis jamesii* Dwarf-shrubland
- 21    *Ephedra torreyana* – (*Atriplex canescens*, *confertifolia*) Sparse Vegetation [Provisional]  
      *Ephedra torreyana* –(*Atriplex canescens*, *confertifolia*) Sparse Vegetation [Provisional]
- 22    *Artemisia nova* Dwarf-shrubland  
      *Artemisia nova* Dwarf-shrubland
- 23    *Atriplex confertifolia* / *Pleuraphis jamesii* Shrubland  
      *Atriplex confertifolia* / *Pleuraphis jamesii* Shrubland
- 24    *Atriplex corrugata* Dwarf-shrubland  
      *Atriplex corrugata* Dwarf-shrubland
- 25    *Atriplex gardneri* Dwarf-shrubland  
      *Atriplex gardneri* Dwarf-shrubland
- 26    *Eriogonum schockleyi* Badlands Sparse Vegetation [Provisional]  
      *Eriogonum schockleyi* Badlands Sparse Vegetation [Provisional]
- 27    *Potamogeton natans* Herbaceous Vegetation  
      *Potamogeton natans* Herbaceous Vegetation
- 28    *Polygonum amphibium* Permanently Flooded Herbaceous Alliance  
      *Polygonum amphibium* Permanently Flooded Herbaceous Alliance
- 30    *Schoenoplectus acutus* Herbaceous Vegetation  
      *Schoenoplectus acutus* Herbaceous Vegetation
32.    *Schoenoplectus pungens* Herbaceous Vegetation  
      *Schoenoplectus pungens* Herbaceous Vegetation

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- 33     *Juncus balticus* Herbaceous Vegetation  
       *Juncus balticus* Herbaceous Vegetation
- 34     *Eleocharis palustris* Herbaceous Vegetation  
       *Eleocharis palustris* Herbaceous Vegetation
- 35     *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation  
       *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation
- 36     *Phalaris arundinacea* Western Herbaceous Vegetation  
       *Phalaris arundinacea* Western Herbaceous Vegetation
- 37     *Hordeum jubatum* Herbaceous Vegetation  
       *Hordeum jubatum* Herbaceous Vegetation
40.     *Distichlis spicata* Herbaceous Vegetation  
       *Distichlis spicata* Herbaceous Vegetation
- 41     *Sporobolus airoides* Southern Plains Herbaceous Vegetation  
       *Sporobolus airoides* Southern Plains Herbaceous Vegetation
- 42     *Pascopyrum smithii* Herbaceous Vegetation  
       *Pascopyrum smithii* Herbaceous Vegetation
- 43     *Achnatherum hymenoides* Herbaceous Alliance  
       *Achnatherum hymenoides* Herbaceous Alliance
- 45     *Sporobolus cryptandrus* Great Basin Herbaceous Vegetation  
       *Sporobolus cryptandrus* Great Basin Herbaceous Vegetation
- 46     *Hesperostipa comata* Great Basin Herbaceous Vegetation  
       *Hesperostipa comata* Great Basin Herbaceous Vegetation
- 47     *Pleuraphis jamesii* Herbaceous Vegetation  
       *Pleuraphis jamesii* Herbaceous Vegetation
- 48     *Bromus tectorum* Semi-natural Herbaceous Alliance  
       *Bromus tectorum* Semi-natural Herbaceous Alliance
- 51     *Krascheninnikovia lanata* / *Pleuraphis jamesii* Dwarf-shrubland  
       *Krascheninnikovia lanata* / *Pleuraphis jamesii* Dwarf-shrubland
- 66     *Lepidium latifolium* Semi-natural Herbaceous Alliance [Provisional]  
       *Lepidium latifolium* Semi-natural Herbaceous Alliance [Provisional]
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***Map Units Representing Multiple Phases of a Plant Association Complex***

The following map units represent plant associations that are divided into multiple map units because of floristic differences easily discerned on the aerial photographs. The floristic differences result from a combination of management, substrate, or moisture differences. Map units used to delineate these types can be considered local plant communities or plant populations.

Map Code	Map Unit
29	<i>Polygonum lapathifolium</i> Permanently Flooded Herbaceous Vegetation Annual Weedy Forbs Mudflat Complex
60	<i>Ambrosia tomentosa-Helianthus annuus</i> Herbaceous Vegetation Annual Weedy Forbs Mudflat Complex
61	<i>Atriplex rosea</i> Semi-natural Herbaceous Vegetation Annual Weedy Forbs Mudflat Complex
62	<i>Xanthium strumarium</i> Herbaceous Vegetation Annual Weedy Forbs Mudflat Complex
64	<i>Kochia scoparia</i> Semi-natural Herbaceous Vegetation Annual Weedy Forbs Mudflat Complex

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***Map Units Representing Aggregations of Plant Associations (Complex)***

In cases where closely related plant associations could not be distinguished on the photos, they were combined into a single map unit.

Map Code	Map Unit
31	<i>Typha domingensis</i> ( <i>Typha angustifolia</i> , <i>latifolia</i> ) Herbaceous Vegetation <i>Typha domingensis</i> Western Herbaceous Vegetation <i>Typha latifolia</i> Western Herbaceous Vegetation

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***Map Units Representing No Association (Refuge specials)***

These map units were created for ONWR to describe vegetation for which no NVCS association exists, or for one of the following reasons:

- To represent important wildlife habitat types not known outside ONWR;
- To represent important wildlife habitat types occurring in patches smaller than the minimum mapping unit of 0.5 ha;
- To represent vegetation that was manipulated in the recent past, such as old fields, areas planted to native grasses and burned and disked cattail stands.

Map Code	Map Unit (Explanation)
7	<i>Tamarix</i> spp. / <i>Sporobolus airoides</i> Shrubland (Map unit not known or described outside of ONWR.)
10	<i>Symphoricarpos occidentalis</i> Shrubland (Map unit represents areas that are below the MMU but have been observed at ONWR)
20	<i>Artemisia dracuncululus</i> Dwarf-shrubland (Map unit not known or described outside of ONWR.)
44	<i>Achnatherum hymenoides</i> - <i>Agropyron cristatum</i> Herbaceous Vegetation (Map unit represents an area that was reseeded along a reclaimed pipeline corridor.)
49	<i>Bouteloua gracilis</i> Introduced Grassland (Map unit represents a re-seeded area)
50	<i>Apocynum cannabinum</i> Herbaceous Vegetation (Map unit represents areas that are often below the MMU. Type closely compares with NVCS Dogbane association C EGL006537 but more dense.)
63	<i>Iva axillaris</i> Herbaceous Vegetation (Map unit represents areas that are often below the MMU.)
65	<i>Medicago sativa</i> / <i>Populus fremontii</i> Herbaceous Vegetation (Map unit represents an area that was seeded or adjacent to an old field.)
67	<i>Opuntia polyacantha</i> - <i>Gutierrezia sarothrae</i> / <i>Halogeton glomeratus</i> - <i>Bromus tectorum</i> Disturbed Vegetation (Map unit represents an old prairie dog town. Map unit is not known or described outside of ONWR.)
68	<i>Glycyrrhiza lepidota</i> Herbaceous Vegetation (Map unit represents individual stands that are not known or described outside of ONWR. Type is likely not a true community but rather a monotypic stand resulting from disturbance.)

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- 101** *Schoenoplectus acutus* Herbaceous Vegetation - Burned  
(Map unit represents *Schoenoplectus acutus* Herbaceous Vegetation (see Map Unit 30) stands that have been burned in the recent past)
- 103** *Typha domingensis* (*Typha angustifolia*, *latifolia*) Herbaceous Vegetation - Burned  
(Map unit represents *Typha* spp. (see Map Unit 31) stands that have been burned for control purposes in the recent past.)
- 104** *Typha domingensis* (*Typha angustifolia*, *latifolia*) Herbaceous Vegetation - Disked  
Map unit represents *Typha* spp. (see Map Unit 31) stands that have been disked for control purposes in the recent past.)
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### **3.4 VEGETATION MAP**

A total of 14,029 acres (5678 ha) comprising Ouray National Wildlife Refuge was mapped, including acreage leased by FWS from other agencies, tribes, and private individuals. Of this total, NVCS-related vegetation map units covered 10,714 acres (4286 ha). The remaining acreage was mapped using land cover and Refuge special map units. Of all the map units, the most frequent was #2 Fremont Cottonwood Temporarily Flooded Woodland with 902 polygons. However these were typically quite small (0.6 acres). The most abundant map unit in terms of area was #15 Rubber Rabbitbrush Dwarf-shrubland (sparse) type covering 1196 acres. Frequencies of map units (*i.e.*, number of polygons) along with acreage per map unit are listed in **Table 5**.

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### **3.5 ACCURACY ASSESSMENT**

Of the 421 sampling points generated for the accuracy assessment (see **Figure 10**), 42 could not be sampled because they were in impenetrable tamarisk thickets or in deep water or mud. The remainders were evaluated for accuracy in August 2001. By comparing these points back to the vegetation map we were able to calculate an overall thematic accuracy of 75.2%. **Table 6** presents the accuracy assessment scores and confidence intervals for each map unit assessed along with the values for the entire map.



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**Table 5.** Total acreage and frequency of map units for Ouray National Wildlife Refuge.

Map Code	Map Unit Common Name	Polygons	Hectares	Ave (h)	Acres	Ave (a)
1	Fremont Cottonwood Temporarily Flooded Forest	38	153.1	4.0	378.3	10.0
2	Fremont Cottonwood Temporarily Flooded Woodland	902	213.8	0.2	528.3	0.6
3	Peachleaf Willow / Coyote Willow Woodland	22	4.4	0.2	10.8	0.5
4	Russian-olive Semi-natural Woodland	113	15.6	0.1	38.5	0.3
5	Coyote Willow / Barren Shrubland	92	54.1	0.6	133.6	1.5
6	Tamarisk spp. Temporarily Flooded Shrubland	95	61.6	0.6	152.1	1.6
7	Tamarisk spp. / Alkali Sacaton Shrubland	456	273.1	0.6	674.7	1.5
8	Ill-scented Sumac – Coyote Willow Shrubland	115	62.2	0.5	153.7	1.3
9	Silver Buffaloberry Great Basin Shrubland	11	1.3	0.1	3.2	0.3
10	Snowberry Shrubland	0	0	0	0	0
11	Black Greasewood / Saltgrass Shrubland	326	446.2	1.4	1102.6	3.4
12	Black Greasewood / Gardner's Saltbush Shrubland	70	267.3	3.8	660.5	9.4
13	Big Sagebrush Shrubland	8	8.6	1.1	21.2	2.7
14	Parryi Rabbitbrush – Black Greasewood Shrubland [Provisional]	18	10.4	0.6	25.8	1.4
15	Rubber Rabbitbrush Sand Deposit Sparse Vegetation	208	483.9	2.3	1195.6	5.7
16	Fourwing Saltbush / James' Galleta Shrubland	16	20.3	1.3	50.2	3.1
17	Spiny Hopsage / James' Galleta Shrubland	41	145.7	3.6	360.0	8.8
18	Short-spine Horsebrush / James' Galleta Dwarf-shrubland	23	64.4	2.8	159.1	6.9
19	Snakeweed – (Prickly-pear spp.) / James' Galleta Dwarf-shrubland	35	24.5	0.7	60.5	1.7
20	Tarragon Dwarf-shrubland	1	0.1	0.1	0.2	0.2
21	Torrey's Joint-fir – (Fourwing Saltbush, Shadscale) Sparse Vegetation [Provisional]	61	18.2	0.3	45.0	0.7
22	Black Sagebrush Dwarf-shrubland	9	6.1	0.7	15.1	1.7
23	Shadscale / James' Galleta Dwarf-shrubland	54	25.7	0.5	63.6	1.2
24	Mat Saltbush Dwarf-shrubland	4	0.5	0.1	1.2	0.3
25	Gardner's Saltbush Dwarf-shrubland	9	32.9	3.7	81.4	9.0
26	Schockley's Buckwheat Badlands Sparse Vegetation [Provisional]	6	2.4	0.4	5.9	1.0
27	Floating Pondweed Herbaceous Vegetation	8	52.8	6.6	130.5	16.3
28	Water Smartweed Permanently Flooded Herbaceous Alliance	59	43.0	0.7	106.2	1.8
29	Pale Smartweed Permanently Flooded Herbaceous Vegetation	13	44.0	3.4	108.8	8.4
30	Hardstem Bulrush Herbaceous Vegetation	68	61.8	0.9	152.8	2.2
31	Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation	243	306.9	1.3	758.3	3.1
32	Threesquare Herbaceous Vegetation	0	0	0	0	0
33	Baltic Rush Herbaceous Vegetation	2	0.2	0.1	0.5	0.3
34	Common Spikerush Herbaceous Vegetation	38	14.1	0.4	34.8	0.9
35	Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation	3	0.3	0.1	0.8	0.3
36	Reed Canary Grass Western Herbaceous Vegetation	12	4.7	0.4	11.6	1.0
37	Foxtail Barley Herbaceous Vegetation	5	14.2	2.8	35.2	7.0

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Map Code	Map Unit Common Name	Polygons	Hectares	Ave (h)	Acres	Ave (a)
40	Saltgrass Herbaceous Vegetation	259	143.5	0.6	354.5	1.4
41	Alkali Sacaton Southern Plains Herbaceous Vegetation	50	19.5	0.4	48.2	1.0
42	Western Wheatgrass Herbaceous Vegetation	101	132.7	1.3	327.9	3.2
43	Indian Ricegrass Herbaceous Alliance	93	62.1	0.7	153.5	1.7
44	Indian Ricegrass - Crested Wheatgrass Herbaceous Vegetation	1	0.7	0.7	1.8	1.8
45	Sand Dropseed Great Basin Herbaceous Vegetation	2	6.7	3.4	16.6	8.3
46	Needle-and-Thread Great Basin Herbaceous Vegetation	116	75.6	0.7	186.9	1.6
47	James' Galleta Herbaceous Vegetation	152	216.6	1.4	535.3	3.5
48	Cheatgrass Semi-natural Herbaceous Alliance	44	24.3	0.6	60.1	1.4
49	Blue Grama Introduced Grassland	2	0.7	0.4	1.8	0.9
50	Hemp Dogbane Herbaceous Vegetation	66	40.3	0.6	99.6	1.5
51	Winter-fat / James' Galleta Dwarf-shrubland	2	0.2	0.1	0.5	0.3
60	Bur Ragweed - Wild Sunflower Herbaceous Vegetation	13	46.0	3.5	113.6	8.7
61	Red Orache Semi-natural Herbaceous Vegetation	33	91.1	2.8	225.0	6.8
62	Cocklebur Herbaceous Vegetation	23	6.2	0.3	15.4	0.7
63	Poverty Sumpweed Herbaceous Vegetation	6	1.0	0.2	2.4	0.4
64	Kochia Semi-natural Herbaceous Vegetation	23	25.7	1.1	63.5	2.8
65	Alfalfa / Fremont Cottonwood Herbaceous Vegetation	12	4.9	0.4	12.0	1.0
66	Pepperweed Semi-natural Herbaceous Vegetation [Provisional]	389	218.1	0.6	538.9	1.4
67	Prairie Dog Town Disturbed Vegetation	42	109.4	2.6	270.3	6.4
68	Wild Licorice Herbaceous Vegetation	42	18.3	0.4	45.2	1.1
70	Agricultural Crop - Alfalfa	5	19.3	3.9	47.8	9.6
71	Agricultural Crop - Barley	1	57.0	57.0	140.8	140.8
72	Agricultural Crop - Fallow Land	6	21.7	3.6	53.7	9.0
73	Clay Bluffs - Barren	79	363.2	4.6	897.5	11.4
74	Mud Flats - Barren	80	121.2	1.5	299.5	3.7
75	Constructed Waterfowl Nesting Islands	23	0.3	0.0	0.8	0.0
76	Point Bars - Dry Sand	92	52.2	0.6	128.9	1.4
77	Point Bars - Wet Sand	65	31.8	0.5	78.5	1.2
78	Islands - Dry Sand	43	21.2	0.5	52.5	1.2
79	Islands - Wet Sand	86	24.8	0.3	61.2	0.7
80	Utah Highway 88 ROW	1	3.0	3.0	7.3	7.3
81	Uintah County Road	10	22.2	2.2	54.9	5.5
82	Hatchery Road	1	18.4	18.4	45.4	45.4
83	Auto Tour Route	1	5.5	5.5	13.5	13.5
84	Service Roads and Trails	40	40.1	1.0	99.0	2.5
85	Levee (Flood Control)	5	9.1	1.8	22.6	4.5
86	Dike (Separate Impoundment)	7	23.4	3.3	57.9	8.3
89	Refuge Facility	17	32.7	1.9	80.9	4.8
90	Oil and Gas Facility	4	1.7	0.4	4.1	1.0

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Map Code	Map Unit Common Name	Polygons	Hectares	Ave (h)	Acres	Ave (a)
91	Green River - Main Channel	4	324.4	81.1	801.5	200.4
92	Green River - Backwater	46	11.0	0.2	27.2	0.6
93	Canal	9	4.2	0.5	10.3	1.1
95	Pond - Fish Hatchery	38	6.6	0.2	16.2	0.4
96	Pond - Impoundment	59	114.9	1.9	283.8	4.8
97	Pond - Moist Soil	1	0.0	0.0	0.1	0.1
98	Pond - Pot hole, Dugout, Livestock	2	0.0	0.0	0.1	0.1
99	Gravel Pit	18	8.5	0.5	21.0	1.2
100	Levee Removal Site	4	3.4	0.9	8.5	2.1
101	Hardstem Bulrush Herbaceous Vegetation - Burned	5	15.5	3.1	38.2	7.6
103	Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation - Burned	32	95.3	3.0	235.4	7.4
104	Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation - Disked	6	43.2	7.2	106.7	17.8
<b>Totals</b>						
<b>All Map Units</b>		<b>5445</b>	<b>5677.7</b>	<b>278.1</b>	<b>14,029.4</b>	<b>687.2</b>
<b>Natural/Semi-natural Vegetation Map Units (1-68, 101, 103, 104)</b>		<b>4698.0</b>	<b>4335.9</b>	<b>82.8</b>	<b>10,713.9</b>	<b>204.7</b>
<b>Planted/Cultivated, Land Use/Land Cover and Refuge Specific Map Units (70-100)</b>		<b>747.0</b>	<b>1341.8</b>	<b>195.3</b>	<b>3315.5</b>	<b>482.5</b>

Using the Accuracy Assessment Contingency Table (Table 6): The contingency table or error matrix is an array of numbers set out in rows and columns corresponding to a particular vegetation map unit relative to the actual vegetation type as verified on the ground. The column headings represent the vegetation associations as determined in the field and the row headings represent the map unit codes taken from the vegetation map (see Table 5). The highlighted diagonal indicates the number of points assessed in the field that agree with the map label. Conversely, the inaccuracies of each map unit are described as both errors of inclusion (user's or commission errors) and errors of exclusion (producer's or omission errors). By reading across this table (*i.e.*, rows) one can calculate the percent error of commission, or how many polygons for each map unit were incorrectly labeled according to the field ecologist. By reading down the table (*i.e.*, columns) one can calculate the percent error of omission, or how many polygons for that type were left off the map. Numbers "on the diagonal" tell the user how well the map unit was interpreted and how confident they can be in using it. Numbers "off the diagonal" yield important information about the deficiencies of the map including which types were often confused and which types were under- or over-represented.



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Twelve map units were not assessed for accuracy due to their limited distribution and small size (usually below the minimum mapping unit):

(Map Unit# Map Unit Name)

9. Silver Buffaloberry Great Basin Shrubland,	35. Common Reed Western North America
10. Snowberry Shrubland,	Temperate Semi-natural Herbaceous
20. Taragon Dwarf-shrubland,	Vegetation,
24. Mat Saltbush Dwarf-shrubland,	44. Indian Ricegrass - Crested Wheatgrass
26. Schockley's Buckwheat Badlands Sparse	Herbaceous Vegetation,
Vegetation [Provisional],	49. Blue grama Introduced Grassland,
32. Threesquare Herbaceous Vegetation,	51. Winter-fat / James' Galleta Dwarf-shrubland,
33. Baltic Rush Herbaceous Vegetation,	63. Poverty Sumpweed Herbaceous Vegetation.

In most cases these units represented very rare types that were already documented in their entirety by plot or observation data. Further, the small nature of these types made it impossible to place and buffer accuracy assessment points within their polygons. Map units 101 and 103 were also not assessed since it was impossible to determine a "burned" cattail or bulrush situation a year after the fire occurred (*i.e.*, difference between 2000 photography and 2001 accuracy assessment sampling). Map units 13 and 14 were combined for assessment purposes due to difficulty in distinguishing between rabbitbrush species in the field.

Of the assessed map units, some had lower than expected levels of accuracy. By carefully examining these discrepancies we found seven common issues that seem to explain most of the errors.

1. Many of the errors occurred when a polygon was mapped as an association very similar, but different to the one identified by the field ecologist. This can happen because the photo interpreter and the field ecologist see the vegetation differently. For example, the photo interpreter sees the cover of shrubs and herbaceous vegetation over a large area, while the field ecologist assesses the cover in a much smaller area. This frequently leads to different estimates of cover and differing conclusions as to the correct plant association or map unit.
  - *Example:* Rabbitbrush map units (14,15) were confused with both Galleta (47) and Needle-and-thread (46) grass types 7 times causing commission error. This is likely a result of a limited perspective of the field ecologist relative to the photo interpreter. Subtle shifts in cover estimation may have caused sites recognized as shrubland on the photos to be assessed as grasslands on the ground. Review of the data does indicate that rabbitbrush was present.
2. Discrepancies with some map units arose from the NVCS, which depends on an arbitrary cutoff of shrub cover to separate herbaceous communities from shrublands. At ONWR, the cutoff between grasslands and shrublands was 25% shrub cover, which was very difficult for the photo interpreters to see.

- *Example:* Errors of commission associated with the Cheatgrass Herbaceous Alliance type (48) are likely explained by the difficulty in seeing the cutoff in shrub cover on the aerial photography. This resulted in having it confused with the Gardner's Saltbush Dwarf-shrubland, which forms a sparse shrubland.
3. Some plant associations are separated from each other based on the percent cover of species in the lower strata that the photo interpreter usually can't see.
    - *Example:* Tamarisk spp./ Temporarily Flooded Shrubland (6) was twice confused with Tamarisk spp./ Alkali Sacaton Shrubland (7) because the understory is obscured by the canopy on the photos. If combined, these types would improve to 90% commission and 78% omission accuracy.
  4. Changes in land use and flooding regimes between 2000 and 2001 within the Refuge helped create inconsistencies between classification fieldwork (2000) and the accuracy assessment (2001). Areas bordering the Green River and the ponds might be covered by annual forbs (or different forb communities in different years) or might be completely bare, depending on the timing, height, and duration of flooding. This change from year to year was called "annual variation" by the accuracy assessment panel and explains most of the map errors in the annual forb and grassland types. This highly dynamic situation may be better categorized and mapped as a 'mixed annual forb mudflat' community.
    - *Example 1:* Alfalfa / Fremont Cottonwood Herbaceous Vegetation map unit (65) was used to describe disturbed areas in the floodplain with only two species, alfalfa and seeding cottonwoods. These areas are likely influenced by annual variation in flooding, which may explain why this map unit was often confused with the Bur Ragweed - Wild Sunflower Herbaceous Vegetation (60). This type should probably be grouped with the other mixed annual forb mudflat communities.
    - *Example 2:* Kochia Semi-natural Herbaceous Vegetation (64), Cocklebur Herbaceous Vegetation (62), and Bur Ragweed - Wild Sunflower Herbaceous Vegetation (60), would all be good candidates for grouping into a mixed annual forb mudflat type.
  5. White-tailed prairie dogs at ONWR presented challenges to the photo interpreters and the accuracy assessment ecologists, due to their highly dynamic nature and life history. Because white-tailed prairie dogs migrate large distances and more frequently than black-tailed prairie dogs, they have less impact on the vegetation and it is more difficult to detect a prairie dog colony on the ground and determine if it is occupied or abandoned. This resulted in AA points in some prairie dog polygons being classified in the field as native undisturbed vegetation with "probably an old prairie dog town" noted in the comments.

- *Example:* Prairie Dog Town Disturbed Vegetation (67) had a high error of commission but an acceptable error of omission. All commission errors occurred with types that are common to disturbed sites and prairie dog towns (*e.g.* Snakeweed (Prickly-pear spp.) James' Galleta Dwarf-shrubland 19). The error is likely a result of the difficulty in distinguishing a prairie dog town from a natural community on the ground. On these grounds, we would recommend that either the error associated with map unit 67 be accepted or this type be dropped from the assessment.
6. The vegetation map was based on the photo interpretation of CIR aerial photography flown in 2000, while the accuracy assessment took place in 2001. Some map errors can be ascribed to changes in plant expression and phenology due to the severe drought in 2000 contrasted with normal precipitation in 2001. For example, upland bunchgrasses were much more evident in 2001 than they were in 2000, in some cases covering the dominant dwarf shrubs. Thus areas that would have appeared to be shrublands in 2000 may have been classified as grasslands in 2001.
- *Example 1:* Relatively high levels of omission error for Foxtail Barley (37), Alkali Sacaton (41), Western Wheatgrass (42), Indian Ricegrass Sparse Dune (43), and Needle-and-thread Grass (46) Herbaceous Vegetation map units are all likely a result of higher moisture levels in 2001. In mesic 2001 these species were present and identified by the field biologist, however in 2000 they dried-up and simply were not visible on the 2000 aerial photography.
  - *Example 2:* Mapping Pepperweed Semi-natural Herbaceous Vegetation (66) is of great importance to Refuge management. In this project we obtained an 88% producers accuracy (indicating that we didn't miss many sites) however our user's accuracy was lower than expected at 63%. The largest source of confusion came between this type and Foxtail Barley Herbaceous Vegetation (37) and Alkali Sacaton Southern Plains Herbaceous Vegetation (41) both types that occur in similar habitat. We feel that this error is likely a function of either a change in species composition from the timing of the photography to the AA work (due to control of pepperweed or flooding) or these types were inclusions within the larger pepperweed polygons. Future work should concentrate on verifying and recording change of pepperweed sites on a yearly basis, especially those polygons that were assessed differently in this project.
7. The white, clayey soils common throughout the barren slopes and surrounding uplands of ONWR produced a high reflectance on the CIR photographs. This reflectance effectively masked some patches of vegetation, causing confusion when assessed. This is especially likely with the cheatgrass map unit (#48).



### **3.6 RECOMMENDATIONS FOR FUTURE PROJECTS**

Several ideas for improving the mapping process resulted from the ONWR project. Implementing these suggestions could improve the quality and increase the efficiency of the process, and result in more accurate and useful products.

#### ***Vegetation Classification and Characterization***

It is highly recommended that a completed (or nearly completed) classification be in place before the actual interpretation begins. Plot sampling should begin early in the project, followed by analysis of the vegetation data to the NVCS before the ground-truthing and interpretation of the aerial photographs. It is important to have written descriptions of the associations, approval of the types by the refuge, and a vegetation key during ground-truthing so that vegetation types can be related to the photo signatures. Also critical is deciding how to characterize and describe vegetation that has been manipulated in the past. This includes dealing with areas inherent to Refuges that have been reclaimed or reseeded and are not necessarily covered by the NVCS.

#### ***Vegetation Mapping***

The objectives of the vegetation mapping process include classifying the vegetation into a system of plant associations and a system of map units. Typically the systems are similar; however, in many cases there is not a strict one-to-one correspondence between the two. Photographic interpretation centers around the ability to accurately and consistently delineate map classes based on complex photographic signatures. Vegetation characteristics that can be seen on aerial photography are not necessarily the same as those that are apparent on the ground. The reverse is also true. Due in part to the manipulated and sometimes altered vegetation on wildlife refuges, lengthy explanations are needed to describe disparities between map units and associations. Having two classification systems that use different approaches to describe the vegetation also creates a need for links or crosswalks between the two systems. No matter how clearly the linkages are described, the potential for confusion remains.

The reason for using the NVCS is to promote increased sharing, exchanging, and comparing of vegetation-related data among federal government agencies and other partners. This is greatly hindered when map units deviate from the NVCS. By creating the NVCS classification for a site before the photo interpretation is started the mapping classification and the entire project will more closely resemble the NVCS types. Further, detailed and effective follow-up fieldwork and map verification can substantially contribute to improving the entire process by discerning the inherent variability of the landscape.

The acquisition of new aerial photography and generating an orthophoto base map from that photography greatly added to the value and quality of this project. In

addition, there is no ground condition difference between the photos used for interpretation and the base map, therefore, this database, at time of completion is only one year old in terms of the 'ground condition'.

Editing and quality checking of the digital polygons created borders that tightly bounded corresponding features on the DOP base map. Automation of the scanning and transfer process (via in-house AMLS) using a 'shell' system greatly aided speed and consistency. Also, to accommodate several technicians working on the transfer work, the work was subdivided. Once all the transfer work was complete, all the individual vegetation coverages were combined into an overall vegetation coverage. This speeded up the digital transfer process without an increase in transfer errors.

### ***Summary***

Recognizing the logistical and technical issues inherent to the vegetation mapping process, there are a number of factors that are critical to the success of any vegetation-mapping project. The amount of time needed to develop map units, create mapping conventions, make photo interpretation decisions, and produce the final digital map is inversely proportional to the degree that the parties involved communicate. Consensus building and good communication among the ecologists, photo interpreters, and Refuge staff greatly increases the quality and efficiency of the project. Future projects should strive to involve USFWS staff (both at the region and local levels), NatureServe ecologists, and BOR ecologists/photo-interpreters at all stages of the project. Prompt and constructive feedback from Refuge personnel throughout, but especially during the initial interpretation and classification can substantially reduce many of the problems that might otherwise surface late in the process.

In particular, the ONWR mapping process was among the smoothest ever experienced by the RSGIS staff. Although the project lead changed in the middle of the process, there was little overall delay. This was due in part to the hard work and high degree of organization of the original project lead, but also in large part to the high degree of involvement by Refuge staff. Refuge staff reviewed every draft product and made helpful suggestions at every major step of the process. Prompt review and substantial response should be the norm for these projects and not the exception.

It was also noted by USFWS staff that 80% accuracy for every map unit might not be realistic nor desirable for vegetation mapping projects in refuges. Having less than 80% accuracy for some classes is likely a result of either land manipulation and/or seasonal/annual variations in precipitation, flooding, draw-down timing etc. Instead of grouping similar types together to increase the overall accuracy it was deemed more important to retain the detail for future studies. This detail will allow the refuge staff to focus their validation/ground-truthing efforts along with their long-term monitoring and inventory studies on types that are subject to anthropogenic or natural environmental change.

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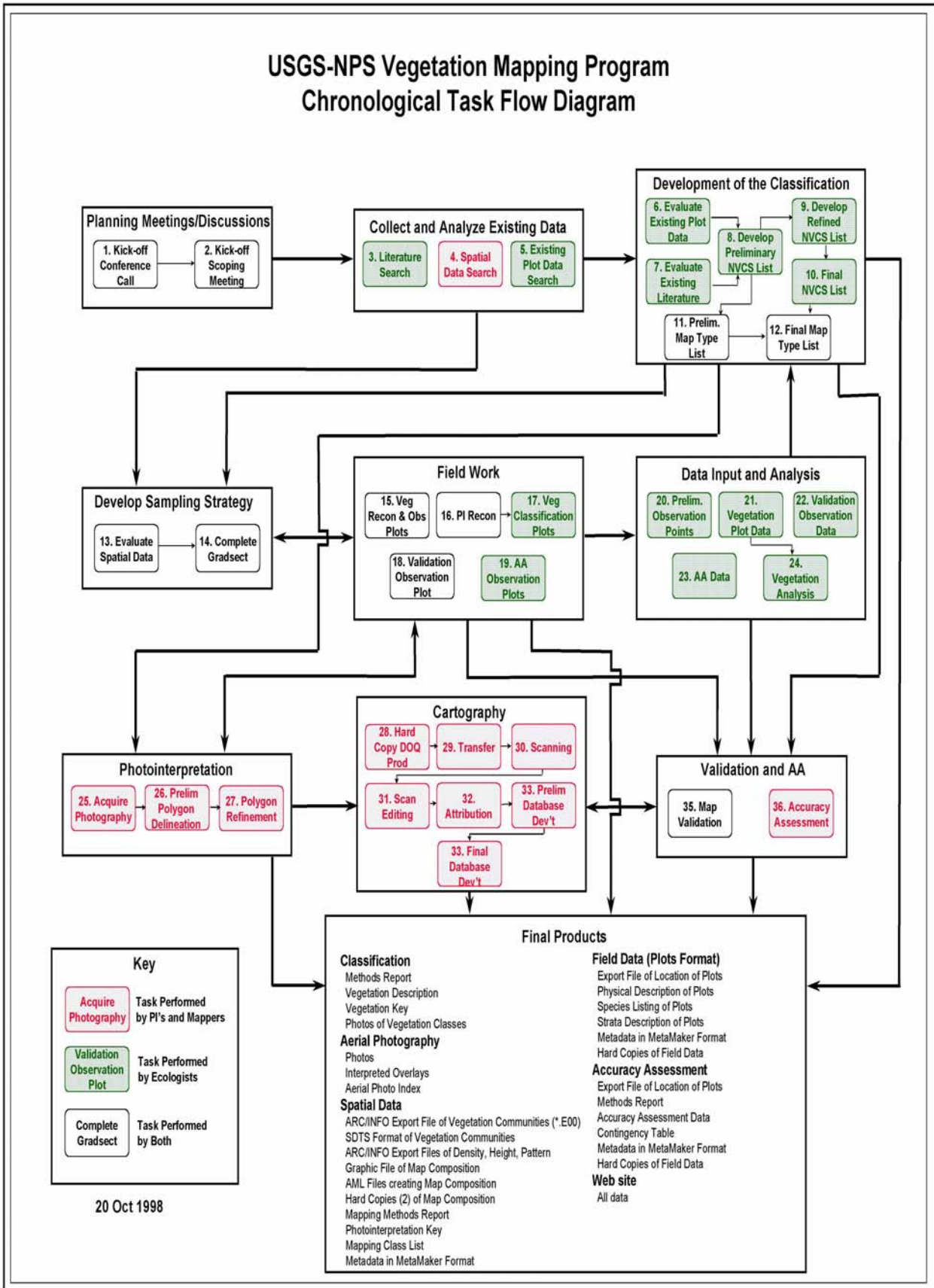
## Ouray National Wildlife Refuge Vegetation Mapping Project

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**APPENDIX A. FLOWCHART FOR THE USGS-NPS VEGETATION MAPPING PROGRAM**

(Tom Owens, USGS-BRD)



**APPENDIX B: USBR-RSGIS WORK PROPOSAL**



*Proposal for Classifying and Mapping Vegetation Communities  
Ouray National Wildlife Refuge - Utah*

U.S. Bureau of Reclamation, Remote Sensing and Geographic Information Group  
Technical Service Center, Denver, Colorado

1. Overview

This document presents our proposed methods and estimated costs associated with classifying and mapping vegetation communities at Ouray National Wildlife Refuge (ONWR), Utah to the standards developed under the USGS-NPS Vegetation Mapping Program. This discussion is based on telephone conversations with Tom Owens of the Center for Biological Informatics, Biological Resources Division, USGS. The mapping effort will cover approximately 12,000 acres inside the ONWR. Note, refer to Section 5. below for abbreviations used in this proposal.

2. Aerial Photograph Acquisition.

It is anticipated that existing aerial photographs will not suffice for this mapping effort and it is proposed that new aerial photography be acquired. The latest NAPP photos (1:40,000) are 1997 and they are B/W film. The latest NAPP CIR photos are 1987 and they are also 1:40,000 scale. In addition, there are no DOQQ's available from USGS for the 4 quads covering ONWR for use as a basemap. The aerial photos will be ortho-rectified and an orthophoto basemap will be produced. This will greatly aid in GIS database creation as it will decrease the amount of time required to transfer interpreted data into the database as compared to using un-rectified photos.

1:12,000 scale, CIR, stereo-pair to be used for photo-interpretation.

1:40,000 scale for 1:12,000 scale, CIR, orthophoto basemap production.

The BOR will cover the cost of the aerial photo acquisition and orthophoto basemap production.

### 3. Project Tasks.

#### 3.1 Scoping / Kick-off Meeting.

A preliminary meeting would be required with Refuge and Regional FWS personnel to discuss the project, present examples of similar projects the BOR has performed, and acquire available information from the FWS (ex: digital files of the Refuge boundary, roads, hydrology, etc). This meeting would allow FWS to address any special mapping needs and vegetation classification. Our proposal is based on this meeting taking place in Denver, therefore, no field time or travel expenses are anticipated:

#### 2 BOR Staff Personnel.

#### 3.2. Field Data Collection.

Vegetation field data will be collected at two levels of intensity: 1) Approximately 50 observation points will be visited and data collected to determine the range of aerial photograph signatures to guide interpretation for potential map classes or units, collect preliminary vegetation data relative to species dominance and habitat structure, and to determine the distribution of plant associations within ONWR; and 2) More detailed plot data (vegetation, soils, hydrology, environmental, etc.) will be collected for each plant association present to determine the NVCS classification. A set of representative color slides or digital photographs for each plant association and a comprehensive species list will be produced.

Detailed vegetation data and photo-documentation will be collected from 1-3 plots per association (approximately 45-60 vegetation plots), depending on stand dominance and variability within the landscape. Likely plant associations will include stand dominants such as Rio Grande cottonwood, willow (Gooding and sandbar/coyote), boxelder, tamarisk, Russian-olive, seep-willow, greasewood, saltbush (four-wing and shadscale), sagebrush (black and big), rabbitbrush, snakeweed, western wheatgrass, needle-and-thread grass, cattail, bulrush, spikerush, sedge, common reed, reed canary grass, smooth brome, Kentucky bluegrass, and cheatgrass, among others. Plots will be established in representative vegetation stands that meet or exceed the minimum mapping unit (MMU) of 0.5 hectares. If determined to be important to Refuge staff, some smaller units of vegetation or land use may be considered as “Refuge Specials”, to be determined during scoping meetings. Unless otherwise directed by FWS-ONWR ecologists/staff, the plots will be 10m x 10m for herbaceous and shrub associations

and 20m x 20m for woodlands. During the Observation data collection field trip, a PI reconnaissance will also take place (see item 3.4 below).

Observation Point/Photo Signature Data Collection.

2 Researchers/2 Travel days/4 data collection/recon days.

Plot/NVCS Classification Data Collection.

2 Researchers/2 Travel Days/8 data collection days.

1 Researcher/ 1 day per trip planning.

### 3.3. Vegetation Classification.

Plot data collected in ONWR will be evaluated using the NVCS (Standardized National Vegetation Classification System); this system contains seven classification levels with the two finest being the alliance and association (community) levels. These data are quantitatively analyzed using ordination techniques (Detrended Correspondence Analysis and Non-Metric Multidimensional Scales), a clustering algorithm, Unweighted Pair-Group Method Using Arithmetic Means, and Two-Way Indicator Species Analysis.

Following analysis, plant associations are described as they occur in ONWR (local description), and nationally or world-wide (global descriptions)('global' by others). Further, a dichotomous key to the plant associations is prepared and illustrated with photos taken during the vegetation data gathering phase of the study. This key is valuable both to researchers conducting the accuracy assessment for this project, but also as an educational guide for other researchers or visitors to ONWR. Another product of this analysis is a comprehensive species list.

Vegetation Data Analysis/Descriptions/Species List.

### 3.4. Photo-interpretation.

A reconnaissance trip to establish photo-signatures and take ground photographs will be conducted before photo-interpretation starts. This trip will be combined with the Field Data Collection trip (see 3.2 above) and will add one day to that trip. Interpretation of the aerial photos will be performed using a combination of stereo pairs and on-screen orthophoto use. Data will be interpreted on drafting film (Mylar) overlays on the hardcopy orthophoto prints.

Photo-interpretation: 1 Researcher.

### 3.5. GIS Database.

Mylar overlays from the photo-interpretation will be scanned, rectified, and converted to ArcInfo coverages. The coverages will be edited, attributed according to the markings on the mylar overlays, and combined into one final coverage. One overall hard-copy map will be produced. An FGDC-compliant metadata\* file will be produced for the coverage and the field data points.

Transfer data into GIS database: 1 Technician  
Produce Map Product: 1 Technician.  
Metadata\*: 1 Technician.

### 3.6. Accuracy Assessment.

An accuracy assessment (AA) of the vegetation map will be performed during the second field season, Summer 2001. Eighty to 100 points will be randomly selected and field ecologists will navigate to their coordinates using a hand-held GPS receiver and determine the vegetation type present. The vegetation type will be determined by using an Illustrated Field Key to the NVCS Vegetation Associations at ONWR, prepared for this purpose. Also recorded will be other vegetation types occurring within 50m of the selected point. This data will be entered into a digital overlay (also export file for AA plot locations) for the vegetation map and each point will be evaluated for accuracy or error of omission or commission; an AA matrix or contingency table will be prepared to summarize results.

Typical guidelines for the AA procedure include:

- Observations of vegetation types are ground-based,
- Ground sampling techniques are similar to the Observation Points collected during initial classification,
- The number of samples per vegetation mapping unit will vary depending on abundance of the class upon the landscape,
- Logistical planning for the AA will revolve around access to work areas within ONWR and will be based on completed vegetation maps, and AA points will be randomly selected.

Following the AA, a decision analysis will be undertaken which examines the accuracy of each vegetation-mapping unit. The analysis will determine if the vegetation mapping unit, with its inherent variability: 1) meets the minimum standard of 80% accurate at the 90% confidence interval and is considered

acceptable, or 2) two or more vegetation mapping units must be combined into an alliance, complex, or mosaic in order to meet the minimum accuracy standard.

2 Researchers/2 Travel days/3 data collection days.

2 Researchers/3 Office days.

### 3.7. Final Report

All study methods, results, and appendices will be presented in a comprehensive final report. At a minimum, the final report will contain: list of contacts and contributors, list of tables and figures, executive summary and introduction, project area description, materials and methods, results, discussion, bibliography, appendices, CD-ROM (containing report and digital point and vegetation coverages in ArcView 3.1 format), and a vegetation map. Along with the final report, all aerial photography, orthophotos, and original observation point/plot/accuracy assessment data, will become the property of FWS-ONWR, as will any plant materials collected and preserved for identification purposes. In addition, a hardcopy orthophoto print of the entire Refuge will be produced to be used by the Refuge for display and other visual uses.

Final Report: 2 Researchers/10 office days.

**APPENDIX C: OBSERVATION, PLOT, AND AA FIELD FORMS**

# Ouray National Wildlife Refuge Vegetation Mapping Project

## NATIONAL WILDLIFE REFUGE VEGETATION MAPPING PROGRAM: OBSERVATION POINT FORM (1997)

### IDENTIFIERS/LOCATORS

Plot Code _____ Polygon Code _____	
Provisional Community Name _____	
State ____	Refuge Name _____ Refuge Site Name _____
Quad Name _____ Quad Code _____	
GPS file name _____	Field UTM X _____ m E Field UTM Y _____ m N
please do not complete the following information when in the field	
Corrected UTM X _____ m E	Corrected UTM Y _____ m N UTM Zone _____
Survey Date _____ Surveyors _____	

### ENVIRONMENTAL DESCRIPTION

Elevation _____	Slope _____	Aspect _____
Topographic Position _____		
Landform _____		

<u>Cowardian System</u>	<u>Hydrologic Regime</u>	<u>Salinity Modifiers</u>
___ Upland	<u>Non-Tidal</u>	___ Saltwater
___ Riverine	___ Permanently Flooded	___ Brackish
___ Palustrine	___ Semipermanently Flooded	___ Freshwater
___ Lacustrine	___ Seasonally Flooded	
	___ Saturated	
	___ Temporarily Flooded/Saturated	
	___ Intermittently Flooded	

Environmental Comments:	Unvegetated Surface: (please use the cover scale below) ___ Bedrock ___ Litter, duff ___ Wood (> 1 cm) ___ Large rocks (cobbles, boulders > 10 cm) ___ Small rocks (gravel, 0.2-10 cm) ___ Sand (0.1-2 mm) ___ Bare soil ___ Other: _____
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### VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata & Unvegetated Surface	Height Scale for Strata
<u>Trees and Shrubs</u>	___ Broad-leaved	___ Forest	01 5%	01 <0.5 m
___ Evergreen	___ Needle-leaved	___ Woodland	02 10%	02 0.5-1m
___ Cold-deciduous	___ Mixed broad-leaved/Needle leaved	___ Shrubland	03 20%	03 1-2 m
___ Drought-deciduous	___ Microphyllous	___ Dwarf Shrubland	04 30%	04 2-5 m
___ Mixed evergreen - cold-deciduous	___ Graminoid	___ Herbaceous	05 40%	05 5-10 m
___ Mixed evergreen - drought-deciduous	___ Forb	___ Nonvascular	06 50%	06 10-15 m
	___ Pteridophyte	___ Sparsely Vegetated	07 60%	07 15-20 m
<u>Herbs</u>			08 70%	08 20-35 m
___ Annual			09 80%	09 35 - 50 m
___ Perennial			10 90%	10 >50 m
			11 100%	

**Ouray National Wildlife Refuge Vegetation Mapping Project**

Strata	Height	Cover Class	Dominant species (mark any known diagnostic species with a * )	Cover Class
T1 Emergent	_____	_____	_____	
			_____	
			_____	
T2 Canopy	_____	_____	_____	
			_____	
			_____	
T3 Sub-canopy	_____	_____	_____	
			_____	
			_____	
S1 Tall shrub	_____	_____	_____	
			_____	
			_____	
S2 Short Shrub	_____	_____	_____	
			_____	
			_____	
S3 Dwarf-shrub	_____	_____	_____	
H Herbaceous	_____	_____	_____	
			_____	
			_____	
N Non-vascular	_____	_____	_____	
V Vine/liana	_____	_____	_____	
E Epiphyte	_____	_____	_____	
			_____	
please see the table on the previous page for height and cover scales for strata				
Other Comments			Cover Scale for Species	
			01 <1%	
			02 1-5%	
			03 5-25%	
			04 25-50%	
			05 50-75%	
			06 75-100%	



# Ouray National Wildlife Refuge Vegetation Mapping Project

## NATIONAL PARK VEGETATION MAPPING PROGRAM: PLOT SURVEY FORM IDENTIFIERS/LOCATORS

Plot Code <u>ONWR</u> Habitat/BPU Code _____	
Provisional Community Name _____	
State <u>UT</u> Park Name <u>Ouray NWR</u> Refuge Site Name _____	
Quad Name _____ Quad Code _____	
GPS file name _____ Field UTM X _____ m E Field UTM Y _____ m N	
Comments: _____ Error +/- _____ m	
<i>Please do not complete the following information when in the field</i>	
Corrected UTM X _____ m E Corrected UTM Y _____ m N UTM Zone _____	
Survey Date _____ Surveyors _____	
Directions to Plot _____	
Plot length(m) _____ Azimuth _____ Plot width(m) _____ If circle (diam) _____ Plot Photos (y/n) _____ Roll # _____ Frame # _____	
Plot Permanent (y/n) _____ Comments on photos or marker _____	
Plot representativeness (discuss decisions for placement and/or reasons for non-representativeness)	
a. Representativeness of association (if known):	
b. Representativeness of plot in stand:	

### ENVIRONMENTAL DESCRIPTION

Elevation _____ Slope _____ Aspect _____							
Topographic Position (see cheat sheet)							
Landform (see cheat sheet)							
Surficial Geology (see cheat sheet)							
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%;">Cowardian System</td> <td style="width:50%;"></td> </tr> <tr> <td><input type="checkbox"/> Upland</td> <td><input type="checkbox"/> Palustrine</td> </tr> <tr> <td><input type="checkbox"/> Riverine</td> <td><input type="checkbox"/> Lacustrine</td> </tr> </table>	Cowardian System		<input type="checkbox"/> Upland	<input type="checkbox"/> Palustrine	<input type="checkbox"/> Riverine	<input type="checkbox"/> Lacustrine	<b>Hydrology</b> <input type="checkbox"/> Permanently Flooded <input type="checkbox"/> Seasonally Flooded <input type="checkbox"/> Temporarily Flooded <input type="checkbox"/> Semipermanently Flooded <input type="checkbox"/> Saturated <input type="checkbox"/> Intermittently Flooded <input type="checkbox"/> Unknown
Cowardian System							
<input type="checkbox"/> Upland	<input type="checkbox"/> Palustrine						
<input type="checkbox"/> Riverine	<input type="checkbox"/> Lacustrine						
Environmental Comments (dynamic stage, fire history, insect damage, etc):	Ground Cover: <i>(please estimate to the nearest percentage. Sum = 100%)</i> <input type="checkbox"/> Bare soil <input type="checkbox"/> Litter / duff <input type="checkbox"/> Wood (> 1 cm) <input type="checkbox"/> Bedrock <input type="checkbox"/> Large rocks (cobbles, boulders > 10 cm) <input type="checkbox"/> Small rocks (gravel, 0.2-10 cm) <input type="checkbox"/> Sand (0.1-2 mm) dune /alluvium <input type="checkbox"/> Moss <input type="checkbox"/> Lichen <input type="checkbox"/> Cryptogam <input type="checkbox"/> Water <input type="checkbox"/> Other (name):						
Soil Texture: <input type="checkbox"/> sand <input type="checkbox"/> loamy sand <input type="checkbox"/> sandy loam <input type="checkbox"/> loam <input type="checkbox"/> silt loam <input type="checkbox"/> silt <input type="checkbox"/> clay loam <input type="checkbox"/> silty clay <input type="checkbox"/> sandy clay <input type="checkbox"/> clay <input type="checkbox"/> peat <input type="checkbox"/> muck	Soil Drainage <input type="checkbox"/> Rapidly drained <input type="checkbox"/> Well drained <input type="checkbox"/> Moderately well drained <input type="checkbox"/> Somewhat poorly drained <input type="checkbox"/> Poorly drained <input type="checkbox"/> Very poorly drained						

# Ouray National Wildlife Refuge Vegetation Mapping Project

## VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata		Height Scale for Strata	
			T	P		
<u>Trees and Shrubs</u> ___Evergreen ___Cold-deciduous ___Mixed evergreen-cold-deciduous	___Broad-leaved	___Forest	1	>5-15%	01	<0.5 m
	___Needle-leaved	___Woodland	2	>15-25%	02	0.5-1m
	___Microphyllous	___Shrubland	3	>25-35%	03	1-2 m
	___Graminoid	___Dwarf Shrubland	4	>35-45%	04	2-5 m
	___Forb	___Herbaceous	5	>45-55%	05	5-10 m
	___Pteridophyte	___Nonvascular	6	>55-65%	06	10-15 m
		___Sparsely Vegetated	7	>65-75%	07	15-20 m
			8	>75-85%	08	20-35 m
			9	>85-95%	09	35 – 50 m
			10	> 95%	10	>50 m
<u>Herbs</u> ___Annual ___Perennial						

	Height/Strata Class	Cover Class	Dominant Species (mark Diagnostics with *)
T1 Emergent	_____	_____	_____
T2 Canopy	_____	_____	_____
T3 Sub-canopy	_____	_____	_____
S1 Tall shrub	_____	_____	_____
S2 Short Shrub	_____	_____	_____
S3 Dwarf-shrub	_____	_____	_____
Ht Herbaceous	_____	_____	_____
H1 Graminoids	_____	_____	_____
H2 Forbs	_____	_____	_____
H3 Ferns	_____	_____	_____
H4 Tree seedlings	_____	_____	_____
N Non-vascular	_____	_____	_____
V Vine/liana	_____	_____	_____
E Epiphyte	_____	_____	_____

Animal Use Evidence (including scat, browse, graze, burrows, bedding sites, etc)

Natural and Anthropogenic Disturbance Comments (please see cheat sheet for impact codes, list intensity as High, Med, or Low)

Other Comments (locations of photos and permanent plot marker)

**Ouray National Wildlife Refuge Vegetation Mapping Project**

Plot Code Ouray

Species/percent cover: Starting with the uppermost stratum, list all species with % cover for each species in the stratum. For each tree species estimate seedling, sapling, mature and total cover indicating stratum. Also for forests and woodlands, on a separate page or line below each tree species, list the DBH of all trees above 5 cm diameter. Separate measurements with a comma (note if measurements are from multi-stemmed tree). Put an asterisk next to any species that are known diagnostics for a particular community in the classification. **Also list species outside the plot at the end of the table or designate with a 0 in Cover Class column.**

Stratum	Species Name	Cover Class	Stratum	Species Name	Cover Class	Stratum	Species Name	Cover Class	Class	Class

**Cover Class Scale**  
 T = >0-1%    5 = >45-55%  
 P = >1-5%    6 = >55-65%  
 1 = >5-15%    7 = >65-75%  
 2 = >15-25%   8 = >75-85%  
 3 = >25-35%   9 = >85-95%  
 4 = >35-45%   10 = >95%



Accuracy assessment Form (1998)  
USGS-USFWS Vegetation Mapping Program

1. Plot Number \_\_\_\_\_ 2. Refuge Code \_\_\_\_\_ 3. Date \_\_\_\_\_

4. Observer(s) \_\_\_\_\_ 5. Datum \_\_\_\_\_ 6. Accuracy \_\_\_\_\_

7. UTM Coordinates: Easting \_\_\_\_\_, \_\_\_\_\_ Northing \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

8. UTM Zone \_\_\_\_\_ 9. Offset from Point: Easting \_\_\_\_\_ m Northing \_\_\_\_\_ m

10. Topographic Description \_\_\_\_\_

11. Elevation \_\_\_\_\_ m 12. Aspect \_\_\_\_\_

13. Veg Assoc. at Site \_\_\_\_\_

14. Veg Assoc 2 within 50m of Site \_\_\_\_\_

15. Veg Assoc 3 within 50m of Site \_\_\_\_\_

16. Major Species Present (by strata) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

17. Canopy Closure of Top Layer \_\_\_\_\_

18. Rationale for Classification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

19. Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**APPENDIX D: DICHOTOMOUS FIELD KEY TO MAPPING UNITS AT OURAY NWR**

## Ouray National Wildlife Refuge Vegetation Mapping Project

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*How to use the Key* – On the following pages, associations/alliances are arranged in dichotomous couplets with corresponding field descriptions. Starting with the number “1”, read through the statements and select the one that is most appropriate. If necessary, follow the numbers in parentheses until a “best match” is found. Read the description to verify the match. It may be necessary to compare descriptions for similar associations by backtracking. The map code for each association is given in parentheses after each association name. Note - not all associations were mapped directly (1:1) on the map; consequently, some map units may appear within alliances.

There will be some stands that do not match any of the descriptions exactly. Many plant associations are variable in composition and, while the descriptions attempt to address that variability, there will always be exceptions. Stands can represent transition zones between two vegetation types. Furthermore, there can be small inclusions of one type in larger stands of another. It is important to survey sufficiently large stands ( $\approx 0.5$  ha or least 50 m diameter area around a point, or at least 100 m length in riparian areas) when classifying or determining representative areas within stands.

1. Site located immediately adjacent to the Green River and terraces created by the River.  
**Floodplain Associatons (2)**
  
1. Site located on badland bluffs, ridges, and associated erosion fans, and sandy to silty-clay areas along the upper boundary of the river floodplain. **Upland Associations (24)**
  
1. Upland or floodplain sites with obvious signs of human or animal disturbance.  
**Modified Vegetation (33)**
  
2. Floodplain sites dominated by herbaceous early successional native or exotic species.  
**Floodplain Units – Herbaceous Non-wetland (3)**
  
3. Sites found in drying mud basins of Leota Bottom, Sheppard Bottom, or Johnson Bottom. **(4)**
  
4. Site dominated by *Atriplex rosea*. **(4a)**
  - 4a. *Atriplex rosea* Semi-natural Herbaceous Vegetation  
Red Orache Semi-natural Herbaceous Vegetation (Map Unit 61)
  
4. Site dominated by clumps of *Medicago sativa* and seedling *Populus fremontii* in Leota Bottom. **(4b)**
  - 4b. *Medicago sativa* / *Populus fremontii* Herbaceous Vegetation  
Alfalfa / Fremont Cottonwood Herbaceous Vegetation (Map Unit 65)
  
4. Site dominated by *Kochia scoparia* with very few associated species. **(4c)**
  - 4c. *Kochia scoparia* Semi-natural Herbaceous Vegetation  
Kochia Semi-natural Herbaceous Vegetation
  
4. Site dominated by *Iva axillaris* and little else. This type appears to occur only in limited situations in the northwest corner of Sheppard Bottom close to SH88. **(4d)**
  - 4d. *Iva axillaris* Herbaceous Vegetation  
Poverty Sumpweed Herbaceous Vegetation (Map Code 63)

4. Site dominated by *Xanthium strumarium* and little else; cover is usually less than 50%. **(4e)**
  - 4e. *Xanthium strumarium* Herbaceous Vegetation  
Cocklebur Herbaceous Vegetation (Map Unit 62)
3. Sites found mainly in drying mud basins of Wyasket Bottom and drained basins in Sheppard Bottom. **(5)**
  5. Site dominated by *Ambrosia tomentosa* and *Helianthus annuus* with few associated species and total cover of less than 50%. **(5a)**
    - 5a. *Ambrosia tomentosa* - *Helianthus annuus* Herbaceous Vegetation  
Bur Ragweed - Wild Sunflower Herbaceous Vegetation (Map Unit 60)
  5. Site dominated by almost monotypic stands of *Hordeum jubatum*. **(5b)**
    - 5b. *Hordeum jubatum* Herbaceous Vegetation  
Foxtail Barley Herbaceous Vegetation (Map Unit 37)
3. Sites found throughout most of the Refuge's floodplains, in all bottoms and on various substrates. **(6)**
  6. Site not dominated by grasses, if present grass is not the major species. **(7)**
    7. Site dominated by an exotic forb, *Lepidium latifolium* forming thick stands characterized by fluffy white seed heads in summer through fall. Stands may show effects of herbicide or manual control efforts. **(7a)**
      - 7a. *Lepidium latifolium* Semi-natural Herbaceous Vegetation [Provisional]  
Pepperweed Semi-natural Herbaceous Vegetation [Provisional] (Map Unit 66)
    7. Site dominated by a native species, *Apocynum cannabinum* forming thick stands (75-100% cover) and small patches. Forb is up to 1 meter tall and has similar appearance to a shrub. **(7b)**
      - 7b. *Apocynum cannabinum* Herbaceous Vegetation  
Hemp Dogbane Herbaceous Vegetation (Map Unit 50).
    7. Small site or patch dominated by a native species, *Glycyrrhiza lepidota* forming stands with 25-50% cover. **(7c)**
      - 7c. *Glycyrrhiza lepidota* Herbaceous Vegetation  
Wild Licorice Herbaceous Vegetation (Map Unit 68)
6. Site dominated by grass species. **(8)**
  8. Site occurs on alkaline, silty clay soils of low channels, depressions, and dike and levee embankments dominated by *Distichlis spicata*. **(8a)**
    - 8a. *Distichlis spicata* Herbaceous Vegetation  
Saltgrass Herbaceous Vegetation (Map Unit 40)



8. Site occurs on undisturbed floodplain terrace and is dominated by *Sporobolus airoides*. **(8b)**
  - 8b.** *Sporobolus airoides* Southern Plains Herbaceous Vegetation  
Alkali Sacaton Southern Plains Herbaceous Vegetation (Map Unit 41)
3. Site limited to portions of Leota Bottom and Wyasket Bottom on undisturbed terraces of the floodplain, site is not located on mud flat. **(9)**
  9. Site dominated by high cover of *Pascopyrum smithii* and may occur as nearly monotypic patches on slightly raised mounds. **(9a)**
    - 9a.** *Pascopyrum smithii* Herbaceous Vegetation  
Western Wheatgrass Herbaceous Vegetation (Map Unit 42)
2. Floodplain sites dominated by herbaceous natives species either growing in standing water, saturated soil, or in close proximity to water. **Floodplain Units – Herbaceous Wetland (10)**
  10. Site has floating vegetation occurring on a thin layer of standing water. **(11)**
    11. Site is dominated by *Potamogeton natans*. **(11a)**
      - 11a.** *Potamogeton natans* Herbaceous Vegetation  
Floating Pondweed Herbaceous Vegetation (Map Unit 27)
  10. Site has emergent vegetation anchored to the substrate, either growing through standing water or in saturated soil. **(12)**
    12. Vegetation is less than ½ meter tall growing in standing water. Vegetation has multiple leaves growing from a bent central stem. **(13)**
      13. Site is dominated by *Polygonum amphibium*, which has bright pink to red seed head at the terminus of the stem during summer and fall. **(13a)**
        - 13a.** *Polygonum amphibium* Permanently Flooded Herbaceous Alliance  
Water Smartweed Permanently Flooded Herbaceous Alliance (Map Unit 28)
      13. Site is dominated by *Polygonum lapathifolium*, which has pale pink to white seed head at the terminus of the stem during summer and fall. **(13b)**
        - 13b.** *Polygonum lapathifolium* Permanently Flooded Herbaceous Vegetation  
Pale Smartweed Permanently Flooded Herbaceous Vegetation (Map Unit 29)
  12. Vegetation is less than ½ meter tall growing in slightly saturated to dry soil. Vegetation has small single leaves (may appear as stems) that do not branch. Type may occur in association with grass species. **(14)**
    14. Site is dominated by *Juncus balticus* with very little else. **(14a)**
      - 14a.** *Juncus balticus* Herbaceous Vegetation  
Baltic Rush Herbaceous Vegetation (Map Unit 33)

14. Site is dominated by *Eleocharis palustris* and may have a large amount of *Pascopyrum smithii* but little else. (Note: The same species may appear as understory components of other vegetation types) **(14b)**

14b. *Eleocharis palustris* Herbaceous Vegetation  
Common Spikerush Herbaceous Vegetation (Map Unit 34)

13. Vegetation is more than ½ meter tall growing in saturated soil. Dominant vegetation has single leaves (may appear as stems) that do not branch. **(15)**

15. Site has tall vegetation growing in saturated soil with thin and tubular leaves, most terminate with a small umbel shaped seed head in the summer and fall. Typically occurs in floodplain bottoms, tributary drainages, and wetland depressions. Site dominated by *Schoenoplectus acutus* and little else. **(15a)** Very small site (<1 acre) dominated by *Schoenoplectus pungens* and little else. **(15b)**

15a. *Schoenoplectus acutus* Herbaceous Vegetation  
Hardstem Bulrush Herbaceous Vegetation (Map Unit 30)

15b. *Schoenoplectus pungens* Herbaceous Vegetation  
Threesquare Herbaceous Vegetation (Map Unit 32)

15. Site has tall vegetation growing in saturated soil dominated by either *Typha domingensis*, *T. angustifolia*, or *T. latifolia* and little else. Leaves are thick and broad, large tubular-shaped seed heads appear on separate stems in the summer and fall. Typically occurs in flooded basins with standing water. **(15c)**

15c. *Typha domingensis* (*Typha angustifolia*, *latifolia*) Herbaceous Vegetation  
Southern (Broad-leaved, Narrow-leaved) Cattail Herbaceous Vegetation (Map Unit 31)

12. Vegetation is more than ½ meter tall growing in saturated or slightly dry soil. Dominant vegetation is a grass with large seed head in the summer and fall. Type may be intermixed with other emergent wetland species. **(16)**

16. Site is dominated by *Phragmites australis*. **(16a)**

16a. *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation  
Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation (Map Unit 35)

16. Site is dominated by *Phalaris arundinacea*. **(16b)**

16b. *Phalaris arundinacea* Western Herbaceous Vegetation  
Reed Canary Grass Western Herbaceous Vegetation (Map Unit 36)

2. Floodplain sites dominated by shrubs. **Floodplain Units – Shrublands (17)**

17. Sites dominated by native shrub species over 1 ½ meters tall, close to the Green River. **(18)**

- 18 Site located on sandy soil (usually sandbars, first terraces, and point bars) along the Green River or major tributary dominated by *Salix exigua*. **(18a)**

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- 18a.** Salix exigua / Barren Shrubland  
Coyote Willow / Barren Shrubland (Map Unit 5)
- 18** Site located on sandy soil on second terraces along the Green River dominated by large, bushy *Rhus trilobata*. **(18b)**
- 18b.** Rhus trilobata – Salix exigua Temporarily Flooded Shrubland  
Ill-scented Sumac – Coyote Willow Shrubland (Map Unit 8)
- 18.** Sites dominated by *Shepherdia argentea* forming small, linear stands along the riverbanks. **(18c)**
- 18c.** Shepherdia argentea Great Basin Shrubland  
Silver Buffaloberry Great Basin Shrubland (Map Unit 9)
- 17.** Sites dominated by native shrub species less than 1 ½ meters tall and usually not close to the Green River. **(19)**
- 19.** Site dominated by *Sarcobatus vermiculatus*; *Ericameria nauseosa* may also have high cover values. Type occurs on the floodplain of the Green River and usually only on the second or third terrace. **(19a)**
- 19a.** Sarcobatus vermiculatus / Distichlis spicata Shrubland  
Black Greasewood – Saltgrass Shrubland (Map Unit 11)
- 19.** Site dominated by *Sarcobatus vermiculatus*; *Atriplex gardneri* may also have high cover. Sites are located on sediments washed from badland formations and are best developed above Wyasket Bottom and on a large erosion fan west of Leota Bottom sites. **(19b)**
- 19b.** Sarcobatus vermiculatus / Atriplex gardneri Shrubland  
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- 19.** Site dominated by *Ericameria parryi* with *Ericameria nauseosa*; geasewood is not abundant. Sites are usually small and on the outer edges of the floodplain. **(19c)**
- 19c.** Ericameria parryi – Sarcobatus vermiculatus Shrubland [Provisional]  
Parryi Rabbitbrush – Black Greasewood Shrubland [Provisional] (Map Unit 14)
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- 19d.** Symphoricarpos occidentalis Shrubland  
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- 17.** Sites dominated by non-native or exotic shrub species with very thin, fine textured leaves. **(20)**
- 20.** Site dominated by *Tamarix* spp. with no understory species. Type is monotypic and occurs on floodplains and basins of the Green River. Other locations include sandbars, islands, side channels, basin edges, dikes, levees roadsides, and riparian habitats. **(20a)**
- 20a.** Tamarix spp. Temporarily Flooded Shrubland  
Tamarisk spp. Temporarily Flooded Shrubland (Map Unit 7)

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20. Site dominated by *Tamarix* spp. with *Sporobolus airoides* in the understory. **(20b)**
- 20b. *Tamarix* spp. / *Sporobolus airoides* Shrubland  
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2. Floodplain sites dominated by trees. **Floodplain Units – Forests and Woodlands (21)**
21. Sites dominated by native tree species. **(22)**
22. Site dominated by large *Populus fremontii* trees with sufficient tree density to provide for interlocking canopies among individual trees. **(22a)**
- 22a. *Populus fremontii* Temporarily Flooded Forest Alliance  
Fremont Cottonwood Temporarily Flooded Forest Alliance (Map Unit 1)
22. Site dominated by large *Populus fremontii* trees with not enough tree density to provide for interlocking canopies of individual trees. **(22b)**
- 22b. *Populus fremontii* Temporarily Flooded Woodland Alliance  
Fremont Cottonwood Temporarily Flooded Woodland Alliance (Map Unit 2)
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- 22c. *Salix amygdaloides* / *Salix exigua* Woodland  
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- 23 *Elaeagnus angustifolia* Semi-Natural Woodland  
Russian-olive Semi-natural Woodland
24. Upland site dominated by grass species. **Upland Units - Herbaceous (25)**
25. Site dominated by native grass species. **(26)**
26. Site on sandy soil, dominated by *Achnatherum hymenoides* with few other grass species. **(26a)**
- 26a. *Achnatherum hymenoides* Herbaceous Alliance  
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- 26c. *Sporobolus cryptandrus* Great Basin Herbaceous Vegetation  
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26. Site on silty-clay soil, dominated by *Hesperostipa comata* with many associated species. **(26d)**

**26d.** *Hesperostipa comata* Great Basin Herbaceous Vegetation  
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26. Site on a variety of soils, dominated by *Pleuraphis jamesii* with many associated species. **(26e)**

**26e.** *Pleuraphis jamesii* Herbaceous Vegetation  
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25. Sites dominated by non-native grasses, specifically by the annual *Bromus tectorum* typically in disturbed areas. **(27)**

**27.** *Bromus tectorum* Semi-natural Herbaceous Alliance  
Cheatgrass Semi-natural Herbaceous Alliance (Map Unit 48)

24. Upland site dominated by shrub species. **Upland Units - Shrubland (28)**

28. *Artemisia* spp. (sagebrush) is the dominant species. Other shrubs such as rabbitbrush, greasewood, joint-fir, or snakeweed may be present; however, they should be considered subdominant to sagebrush. **(29)**

29. Site is dominated by *Artemisia tridentata* shrubs, silver-gray in appearance with forked leaves. **(29a)**

**29a.** *Artemisia tridentata* Shrubland  
Big Sagebrush Shrubland (Map Unit 13)

29. Site is dominated by short green *Artemisia dracunculus* shrubs and occurs on sparsely vegetated badland slopes or bluffs. **(29b)**

**29b.** *Artemisia dracunculus* Dwarf-shrubland  
Tarragon Dwarf-shrubland (Map Unit 20)

29. Site is dominated by short, dark gray *Artemisia nova* shrubs occurring on coarse, cobbly soils. **(29c)**

**29c.** *Artemisia nova* Dwarf-shrubland  
Black Sagebrush Dwarf-shrubland (Map Unit 22)

28. *Atriplex* spp. (Saltbushes) are the dominant species. Other species maybe present, especially spiny hopsage, rabbitbrush, or short-spine horsebrush but they are clearly not dominant. **(30)**

30. Site is dominated by *Atriplex canescens* shrubs occurring on sandy soils near the Refuge entryway gate and along SH88 corridor paralleling the west side of the Refuge. **(30a)**

**30a.** *Atriplex canescens* / *Pleuraphis jamesii* Sparse Shrubland  
Fourwing Saltbush / James' Galleta Sparse Shrubland (Map Unit 16)

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- 30b.** *Atriplex confertifolia* / *Pleuraphis jamesii* Shrubland  
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- 31a.** *Ephedra torreyana* – (*Atriplex canescens*, *confertifolia*) Sparse Vegetation [Provisional]  
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- 31.** Shrub species occur on open, flat to rolling plains with little associated species. **(32)**
- 32.** Site is dominated by *Ericameria nauseosa* and is not in the floodplain. Individual plants are short and spaced widely apart. **(32a)**
- 32a.** *Ericameria nauseosa* Sand Deposit Sparse Vegetation  
Rubber Rabbitbrush Sand Deposit Sparse Vegetation (Map Unit 15)
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- 32d.** *Gutierrezia sarothrae* – (*Opuntia* spp.) / *Pleuraphis jamesii* Dwarf-shrubland  
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- 32.** Site is dominated by small *Eriogonum schockleyi* shrubs on cobbly soils. **(32e)**

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- 32e.** *Eriogonum schockleyi* Badlands Sparse Vegetation [Provisional]  
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**APPENDIX E: VEGETATION COMMUNITY DESCRIPTIONS OF OURAY NWR**

(Produced by NatureServe 2000 Western Regional Office (Keith Schulz))



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## I. Forest

### I.B.2.N.A. LOWLAND OR SUBMONTANE COLD-DECIDUOUS FOREST

#### *I.B.2.N.a.400. ELAEAGNUS ANGUSTIFOLIA SEMI-NATURAL WOODLAND ALLIANCE*

Russian-olive Semi-natural Woodland Alliance

Alliance Identifier: A.3566

*Elaeagnus angustifolia* Semi-natural Woodland

Russian-olive Semi-natural Woodland

*Russian-olive Woodland*

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This widespread Russian-olive woodland type is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. It is a naturalized type that has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, particularly more mesic ones, such as near streams and rivers. The vegetation is dominated by *Elaeagnus angustifolia*. In Badlands National Park, this type occupies a portion of shoreline along the White River, upstream of a highway bridge (Von Loh et al. 1999). In Ouray National Wildlife Refuge in Utah these woodlands are found in the floodplain along the Green River and in upland basins and drainages. Stands tend to be small and linear. The vegetation is dominated by the tree *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. Associated species have not been characterized. In a stand in Badlands National Park of South Dakota, *Elaeagnus angustifolia* is dominant. Canopy closure approaches 40-50%, about equal to the tall-shrub cover provided by *Salix exigua*. *Amorpha fruticosa* and *Pascopyrum smithii* make up the short-shrub and herbaceous cover, which are less than 10%. At Ouray National Wildlife Refuge in Utah, tree canopies were denser to (80% cover) and had remnant *Populus fremontii* trees (to 10% cover). Other than a few native grasses (*Sporobolus airoides*, *Distichlis spicata*, and *Hordeum jubatum*) and *Atriplex patula* in the herbaceous layer, the understory was dominated by introduced species, both in the moderately dense to dense tall-shrub layer (*Tamarix ramosissima*) and in the herbaceous layer (*Lepidium latifolium*, *Descurainia sophia*, and *Bassia scoparia* (= *Kochia scoparia*)).

#### ENVIRONMENTAL DESCRIPTION

##### USFWS WETLAND SYSTEM: RIPARIAN

**Ouray National Wildlife Refuge Environment:** The large stand of *Elaeagnus angustifolia* Semi-natural Woodland in Brennan Flats occupies a basin or small depression adjacent to sandy uplands. This stand was probably introduced by seed dispersed from windbreak plantings on private lands to the west. The soils are alkaline and support patches of *Distichlis spicata* and *Sporobolus airoides*, in addition to the exotic *Tamarix ramosissima*. Another stand occupies an unnamed drainage along the west side of the Refuge where it abuts land managed by the BLM. Only a few young trees have become established within the Refuge boundary, on the upper margin of a *Typha latifolia* emergent wetland, but a large stand is present on the adjacent BLM land. Most stands of Russian-olive within the Refuge are small, linear, and riparian and have become established on the Green River banks and islands within the river. One small stand sampled in Johnson Bottom had total foliar cover exceeding 80% and had a few *Artemisia tridentata* ssp. *tridentata* associated with the stand. At a few locations, Refuge staff are managing Russian-olive by cutting and herbicide application to the cut stumps.

**Global Environment:** This type is naturalized, probably spreading as a result of being widely planted in hedgerows for windbreaks. It has spread to a variety of native habitats, particularly more mesic ones, such as near streams and rivers. In Badlands National Park, this type occupies a portion of shoreline along the White River, upstream of a highway bridge (Von Loh et al. 1999). In Ouray National Wildlife Refuge in Utah these woodlands are found in the floodplain along the Green River and in upland basins and drainages. Stands tend to be small and linear. Adjacent vegetation includes other riparian shrublands and wetlands dominated by *Salix exigua* or *Schoenoplectus* spp. Upland vegetation is variable.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** Stands of *Elaeagnus angustifolia* Semi-natural Vegetation within the Refuge are small and for the most part, even-aged. Reproduction is obviously occurring, as some sapling and seedling trees are nearly always present in and adjacent to these stands. This type occurs more commonly in the Refuge, as understory to *Populus fremontii* woodland and forest stands, and over time will probably join *Tamarix ramosissima* as the dominant tree/shrub association along this portion of the Green River. One stand sampled on the Green River bank had trees in the 18" - 23" dbh range and heights to 10m tall. Many scattered Russian-olive trees and saplings are present within the Refuge, along dikes, levees, scattered in grasslands and shrublands, and in small drainages and depressions within the Green River floodplain. The largest stand of Russian-olive observed in Brennan Flats has no connection with the river, rather it has become established within a small depression or basin adjacent to sandy hills on the Refuge and a large, flat drainage between irrigated agricultural fields on adjacent private land. This stand is more mature, with tree diameters ranging from 17" - 45" dbh and heights to 10 m. It is being invaded by *Tamarix ramosissima* and its past grazing history has resulted in a number of exotic annual forbs being present the most notable are *Kochia scoparia*, *Lepidium latifolium*, *Atriplex patula*, and *Descurainia sophia*.

**Global Vegetation:** The vegetation is dominated by the tree *Elaeagnus angustifolia* with a variety of native and introduced species in the shrub and herbaceous layers. Associated species have not been characterized. In a stand in Badlands National Park of South Dakota, *Elaeagnus angustifolia* is dominant. Canopy closure approaches 40-50%, about equal to the tall-shrub cover provided by *Salix exigua*. *Amorpha fruticosa* and *Pascopyrum smithii* make up the short-shrub and herbaceous cover, which are less than 10%. At Ouray National Wildlife Refuge in Utah, tree canopies were denser to (80% cover) and had remnant *Populus fremontii* trees (to 10% cover). Other than a few native grasses (*Sporobolus airoides*, *Distichlis spicata*, and *Hordeum jubatum*) and *Atriplex patula* in the herbaceous layer, the understory was dominated by introduced species, both in the moderately dense to dense tall-shrub layer (*Tamarix ramosissima*) and in the herbaceous layer (*Lepidium latifolium*, *Descurainia sophia*, and *Bassia scoparia* (= *Kochia scoparia*)).

**Dynamics:** *Elaeagnus angustifolia* has been planted widely across the western U.S. in windbreaks and as an ornamental. This tree species has bird-dispersed seeds and has invaded riparian woodlands extensively, replacing the native tree species, especially where flood control efforts limit regeneration of native trees such as *Populus deltoides* and *Populus fremontii*.

**MOST ABUNDANT SPECIES**

***Ouray National Wildlife Refuge***

<u>Stratum</u>	<u>Species</u>
Tree Canopy	<i>Elaeagnus angustifolia</i> , <i>Tamarix ramosissima</i>
Shrub	<i>Tamarix ramosissima</i> , <i>Elaeagnus angustifolia</i>
Herbaceous	<i>Sporobolus airoides</i> , <i>Distichlis spicata</i> , <i>Lepidium latifolium</i>

***Global***

<u>Stratum</u>	<u>Species</u>
Tree Canopy	<i>Elaeagnus angustifolia</i>
Tall Shrub	<i>Salix exigua</i>
Tall Shrub	<i>Tamarix ramosissima</i>
Shrub	<i>Amorpha fruticosa</i>
Graminoid	<i>Distichlis spicata</i>
Graminoid	<i>Pascopyrum smithii</i>
Graminoid	<i>Sporobolus airoides</i>

**CHARACTERISTIC SPECIES**

***Ouray National Wildlife Refuge***

<u>Species</u>
<i>Elaeagnus angustifolia</i> , <i>Tamarix ramosissima</i>

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### *Global*

#### Species

*Elaeagnus angustifolia*, *Pascopyrum smithii*, *Salix exigua*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

Forb

##### Species

*Lepidium latifolium*

### *Global*

#### Stratum

Forb

##### Species

*Lepidium latifolium*

GLOBAL SIMILAR ASSOCIATIONS: N/A

SYNONYMY: N/A

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** The Refuge is currently managing, by cutting and herbicide application, some small stands and individual trees of Russian-olive. Its' presence, along with salt-cedar, in the understory of Fremont cottonwood riparian forest and woodland stands, indicates a succession away from deciduous trees when these stands become decadent.

**Global Comments:** *Populus deltoides*- and *Populus fremontii*-dominated associations may have significant cover of *Elaeagnus angustifolia* in the tree canopy, but are generally considered native woodlands until *Elaeagnus angustifolia* comprises over 80-90% of the tree cover. Some stands have a nearly closed tree canopy (80% cover), or may have significant gaps in the tree canopy.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** A few small stands of *Elaeagnus angustifolia* Semi-natural Woodland are present within the Refuge, occurring as two types, e.g., riparian stands growing along the Green River and as understory to *Populus fremontii* forest and woodland stands and as upland stands growing in small basins and drainages that are more mesic than surrounding uplands. The largest stand of Russian-olive on the Refuge occupies one such upland basin in Brennan Flats. Most stands occur as several trees growing in a linear fashion adjacent to the river.

**Global Range:** This widespread Russian-olive woodland type is reported from the northern Great Plains, Utah, and probably occurs throughout much of the western United States and adjacent Canada along rivers and streams where it replaces the native *Populus* spp.- and *Acer negundo*-dominated forests and woodlands.

**Nations:** US

**States/Provinces:** ND SD UT

**TNC Ecoregions:** 10:C

**USFS Ecoregions:** 341C:CC

**Federal Lands:** NPS (Badlands); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL005269 **Confidence:** 3 **Conservation Rank:** GW

**REFERENCES:** Great Plains Flora Association 1986, Von Loh et al. 1999, Von Loh 2000

**I.B.2.N.D. TEMPORARILY FLOODED COLD-DECIDUOUS FOREST**

***I.B.2.N.d.38. POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE***

**Fremont Cottonwood Temporarily Flooded Forest Alliance**

**ALLIANCE CONCEPT**

**Summary:** This forest alliance occurs in riparian areas in the southwestern United States. Stands have been described from floodplains along the valley floors of large rivers in New Mexico and Arizona. Although periodic drought can result in the rivers becoming dry, water tables are generally high throughout the year, with surface flooding during the spring months. Soils are alluvial, deposited in stratified layers of clays, sands, silts and gravels. Forests included in this alliance are characterized in mature stands by a dense overstory canopy 20-25 m tall of *Populus fremontii*. Canopy cover is variable, depending upon the age of the stand, but averages well over 60%. In the subcanopy, *Salix gooddingii*, a small tree (to 15 m tall), is usually present with low cover. Scattered shrubs are found in the understory, but total cover of this layer is typically less than 10%. Shrub species may include *Amorpha fruticosa*, *Baccharis salicifolia*, and *Salix exigua*. The herbaceous layer is sparse. Associated species include *Anemopsis californica*, *Distichlis spicata*, and *Juncus balticus*. Tree litter covers much of the ground surface. Diagnostic of this alliance is the dominance of *Populus fremontii* in the relatively dense tree canopy of forests that are briefly flooded during the growing season and have relatively high water tables.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** The Fremont Cottonwood Temporarily Flooded Forest occupies second and third terraces and large islands within the Green River Floodplain. These stands have become established on sediments deposited in and along the river. More mature trees are typically located further from the flowing water, and younger trees are established nearer the river. Individual trees are occasionally uprooted by river flows and some stands are affected by beaver foraging activity. This extremely important habitat is used by nearly all species (except strict aquatic and wetland species) of wildlife present in the Refuge to some degree.

**Global Environment (Alliance):** Vegetation types within this alliance occur mainly in dry, hot areas of the southwestern United States. The climate of this region is typically hot and arid. There is great fluctuation in precipitation between wet and dry years, but the annual average is 19.8 cm. Periodic droughts can result in the rivers becoming dry, while spring flooding results in very high water tables and much deposition of silt and sands. Stands of this alliance occur primarily along the valley floors of large rivers in central and southern New Mexico, from 1500 to near 2100 m elevation. They are also reported from relatively flat floodplains along low-gradient rivers in Arizona. The deposition of alluvial materials by tributaries is the primary formative agent for these floodplains. On the Rio Grande, from the vicinity of Albuquerque south, the river drops an average of 1.5 m per 0.6 km.

These vegetation types are found on the most mesic or hydric of floodplain sites along these rivers. Soils are somewhat alkaline, and derived from alluvial materials, deposited in stratified layers of clays, sands, silts and gravels. Soil textures are variable, but clays are reported to be the most common. Water tables are high throughout the year, with surface flooding during the spring months.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Populus fremontii* Temporarily Flooded Forest stands are littered by downed trunks, branches, and leaves so that little if any bare ground is visible. This litter overlies fine, silty clay soil deposited by flood flows and occasional cobbles. A few stands have an emergent canopy of *Populus fremontii* that were estimated at 25% foliar cover and stood between 30-35 m tall. One emergent tree was measured at 92" dbh, but most mature trees measure from 45-65" dbh. Most stands have an even canopy layer of predominantly *Populus fremontii*, which provides 60-80% foliar cover. These trees measure from 20-40" dbh and stand approximately 30m tall. In the subcanopy, *Elaeagnus angustifolia* trees are becoming established with sapling *Populus fremontii* and an occasional *Salix amygdaloides* tree. The subcanopy foliar cover rarely exceeds 20% for any stand and the trees reach heights averaging 5-10 m tall. In one island stand north of the Fish Hatchery, however, *Elaeagnus angustifolia* in the subcanopy was recorded at approximately 70% foliar cover and approximately 40% foliar cover in the tall shrub vegetation layer. The tall shrub zone is dominated by *Tamarix ramosissima* in most stands although *Rhus trilobata*, *Populus fremontii*, and *Elaeagnus angustifolia* are sometimes recorded. Tall shrub foliar cover is usually close to 5%, but may range to 20% when *Rhus*

## Ouray National Wildlife Refuge Vegetation Mapping Project

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*trilobata* is present and the shrubs usually are in the 5-10 m height range. The short shrub class is also dominated by *Rhus trilobata* and *Tamarix ramosissima*, but the roles are reversed and more skunkbrush is usually present; foliar cover values range from 1-10%. Forest stands rarely have herbaceous vegetation foliar cover over 5%, and this is typically provided by *Phalaris arundinacea*, *Lepidium latifolium*, *Apocynum cannabinum*, and *Iva axillaris*.

Young *Populus fremontii* stands of the same species composition described above also occur in the Refuge. They are described here in more detail, but may comprise a separate classification unit and map unit. Typically, Fremont cottonwood trees (sometimes in association with peachleaf willow trees) in young stands contribute approximately 30% foliar cover, are approximately 10-15 m tall, and have dbh measurements in the 10-15 cm range. Salt-cedar dominates the tall shrub layer, contributing approximately 20% foliar cover and standing 2-5 m tall. Understory herbaceous species include *Pascopyrum smithii*, *Phalaris arundinacea*, and *Eleocharis palustris*.

**Global Vegetation (Alliance):** These riparian cottonwood forests are characterized in mature stands by a dense canopy of the broad-leaved deciduous tree *Populus fremontii*, with heights of 20-25 m. Cover is variable, depending upon the age of the stand, but averages well over 60% and occasionally is over 90%. A smaller (to 15 m tall), broad-leaved deciduous tree, *Salix gooddingii*, is usually present with low cover (averaging <15%). Broad-leaved deciduous shrubs are found scattered in the understory, but total cover of this layer is typically less than 10%. *Amorpha fruticosa* is the only shrub found under the dense tree canopy, while *Baccharis salicifolia* and *Salix exigua* are more commonly found near the riverbanks or under less dense canopies. The herbaceous layer is sparse; in the spring the perennial forb *Anemopsis californica* is the dominant species. The perennial graminoids *Distichlis spicata* and *Juncus balticus* are usually present, but not abundant. Litter layers on the ground surface are thick, ranging from 2-15 cm deep.

**Dynamics (Alliance):** *Populus fremontii* requires particular flood regime characteristics for germination and establishment (Stromberg et al. 1991, Stromberg 1993a). Stands dominated by this species can occur on relatively flat floodplains along low-gradient rivers.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Tree Emergent	<i>Populus fremontii</i>
Tree Canopy	<i>Populus fremontii</i> , <i>Elaeagnus angustifolia</i>
Tree Subcanopy	<i>Populus fremontii</i> , <i>Elaeagnus angustifolia</i> , <i>Salix amygdaloides</i>
Shrub Tall	<i>Rhus trilobata</i> , <i>Tamarix ramosissima</i>
Short Shrub	<i>Salix exigua</i> , <i>Apocynum cannabinum</i>
Herbaceous	<i>Sporobolus airoides</i> , <i>Phalaris arundinacea</i> , <i>Eleocharis palustris</i> , <i>Lepidium latifolium</i> , <i>Iva axillaris</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Tree Canopy	<i>Populus fremontii</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Populus fremontii*, *Salix amygdaloides*, *Elaeagnus angustifolia*, *Rhus trilobata*, *Tamarix ramosissima*, *Apocynum cannabinum*, *Phalaris arundinacea*

#### *Global*

Species  
*Populus fremontii*

**OTHER NOTEWORTHY SPECIES**

*Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

*Global*

<u>Stratum</u>	<u>Species</u>
TALL SHRUB	<i>Elaeagnus angustifolia</i>
TALL SHRUB	<i>Tamarix</i> spp.
FORB	<i>Melilotus officinalis</i>

**GLOBAL SIMILAR ASSOCIATIONS:** N/A

**SYNONYMY:** N/A

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** It is notable that almost no lianas were observed in the Fremont cottonwood forest stands; the few present were *Clematis ligusticifolia*.

**Global Comments (Alliance):** Further inventory and classification work are needed for all *Populus fremontii* communities. This is hindered by the alteration of species structure and composition that has occurred in most remaining stands because of hydrologic alterations, exotic species invasions, grazing, and other human impacts.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** The Fremont Cottonwood Temporarily Flooded Forest type lines the Green River banks, point bars, side channels, and grows on islands within the river. It is the most common forest type within the Refuge.

**Global Range (Alliance):** Communities within this alliance are described for central New Mexico, mainly along the Rio Grande River corridor, and southern and central Arizona. The alliance likely also occurs in California, Colorado, Nevada, and Utah, and possibly in northern Mexico.

**Nations:** MX? US

**States/Provinces:** AZ CA? CO? NM NV?

**TNC Ecoregions:** 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 22:C, 24:C

**USFS Ecoregions:** 313A:CC, 321A:CC, 322A:CC, 341C:CC, M313A:CC, M313B:C?, M331F:??, M341C:CC

**Federal Lands:** USFWS (Ouray)

**ALLIANCE SOURCES**

**Identifier:** A.313 **Confidence:** N/A **Conservation Rank:** N/A

**REFERENCES:** Brown 1982, Campbell and Dick-Peddie 1964, Eyre 1980, Henry 1981, Muldavin et al. 1993a, Muldavin et al. 1993b, Reid et al. 1994, Stromberg 1993a, Stromberg et al. 1991, Szaro 1989, Von Loh et al. 1999, Von Loh 2000, Watson 1912.



## **II. Woodland**

### **II.B.2.N.B. TEMPORARILY FLOODED COLD-DECIDUOUS WOODLAND**

#### ***II.B.2.N.b.12. POPULUS FREMONTII TEMPORARILY FLOODED WOODLAND ALLIANCE***

##### **Fremont Cottonwood Temporarily Flooded Woodland Alliance**

###### **ALLIANCE CONCEPT**

**Summary:** These woodlands occur as small isolated stands or as linear bands that parallel stream channels. In the Southeast, this alliance has limited occurrence and may be extirpated in the Trans-Pecos of western Texas. It also occurs in New Mexico, Arizona, Utah, the Mexican states of Chihuahua and Coahuila, and possibly California. This alliance contains riparian woodlands dominated by *Populus fremontii*. Individuals of *Populus fremontii* are scattered or occur in groves, and may reach 30 m in height and 2 m in diameter. Other species that may occur in the canopy/subcanopy include *Populus deltoides ssp. wislizenii*, *Baccharis salicifolia*, *Salix lasiolepis*, *Salix exigua*, *Salix amygdaloides*, *Salix gooddingii*, *Fraxinus berlandieriana*, *Fraxinus velutina*, *Celtis laevigata var. reticulata*, *Juglans microcarpa*, *Prosopis pubescens*, *Prosopis glandulosa*, and *Prosopis velutina*. The understory of most examples has been considerably altered by grazing and other factors, thus the composition and cover of the native understory are difficult to ascertain but frequently consist of shrubs and small trees (1-5 m tall). The herbaceous stratum varies in composition and coverage but is characterized by mixed annuals and short-lived perennials.

###### **ENVIRONMENTAL DESCRIPTION**

###### **USFWS WETLAND SYSTEM: PALUSTRINE**

**Ouray National Wildlife Refuge Environment:** Mature *Populus fremontii* trees have persisted on a third terrace from the Green River, probably for more than a century, resulting in an open woodland formation. The soils are silty clay and have become well-vegetated with riparian grasses. The massive trunks of these trees exhibit fire scarring.

**Global Environment (Alliance):** Woodlands included in this riparian alliance are found in floodplains and on lower alluvial terraces along the perennial streams that occur in the southern deserts. Elevations range from 400-2500 m. Climate is arid to semi-arid with hot summers and typically mild winters, but with freezing temperatures not uncommon in northern stands. Mean annual precipitation ranges from 15-28 cm, but can vary greatly from year to year. Drought is not uncommon. Annual precipitation has bimodal distribution with the proportion of summer precipitation decreasing westward (Barbour and Major 1977). At the Jornada Experimental Range in southwestern New Mexico, about two-thirds of the annual precipitation occurs in July through October and a third during the winter months. At Tucson, Arizona about half of the annual rain falls in July to October with the balance during the winter months. In southern California the precipitation is mostly winter and the mean annual precipitation may be less than 15 cm in the deserts. The most arid season is late spring and early summer. The summer rain often occurs as high-intensity convective storms.

Stands are restricted to the floodplains and corridors of perennial streams by the arid upland environment. This vegetation type is dependent on a subsurface water supply and varies considerably with the water table levels. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape these woodlands. These woodlands occur as small isolated stands or as linear bands that parallel stream channels. Sites are flat to gently sloping and occur in lower canyons in desert mountains, alluvial fans and valleys. Substrates are generally well-drained, coarse-textured soils derived from stratified alluvium composed of sand, loam, gravel and cobbles. The soils may be slightly alkaline and saline.

Adjacent stands include other riparian and semi-riparian shrublands and woodlands, desert scrub, montane scrub and montane forests.

###### **VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** This Fremont cottonwood stand is significant because of the size and age of the mature trees present; they measured 136 cm and 171 cm dbh and were over 40 m tall. Total stand foliar cover was about 70% and the mature Fremont cottonwoods contributed about 30% to that total for the plot. The subcanopy consisted of *Elaeagnus angustifolia*, from 5-10 m tall and contributing approximately 10% foliar cover. *Tamarix ramosissima* was the only tall shrub present at 2-5 m tall and contributing approximately 20% foliar cover. Less than 5% of the plot had herbaceous cover and this was primarily *Distichlis spicata*, *Hordeum jubatum*, *Iva axillaris*, and *Lepidium latifolium*.

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**Global Vegetation (Alliance):** This alliance contains woodlands classified as temporarily flooded. The canopy is dominated by open stands of *Populus fremontii* generally forming 30-70% cover; individuals may be scattered or occur in groves. This species may reach 30 m in height and 2 m in diameter. Other woody species that may occur in the canopy/subcanopy include *Populus deltoides ssp. wislizeni*, *Baccharis salicifolia*, *Salix lasiolepis*, *Salix exigua*, *Salix amygdaloides*, *Salix goodingii*, *Fraxinus berlandieriana*, *Fraxinus velutina*, *Celtis laevigata var. reticulata*, *Juglans microcarpa*, *Prosopis pubescens*, *Prosopis glandulosa*, or *Prosopis velutina*. The understories of most examples have been considerably altered by grazing and other factors, thus the composition and cover of the native understory is difficult to ascertain, but frequently consists of shrubs and small trees (1-5 m tall) of the above species. The herbaceous stratum varies in composition and coverage, but is characterized by mixed annuals and short-lived perennials.

**Dynamics (Alliance):** This alliance is dependent on a subsurface water supply and varies considerably with the water table levels. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape these woodlands.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Tree Canopy	<i>Populus fremontii</i>
Tree Subcanopy	<i>Elaeagnus angustifolia</i>
Shrub Tall	<i>Tamarix ramosissima</i>
Shrub Short	<i>Rhus trilobata</i> , <i>Elaeagnus angustifolia</i>
Herbaceous	<i>Distichlis spicata</i> , <i>Hordeum jubatum</i> , <i>Iva axillaris</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Tree Canopy	<i>Populus fremontii</i>
Tall Shrub	<i>Salix goodingii</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Populus fremontii*, *Elaeagnus angustifolia*, *Tamarix ramosissima*, *Distichlis spicata*, *Iva axillaris*

#### *Global*

Species  
*Populus fremontii*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
Tree Subcanopy              *Elaeagnus angustifolia*  
Tall Shrub                      *Tamarix spp.*  
Graminoid                      *Cynodon dactylon*  
Forb                              *Melilotus officinalis*

**GLOBAL SIMILAR ASSOCIATIONS:** N/A

**SYNONYMY:** N/A

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments (Alliance):** This vegetation is dependent on a subsurface water supply and varies considerably with the water table levels. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape these woodlands. Woodlands in this alliance once occupied the floodplains and riverbanks of most perennial waterways within the range of *Populus fremontii* but have mostly been replaced by disturbance types dominated by exotic species. The II.B.2.N.c *Populus fremontii* Seasonally Flooded Woodland Alliance (A.654) differs due to constancy of surface water and depth to water table.

This alliance is poorly studied; further inventory and classification work are needed for all *Populus fremontii* communities. This is hindered by the alteration of species structure and composition that has occurred in most remaining stands because of hydrologic alterations, exotic species invasions, grazing, and other human impacts.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** This description is from one mature stand in Johnson Bottom.

**Global Range (Alliance):** Riparian woodlands included in this alliance are reported from western Texas to southern California and in southwestern Utah. It is also found in the Mexican states of Chihuahua and Coahuila, and likely found in southern Nevada.

**Nations:** MX US

**States/Provinces:** AZ CA? MXCH? MXSO? NM TX UT

**TNC Ecoregions:** 10:C, 11:C, 18:C, 19:C, 20:C, 21:C, 22:C, 24:C

**USFS Ecoregions:** 313A:CC, 321A:CC, 322B:C?, M313A:CC, M313B:C?

**Federal Lands:** USFWS (Ouray)

**ALLIANCE SOURCES**

**Identifier:** A.644 **Confidence:** N/A **Conservation Rank:** N/A

**REFERENCES:** Allard 1990, Barrows et al. 1977, Boles and Dick-Peddie 1983, Brown 1982, Campbell and Dick-Peddie 1964, Diamond 1993, Diamond et al. 1992, Dick-Peddie 1993, Eyre 1980, Holland 1986b, Metcalfe 1902, Muldavin 1987, New Mexico Natural Heritage Program (NMNHP) n.d., Sawyer and Keeler-Wolf 1995, Stromberg 1993a, Stromberg 1995b, Szaro 1989, The Nature Conservancy (TNC) 1992, Von Loh 2000, Webb and Brotherson 1988.

**II.B.2.N.b.13. SALIX AMYGDALOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE**  
**Peachleaf Willow Temporarily Flooded Woodland Alliance**

**Alliance Identifier:** A.645

***Salix amygdaloides* / *Salix exigua* Woodland**  
**Peachleaf Willow / Coyote Willow Woodland**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** The vegetation in this association occurs in riparian habitats on the Columbian Plateau in the interior Northwest and in the Uinta Basin in northeastern Utah. Elevation ranges from 100-1600 m. Stands are located in overflow channels of large rivers, on narrow floodplains of small creeks. Substrates include a wide range of soil textures with the exception of clay. Soils are classified predominantly as Entisols (Fluvents) or Mollisols (Borolls). The water table is within 1 m of the soil surface during the growing season, and the vegetation is tolerant of prolonged flooding. This riparian woodland has a moderately open overstory canopy dominated by the small tree *Salix amygdaloides* with *Salix exigua* dominating the tall-shrub layer near the shore. Other tree species may include scattered *Populus fremontii*, *Acer negundo*, *Populus angustifolia*, *Populus deltoides*, and the introduced *Elaeagnus angustifolia*. Associated shrubs in the moderately dense short-shrub layer include *Rhus trilobata* and *Apocynum cannabinum*. The introduced tall-shrub *Tamarix ramosissima* may present in the tall-shrub layer in disturbed stands. The herbaceous layer is often dominated by graminoids such as *Hordeum jubatum*, *Phalaris arundinacea*, *Pascopyrum smithii*, *Eleocharis palustris*, and *Distichlis spicata*, with forbs such as *Maianthemum stellatum*, *Ambrosia tomentosa*, and *Iva axillaris*. Introduced herbaceous species are present to dominant in many stands and may include *Bromus inermis*, *Cirsium arvense*, *Lepidium latifolium*, *Melilotus officinalis* (= *Melilotus albus*), and *Poa pratensis*.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** Peachleaf willow / Coyote willow stands persist on lower second terraces of the Green River floodplain on sites that are too mesic for *Populus fremontii* Forest to become well established. Typically, Peachleaf willow / Coyote willow stands occupy side channels or are immediately adjacent to the Green River. The slope is usually <2%. These sites tend to accumulate debris following overbank flood events. Wildlife use of these stands is high particularly for species of mammals and passerine birds.

**Global Environment:** The vegetation in this association occurs in riparian habitats on the Columbian Plateau in the interior Northwest and in the Uinta Basin in northeastern Utah. Elevation ranges from 100-1600 m. Stands are located in overflow channels of large rivers, on narrow floodplains of small creeks. Substrates include a wide range of soil textures with the exception of clay. Soils are classified predominantly as Entisols (Fluvents) or Mollisols (Borolls). The water table is within 1 m of the soil surface during the growing season (Hansen et al. 1995), and the vegetation is tolerant of prolonged flooding. Adjacent riparian vegetation may include *Acer negundo*, *Fraxinus pennsylvanica*, and *Populus deltoides* woodlands and *Schoenoplectus pungens* and *Typha latifolia* herbaceous communities.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Salix amygdaloides* / *Salix exigua* Temporarily Flooded Woodland occurs as small stands with relatively dense canopy cover. Cover values recorded for this type ranged from 60-100+%, the highest value occurs because of overlapping canopies. Peachleaf willow trees on the Refuge are mature, exceeding 15 m in height, recording foliar cover values of 25-70% for the species, and the largest dbh recorded was 21". Typical dbh measurements ranged from 12-16" for peachleaf willow trees, which are multiple-branched from the base. Other tree species present in the canopy or understory to *Salix amygdaloides* included *Populus fremontii* and *Elaeagnus angustifolia*. The most common understory shrubs include *Salix exigua* and *Rhus trilobata* in the tall shrub layer (1-20% foliar cover) and *Rhus trilobata*, *Tamarix ramosissima*, and *Apocynum cannabinum* in the short shrub layer (1-20% foliar cover). Common grasses and grass-like species include *Phalaris arundinacea*, *Eleocharis palustris*, and *Distichlis spicata* (5-30% foliar cover) and common forbs include *Acroptilon repens*, *Lepidium latifolium*, *Maianthemum stellatum*, *Ambrosia tomentosa*, and *Iva axillaris* (1-10% foliar cover).

**Global Vegetation:** This riparian woodland has a moderately open overstory canopy dominated by the small tree *Salix*

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*amygdaloides* with *Salix exigua* dominating the tall-shrub layer near the shore. Other tree species may include scattered *Populus fremontii*, *Acer negundo*, *Populus angustifolia*, *Populus deltoides*, and the introduced *Elaeagnus angustifolia*. Associated shrubs in the moderately dense short-shrub layer include *Rhus trilobata* and *Apocynum cannabinum*. The introduced tall shrub *Tamarix ramosissima* may present in the tall-shrub layer in disturbed stands. The herbaceous layer is often dominated by graminoids such as *Hordeum jubatum*, *Phalaris arundinacea*, *Pascopyrum smithii*, *Eleocharis palustris*, and *Distichlis spicata*, with forbs such as *Maianthemum stellatum*, *Ambrosia tomentosa*, and *Iva axillaris*. Introduced herbaceous species are present to dominant in many stands and may include *Bromus inermis*, *Cirsium arvense*, *Lepidium latifolium*, *Melilotus officinalis*, and *Poa pratensis*.

**Dynamics:** This association is restricted to sites that are temporarily flooded or have a shallow water table.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Tree	<i>Salix amygdaloides</i> , <i>Populus fremontii</i> , <i>Elaeagnus angustifolia</i>
Shrub	<i>Salix exigua</i> , <i>Rhus trilobata</i>
Herbaceous	<i>Phalaris arundinacea</i> , <i>Eleocharis palustris</i> , <i>Ambrosia tomentosa</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Tree Canopy	<i>Salix amygdaloides</i>
Tall Shrub	<i>Salix exigua</i>
Short Shrub	<i>Rhus trilobata</i>
Graminoid	<i>Hordeum jubatum</i>
Forb	<i>Maianthemum stellatum</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Salix amygdaloides*, *Salix exigua*, *Rhus trilobata*, *Phalaris arundinacea*, *Lepidium latifolium*

#### *Global*

Species  
*Salix amygdaloides*, *Salix exigua*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
Tall Shrub                      *Tamarix ramosissima*  
Forb                                *Lepidium latifolium*

**GLOBAL SIMILAR ASSOCIATIONS:** N/A

#### **SYNONYMY:**

*Salix amygdaloides* (Evans 1989a)

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** Stands from the Green River in Utah may be different from the stands described from small creeks on the Hanford Site along the Columbia River in Washington.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** Only a few stands of *Salix amygdaloides* / *Salix exigua* Temporarily Flooded Woodland occur within the Refuge. These were observed and sampled off the Hatchery Road near the boat ramp and in Wyasket Bottom.

**Global Range:** This riparian woodland has been described from the Columbia River Basin in Washington and along the Uinta Basin in Utah where it occurs on the banks small creeks and large rivers.

**Nations:** US

**States/Provinces:** ID? OR UT WA

**TNC Ecoregions:** 10:C, 6:C

**USFS Ecoregions:** 341C:CC, 342C:CC, 342I:C?, M332A:CC, M332E:CC, M332F:CC, M332G:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL000948 **Confidence:** 3 **Conservation Rank:**G1Q

**REFERENCES:** Evans 1989a, Hansen et al. 1995, Hirschberger 1978, Von Loh 2000.

### III. Shrubland

#### III.A.4.N.A. LOWLAND MICROPHYLLOUS EVERGREEN SHRUBLAND

##### *III.A.4.N.a.17. ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE*

##### **Big Sagebrush Shrubland Alliance**

**Alliance Identifier:** A.829

*Artemisia tridentata* Shrubland

**Big Sagebrush Shrubland**

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#### **ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This broadly defined sagebrush shrubland is described from eastern California, Nevada, and Utah, but likely occurs throughout much of the western U.S. Elevations range from 1340-2225 m. Landforms include dunes, basins and slopes. Substrates are variable; soil texture ranges from sand to clay. This association is used to describe *Artemisia tridentata*-dominated shrublands where the subspecies is not known and the herbaceous layer is generally sparse. The herbaceous layer may be limited by substrate or disturbance. Stands in Utah and California had moderate cover (25-50%) of *Artemisia tridentata* often with scattered individuals of *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Sarcobatus vermiculatus*, *Grayia spinosa*, *Gutierrezia sarothrae*, or *Opuntia polyacantha*. If present, the herbaceous layer typically consists of low cover of graminoids such as *Distichlis spicata* and *Elymus elymoides*.

#### **ENVIRONMENTAL DESCRIPTION**

##### **USFWS WETLAND SYSTEM:**

**Ouray National Wildlife Refuge Environment:** Near the Refuge headquarters and in Johnson Bottom, big sagebrush shrubland grows on sandy soils of high second terraces, while in Brennan Flat, the terrace soils are silty clays, and are more compact due to sheet runoff. At all sites, big sagebrush shrubs commingle with greasewood in a narrow ecotone, then greasewood becomes the dominant shrub.

**Global Environment:** This broadly defined sagebrush shrubland is reported from the Great Basin and Uinta Basin but is likely more widespread. Elevations range from 1340-2225 m. Landforms include dunes, basins and slopes. Substrates are variable; soil texture ranges from sand to clay.

#### **VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Artemisia tridentata* ssp. *tridentata* Shrubland is rare in the Refuge, occupying only three stands. For the stand in Brennan Flat, foliar cover approached 45%, with both very old, mature shrubs and young shrubs/seedlings providing equal amounts of ground cover. The older shrubs were very tall in the Brennan Flats stand, between 3-4 m in height, and some had short, single trunks. In the sandy soils of Johnson Bottom and the site near Refuge headquarters, the big sagebrush shrubs were between 1-2 m tall and foliar cover was 30% and 60% respectively for the stands. Associated shrubs in all big sagebrush stands were *Sarcobatus vermiculatus* and *Ericameria nauseosa*, their contribution to foliar cover was between 5-10%. Little understory growth was present in these stands, the only species observed were *Gutierrezia sarothrae*, *Opuntia polyacantha*, and *Elymus elymoides*.

**Global Vegetation:** This broadly defined association is used to describe *Artemisia tridentata*-dominated shrublands where the subspecies is not known and the herbaceous layer is generally sparse. The herbaceous layer may be limited by substrate or disturbance. Stands in Utah and California had a moderately dense short-shrub layer (25-70%) dominated by *Artemisia tridentata*. Associated shrub species may codominate, but more typically occur as scattered individuals including *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Sarcobatus vermiculatus*, *Grayia spinosa*, *Gutierrezia sarothrae*, or *Opuntia polyacantha*. If present, the herbaceous layer typically consists of low cover of graminoids such as *Distichlis spicata* and *Elymus elymoides*.

**Dynamics:** Ecological processes vary among sites, but is usually indicative of upper terraces or incised stream systems that have been separated from groundwater.

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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Artemisia tridentata</i> ssp. <i>tridentata</i> , <i>Sarcobatus vermiculatus</i> , <i>Ericameria nauseosa</i>
Herbaceous	<i>Elymus elymoides</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Artemisia tridentata</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Artemisia tridentata* ssp. *tridentata*, *Sarcobatus vermiculatus*, *Ericameria nauseosa*

#### *Global*

Species  
*Artemisia tridentata*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

### GLOBAL SIMILAR ASSOCIATIONS:

*Artemisia tridentata* / *Distichlis spicata* Shrubland (CEGL001000)--This is one of many similar *Artemisia tridentata* associations without variety of *Artemisia tridentata* specified.

*Artemisia tridentata* / *Elymus elymoides* Shrubland (CEGL001001)--This is one of many similar *Artemisia tridentata* associations without variety of *Artemisia tridentata* specified.

### SYNONYMY:

*Artemisia tridentata* Association (Leary and Peterson 1984)  
*Artemisia tridentata* Vegetation Zone VIII (Ralston 1969)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This is a broadly defined, low-confidence association that could be split into several associations with more information. There are many associations defined for all subspecies of *Artemisia tridentata*. Leary and Peterson (1984) identified *Artemisia tridentata* in their stands to ssp. *tridentata*; however, their stands were almost pure *Artemisia tridentata* with little else to classify into a less general association.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Artemisia tridentata* ssp. *tridentata* Shrubland is known only from a small stand about 0.5 mi north of headquarters on Hatchery Road (the road divides the stand), a small stand in Johnson Bottom, and a larger stand in the northern portion of Brennan Flat.

**Global Range:** This sagebrush shrubland is reported from eastern California, Nevada, and Utah, but likely occurs throughout much of the Intermountain West.



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**Nations:** US

**States/Provinces:** CA NV UT

**TNC Ecoregions:** 10:C, 6:C

**USFS Ecoregions:** 341C:CC, 342B:CC

**Federal Lands:** USFWS (Ouray)

### **ELEMENT SOURCES**

**Identifier:** CEGL000991 **Confidence:** 3 **Conservation Rank:**G5?

**REFERENCES:** Leary and Peterson 1984, Ralston 1969, Von Loh 2000.

**III.A.4.N.c. TEMPORARILY FLOODED MICROPHYLLOUS SHRUBLAND**

**III.A.4.N.c.1. TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED SHRUBLAND ALLIANCE**

**Tamarisk species Semi-natural Temporarily Flooded Shrubland Alliance**

**Alliance Identifier:** A.842

***Tamarix* spp. Temporarily Flooded Shrubland**

**Tamarisk species Temporarily Flooded Shrubland**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This broadly defined association is composed of shrublands which form moderately dense to dense thickets on banks of larger streams across the western Great Plains, interior and southwestern U.S. and northern Mexico. Stands are dominated by introduced species of *Tamarix*, including *Tamarix ramosissima*, *Tamarix chinensis*, *Tamarix gallica*, and *Tamarix parviflora*. *Tamarix* spp. were introduced from the Mediterranean and have become naturalized in various sites, including salt flats and other saline habitats, springs, and especially along streams and regulated rivers, where it replaces the native vegetation, such as shrublands dominated by species of *Salix* or *Prosopis*. A remnant herbaceous layer may be present, depending on the age and density of the shrub layer. *Tamarix* species have become a critical nuisance along most large rivers in the semi-arid West and, because of the difficulty to remove, may have irreversibly changed the vegetation on many sites.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** *Tamarix ramosissima* readily becomes established as seedlings on moist silt and sand of sand bars and point bars; it also readily colonizes drying mudflats and Green River channels. Salt-cedar competes with native species such as *Salix exigua*, *Salix amygdaloides*, and *Populus fremontii* on these sites.

**Global Environment:** These widespread shrublands are common along larger streams, rivers, and around playas in the western U.S. and Mexico. Elevation ranges from 75 m below sea level to 1860 m. *Tamarix* spp. have become naturalized in various sites including riverbanks, floodplains, basins, sandbars, side channels, springs, salt flats, and other saline habitats. Stands grow especially well along regulated rivers where flood-regenerated native species like *Populus* are declining. Substrates are commonly thin sandy loam soil over alluvial deposits of sand, gravel or cobbles.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Tamarix ramosissima* is the dominant species in all stands, but because of its very small leaves foliar cover for this shrub usually is recorded at the 40-60% range. The lowest foliar cover value recorded (40%) was in a young stand in Leota Bottom where the shrub height was between 0.5 and 1 m. One stand in Sheppard Bottom was extremely tall and dense and was estimated at 90% foliar cover for salt-cedar, where shrub heights were nearly 5 m. Stand height is typically recorded in the 2-5 m range for *Tamarix ramosissima*, although a stand averaging over 5 m tall was recorded in Johnson Bottom. Salt-cedar stands that have established on point bars and islands are more dense than stands that are invading into adjacent grasslands and shrublands. Other shrubs or sapling trees that are present in *Tamarix ramosissima* stands at various densities include *Populus fremontii*, *Salix amygdaloides*, *Salix exigua*, *Sarcobatus vermiculatus*, and *Rhus trilobata*. Foliar cover values for associated shrub species are usually less than 5% in a salt-cedar stand. The most common grasses and forbs present in salt-cedar stands include *Distichlis spicata*, *Sporobolus airoides*, *Polypogon monspeliensis*, *Hordeum jubatum*, *Iva axillaris*, *Conyza canadensis*, and *Lepidium latifolium*. Foliar cover for herbaceous species ranged from approximately 5-50% for the stands sampled, e.g., less herbaceous cover in dense salt-cedar stands colonizing point bars vs. more herbaceous cover where salt-cedar shrubs are invading grasslands.

**Global Vegetation:** This semi-natural shrubland occurs along streams, rivers and playas where it forms a moderate to dense tall-shrub layer that is solely or strongly dominated by species of *Tamarix* including *Tamarix ramosissima*, *Tamarix chinensis*, *Tamarix gallica*, and *Tamarix parviflora*. Other shrubs may include species of *Salix* (especially *Salix exigua*) and *Prosopis*, *Rhus trilobata*, and *Sarcobatus vermiculatus* but with low cover (if shrub species are codominant then stand is classified as a natural shrubland). Scattered *Acer negundo*, *Salix amygdaloides*, *Populus* spp., or *Elaeagnus angustifolia* trees may also be present. Depending on stand age and density of the shrub layer, an herbaceous layer may be present. Associated species include *Distichlis spicata*, *Sporobolus airoides*, and introduced forage species such as *Agrostis*

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*gigantea*, *Agrostis stolonifera*, and *Poa pratensis*. Introduced herbaceous species such as *Polypogon monspeliensis*, *Conyza canadensis*, *Lepidium latifolium*, and others have been reported from shrublands in this association.

**Dynamics:** *Tamarix* spp. are highly competitive shrubs that have invaded many riparian and wetland environments in the western U.S. Hansen *et al.* (1995) report that these shrubs are extremely drought- and salt-tolerant, produce prolific wind-dispersed seeds over much of the growing season, can resprout after burning or cutting, and if kept moist, buried or broken branches will develop adventitious roots and grow. Stands seem to favor disturbed and flow-regulated rivers, but establish well in pristine areas, too. Under optimum conditions riparian areas can be converted to a dense thicket in less than 10 years (Hansen *et al.* 1995). Once established stands are extremely difficult to eradicate, requiring cutting with herbicide application on stumps to prevent resprouting (Smith 1989).

### MOST ABUNDANT SPECIES

#### Ouray National Wildlife Refuge

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Tamarix ramosissima</i> , <i>Populus fremontii</i> , <i>Salix exigua</i>
Herbaceous	<i>Distichlis spicata</i> , <i>Sporobolus airoides</i> , <i>Polypogon monspeliensis</i> , <i>Iva axillaris</i> , <i>Lepidium latifolium</i>

#### Global

<u>Stratum</u>	<u>Species</u>
Tall Shrub	<i>Tamarix</i> spp.

### CHARACTERISTIC SPECIES

#### Ouray National Wildlife Refuge

Species  
*Tamarix ramosissima*, *Salix exigua*, *Distichlis spicata*, *Lepidium latifolium*

#### Global

Species  
*Tamarix* spp.

### OTHER NOTEWORTHY SPECIES

#### Ouray National Wildlife Refuge

Stratum                      Species  
N/A

#### Global

Stratum                      Species  
N/A

### GLOBAL SIMILAR ASSOCIATIONS:

*Tamarix* spp. - (*Baccharis halimifolia*) Shrubland (CEGL004918)

### SYNONYMY:

*Tamarix chinensis* Community Type (Hansen et al. 1995)

Tamarisk Scrub (Holland 1986b)

Saltcedar Alliance (Muldavin et al. 2000a) includes 8 community types.

*Tamarix ramosissima*/*Salix exigua* Community Type (Muldavin et al. 2000a) includes 8 community types.

*Tamarix ramosissima*/*Sporobolus airoides* Community Type (Muldavin et al. 2000a) includes 8 community types.

Tamarisk series (Sawyer and Keeler-Wolf 1995) includes 8 community types.

*Tamarix ramosissima* (Salt cedar) Association (Nachlinger and Reese 1996) classified within the Disturbed Spring Habitats.

Salt cedar series (Paysen et al. 1980) classified within the Disturbed Spring Habitats.

*Tamarix pentandra* Community Type (Szaro 1989) classified within the Disturbed Spring Habitats.

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### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** *Tamarix ramosissima* is a common understory shrub of *Populus fremontii* woodlands and forests within the Refuge.

**Global Comments:** *Tamarix* spp. Temporarily Flooded Shrubland (CEGL003114) is a broadly defined plant association that is composed of many diverse *Tamarix* spp.-dominated vegetation communities from a wide variety of environments. Muldavin et al. (2000a) described 8 community types that will be reviewed as possible NVCS associations.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Tamarix ramosissima* Temporarily Flooded Shrubland is becoming established along the Green River, its floodplain and basins, and along the unnamed tributary drainage near the Refuge entryway. This exotic shrub type occupies sand bars and islands, side channels, basin edges, drying basins, dikes, levees, roadsides, and riparian habitats within the Refuge.

**Global Range:** This semi-natural shrubland is found along drainages in the semi-arid western Great Plains, interior and southwestern U.S. and northern Mexico, from central and eastern Montana, south to Colorado, western Oklahoma and Texas, west to California.

**Nations:** MX US

**States/Provinces:** AZ CA CO MT MXCH MXCO MXSO NM NV OK TX UT WY?

**TNC Ecoregions:** 10:C, 19:C, 22:C, 23:C, 24:C, 26:C, 27:C, 28:C

**USFS Ecoregions:** 261A:CC, 261B:CC, 262A:CC, 313A:CC, 313C:CC, 313D:CC, 313E:CC, 321:C, 322:C, 331I:CC, 331J:CC, 341C:CC, M261A:CC, M261E:CC, M261F:CC, M262A:CC, M262B:CC

**Federal Lands:** NPS (Big Bend, Wupatki, Zion); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL003114 **Confidence:** 2 **Conservation Rank:** GW

**REFERENCES:** Hansen et al. 1995, Hoagland 1997, Holland 1986b, Muldavin et al. 2000a, Nachlinger and Reese 1996, Paysen et al. 1980, Sawyer and Keeler-Wolf 1995, Smith 1989, Szaro 1989, Thompson 2001, Von Loh 2000.

**III.A.5.N.B. FACULTATIVELY DECIDUOUS EXTREMELY XEROMORPHIC SUBDESERT SHRUBLAND**

**III.A.5.N.b.6. ATRIPLEX CANESCENS SHRUBLAND ALLIANCE**

**Fourwing Saltbush Shrubland Alliance**

**Alliance Identifier:** A.869

*Atriplex canescens* / *Pleuraphis jamesii* Shrubland

Fourwing Saltbush / James' Galleta Shrubland

*Fourwing Saltbush* / *Galleta Shrubland*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This broadly defined shrubland association has been reported from the southwestern Great Plains, Colorado Plateau, Uinta Basin, and may occur in the Chihuahuan Desert and eastern California. As defined, this association occurs on two distinct types of landforms: alluvial flats and stream terraces with fine-textured soils, or on sand sheets and dunes with sand or sandy loam substrates. The alluvial soils are often deep, alkaline, saline silty clay loams. The vegetation is characterized by a sparse to moderately dense shrub layer (10-40% cover) dominated by *Atriplex canescens* with *Pleuraphis jamesii* dominating the herbaceous layer. Associated shrubs include *Ericameria nauseosa*, *Ephedra torreyana*, *Chrysothamnus viscidiflorus*, *Krascheninnikovia lanata*, *Gutierrezia sarothrae*, *Artemisia bigelovii*, or *Opuntia polyacantha* depending on substrate. Other graminoids include *Achnatherum hymenoides* and *Sporobolus cryptandrus* on sandy sites and *Bouteloua gracilis* and *Sporobolus airoides* on fine-textured soil. Forbs generally have low cover and may include *Sphaeralcea grossulariifolia* and *Chenopodium* spp. Introduced species such as *Bromus tectorum* and *Salsola kali* are common on some sites.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** *Atriplex canescens* Sparse Shrubland has become established on level sites with deposits of sandy loam to sandy soils. These sites show signs of wind erosion and have high concentrations of small mammal burrows.

**Global Environment:** This shrubland association occurs in the southern Great Plains, Colorado Plateau, Uinta Basin, and may occur in the Chihuahuan Desert and eastern California. Elevation ranges from 300-1800 m. It occurs on two distinct types of landforms: sandy sites such as sand sheets and dunes, or lowland sites such as alluvial flats and stream terraces with fine-textured soils. Sites are generally level to gently sloping. The sandy site substrates are aeolian sand or sandy loam. Lowland sites are typically deep, alkaline, saline silty clay loams derived from alluvium. These substrates are generally less saline and occur higher than of *Atriplex canescens* / *Sporobolus airoides*- or *Atriplex confertifolia*-dominated shrublands that occur in alkaline bottomland sites.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Atriplex canescens* Sparse Shrubland is relatively short-statured, with four-wing saltbush shrubs less than one m tall. Other associated shrubs (*Gutierrezia sarothrae*, *Chrysothamnus viscidiflorus*, and *Krascheninnikovia lanata*) are much shorter, rarely exceeding 25 cm in height. Grass species common to this type are typical of those found on sandy soils of the region, e. g., *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Sporobolus cryptandrus*, and the annual exotic *Bromus tectorum*. Forbs common to this type include *Salsola kali*, *Sisymbrium altissimum*, and *Sphaeralcea coccinea*. The foliar cover for four-wing saltbush stands is low, usually between 10-15%, but one site sampled was estimated at approximately 30%, because of the contribution of grass cover.

**Global Vegetation:** This broadly defined association is characterized by a sparse to moderately dense canopy (10-40% cover) of shrubs dominated by *Atriplex canescens* with a sparse to moderate graminoid layer that is dominated by *Pleuraphis jamesii*. Associated shrubs may include *Ericameria nauseosa*, *Ephedra torreyana*, *Chrysothamnus viscidiflorus*, *Krascheninnikovia lanata*, *Gutierrezia sarothrae*, *Artemisia bigelovii*, or *Opuntia polyacantha* depending on substrate. Other graminoids include *Achnatherum hymenoides* and *Sporobolus cryptandrus* on sandy sites, and *Bouteloua gracilis* and *Sporobolus airoides* on fine-textured soil of the lowland sites. Forbs generally have low cover and may include *Sphaeralcea grossulariifolia* and *Chenopodium* spp. Introduced species such as *Bromus tectorum* and *Salsola kali* are common on some sites.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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**Dynamics:** Ecological processes vary with landscape type.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Atriplex canescens</i> , <i>Gutierrezia sarothrae</i> , <i>Chrysothamnus viscidiflorus</i>
Herbaceous	<i>Pleuraphis jamesii</i> , <i>Achnatherum hymenoides</i> , <i>Sporobolus cryptandrus</i> , <i>Bromus tectorum</i> , <i>Salsola kali</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Atriplex canescens</i>
Short Shrub	<i>Chrysothamnus viscidiflorus</i>
Short Shrub	<i>Ericameria nauseosa</i>
Short Shrub	<i>Gutierrezia sarothrae</i>
Short Shrub	<i>Krascheninnikovia lanata</i>
Graminoid	<i>Achnatherum hymenoides</i>
Graminoid	<i>Bouteloua gracilis</i>
Graminoid	<i>Bromus tectorum</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Atriplex canescens*, *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Sporobolus cryptandrus*, *Bromus tectorum*

#### *Global*

Species  
*Atriplex canescens*, *Pleuraphis jamesii*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS :

*Ericameria nauseosa* Shrubland occurs on similar habitats.

### GLOBAL SIMILAR ASSOCIATIONS:

*Atriplex canescens* / *Sporobolus airoides* Shrubland (CEGL001291)--Similar to clayey bottomland and alluvial flats stands of this association.

*Atriplex canescens* / *Bouteloua gracilis* Shrubland (CEGL001283)--Similar to clayey bottomland and alluvial flats stands of this association.

*Atriplex canescens* / *Achnatherum hymenoides* Shrubland (CEGL001289)--Similar to sandy site stands of this association.

### SYNONYMY:

*Atriplex canescens* / *Pleuraphis jamesii* p. c. (Francis 1986) . This association described from a site in the upper Rio Puerco watershed of northwestern New Mexico.

Mapping symbol 313.11 Atca - Bogr - Hija - Spai (Miller et al. 1977) I. This vegetation unit is characterized as a grassland with scattered Atca shrubs, with clayey sites dominated by Hija. It is not clear how this relates to this association.

Greasewood-saltbush map symbol (BLM 1979a) I. This vegetation unit is characterized as a grassland with scattered Atca shrubs, with clayey sites dominated by Hija. It is not clear how this relates to this association.

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** As this association is currently defined, it is characterized only by the codominance of *Atriplex canescens* and *Pleuraphis jamesii*. Its relation to several similar associations is also unclear. Most of the information available suggests that the sparse shrub canopy is more typical and that this association should not be classified as a shrubland (Francis 1986, Miller et al. 1977, Von Loh 2000). Because it has a wide distribution (from southern Great Plains to the Mojave Desert), stands occur on diverse habitats (clayey bottomland to sand dunes) and vary from a sparse to moderate shrub canopy. It is likely that when more information becomes available and the needed classification work is completed, this association will be subdivided.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Atriplex canescens* Sparse Shrubland is distributed mostly on sandy soils near the entryway gate, and along the SH 88 corridor paralleling the west side of the Refuge. Some sandy soils in the western portion of the Refuge, northwest of the headquarters building, also support small stands of four-wing saltbush.

**Global Range:** This shrubland association occurs in the southwestern Great Plains, Colorado Plateau, Uinta Basin, and probably occurs in the Chihuahuan Desert and eastern California.

**Nations:** US

**States/Provinces:** AZ CA? CO NM TX UT

**TNC Ecoregions:** 10:C, 19:C, 24:C, 27:C, 28:?, 29:?

**USFS Ecoregions:** 313A:CC, 313B:CC, 315:C, 321:C, 331I:??, 341B:CC, 341C:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEG001288 **Confidence:** 3 **Conservation Rank:** G3G4

**REFERENCES:** BLM 1979a, BLM 1979b, Diamond 1993, Francis 1986, Miller et al. 1977, Shute and West 1977, Soil Conservation Service 1978, U.S. Bureau of Reclamation 1976, Von Loh 2000.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### III.A.5.N.b.7. *ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE* Shadscale Shrubland Alliance

**Alliance Identifier:** A.870

*Atriplex confertifolia* / *Pleuraphis jamesii* Shrubland  
Shadscale / James' Galleta Shrubland

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#### ELEMENT CONCEPT

##### GLOBAL SUMMARY:

N/A

#### ENVIRONMENTAL DESCRIPTION

##### USFWS WETLAND SYSTEM: TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** Flats near the edges of mesas, hills and ridges at the toeslopes of bluff faces, and hills adjacent to the Green River near Wyasket Bottom all may have exposed gravel and cobble which typically supports *Atriplex confertifolia* Dwarf-shrubland. These sites range from level to approximately 12% slopes for the sites sampled and have a variety of aspects. Wildlife use is high, particularly by pronghorn, cottontail rabbits, and small mammals.

**Global Environment:** This association is found in the southwestern Great Plains, Colorado Plateau, Great Basin, and Mojave Desert mountains. It occurs on two distinct substrates: coarse-textured (rocky or sandy), non-saline soils derived from sandstone or gravel, or deep fine-textured, poorly drained, alkaline, often-saline soils derived from shale or shale-derived alluvium. Sites with coarse-textured soils include gravel and cobble outcrops, mesa escarpments, mountain and hill slopes, ridges, and along toeslopes of river bluffs. Fine-textured soil sites include alluvial flats, floodplains and basins. The common trait of these different substrates is that they are very dry either because of low precipitation (15-23 cm annually) or because of high internal plant moisture stress from soil salinity. Cryptogamic crusts and mosses are important in some stands.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** Total foliar cover is low in the *Atriplex confertifolia* Dwarf-shrubland type, ranging from approximately 10-30%. On only one site sampled, in sandier soils, *Atriplex confertifolia* contributed more than 5% of the foliar cover (approximately 20%). This type supported a rare cacti at one sample site, but common shrubs and succulents include *Gutierrezia sarothrae*, *Ephedra torreyana*, *Leptodactylon pungens*, *Opuntia polyacantha*, and *Tetradymia spinosa*. Grasses common to this type include *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Elymus elymoides*, and *Bromus tectorum*. Foliar cover for herbaceous species ranges from 5-20% in the stands sampled.

**Global Vegetation:** This association is characterized by an open canopy (10-30% cover) of shrubs dominated by *Atriplex confertifolia* with a sparse to moderate graminoid layer dominated by *Pleuraphis jamesii*. Associated shrubs include *Ericameria nauseosa*, *Ephedra torreyana*, *Chrysothamnus viscidiflorus*, *Krascheninnikovia lanata*, *Gutierrezia sarothrae*, *Artemisia bigelovii*, *Picrothamnus desertorum*, *Grayia spinosa*, *Suaeda moquinii* (= *Suaeda fruticosa*), and *Opuntia polyacantha* depending on substrate, or *Amphipappus fremontii*, *Ambrosia dumosa*, and *Lycium pallidum* in the Mojave Desert. If other *Atriplex* species are present, they do not dominate the canopy. Other graminoids include *Achnatherum hymenoides*, *Sporobolus cryptandrus*, and *Elymus elymoides* on sandy sites and *Bouteloua gracilis* and *Sporobolus airoides* on fine-textured soil. Forbs generally have low cover and may include *Sphaeralcea grossulariifolia*, *Eriogonum inflatum*, and species of *Chaenactis*, *Phacelia*, and *Chenopodium*. Introduced species such as *Bromus tectorum* and *Salsola kali* are common on some sites.

**Dynamics:** Ecological processes vary with landscape type.

#### MOST ABUNDANT SPECIES

##### *Ouray National Wildlife Refuge*

##### Stratum

Short Shrub

##### Species

*Atriplex confertifolia*, *Gutierrezia sarothrae*, *Ephedra torreyana*, *Leptodactylon pungens*



## Ouray National Wildlife Refuge Vegetation Mapping Project

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Herbaceous                      *Pleuraphis jamesii*, *Bromus tectorum*

### **Global**

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Atriplex confertifolia</i>
Short Shrub	<i>Gutierrezia sarothrae</i>
Graminoid	<i>Bromus tectorum</i>
Graminoid	<i>Pleuraphis jamesii</i>

### CHARACTERISTIC SPECIES

#### **Ouray National Wildlife Refuge**

##### Species

*Atriplex confertifolia*, *Gutierrezia sarothrae*, *Ephedra torreyana*, *Leptodactylon pungens*, *Pleuraphis jamesii*, *Bromus tectorum*

### **Global**

##### Species

*Atriplex confertifolia*, *Pleuraphis jamesii*

### OTHER NOTEWORTHY SPECIES

#### **Ouray National Wildlife Refuge**

<u>Stratum</u>	<u>Species</u>
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N/A

### **Global**

<u>Stratum</u>	<u>Species</u>
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N/A

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Ephedra torreyana* Dwarf-shrubland occupies similar habitat on mesa rims and bluff edges.

### GLOBAL SIMILAR ASSOCIATIONS:

*Atriplex confertifolia* Wyoming Basins Shrubland (CEGL001293)

*Atriplex confertifolia* Great Basin Shrubland (CEGL001294)

*Atriplex confertifolia* / *Achnatherum hymenoides* Shrubland (CEGL001311)

### SYNONYMY:

*Atriplex confertifolia* Association in the Mixed Shrub Zone (Annable 1985).

*Atriplex confertifolia* Plant Community (Branson et al. 1976).

Mat *Atriplex-Pleuraphis* Community (Dastrup 1963) I. This community is codominated by *Atriplex confertifolia* and *Atriplex corrugata*.

*Atriplex-Tetradymia* Association (Graham 1937) . This community is codominated by *Atriplex confertifolia* and *Atriplex corrugata*.

Shadscale/grass (Harper and Jaynes 1986) . This community is codominated by *Atriplex confertifolia* and *Atriplex corrugata*.

*Atripletum confertifolae* association (Ibrahim et al. 1972) I. Total canopy cover was sparse (10%) with 4.6% ATCO and 3.3% PLJA.

*Gutierrezia sarothrae* - *Atriplex confertifolia* (Potter et al. 1985) I. Occurs on top of Mancos Shale knolls.

*Atriplex confertifolia* cover type (Tuhy and MacMahon 1988) . Includes both *Atriplex confertifolia/Pleuraphis jamesii* community type and *Atriplex confertifolia/Pleuraphis jamesii*- *Hesperostipa hymenoides* community type.

*Atriplex confertifolia/Pleuraphis jamesii* Habitat Type (West and Ibrahim 1968) . See note from Ibrahim et al. 1972.

Frontier Sandstone (Welsh 1957) I. Occurs on northern exposures on sand and on southern aspects at base of slope.

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This widespread shrubland association is only defined by the codominance of *Atriplex confertifolia* and *Pleuraphis jamesii*. Stands are found in different regions (from southwestern Great Plains to Great Basin), in different environments (clay bottomlands, dunes, desert mountains) and with different associated species. This association will likely need to be subdivided as more classification information becomes available.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Atriplex confertifolia* Dwarf-shrubland is typically distributed on gravel and cobble outcrops/exposures that are found on mesa edges in the vicinity of the Leota Bottom and Johnson Bottom overlooks, bluff toeslopes in the vicinity of both Headquarters and the Fish Hatchery, and rolling hills along the Green River near Wyasket Bottom. One stand was observed growing on deep, silty clay soils, about two miles northwest of the Johnson Bottom overlook parking area.

**Global Range:** This shrubland association is reported from the southwestern Great Plains, Colorado Plateau, Great Basin, and Mojave Desert mountains, occurring on a variety of landforms.

**Nations:** US

**States/Provinces:** CA? CO NV UT

**TNC Ecoregions:** 10:C, 11:C, 19:C, 6:C

**USFS Ecoregions:** 341C:CC, 342B:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEG001304 **Confidence:** 2 **Conservation Rank:** G3G5

**REFERENCES:** Annable 1985, Branson and Owen 1970, Branson et al. 1976, Campbell 1977, Dastrup 1963, Graham 1937, Harper and Jaynes 1986, Ibrahim et al. 1972, Lusby et al. 1963, Potter et al. 1985, Singh and West 1971, Soil Conservation Service 1978, Tuhy and MacMahon 1988, U.S. Bureau of Reclamation 1976, Von Loh 2000, Welsh 1957, West and Ibrahim 1968.

**III.B.2.N.c. INTERMITTENTLY FLOODED COLD-DECIDUOUS SHRUBLAND**

**III.B.2.N.c.7. RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE**

**Ill-scented Sumac Intermittently Flooded Shrubland Alliance**

**Alliance Identifier:** A.938

***Rhus trilobata* - *Salix exigua* Shrubland**

**Ill-scented Sumac - Coyote Willow Shrubland**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This minor association occurs in riparian and non-riparian sites in western Colorado, northeastern Utah and southwestern Idaho. Stands are reported from stream and river bottoms and terraces, and upland in mesic swales and on hillslopes below seeps and springs. Along large rivers in canyons stands often form linear bands on rocky, well-drained benches and toeslopes where it is often confined between the high water mark of a river and adjacent cliff faces and has access to the high water table. In broad river bottoms, stands occur in the floodplain on second terraces between older *Populus* spp. forests on upper terraces and *Salix exigua* shrublands next to the river. In these large floodplains, habitats are in flux with stream meanders, channel downcutting, and sediment deposition; sites where this shrubland persists are generally too dry for the establishment of *Populus* and *Salix* spp. Substrates are variable and range from shallow loamy sand to silt loam or over coarse alluvium, boulders or bedrock, to fine silty clays with the depth to groundwater between 2-4 m. The vegetation is characterized by a dense short-shrub layer dominated by 30-90% cover of *Rhus trilobata*. The tall shrub *Salix exigua* is typically present to codominant. Other associated shrubs include *Ericameria nauseosa*, *Ribes aureum*, *Salix lutea*, *Shepherdia argentea*, *Toxicodendron radicans*, and occasional sapling trees of *Populus fremontii*, *Populus angustifolia*, or *Salix amygdaloides*. The herbaceous layer is relatively sparse (<20% cover) and is composed primarily of graminoids such as *Elymus canadensis*, *Leymus cinereus* (= *Elymus cinereus*), *Equisetum* spp., *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Pascopyrum smithii*, or *Phragmites australis*. Forb associates include *Apocynum cannabinum* and *Artemisia ludoviciana*. Exotic species are common in disturbed sites.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM: PALUSTRINE**

**Ouray National Wildlife Refuge Environment:** Stands of *Rhus trilobata* Temporarily Flooded Shrubland have become established at the mid-elevation of the Green River floodplain and persist on these sites that are too dry for establishment of Fremont cottonwood, peachleaf willow, and coyote willow. Skunkbrush stands form on sediment bars that elevate over time by deposition or by down-cutting and moving of the river channel. The soils are fine, silty clays, and depth to ground water is probably between 2-4 m.

**Global Environment:** This minor association occurs in riparian and non-riparian sites in western Colorado, northeastern Utah and southwestern Idaho. Elevation ranges from 940-2000 m. These small shrublands are reported from stream and river bottoms and terraces, and upland in mesic swales and on hillslopes below seeps and springs. Along the Yampa, San Miguel, and Dolores rivers stands often form linear bands on rocky, well-drained benches and toeslopes where it is often confined between the high water mark of a river and adjacent cliff faces and has access to the high water table. Along the Green River stands occur in the floodplain on second terraces between older *Populus fremontii* forests on upper terraces and *Salix exigua* shrublands next to the river. In large floodplains, habitats are in flux with stream meanders, channel downcutting, and sediment deposition; sites where this shrubland persists are generally too dry for the establishment of *Populus* and *Salix* spp. Substrates are variable and range from shallow loamy sand to silt loam or over coarse alluvium, boulders or bedrock, to fine silty clays with the depth to groundwater between 2-4 m. Adjacent riparian vegetation includes communities dominated by *Schoenoplectus* spp., *Typha* spp., *Phragmites australis*, *Salix exigua*, *Alnus incana*, *Betula occidentalis*, *Populus angustifolia*, and *Populus fremontii*.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Rhus trilobata* is the dominant shrub in all stands, with individual shrubs exceeding 10 m in crown diameter and up to 5 m in height. They persist both in open sites on second terraces of the Green River floodplain and as understory shrubs to Fremont cottonwood forest and woodland stands. Foliar cover for *Rhus trilobata* ranges from approximately 40% to as much as 90% depending on shrub density within a stand and stand age. Some foliar cover within a skunkbrush stand is usually supplied by shrubs, including coyote willow, silver buffaloberry,

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and rabbitbrush, and sapling trees, including Fremont cottonwood, peachleaf willow, and Russian-olive. One stand sampled near Woods Bottom was evenly mixed with *Tamarix ramosissima*, both shrubs were present at approximately 40% foliar cover each. Salt-cedar is invading almost all of the riparian stands/vegetation types present along the Green River. *Iva axillaris* is the common native herbaceous species within all stands of skunkbrush, and *Lepidium latifolium* is the common exotic species. Herbaceous species contribute approximately 10-15% foliar cover as part of this plant association. Grass species associated with *Rhus trilobata* shrubs include *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Agropyron intermedium*, and *Elymus canadensis*. In addition to those listed above, forb species identified growing near skunkbrush include, *Apocynum cannabinum*, *Helianthus annuus*, *Conyza canadensis*, and *Artemisia ludoviciana*.

**Global Vegetation:** This plant association is characterized by a dense short-shrub layer dominated by 30-90% cover of *Rhus trilobata* sometimes forming near monocultures. However, the tall shrub *Salix exigua* is typically present to codominant. Other associated shrubs include *Ericameria nauseosa*, *Ribes aureum*, *Salix lutea*, *Shepherdia argentea*, *Toxicodendron radicans*, and occasional sapling trees of *Populus fremontii*, *Populus angustifolia*, or *Salix amygdaloides*. In cooler, mesic sites *Cornus sericea*, *Salix ligulifolia* (= *Salix eriocephala* var. *ligulifolia*), *Berberis fendleri*, *Rosa woodsii*, and *Clematis ligusticifolia* may be present to abundant. The herbaceous layer is relatively sparse (<20% cover) and is composed primarily of graminoids such as *Elymus canadensis*, *Leymus cinereus* (= *Elymus cinereus*), *Equisetum* spp., *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Pascopyrum smithii*, or *Phragmites australis*. Forb associates include *Apocynum cannabinum* and *Artemisia ludoviciana*. Exotic species are common in disturbed stands and may include *Elaeagnus angustifolia*, *Tamarix ramosissima*, *Lepidium latifolium*, *Cirsium arvense*, *Thinopyrum intermedium*, *Poa pratensis*, *Agropyron cristatum*, *Melilotus officinalis*, and *Helianthus annuus*.

**Dynamics:** This shrubland association is considered late-seral by both Kittel et al. (1999) and Hall and Hansen (1997).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Tall Shrub	<i>Rhus trilobata</i>
Herbaceous	<i>Lepidium latifolium</i> , <i>Iva axillaris</i> , <i>Hordeum jubatum</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Tall Shrub	<i>Salix exigua</i>
Short Shrub	<i>Rhus trilobata</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Rhus trilobata*, *Salix exigua*, *Lepidium latifolium*, *Iva axillaris*

#### *Global*

Species  
*Rhus trilobata*, *Salix exigua*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
Tall Shrub                      *Tamarix ramosissima*  
Forb                                *Lepidium latifolium*

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS

*Shepherdia argentea* Temporarily Flooded Shrubland grows adjacent to and intermingles with this type.

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### GLOBAL SIMILAR ASSOCIATIONS:

*Rhus trilobata* - *Prunus serotina* Shrubland (CEGL001119)--This association is described from riparian habitats in southwestern New Mexico.

### SYNONYMY:

Skunkbrush plant association (Kittel and Lederer 1993)

*Rhus trilobata* - *Salix exigua* Shrubland (Kittel et al. 1999)

*Rhus trilobata* Community Type (Hall and Hansen 1997)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** Most other *Rhus trilobata* shrublands sampled are more northerly distributed and are associated with relatively dry, upland grass/grass-like species, including; *Carex filifolia*, *Festuca idahoensis*, *Pseudoroegneria spicata*, and *Schizachyrium scoparium*.

**Global Comments:** This association occurs in both riparian and mesic upland environmental settings (Jankovsky-Jones 2000, Hall and Hansen 1997). Shrub cover is often so dense that there are few consistent understory indicator species to distinguish two associations. In addition, many riparian communities are impacted by the introduced species *Tamarix ramosissima*. Stands are considered a poor condition example of the natural type until strongly dominated by the introduced species. More survey and classification work are needed to refine the concept of this association.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Rhus trilobata* Temporarily Flooded Shrubland grows within the floodplain of the Green River. This association is typically found on second terraces between stands of Fremont cottonwood (upper second or third terrace) and coyote willow (first terrace or lower second terrace). Skunkbrush shrubland is also present as understory to Fremont cottonwood forest and woodland types, in addition it grows adjacent to silver buffaloberry stands on the river banks. The most well-developed stands occupy Sheppard Bottom and Wyasket Bottom.

**Global Range:** This minor shrubland association is known from the Yampa, Gunnison, San Miguel and Dolores river basins of the western slope of Colorado, and along the Green River in northeastern Utah.

**Nations:** US

**States/Provinces:** CO ID UT

**TNC Ecoregions:** 10:C, 19:C, 20:C

**USFS Ecoregions:** 341B:CC, 341C:CC, M331:C

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001121 **Confidence:** 3 **Conservation Rank:** G2

**REFERENCES:** Hall and Hansen 1997, Jankovsky-Jones 2000, Kittel and Lederer 1993, Kittel et al. 1999, Von Loh 2000.

### **III.B.2.N.D. TEMPORARILY FLOODED COLD-DECIDUOUS SHRUBLAND**

#### **III.B.2.N.d.6. SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance**

**Alliance Identifier:** A.947

**Salix exigua / Barren Shrubland**

**Coyote Willow / Barren Shrubland**

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#### **ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This riparian shrubland is common in the Rocky Mountains, Colorado Plateau and Great Basin. It is composed of nearly pure stands of *Salix exigua*, with few other species. Exposed gravel, cobbles or sand characterize the ground cover, but an undergrowth of a few scattered forbs and grasses is usually present. This association occurs within the annual flood zone of rivers on point bars, islands, sand or cobble bars, and streambanks.

#### **ENVIRONMENTAL DESCRIPTION**

##### **USFWS WETLAND SYSTEM: PALUSTRINE**

**Ouray National Wildlife Refuge Environment:** Coyote willow establish on barren, moist point bars and islands and persist as more sediments are added to these first terrace sites. Other species, including Fremont cottonwood and salt-cedar also establish in this manner, therefore, stands of coyote willow on the Refuge usually contain these three species. Side channels of the Green River that are only intermittently flooded, are usually choked with coyote willow shrubs. Individual coyote willow shrubs and small patches are often observed in moist drainages and along dikes and levees in the Refuge.

**Global Environment:** This riparian shrubland is common in the Rocky Mountains, Colorado Plateau and Great Basin. Elevation ranges from 780-2600 m. This association occurs within the annual flood zone of rivers on point bars, islands, sand or cobble bars, and on streambanks occurring along a wide variety of stream reaches, from moderately sinuous and moderate-gradient reaches. It can form large, wide stands on mid-channel islands in larger rivers or narrow stringer bands on small, rocky tributaries. Substrates are typically coarse alluvial deposits of sand, silt and cobbles that are highly stratified vertically from flooding scour and deposition, often consisting of alternating layers of finer textured soil with organic material over coarser alluvium. Occasionally, this association occurs on deep pockets of sand. The lack of soil development and high ground cover of coarse alluvial material are key indicators for this association.

#### **VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** Stands of *Salix exigua* / Barren Shrubland are often linear or crescent-shaped, because they establish on the edges of point bars and islands. Newly established coyote willow stands are typically less than two meters tall while older stands exceed 5m in height and may approach 8-10 m tall; all coyote willow stands are nearly devoid of understory vegetation. Common associates include Fremont cottonwood, peachleaf willow, and salt-cedar, but these woody species rarely account for more than 5% foliar cover in a stand. These habitats are also often subject to beaver foraging activity. Foliar cover of coyote willow is dense, sometimes reaching approximately 95%, but more commonly is in the 80% range. Coyote willow stands within the Refuge are nearly monotypic, however, one stand sampled included a side channel with a seep that was quite diverse. This seep supported three grass, one sedge, two rush-like, and eight forb species, however, the total foliar cover for all 14 species was less than 5%.

**Global Vegetation:** This riparian association is characterized by a sparse to dense tall-shrub (1.5-3 m) canopy composed of *Salix exigua* with ground cover of exposed gravel, cobbles or sand. Relatively low cover of several other shrubs and trees may be present including *Alnus incana*, *Salix monticola*, *Salix eriocephala* var. *ligulifolia*, *Salix irrorata*, *Salix lucida*, *Acer negundo*, *Abies lasiocarpa*, *Populus angustifolia*, *Populus deltoides*, and *Populus fremontii*. A sparse herbaceous layer may be present among the bare soil, gravel, cobbles, or boulders consisting of a wide variety of forbs and graminoids. *Mentha arvensis*, and species of *Carex*, *Eleocharis*, *Juncus*, *Schoenoplectus*, and *Equisetum* are often present. Introduced species, such as *Elaeagnus angustifolia*, *Tamarix* spp., *Bromus tectorum*, *Bromus inermis*, *Elytrigia repens*, *Poa pratensis*, *Agrostis stolonifera* (and other exotic forage species), *Taraxacum officinale*, *Conyza canadensis*, and *Lepidium latifolium*, have been reported from some stands.

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**Dynamics:** This association is an early-seral type that colonizes newly created point bars and other recent alluvial deposits formed in rivers and streams (Kittel et al. 1999).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Tall Shrub	<i>Salix exigua</i> , <i>Populus fremontii</i> , <i>Salix amygdaloides</i> , <i>Tamarix ramosissima</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Tall Shrub	<i>Salix exigua</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Salix exigua*, *Populus fremontii*, *Salix amygdaloides*, *Tamarix ramosissima*, *Conyza canadensis*

#### *Global*

Species  
*Salix exigua*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Lepidium latifolium</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS :

*Salix exigua* / Mesic Graminoids Shrubland (CEGL001203)

### SYNONYMY:

*Salix exigua* / Barren Shrubland (Kittel et al. 1999)  
Unclassified stands of *Salix exigua* (Jones and Walford 1995)  
*Salix exigua* Community Type (Hansen et al. 1995)  
*Salix exigua* Community Type (Hall and Hansen 1997)  
*Salix exigua*-*Salix* spp./*Poa* spp. (Johnston 1987)  
*Salix exigua*/Gravel Bar Community Type (Muldavin et al. 2000a)  
*Salix exigua* / Barren Community Type (Padgett et al. 1989)  
*Salix exigua* ssp. *exigua* Communities (Tuhy and Jensen 1982)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** In the western Great Plains this association includes stands composed of intermediates between *Salix interior* (= *Salix exigua* ssp. *interior*) and *Salix exigua* (= *Salix exigua* ssp. *exigua*) (Dorn 1997, G. Kittel pers. comm. 2001). These taxa were combined at the species level (Kartesz 1999). More information on the distribution of introgression between *Salix interior* (= *Salix exigua* ssp. *interior*) and *Salix exigua* (= *Salix exigua* ssp. *exigua*) is needed to fully understand the ranges of these two species.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Salix exigua* / Barren Shrubland stands are found along the banks of the Green River and on islands within the channel. Younger plants establish on the newly deposited, moist sediments nearest the river, while older stands occupy higher portions of point bars and islands in addition to side channels. Occasional coyote

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willow shrubs grow from dike, levee, and roadway edges and are also observed in intermittent drainages capable of supporting emergent wetlands.

**Global Range:** This riparian shrubland association is common at lower to middle elevations in the Great Basin, Colorado Plateau and Rocky Mountains extending out into the western Great Plains along major rivers.

**Nations:** US

**States/Provinces:** CO ID? UT WA

**TNC Ecoregions:** 10:C, 18:C, 19:C, 20:C, 27:C, 6:C

**USFS Ecoregions:** 311:C, 313A:CC, 313B:CC, 331C:CC, 331H:CC, 331I:CC, 341B:CC, 341C:CC, 342B:CC, 342D:CC, 342E:CC, 342G:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332E:CC, M341B:CC, M341C:CC

**Federal Lands:** NPS (Zion); USFWS (Ouray)

### **ELEMENT SOURCES**

**Identifier:** CEGL001200 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Christy 1973, Dorn 1997, Hall and Hansen 1997, Hansen et al. 1995, Johnston 1987, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999, Padgett et al. 1988b, Padgett et al. 1989, Thompson 2001, Tuhy and Jensen 1982, Von Loh 2000.



**III.B.3.N.B. INTERMITTENTLY FLOODED EXTREMELY XEROMORPHIC DECIDUOUS SUBDESERT SHRUBLAND**

***III.B.3.N.b.3. SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE***  
**Black Greasewood Intermittently Flooded Shrubland Alliance**

**Alliance Identifier:** A.1046

*Sarcobatus vermiculatus* / *Atriplex gardneri* Shrubland

Black Greasewood / Gardner's Saltbush Shrubland

*Greasewood* / *Gardner's Saltbush Shrubland*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This "badlands" association is reported from Montana, Wyoming and Utah. Stands occur on all aspects of moderately steep to steep eroded slopes or on toeslopes composed of "badland" sediments. Substrates are fine-textured, alkaline and saline, have low permeability, and are composed of acid shale, bentonite, or some other highly erodible material. Bare ground and gravel make of the majority (80%) of the ground surface. The vegetation is characterized by a sparse to moderately dense (20-40% cover) woody layer codominated by the short shrub *Sarcobatus vermiculatus* and the dwarf-shrub *Atriplex gardneri*. Other shrubs and dwarf-shrubs include scattered *Artemisia tridentata*, *Picrothamnus desertorum* (= *Artemisia spinescens*), *Atriplex confertifolia*, *Ericameria nauseosa*, *Gutierrezia sarothrae*, *Suaeda calceoliformis*, and *Suaeda moquinii*. The graminoid layer, if present, is sparse and may include *Poa secunda*, *Achnatherum hymenoides*, *Elymus elymoides*, and the introduced annual *Bromus tectorum*. The forb layer is highly variable in cover and composition because much of it is annual, such as *Endolepis dioica* (= *Atriplex dioica*) and *Lappula squarrosa*. Common perennial forbs include *Iva axillaris*, *Machaeranthera canescens*, and *Allium textile*.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** This type becomes established on sediments washed from badlands bluffs, ridges and hills into the floodplain of the Green River. The most significant of these outwash deposits occurs west of Leota Bottom, where Greasewood Shrubland forms a large ecotone with Gardner Saltbush Dwarf-shrubland. A similar, but smaller area is present above the basin in Wyasket Bottom. The soils associated with this ecotone are alkaline and consist of fine-grained silty clay. Wildlife use is limited to pronghorn, deer, and small mammals.

**Global Environment:** This "badlands" association is reported from Montana, Wyoming and Utah. Stands occur on all aspects of moderately steep to steep eroded slopes or on toeslopes composed of "badland" sediments. Substrates are fine-textured, alkaline and saline, have low permeability, and are composed of acid shale, bentonite, or some other highly erodible material. Bare ground and gravel make of the majority (80%) of the ground surface.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** This is a sparse vegetation type, with total foliar cover of 20% or less. Greasewood shrubs can exceed 0.5 m in height, but *Atriplex gardneri*, *Gutierrezia sarothrae*, and *Artemisia spinescens* only rarely exceed 25 cm in height. The shrubs are widely spaced, with only a few bunches of *Oryzopsis hymenoides* between (<5% foliar cover). Both *Elymus elymoides* and *Bromus tectorum* grow under the dwarf shrubs in the small amount of litter trapped between branches. Mosses, lichens, and cryptogamic soils can all be observed within this type. Sheet erosion by water and wind erosion are common to this type; the sheet erosion is the mechanism by which the sediments are washed into the floodplain.

**Global Vegetation:** The vegetation in this association is characterized by a sparse to moderately dense (20-40% cover) woody layer codominated by the short shrub *Sarcobatus vermiculatus* and the dwarf-shrub *Atriplex gardneri*. Other shrubs and dwarf-shrubs include scattered *Artemisia tridentata*, *Picrothamnus desertorum* (= *Artemisia spinescens*), *Atriplex confertifolia*, *Ericameria nauseosa*, *Gutierrezia sarothrae*, *Suaeda calceoliformis*, and *Suaeda moquinii*. The graminoid layer, if present, is sparse and may include *Poa secunda*, *Achnatherum hymenoides*, *Elymus elymoides*, and the introduced annual *Bromus tectorum*. The forb layer is highly variable in cover and composition because much of it is annual, such as *Endolepis dioica* (= *Atriplex dioica*) and *Lappula squarrosa*. Common perennial forbs include *Iva axillaris*, *achaeranthera*

## Ouray National Wildlife Refuge Vegetation Mapping Project

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*canescens*, and *Allium textile*.

**Dynamics:** Both *Sarcobatus vermiculatus* and *Atriplex gardneri*, like many facultative halophytes, are tolerant of alkaline and saline soil conditions that allow the species to occur in sites with less interspecific competition (Ungar et al. 1969, Bransen et al. 1976).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Sarcobatus vermiculatus</i> , <i>Tetradymia spinosa</i>
Dwarf Shrub	<i>Atriplex gardneri</i> , <i>Gutierrezia sarothrae</i> , <i>Artemisia spinescens</i> , <i>Suaeda depressa</i>
Herbaceous	<i>Achnatherum hymenoides</i> , <i>Elymus elymoides</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Sarcobatus vermiculatus</i>
Dwarf Shrub	<i>Atriplex gardneri</i>
Dwarf Shrub	<i>Gutierrezia sarothrae</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Sarcobatus vermiculatus*, *Atriplex gardneri*, *Gutierrezia sarothrae*, *Achnatherum hymenoides*

#### *Global*

Species  
*Atriplex gardneri*, *Sarcobatus vermiculatus*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

### GLOBAL SIMILAR ASSOCIATIONS:

*Sarcobatus vermiculatus* / *Pseudoroegneria spicata* Shrubland (CEGL001367)

*Sarcobatus vermiculatus* / *Artemisia tridentata* Shrubland (CEGL001359)

*Atriplex gardneri* Dwarf-shrubland (CEGL001438)

*Atriplex gardneri* / *Artemisia tridentata* Dwarf-shrubland (CEGL001440)

### SYNONYMY:

*Sarcobatus vermiculatus* / *Atriplex nuttallii* community type (DeVelice et al. 1991)

*Sarcobatus vermiculatus* / *Atriplex nuttallii* community type (DeVelice et al. 1995)

*Sarcobatus vermiculatus* / *Atriplex nuttallii* community type (DeVelice and Lesica 1993)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** Understory species vary across the Refuge, depending on the location of the particular greasewood stand. Rabbitbrush is common on the edge of the existing floodplain, but a long abandoned floodplain channel (actually crossed by SH 88) supports a variety of drier shrubs including snakeweed, green sage, and spiny sagebrush. In Brennan Flats, big sagebrush is associated with greasewood. A greasewood stand on the edge of Wyasket Bottom contains only foxtail barley in the understory. The sparse greasewood stand in Johnson Bottom is difficult to classify, since foliar cover values are equal for greasewood and prickly-pear cactus. For mapping purposes, this stand may require application

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of a special attribute code.

**Global Comments:** This type should be compared to *Sarcobatus vermiculatus* / *Pseudoroegneria spicata* Shrubland (CEGL001367). The two types may be synonymous since they occupy the same badlands slope habitat.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** The *Sarcobatus vermiculatus* - *Atriplex gardneri* Shrubland type is best developed above the basin in Wyasket Bottom and on the large erosion fan west of Leota Bottom.

**Global Range:** This shrubland association occurs in eastern Montana, Big Horn Basin in north-central Wyoming, and northeastern Utah.

**Nations:** US

**States/Provinces:** MT UT WY

**TNC Ecoregions:** 10:C, 11:C, 26:C

**USFS Ecoregions:** 331D:C?, 331G:C?, 341C:CC, 342A:CC, 342F:CC, 342G:CC, M331B:??

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001360 **Confidence:** 1 **Conservation Rank:** G4?

**REFERENCES:** Branson et al. 1976, DeVelice and Lesica 1993, DeVelice et al. 1991, DeVelice et al. 1995, Hamner 1964, Medicine Bow Mine Application n.d., Sweetwater Uranium Project 1978, Ungar et al. 1969, Von Loh 2000.

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### *Sarcobatus vermiculatus* / *Distichlis spicata* Shrubland Black Greasewood / Saltgrass Shrubland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association is reported from western Montana to Washington, south to Nevada, Utah and Colorado. Elevation ranges from approximately 600-2300 m. It forms expansive shrublands on broad floodplains along large rivers and streams, and forms an outer ring around playas above the *Distichlis spicata*-dominated center. Flooding is generally intermittent. Substrates are deep, alkaline, saline and generally fine-textured soils with a perennial high water table. However, in southern Colorado's San Luis valley, stands grow between salt flat depressions (playas) on sandy hummocks approximately 1.2 m above the lakebed. The vegetation is characterized by a fairly open to moderate shrub canopy (18-60% cover) dominated by *Sarcobatus vermiculatus* with an herbaceous layer dominated by the rhizomatous graminoid *Distichlis spicata* (10-80% cover). Associated shrubs and dwarf-shrubs may include *Ericameria nauseosa*, *Gutierrezia sarothrae*, and *Tetradymia canescens*. *Sporobolus airoides* may codominate the graminoid layer, and *Hordeum jubatum* is common in disturbed stands. *Juncus balticus* and *Leymus cinereus* are also present in some stands. The forb layer is generally sparse and composed of species such as *Iva axillaris* and *Ipomopsis* spp. Introduced species may be present to abundant in disturbed stands.

#### ENVIRONMENTAL DESCRIPTION

##### USFWS WETLAND SYSTEM: PALUSTRINE

**Ouray National Wildlife Refuge Environment:** Stands of this shrubland type have become established on the middle and upper floodplain terraces of the Green River and within the channels of tributary drainages. These stands are rarely flooded, as cryptogamic soils have developed under the most mature of them. The soils tend to be silty clay with a mild slope; the aspect is that of the floodplain on which the stand has become established and the slope is usually less than 2%. In the long-abandoned channel west of Sheppard Bottom, the soil is sufficiently dry that a different suite of understory shrubs are present, while along the edge of Wyasket Bottom, only the grass *Hordeum jubatum* is present in the understory. Wildlife use is relatively high, especially small mammals which burrow under these shrubs.

**Global Environment:** This shrubland association is reported from western Montana to Washington, south into Nevada and east into southeastern Colorado. Elevation ranges from approximately 600-2300 m. It forms expansive shrublands on broad floodplains along large rivers and streams, and forms an outer ring around playas above the *Distichlis spicata*-dominated center. Flooding is generally intermittent. Substrates are deep, alkaline, saline and generally fine-textured soils with a perennial high water table. However, in southern Colorado's San Luis Valley, stands grow between salt flat depressions (playas) on sandy hummocks approximately 1.2 m above the lakebed. Cryptogamic crusts are important on some sites.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** *Sarcobatus vermiculatus* shrubs classified in this type are usually between one and two m tall, however, one stand near the Fish Hatchery was estimated to be 2-3 m in height. Foliar cover for greasewood shrubs is typically 40-50%, but the very tall stand is estimated at approximately 60% ground cover. In Johnson Bottom, tall, sparse greasewood shrubs are present that share equal foliar cover values with prickly pear cactus. Associated shrubs are short-statured (<1 m) and usually provide less than 10% foliar cover; these include *Ericameria nauseosa*, *Ericameria parryi*, *Tetradymia spinosa*, *Gutierrezia sarothrae*, and *Opuntia polyacantha*. In Brennan Bottom, *Artemisia tridentata* ssp. *tridentata* is the associated shrub. Herbaceous foliar cover can be quite high, up to approximately 50% where greasewood has invaded grasslands dominated by *Distichlis spicata* and/or *Sporobolus airoides*. Normally, herbaceous foliar cover is estimated at less than 5% and includes the exotics *Bromus tectorum*, *Kochia scoparia*, and *Lepidium latifolium* in addition to *Hordeum jubatum* and *Iva axillaris*. Fire had burned near one sampled stand and *Sarcobatus vermiculatus* was observed producing stump-sprouts. It is unclear whether greasewood shrubs invade established saltgrass and alkali sacaton grasslands or if these grasses expand across greasewood shrublands following fire.

**Global Vegetation:** The vegetation is characterized by a fairly open to moderate shrub canopy (18-60% cover) dominated by *Sarcobatus vermiculatus* with an herbaceous layer dominated by the rhizomatous graminoid *Distichlis spicata* (10-80% cover). Associated shrubs and dwarf-shrubs may include *Ericameria nauseosa*, *Gutierrezia sarothrae*, and *Tetradymia canescens*. *Sporobolus airoides* may codominate the graminoid layer, and *Hordeum jubatum* is common in disturbed

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stands. *Juncus balticus* and *Leymus cinereus* are also present in some stands. The forb layer is generally sparse and composed of species such as *Iva axillaris* and *Ipomopsis* spp. Introduced species such as *Bromus tectorum*, *Lepidium latifolium*, *Lepidium perfoliatum*, and *Bassia hyssopifolia* may be present to abundant in disturbed stands.

**Dynamics:** *Sarcobatus vermiculatus* and *Distichlis spicata*, like many facultative halophytes, are tolerant of alkaline and saline soil conditions that allow the species to occur in sites with less interspecific competition (Ungar et al. 1969, Branson et al. 1976). *Sarcobatus vermiculatus* is often found on sites with high water tables that are intermittently flooded. Hansen et al. (1995) reported that it can tolerate saturated soil conditions for up to 40 days. *Sarcobatus vermiculatus*-dominated vegetation can occur as a narrow band along a stream, a broad floodplain shrubland, or as a mosaic of communities where composition and density of the shrub and understory species vary with depth to water table, salinity and alkalinity, soil texture, and past land use or disturbance. This shrubland may occur as a band of abrupt concentric rings of vegetation 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.

The warm-season grass *Distichlis spicata* is rhizomatous, tolerant of moderate grazing, and its roots resist trampling. Although relatively unpalatable, it can provide valuable winter forage for livestock, if needed. When grazed, *Distichlis spicata* generally increases because of reduced competition from other less grazing-tolerant species. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as tumblegrass (*Schedonnardus paniculatus*), or *Hordeum jubatum* (Costello 1944b, Jones and Walford 1995). Weeds are generally not a problem because few grow well in saline soils. However, severely disturbed sites are susceptible to invasion by introduced species such as *Bromus tectorum*, *Lepidium latifolium*, *Lepidium perfoliatum*, and *Bassia hyssopifolia* (Franklin and Dyrness 1973).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Sarcobatus vermiculatus</i> , <i>Ericameria nauseosa</i> , <i>Tetradymia spinosa</i> , <i>Gutierrezia sarothrae</i>
Herbaceous	<i>Distichlis spicata</i> , <i>Sporobolus airoides</i> , <i>Hordeum jubatum</i> , <i>Bromus tectorum</i> , <i>Iva axillaris</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Ericameria nauseosa</i>
Short Shrub	<i>Gutierrezia sarothrae</i>
Short Shrub	<i>Sarcobatus vermiculatus</i>
Graminoid	<i>Distichlis spicata</i>
Graminoid	<i>Hordeum jubatum</i>
Graminoid	<i>Sporobolus airoides</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Species</u>
<i>Sarcobatus vermiculatus</i> , <i>Ericameria nauseosa</i> , <i>Distichlis spicata</i> , <i>Gutierrezia sarothrae</i> , <i>Hordeum jubatum</i> , <i>Bromus tectorum</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Species</u>
<i>Distichlis spicata</i> , <i>Sarcobatus vermiculatus</i>

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

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### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Bromus tectorum</i>
Forb	<i>Lepidium latifolium</i>
Forb	<i>Lepidium perfoliatum</i>

### **GLOBAL SIMILAR ASSOCIATIONS:**

*Sarcobatus vermiculatus* Shrubland (CEGL001357)--similar but no herbaceous layer.

*Sarcobatus vermiculatus* / *Ericameria nauseosa* Shrubland (CEGL001362)--also occurs on playa in NV.

*Sarcobatus vermiculatus* / *Leymus cinereus* Shrubland (CEGL001366)--occurs in similar habitats those not as saline.

*Sarcobatus vermiculatus* / *Sporobolus airoides* Sparse Vegetation (CEGL001368)--occurs in similar habitats those not as saline.

*Sarcobatus vermiculatus* / *Elymus elymoides* Shrubland (CEGL001372)--occurs in similar habitats those not as saline.

*Sarcobatus vermiculatus* / *Distichlis spicata* - (*Puccinellia nuttalliana*) Shrub Herbaceous Vegetation (CEGL002146)--similar but known from the northern Great Plains and not flooded.

### **SYNONYMY:**

*Sarcobatus vermiculatus* / *Distichlis stricta* Association (Daubenmire 1970)

*Sarcobatus vermiculatus* - *Distichlis stricta* association (Franklin and Dyrness 1973)

*Sarcobatus vermiculatus* - *Distichlis stricta* Habitat Type (Mueggler and Stewart 1980)

*Sarcobatus vermiculatus* - *Distichlis spicata* Community (Crawford 2001)

*Sarcobatus vermiculatus* - *Distichlis spicata* Association (Kittel et al. 1999)

### **CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** Understory species vary across the Refuge, depending on the location of the particular greasewood stand. Rabbitbrush is common on the edge of the existing floodplain, but a long abandoned floodplain channel (actually crossed by SH 88) supports a variety of drier shrubs including snakeweed, green sage, and spiny sagebrush. In Brennan Flats, big sagebrush is associated with greasewood. A greasewood stand on the edge of Wyasket Bottom contains only foxtail barley in the understory. The sparse greasewood stand in Johnson Bottom is difficult to classify, since foliar cover values are equal for greasewood and prickly-pear cactus. For mapping purposes, this stand may require application of a special attribute code.

**Global Comments:** N/A

### **ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Sarcobatus vermiculatus* is a widespread shrub within the Refuge. However, the association with *Distichlis spicata* and *Ericameria* spp. occurs only on the floodplain of the Green River, usually on the second or third terrace. A variety of shrub species are present with greasewood in the long-abandoned channel of Sheppard Bottom, but *Gutierrezia sarothrae* is most abundant in the stand, following greasewood. Sparse stands of greasewood in association with saltbush species and species of grasses are described as the *Sarcobatus vermiculatus* - *Atriplex gardneri* Shrubland.

**Global Range:** This shrubland association occurs throughout much of the interior West from western Montana to Washington, south to Nevada, Utah and Colorado.

**Nations:** US

**States/Provinces:** CO ID MT NV? OR UT WA WY

**TNC Ecoregions:** 10:C, 19:C, 20:C, 6:C

**USFS Ecoregions:** 341C:CC, 342C:CC

**Federal Lands:** USFWS (Ouray)

### **ELEMENT SOURCES**

**Identifier:** CEGL001363 **Confidence:** 1 **Conservation Rank:** G4

**REFERENCES:** Branson et al. 1976, Costello 1944b, Crawford 2001, Daubenmire 1970, Franklin and Dyrness 1973, Hansen et al. 1995, Jones and Walford 1995, Kittel et al. 1999, Mueggler and Stewart 1980, Ungar et al. 1969, Von Loh 2000

## IV. Dwarf-shrubland

### IV.A.2.N.A. EXTREMELY XEROMORPHIC EVERGREEN SUBDESERT DWARF-SHRUBLAND

#### *IV.A.2.N.a.9. ARTEMISIA NOVA DWARF-SHRUBLAND ALLIANCE*

##### **Black Sagebrush Dwarf-shrubland Alliance**

**Alliance Identifier:** A.1105

*Artemisia nova Dwarf-shrubland*

**Black Sagebrush Dwarf-shrubland**

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#### **ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This broadly defined association is reported from eastern Wyoming to eastern California but may be found elsewhere in the interior western U.S. Stands occur at middle to upper elevations (1400-2730 m) on mountain and hill slopes, ridges, mesa tops, alluvial fans and river bluffs. Sites are nearly level to moderately sloping; aspects are variable. Soils are shallow (often <30 cm deep), well-drained, and coarse-textured with high cover (35-70% cover) of gravel and cobbles (desert pavement). Soil texture ranges from gravelly loam to sandy clay loam. The vegetation is characterized by an open to moderately dense (12-40% cover) dwarf-shrub layer (<0.5 m tall) that is dominated by *Artemisia nova*. Other woody species present include *Picrothamnus desertorum* (= *Artemisia spinescens*), *Atriplex confertifolia*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ephedra* spp., *Grayia spinosa*, *Krascheninnikovia lanata*, and *Opuntia erinacea*. Diagnostic of this community is a sparse herbaceous understory with only scattered grasses and forbs. Common grasses may include *Achnatherum hymenoides*, *Aristida purpurea*, *Hesperostipa comata*, *Pleuraphis jamesii*, and *Poa secunda*. Forbs such as *Erysimum capitatum* (= *Erysimum asperum*), *Erigeron aphanactis*, and *Phlox viridis* may also be present. Scattered trees may be present, such as *Juniperus osteosperma*, *Pinus monophylla*, or *Yucca brevifolia*, depending on location. Introduced species are important in some stands and may include *Bromus tectorum*, *Salsola kali*, and *Halogeton glomeratus*.

#### **ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** UPLAND

**Ouray National Wildlife Refuge Environment:** The ridgeline and mesa edge that supports *Artemisia nova* Dwarf-shrubland consists of exposed cobble with small patches of silty clay soil among the rocks. This site has orientation to all aspects and the slope ranges from 3-5%. A fair amount of browsing was noted, probably from pronghorn, mule deer, and cottontail rabbit.

**Global Environment:** This broadly defined dwarf-shrubland association is reported from eastern Wyoming to eastern California but may be found elsewhere in the interior western U.S. Stands occur at middle to upper elevations (1400-2730 m) on mountain and hill slopes, ridges, mesa tops, alluvial fans and river bluffs. Sites are nearly level to moderately sloping; aspects are variable, but stands are reported from northwestern slope. Soils are often shallow (<30 cm deep), well-drained, calcareous and coarse-textured with high cover (35-70% cover) of gravel and cobbles (desert pavement). Soil texture ranges from gravelly loam to sandy clay loam. Adjacent vegetation includes *Juniperus osteosperma*-dominated woodlands.

#### **VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** The *Artemisia nova* Dwarf-shrubland is relatively sparse, providing only about 25% cover over the cobble substrate. The shrubs present are less than 25 cm tall and are spread uniformly through the stand. This type is dominated by black sagebrush, but *Atriplex confertifolia*, *Eriogonum schockleyi*, and *Ephedra torreyana* are also present in the stand. Common herbaceous plants include the bunch grasses *Hesperostipa comata* and *Aristida purpurea* and the sod-forming *Pleuraphis jamesii*. The only forb observed was *Erysimum asperum*.

**Global Vegetation:** This association has an open to moderately dense (12-40% cover) dwarf-shrub layer (<0.5 m tall) that is dominated by *Artemisia nova*. Other woody species present include *Picrothamnus desertorum* (= *Artemisia spinescens*), *Atriplex confertifolia*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ephedra nevadensis*, *Ephedra torreyana*, *Ephedra viridis*, *Grayia spinosa*, *Krascheninnikovia lanata*, and *Opuntia erinacea*. Diagnostic of this community is a sparse herbaceous understory with only scattered grasses and forbs. Common grasses may include *Achnatherum*

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*hymenoides*, *Aristida purpurea*, *Hesperostipa comata*, *Pleuraphis jamesii*, and *Poa secunda*. Forbs such as *Erysimum capitatum* (= *Erysimum asperum*), *Erigeron aphanactis*, and *Phlox viridis* may be present. Scattered *Juniperus osteosperma*, *Pinus monophylla*, and *Yucca brevifolia* may be present in eastern Mojave stands such as Cottonwood Mountains in Death Valley National Park in California. Introduced species are important in some stands and may include *Bromus tectorum*, *Salsola kali*, and *Halogeton glomeratus*.

**Dynamics:** Beatley (1976) observed *Artemisia nova* communities above the *Coleogyne ramosissima* and *Atriplex confertifolia* zones and below the Pinyon-Juniper zone in the Great Basin. Milton and Purdy (1983) found *Artemisia nova* common on hydrothermally altered rocks of the Harmony Formation at the Battle Mountain study site in Utah. They reported that altered soils had lower total vegetation cover, higher pH and more kaolinite and less illite than the unaltered sites, but could not explain why *Artemisia nova* replaced *Artemisia tridentata* on the altered sites.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Artemisia nova</i> , <i>Atriplex confertifolia</i> , <i>Eriogonum schockleyi</i>
Herbaceous	<i>Hesperostipa comata</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Artemisia nova</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Species</u>
<i>Artemisia nova</i> , <i>Atriplex confertifolia</i> , <i>Hesperostipa comata</i>

#### *Global*

<u>Species</u>
<i>Artemisia nova</i>

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

*Grayia spinosa* / *Artemisia nova* / *Achnatherum speciosum* Shrubland (CEGL001344)  
*Artemisia nova* / *Elymus elymoides* Dwarf-shrubland (CEGL001418)  
*Artemisia nova* - *Gutierrezia sarothrae* / *Bouteloua gracilis* - *Pleuraphis jamesii* Dwarf-shrubland (CEGL001419)  
*Artemisia nova* / *Pleuraphis jamesii* Dwarf-shrubland (CEGL001420)  
*Artemisia nova* / *Leymus salinus* ssp. *salmonis* Dwarf-shrub Herbaceous Vegetation (CEGL001421)  
*Artemisia nova* / *Achnatherum hymenoides* Dwarf-shrubland (CEGL001422)  
*Artemisia nova* / *Poa secunda* Dwarf-shrubland (CEGL001423)  
*Artemisia nova* / *Pseudoroegneria spicata* Dwarf-shrubland (CEGL001424)  
*Artemisia nova* / *Hesperostipa comata* Dwarf-shrubland (CEGL001425)  
*Artemisia nova* / *Festuca idahoensis* Dwarf-shrub Herbaceous Vegetation (CEGL001524)

### SYNONYMY:

*Artemisia nova* communities (Beatley 1976)  
*Artemisia nova* Community (Blackburn et al. 1968c)



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*Artemisia nova* Association (Leary and Peterson 1984)  
*Artemisia nova* Association (Peterson 1984)  
Black Sagebrush Series (Sawyer and Keeler-Wolf 1995)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This wide-ranging and broadly defined association is distinguished from other *Artemisia nova* dwarf-shrublands by the lack of a significant graminoid layer and therefore is quite variable in species composition. Blackburn et al. (1968c) described an *Artemisia nova* / *Bromus tectorum* association that may be included here until a new *Artemisia nova* / *Bromus tectorum* Shrubland association is created in the NVCS.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** Only one stand of *Artemisia nova* Dwarf-shrubland is present within the Refuge, at the junction of Leota Bottom Overlook and Johnson Bottom Overlook roads. This stand occupies the ridgeline and mesa edge, extending northeastward approximately half the distance up the Leota Bottom Overlook Road and just a short distance up the Johnson Bottom Overlook Road. A small patch of *Artemisia nova* is also present on the mesa edge approximately 200 m northwest of the Johnson Bottom Overlook parking area.

**Global Range:** This association occurs from eastern Wyoming to eastern California.

**Nations:** US

**States/Provinces:** CA NV UT WY

**TNC Ecoregions:** 10:C, 17:C, 20:C, 26:C, 6:C

**USFS Ecoregions:** 322:C, 331F:CC, 341C:CC, 342B:CC, 342F:CC, M261:C, M331A:CC, M331B:CC, M331I:CC, M331J:CC

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001417 **Confidence:** 3 **Conservation Rank:** G3G5

**REFERENCES:** Beatley 1976, Blackburn et al. 1968c, Heinze et al. 1962, Leary and Peterson 1984, Milton and Purdy 1983, Peterson 1984, Sawyer and Keeler-Wolf 1995, Von Loh 2000

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### IV.A.2.N.a.8. KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE Winter-fat Dwarf-shrubland Alliance

**Alliance Identifier:** A.1104

*Krascheninnikovia lanata* / *Pleuraphis jamesii* Dwarf-shrubland  
Winter-fat / James' Galleta Dwarf-shrubland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This minor dwarf-shrubland association is reported from northwestern New Mexico and eastern Utah, but likely occurs throughout the Colorado Plateau. Stands typically occur on alluvial flats and plains. Sites are typically flat to gently sloping, occurring on any aspect. Soils are generally moderately deep, calcareous, and moderately alkaline and derived from sandstone and shale. Soil texture ranges from sandy loam to silty clay. The ground surface has high cover of bare soil (70-90%). Vegetation is characterized by a sparse to moderately dense dwarf-shrub layer codominated by *Krascheninnikovia lanata* and *Gutierrezia sarothrae*. Other woody species may include scattered *Artemisia tridentata*, *Artemisia bigelovii*, *Chrysothamnus viscidiflorus*, *Opuntia imbricata*, *Opuntia polyacantha*, or *Yucca glauca*. The herbaceous layer has sparse to moderately dense cover that is dominated or codominated by *Pleuraphis jamesii* with scattered perennial forbs. Associated graminoids may include *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus elymoides*, *Hesperostipa comata*, and *Sporobolus airoides*. Scattered perennial forbs may be present such as *Chaetopappa ericoides*, *Machaeranthera pinnatifida*, and *Sphaeralcea coccinea*. Exotic annuals may include *Bromus tectorum*, *Salsola kali*, and *Sisymbrium altissimum*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS WETLAND SYSTEM:** PALUSTRINE – UPLAND

**Ouray National Wildlife Refuge Environment:** The *Krascheninnikovia lanata* Shrubland occurs in two small stands on flats separated by a draw dominated by *Sarcobatus vermiculatus* Shrubland. Soils are silty clay, and nearly 70% of the ground surface is without vegetative cover. The most evident soil features of the stand include disturbance due to small mammal burrowing activity and wind erosion, which results in some pedestaling at the base of the dominant shrubs.

**Global Environment:** This minor dwarf-shrubland association is reported from northwestern New Mexico and eastern Utah, but likely occurs throughout the Colorado Plateau. Elevations range from 1450-2050 m. Climate is temperate and semi-arid. Annual precipitation ranges from 20-30 cm with most occurring during the growing season, often as short-duration, convective thunderstorms. Stands typically occur on alluvial flats and plains. Sites are typically flat to gently sloping, occurring on any aspect. Soils are generally moderately deep, calcareous, and moderately alkaline and derived from sandstone and shale. Soil texture ranges from sandy loam to silty clay. The ground surface has high cover of bare soil (70-90%).

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** *Krascheninnikovia lanata* is the dominant short shrub with foliar cover of approximately 15%. The dwarf shrub *Gutierrezia sarothrae* is also common, providing approximately 10% foliar cover. Other dwarf shrubs present in the stand, in trace amounts, include *Opuntia polyacantha* and *Chrysothamnus viscidiflorus*. Native herbaceous species provide less than 5% foliar cover in the stand and are represented by *Pleuraphis jamesii*, *Hesperostipa comata*, *Achnatherum hymenoides*, and *Sphaeralcea coccinea*. The most common exotic species is *Bromus tectorum*, with approximately 2% foliar cover, but *Sisymbrium altissimum* and *Salsola kali* are also present.

**Global Vegetation:** This association is characterized by a sparse to moderately dense dwarf-shrub layer codominated by *Krascheninnikovia lanata* and *Gutierrezia sarothrae*, and a sparse to moderately dense herbaceous layer dominated by the perennial graminoid *Pleuraphis jamesii*. Scattered *Artemisia tridentata*, *Artemisia bigelovii*, *Chrysothamnus viscidiflorus*, *Opuntia imbricata*, *Opuntia polyacantha*, or *Yucca glauca* may also be present in the woody layer. Other graminoids present in minor amounts may include *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus elymoides*, *Hesperostipa comata*, and *Sporobolus airoides*. Scattered perennial forbs may be present such as *Chaetopappa ericoides*, *Machaeranthera pinnatifida*, and *Sphaeralcea coccinea*. Exotic annuals may include *Bromus tectorum*, *Salsola kali*, and *Sisymbrium altissimum*.

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Dynamics: N/A

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Krascheninnikovia lanata</i>
Dwarf Shrub	<i>Gutierrezia sarothrae</i> , <i>Opuntia polyacantha</i>
Herbaceous	<i>Pleuraphis jamesii</i> , <i>Bromus tectorum</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Gutierrezia sarothrae</i>
Dwarf Shrub	<i>Krascheninnikovia lanata</i>
Graminoid	<i>Bromus tectorum</i>
Graminoid	<i>Pleuraphis jamesii</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Krascheninnikovia lanata*, *Gutierrezia sarothrae*, *Pleuraphis jamesii*

#### *Global*

Species  
*Gutierrezia sarothrae*, *Krascheninnikovia lanata*, *Pleuraphis jamesii*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
Graminoid                      *Bromus tectorum*

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Gutierrezia sarothrae* Dwarf-shrubland is similar in all respects, except the dominant species, to this type.

### GLOBAL SIMILAR ASSOCIATIONS:

*Krascheninnikovia lanata* / *Bouteloua gracilis* Dwarf-shrub Herbaceous Vegetation (CEGL001321)

*Krascheninnikovia lanata* / *Achnatherum hymenoides* Dwarf-shrubland (CEGL001323)

*Krascheninnikovia lanata* / *Hesperostipa comata* Dwarf-shrubland (CEGL001327)

*Gutierrezia sarothrae* - *Krascheninnikovia lanata* - *Atriplex canescens* / *Bouteloua eriopoda* Shrub Herbaceous Vegetation (CEGL001733)

### SYNONYMY:

*Ceratoides lanata* - *Gutierrezia sarothrae*/*Pleuraphis jamesii* plant association (Francis 1986).

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** Stands described by Francis (1986) were generally too sparse to be classified as dwarf-shrublands and may be better classified in a shrub herbaceous association. Current and past livestock management can have a large impact on cover and composition of the woody and herbaceous layers. Both *Krascheninnikovia lanata* (winter-fat) and *Pleuraphis jamesii* are valuable livestock forage and are negatively impacted by heavy use. *Gutierrezia sarothrae* increases

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under heavy livestock use. Significant small mammal burrows and plant pedicelling caused by wind erosion were reported from the Utah stands.

### **ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Krascheninnikovia lanata* Shrubland was observed at only two sites near SH 88 in the vicinity of Sheppard Bottom. The larger stand just equals the project minimum mapping unit, but the smaller stand does not. Both stands occupy nearly flat ground on the large plain that lies adjacent to the Green River floodplain.

**Global Range:** This dwarf-shrubland association is reported from alluvial flats in northwestern New Mexico in the upper Rio Puerco basin, and in eastern Utah in flats above the Green River floodplain. It likely occurs throughout the Colorado Plateau.

**Nations:** US

**States/Provinces:** CO? NM UT

**TNC Ecoregions:** 10:C, 19:C

**USFS Ecoregions:** 313A:CC, 341C:CC

**Federal Lands:** USFWS (Ouray)

### **ELEMENT SOURCES**

**Identifier:** CEGL001322 **Confidence:** 2 **Conservation Rank:** G3G4

**REFERENCES:** Francis 1986, Von Loh 2000.

**IV.A.2.N.B. FACULTATIVELY DECIDUOUS SUBDESERT DWARF-SHRUBLAND**

**IV.A.2.N.b.2. ATRIPLEX CORRUGATA DWARF-SHRUBLAND ALLIANCE**

**Mat Saltbush Dwarf-shrubland Alliance**

**Alliance Identifier:** A.1109

*Atriplex corrugata Dwarf-shrubland*

**Mat Saltbush Dwarf-shrubland**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This dwarf-shrubland association is found on lower hillslopes, clay barrens and alkaline flats on Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah. Sites are nearly flat to moderately steep and often resemble "badlands" because of high water and wind erosion: Soils are typically derived from Mancos Shale. They are moderately deep, strongly saline, moderately alkaline, fine-textured (clayey), poorly developed and typically have high erosion rates. The soil surface is mostly barren. The vegetation is characterized by a very sparse to moderate cover (5-30%) of woody vegetation that is dominated by the halophytic evergreen dwarf-shrub *Atriplex corrugata*. There is typically very low species diversity, but depending on soil salinity and moisture, other plants may be present, including the shrubs *Atriplex gardneri*, *Tetradymia spinosa*, *Picrothamnus desertorum* (= *Artemisia spinescens*), *Suaeda calceoliformis* (= *Suaeda depressa*), and *Krascheninnikovia lanata*. The herbaceous layer is very sparse. Only scattered perennial forbs, such as *Xylorhiza glabriuscula*, *Xylorhiza venusta*, and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides* (= *Achnatherum hymenoides*) and *Elymus elymoides* (= *Sitanion hystrix*), have been reported. Annuals are seasonally present and may include *Eriogonum inflatum*, *Plantago tweedyi*, and *Atriplex argentea*. Introduced species such as *Bromus tectorum* and *Salsola kali* are often present.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** UPLAND

**Ouray National Wildlife Refuge Environment:** *Atriplex corrugata* Dwarf-shrubland vegetation grows on lower hillslopes, on clay soils that lie on 2-3% slopes and are subject to both sheet erosion by water and wind erosion. This results in plants that grow on the pedestals of soil protected beneath their canopy and held by their root system. Some soil cracks were evident, and at one site, white-tailed prairie dogs were digging at the base of saltbush shrubs, probably foraging for roots of *Elymus elymoides*.

**Global Environment:** This dwarf-shrubland association is found on lower hillslopes, clay barrens and alkaline flats on Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah. Climate is semi-arid with most of the highly variable precipitation falling in July and August as high-intensity thunderstorms. Mean annual precipitation is approximately 23 cm. Elevation ranges from 1300-1820 m. Sites are nearly flat to moderately steep and often resemble "badlands" because of high water and wind erosion: Soils are typically derived from Mancos Shale. They are moderately deep, strongly saline, moderately alkaline, fine-textured (clayey), poorly developed and typically have high erosion rates. The soil surface is mostly barren. In the Badger Wash Basin of Colorado there is 25% *Atriplex corrugata*, 60% bare ground, 8% litter and 8% algal crusts (Branson et al. 1976).

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Atriplex corrugata* Dwarf-shrubland is sparsely distributed on clay soils, providing less than 10% foliar cover in a given stand. Mat saltbush and Gardner saltbush are the most common species in each stand, other dwarf shrubs present include *Suaeda depressa*, *Artemisia spinescens*, *Tetradymia spinosa*, and *Xylorhiza venusta*. All of these dwarf shrubs grow on small pedestals of soil that remain following erosion of adjacent soils. The only herbaceous plant species recorded were *Atriplex argentea* and *Elymus elymoides*, which occurred at less than 1% foliar cover. In one stand, herbaceous litter was present, and was identified as the remains of *Halogeton glomeratus*.

**Global Vegetation:** These shrublands are found on the lower slopes of shale outcrops and alkaline flats on the Colorado Plateau. Stands have very sparse to moderate cover (5-30%) of woody vegetation that is dominated by the halophytic evergreen dwarf-shrub *Atriplex corrugata*. Sparse stands are often solely dominated by this plant. Stands typically have very low species diversity. Depending on soil salinity and moisture, other plants may be present, including the shrubs *Atriplex gardneri*, *Tetradymia spinosa*, *Picrothamnus desertorum* (= *Artemisia spinescens*), *Suaeda calceoliformis* (=

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*Suaeda depressa*), and *Krascheninnikovia lanata*. The herbaceous layer is very sparse. Scattered perennial forbs, such as *Xylorhiza glabriuscula*, *Xylorhiza venusta*, and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides* and *Elymus elymoides*, have been reported. Annuals are seasonally present and may include *Eriogonum inflatum*, *Plantago tweedyi*, and *Atriplex argentea*. Introduced species include *Bromus tectorum*, *Halogeton glomeratus*, *Malcolmia africana*, and *Salsola kali*. Plants may be pedestaled because of high erosion on these sites.

**Dynamics:** *Atriplex corrugata*-dominated shrublands are the most saline-tolerant of the Mancos Shale plant communities studied by Branson et al. (1976). Although very slow-growing, *Atriplex corrugata* can completely dominate these extremely saline sites (Branson et al. 1976). It is a true evergreen dwarf-shrub retaining leaves for several years. This plant utilizes winter soil moisture, beginning new growth in March when the soils are relatively warm and moist. It flowers in April and by mid-July fruits are shattered (Branson et al. 1976). If the soils dry out in midsummer, it can go dormant until the late summer monsoon rains begin.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Atriplex corrugata</i> , <i>Atriplex gardneri</i>
Herbaceous	<i>Atriplex argentea</i> , <i>Elymus elymoides</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Atriplex corrugata</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Atriplex corrugata*, *Atriplex gardneri*, *Atriplex argentea*

#### *Global*

Species  
*Atriplex corrugata*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

**OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:** *Atriplex gardneri* Dwarf-shrubland is similar, but grows on erosion fans.

**GLOBAL SIMILAR ASSOCIATIONS:** N/A

#### **SYNONYMY:**

Mat saltbush association (Shantz 1925).

*Atriplex corrugata* Shrub Association (Baker 1984a).

*Atriplex corrugata* Shale Barren (Baker 1984a).

*Atriplex confertifolia* Plant Community (Branson et al. 1976).

Mat *Atriplex-Pleuraphis* Community (Dastrup 1963) I. This community includes two other species of *Atriplex* plus significant *Artemisia nova* cover.

Mat *Atriplex* Association (Graham 1937). This community includes two other species of *Atriplex* plus significant *Artemisia nova* cover.

*Atriplex corrugata* cover type (Collins 1984) referred to Branson 1966.

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Mat saltbush vegetation type (Harper and Jaynes 1986) referred to Branson 1966.

*Atripletum corrugate* (Ibrahim et al. 1972) referred to Branson 1966.

Mat Saltbush Community, Shrub Phase A3a (Romme et al. 1993) referred to Branson 1966.

*Atriplex corrugata* (Potter et al. 1985) occurs in saline low areas in Mancos Shale between knolls.

*Atriplex corrugata* cover type (Tuhy and MacMahon 1988) occurs in saline low areas in Mancos Shale between knolls.

Desert Shrub Habitat (U.S. Bureau of Reclamation 1976) occurs in saline low areas in Mancos Shale between knolls.

Mancos Shale (Welsh 1957) occurs in saline low areas in Mancos Shale between knolls.

*Atriplex corrugata* Habitat Type (West and Ibrahim 1968) occurs in saline low areas in Mancos Shale between knolls.

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** (not available)

**Global Comments:** Vegetation cover in this association may vary greatly depending on soil chemistry and slope. Some stands should be classified as shrublands with 25-30% shrub cover (Branson et al. 1976, Potter et al. 1985). However, most stands are in the 3-20% shrub cover range and should be classified in a sparsely vegetated alliance (Harper and Jaynes 1986, Ibrahim and West 1972, West and Ibrahim 1968, Von Loh 2000). Further investigation is needed throughout its range to resolve this issue.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Atriplex corrugata* Dwarf-shrubland was observed only on clay barrens in the Wonsit Valley and just south of the Fish Hatchery complex.

**Global Range:** Shrublands in this association are found on lower hillslopes and alkaline flats on Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah.

**Nations:** US

**States/Provinces:** CO UT

**TNC Ecoregions:** 10:C, 19:C

**USFS Ecoregions:** 341B:C?, 341C:CC, M341B:??

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001437 **Confidence:** 2 **Conservation Rank:** G5

**REFERENCES:** Baker 1984a, Branson 1966, Branson et al. 1967, Branson et al. 1976, Collins 1984, Dastrup 1963, Graham 1937, Harper and Jaynes 1986, Ibrahim et al. 1972, Lusby et al. 1963, Potter et al. 1985, Romme et al. 1993, Shantz 1925, Shute and West 1977, Tuhy and MacMahon 1988, U.S. Bureau of Reclamation 1976, Von Loh 2000, Welsh 1957, West and Ibrahim 1968.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### IV.A.2.N.b.3. *ATRIPLEX GARDNERI DWARF-SHRUBLAND ALLIANCE* Gardner's Saltbush Dwarf-shrubland Alliance

**Alliance Identifier:** A.1110

*Atriplex gardneri* Dwarf-shrubland

Gardner's Saltbush Dwarf-shrubland

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This dwarf-shrubland association is reported from northern and eastern Utah and Montana. Utah stands occur in flat bottomlands north of the Great Salt Lake, and alluvial fans and hillsides along the Green River. Sites are flat to moderately steep (12%). Soils are calcareous, alkaline, and typically saline and fine-textured. One site had gravelly/cobbly substrate. The vegetation is composed solely of or dominated by *Atriplex gardneri* without an herbaceous layer. Associated shrubs may include minor cover of *Gutierrezia sarothrae*, *Atriplex confertifolia*, *Sarcobatus vermiculatus*, or *Picrothamnus desertorum* (= *Artemisia spinescens*). No herbaceous layer is reported though scattered grasses such as *Pleuraphis jamesii* and *Elymus elymoides* may be present. Invasive species such as *Bromus tectorum* and *Halogeton glomeratus* are present in some stands. The dominance of *Atriplex gardneri* and the lack of an herbaceous layer are diagnostic of this association.

#### ENVIRONMENTAL DESCRIPTION

**USFWS WETLAND SYSTEM:** UPLAND

**Ouray National Wildlife Refuge Environment:** The erosion fan upon which the *Atriplex gardneri* Dwarf-shrubland has become established consists of silty clay outwash from badlands bluffs to the west. Therefore, there is little gravel or cobble at the soil surface, rather a very fine-grained, alkaline substrate. The erosion fan aspect is nearly due east and the slope is relatively mild, approximately 2%. The hillslope south of the Leota Bottom Overlook is gravelly, cobbly, and relatively steep with an approximately 12% slope.

**Global Environment:** This dwarf-shrubland association is reported from northern and eastern Utah and Montana. Elevation ranges from 1350-1500 m. Climate is temperate semi-arid. Utah stands occur in Curlew Valley, a dry Pleistocene lakebed north of the Great Salt Lake, and alluvial fans and hillsides along the Green River. Sites are flat to moderately steep (12%). Soils are calcareous, alkaline, and typically saline and fine-textured. One site had gravelly/cobbly substrate.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** The *Atriplex gardneri* Dwarf-shrubland has very low foliar cover values for all species present, the total foliar cover is estimated at 10-15%. Common dwarf shrubs include *Atriplex gardneri*, *Atriplex confertifolia*, *Sarcobatus vermiculatus*, *Artemisia spinescens*, and *Gutierrezia sarothrae*. The stand on the hillslope south of Leota Bottom overlook also has *Kochia americana* as an associated dwarf shrub. Considerable spacing between individual shrubs is evident. Most of the shrubs present are less than 25 cm tall, but *Sarcobatus vermiculatus* may approach 0.5 m in height. Very little herbaceous foliar cover is available, usually less than 3%, provided by *Pleuraphis jamesii*, *Hesperostipa comata*, and *Elymus elymoides*. Minor foliar cover is provided by the exotic annuals *Bromus tectorum* and *Halogeton glomeratus*.

**Global Vegetation:** This association is broadly defined as a dwarf-shrubland composed solely of or dominated by *Atriplex gardneri* without an herbaceous layer. Associated shrubs may include scattered *Gutierrezia sarothrae*, *Atriplex confertifolia*, *Sarcobatus vermiculatus*, and *Picrothamnus desertorum* (= *Artemisia spinescens*). No herbaceous layer is reported though scattered grasses such as *Pleuraphis jamesii* and *Elymus elymoides* may be present. Invasive species such as *Bromus tectorum* and *Halogeton glomeratus* are present in some stands. The dominance of *Atriplex gardneri* and the lack of an herbaceous layer are diagnostic of this association.



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**Dynamics:** Although very slow-growing, *Atriplex gardneri* can completely dominate these extremely saline sites (Branson et al. 1976). This plant utilizes winter soil moisture, beginning new growth in March when the soils are relatively warm and moist. It flowers in April and by mid-July fruits are shattered (Branson et al. 1976). *Atriplex gardneri*-dominated vegetation occurs on the most saline-alkaline soils that Gates et al. (1956) studied. It is not limited to the harsh saline soils but was also found on calcareous loam.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Atriplex gardneri</i> , <i>Atriplex confertifolia</i> , <i>Sarcobatus vermiculatus</i> , <i>Artemisia spinescens</i> , <i>Gutierrezia sarothrae</i>
Herbaceous	<i>Pleuraphis jamesii</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Atriplex gardneri</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Atriplex gardneri*, *Atriplex confertifolia*, *Sarcobatus vermiculatus*, *Artemisia spinescens*, *Gutierrezia sarothrae*, *Pleuraphis jamesii*

#### *Global*

Species  
*Atriplex gardneri*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

**OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:** *The Sarcobatus vermiculatus – Disticlis spicata* Sparse Shrubland and *Atriplex corrugata -Atriplex gardneri* Dwarf-shrubland share species and habitats with Gardner saltbush stands.

### GLOBAL SIMILAR ASSOCIATIONS:

*Allenrolfea occidentalis* / *Atriplex gardneri* Shrubland (CEGL000989)  
*Sarcobatus vermiculatus* / *Atriplex gardneri* Shrubland (CEGL001360)  
*Atriplex gardneri* - *Picrothamnus desertorum* Dwarf-shrubland (CEGL001439)  
*Atriplex gardneri* / *Artemisia tridentata* Dwarf-shrubland (CEGL001440)  
*Atriplex gardneri* / *Pleuraphis jamesii* Dwarf-shrubland (CEGL001441)  
*Atriplex gardneri* / *Leymus salinus* Dwarf-shrubland (CEGL001442)  
*Atriplex gardneri* / *Monolepis nuttalliana* Dwarf-shrubland (CEGL001443)  
*Atriplex gardneri* / *Achnatherum hymenoides* Dwarf-shrubland (CEGL001444)  
*Atriplex gardneri* / *Pascopyrum smithii* Dwarf-shrubland (CEGL001445)  
*Atriplex gardneri* / *Xylorhiza venusta* Dwarf-shrubland (CEGL001446)  
*Artemisia pedatifida* - *Atriplex gardneri* Dwarf-shrubland (CEGL001525)

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### SYNONYMY:

*Atriplex* spp. Series (Johnston 1987) B

*Atriplex nuttallii* plant community (Branson et al. 1976) B

*Atriplex nuttallii* community (Mitchell et al. 1966)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This association is poorly defined and is only referred to as a "pure, evidently stable stand of saltsage" in Mitchell et al. (1966). Mitchell et al. (1966) investigated the relatively sharp boundaries between the *Atriplex gardneri* and the *Krascheninnikovia lanata* communities at their study site; no edaphic factor was identified to explain the abrupt change. This association is separated from other *Atriplex gardneri*-dominated associations by the lack of codominant shrubs or significant herbaceous layer. This may be a seral community in areas with a history of over-grazing by livestock. More classification work is needed to further define this association.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** The *Atriplex gardneri* Dwarf-shrubland type has become established on an erosion fan west of Leota Bottom. *Atriplex gardneri* is a component of sparse greasewood shrublands just above Wyasket Bottom. Small patches of *Atriplex gardneri* have become established on hillslopes south of the Leota Bottom Overlook.

**Global Range:** This dwarf-shrubland association is reported from northern and eastern Utah and Montana, but likely has a wider distribution in the interior West.

**Nations:** US

**States/Provinces:** MT UT

**TNC Ecoregions:** 10:C, 11:C, 6:C

**USFS Ecoregions:** 341C:CC, 342B:??

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001438 **Confidence:** 2 **Conservation Rank:** G3G5

**REFERENCES:** Branson et al. 1976, Gates et al. 1956, Johnston 1987, MTNHP n.d., Mitchell et al. 1966, Von Loh 2000.

**IV.B.2.N.A. CAESPITOSE COLD-DECIDUOUS DWARF-SHRUBLAND**

**IV.B.2.N.a.200. GUTIERREZIA SAROTHRAE DWARF-SHRUBLAND ALLIANCE**

**Snakeweed Dwarf-shrubland Alliance**

**Alliance Identifier:** A.2528

***Gutierrezia sarothrae* - (*Opuntia* spp.) / *Pleuraphis jamesii* Dwarf-shrubland**

**Snakeweed - (Prickly-pear species) / James' Galleta Dwarf-shrubland**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This dwarf-shrubland was described from Utah and northern Arizona where it occurs on level to gently sloping hillslopes, plateaus and bluffs. Elevations range from 1350-2000 m. Aspects are reported from the southeast, south and southwest. Soils are variable, but tend to be fine-textured and may occur over gravel and cobbles. Disturbance may be important in maintaining this vegetation community as some stands have been created by chaining of trees and improper grazing by livestock. This broadly defined association is characterized by an open dwarf-shrub canopy (10-30% cover) that is dominated by *Gutierrezia sarothrae*, frequently with *Opuntia* spp. and an herbaceous layer with *Pleuraphis jamesii* present to abundant (1-30% cover). Some stands have a diverse woody layer that includes low cover of several shrub species and occasional *Pinus edulis* or *Juniperus osteosperma* trees. The herbaceous layer is typically dominated by graminoids with several species present including *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua gracilis*, *Elymus elymoides*, *Hesperostipa comata*, or *Pascopyrum smithii*. There is usually only sparse cover of native forbs like *Chamaesyce* spp. or *Sphaeralcea coccinea*; however, introduced species such as *Bromus tectorum* or *Salsola kali* may dominate the herbaceous layer of some disturbed stands.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** UPLAND

**Ouray National Wildlife Refuge Environment:** *Gutierrezia sarothrae* Dwarf-shrubland becomes established on sites with little competition from other plant species. Some of these sites are gravel and cobble knolls and flats, others are silty clay flats that may have been disturbed historically by fire or grazing. One stand of *Gutierrezia sarothrae* Dwarf-shrubland was a successional stage from historic occupation by white-tailed prairie dogs.

**Global Environment:** This association is described from Utah and northern Arizona where it occurs on level to gently sloping hillslopes, plateaus and bluffs. Elevations range from 1350-2000 m. Aspects are reported from the southeast, south and southwest. Soils are variable, but tend to be fine-textured and may occur over gravel and cobbles. Disturbance may be important in maintaining this vegetation community as some stands may have been created by chaining of trees and improper grazing by livestock.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Gutierrezia sarothrae* Dwarf-shrubland stands are also a sparse shrubland with total foliar cover ranging from approximately 10-30%. This type is very likely a successional stage that has become established following a previous disturbance such as prairie dog occupation or heavy livestock grazing. Shrubs in this type rarely exceed 25 cm in height, and except for snakeweed, have foliar cover values of less than 5%. *Gutierrezia sarothrae* foliar cover ranges from 10-25% for the plots sampled. The most commonly associated dwarf shrubs include *Opuntia polyacantha*, *Atriplex confertifolia*, and *Eriogonum microthecum*. Grass species common to this type are *Pleuraphis jamesii* and *Aristida purpurea*; they are usually present at less than 10% foliar cover.

**Global Vegetation:** This broadly defined association is characterized by an open dwarf-shrub canopy (10-30% cover) dominated by *Gutierrezia sarothrae*, frequently with *Opuntia* spp. and an herbaceous layer with *Pleuraphis jamesii* present to abundant (0-30% cover). Some stands have a diverse woody layer that includes low cover of *Artemisia nova*, *Atriplex canescens*, *Atriplex confertifolia*, *Chrysothamnus viscidiflorus*, *Coleogyne ramosissima*, *Ephedra* spp., *Eriogonum* spp., *Grayia spinosa*, *Lycium pallidum*, *Purshia tridentata*, or occasional *Pinus edulis* or *Juniperus osteosperma* trees. The herbaceous layer is typically dominated by graminoids with several species present including *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua gracilis*, *Elymus elymoides*, *Hesperostipa comata*, or *Pascopyrum smithii*. There is usually only sparse cover of native forbs like *Chamaesyce* spp. or *Sphaeralcea coccinea*; however, introduced species such as *Bromus tectorum*, *Erodium cicutarium*, *Sisymbrium altissimum*, or *Salsola kali* may dominate

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the herbaceous layer of some disturbed stands.

**Dynamics:** *Gutierrezia sarothrae* occurs in many natural grassland and steppe communities in the western U.S. and is known to increase when these communities are disturbed mechanically or by over-grazing (Stubbendieck et al. 1992, USFS 1937). The role of disturbance in this association needs further study to understand its successional nature.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

Dwarf Shrub  
Herbaceous

##### Species

*Gutierrezia sarothrae*, *Atriplex confertifolia*, *Opuntia polyacantha*, *Eriogonum microthecum*  
*Pleuraphis jamesii*, *Aristida purpurea*, *Salsola kali*

#### *Global*

##### Stratum

Dwarf Shrub  
Graminoid

##### Species

*Gutierrezia sarothrae*  
*Pleuraphis jamesii*

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

##### Species

*Gutierrezia sarothrae*, *Opuntia polyacantha*, *Pleuraphis jamesii*, *Aristida purpurea*

#### *Global*

##### Species

*Gutierrezia sarothrae*, *Pleuraphis jamesii*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

N/A

##### Species

#### *Global*

##### Stratum

N/A

##### Species

### GLOBAL SIMILAR ASSOCIATIONS:

*Gutierrezia sarothrae* / *Pleuraphis rigida* Shrub Herbaceous Vegetation (CEGL001543)--possibly an anthropogenically disturbed *Pleuraphis rigida* grassland.

*Gutierrezia sarothrae* - *Krascheninnikovia lanata* - *Atriplex canescens* / *Bouteloua eriopoda* Shrub Herbaceous Vegetation (CEGL001733)--rare grassland endemic to Grand Canyon National Park.

*Gutierrezia sarothrae* / *Sporobolus airoides* - *Pleuraphis jamesii* Shrub Herbaceous Vegetation (CEGL001776)--described from northwestern New Mexico.

**SYNONYMY:** N/A

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This broadly defined dwarf-shrubland includes stands that could also be classified as a dwarf-shrub herbaceous association.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Gutierrezia sarothrae* Dwarf-shrubland occupies thin silty clay soils and gravel and cobble beds, on relatively flat surfaces. The largest stands are located at the overlooks for Leota and Johnson Bottoms and a hillslope west of SH 88.

**Global Range:** This association is described from Utah and northern Arizona, but is likely more widespread throughout the semi-arid western U.S.

**Nations:** US

**States/Provinces:** AZ UT

**TNC Ecoregions:** 10:C, 19:C, 21:C

**USFS Ecoregions:** 313A:CC, 341C:CC, M313A:CC

**Federal Lands:** NPS (Walnut Canyon, Zion); USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL002690 **Confidence:** **Conservation Rank:** G?

**REFERENCES:** Stubbendieck et al. 1992, Thompson 2001, USFS 1937, Von Loh 2000.

## V. Herbaceous Vegetation

### V.A.5.N.C. MEDIUM-TALL SOD TEMPERATE OR SUBPOLAR GRASSLAND

#### *V.A.5.N.c.27. PASCOPYRUM SMITHII HERBACEOUS ALLIANCE*

##### Western Wheatgrass Herbaceous Alliance

**Alliance Identifier:** A.1232

*Pascopyrum smithii* Herbaceous Vegetation

Western Wheatgrass Herbaceous Vegetation

*Western Wheatgrass Mixedgrass Prairie*

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, and the interior western United States and possibly Canada. Stands occur on level to gently sloping terrain. They are found on alluvial fans, swales, river terraces, floodplains, valley floors and basins. The soils are clay, clay loam, and silt loam. *Pascopyrum smithii* strongly dominates the moderate to dense (40-100% cover) mixedgrass herbaceous canopy that grows 0.5-1 m tall. Other graminoids that co-occur and may achieve local dominance are *Koeleria macrantha*, *Eleocharis palustris*, and *Poa* spp. Many other species common in midgrass prairies are also found in this community. These include *Artemisia ludoviciana*, *Eriogonum* spp., *Bouteloua gracilis*, *Nassella viridula*, and *Hesperostipa comata* (= *Hesperostipa comata*). Shrubs and dwarf-shrubs are rare in this community, but occasional woody plants such as *Artemisia tridentata*, *Symphoricarpos* spp., *Ericameria nauseosa*, or *Krascheninnikovia lanata* may be present. Introduced species, such as *Bromus tectorum*, *Bromus inermis*, *Poa pratensis*, *Melilotus* spp. or *Cirsium arvensis*, are common in some stands, especially where disturbed.

#### ENVIRONMENTAL DESCRIPTION

**USFWS WETLAND SYSTEM:** TERRESTRIAL / RIPARIAN / PAUSTRINE

**Ouray National Wildlife Refuge Environment:** Western Wheatgrass Herbaceous Vegetation has become established on shallow swales or depressions on second terraces and historic side channels of the Green River floodplain. These sites are essentially flat, holding water following precipitation events and overbank flooding events. Soils are fine, silty clay and clay and exhibited a high degree of cracking during the summer drought. Western wheatgrass stands are grazed by stray horses and elk, and they provide bedding areas for deer and elk in Wyasket Bottom.

**Global Environment:** This grassland association is widespread in the northern and western Great Plains, Rocky Mountains, the intermountain western United States and possibly Canada. Stands occur on level to gently sloping terrain. They are found on alluvial fans, swales, river terraces, floodplains, valley bottoms and basins. The soils are deep (40-100 cm) and well-developed with clay, clay loam, and silt loam textures. Some stands occur above perched water tables.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** *Pascopyrum smithii* Herbaceous Vegetation occurs in dense stands, but with a limited distribution within the Refuge. It is likely that more of this type was present prior to construction of dike, levee, and basin facilities. Foliar cover is dense in this association, ranging from 70-90%, with almost all cover being provided by western wheatgrass. Commonly associated species, accounting for <5% foliar cover in any stand, include *Eleocharis palustris*, *Iva axillaris*, *Malvella leprosa*, *Distichlis spicata*, and *Sporobolus airoides*. One interesting site had nearly equal foliar cover of *Pascopyrum smithii* and *Typha latifolia*. Although minor invasion of Western Wheatgrass Herbaceous Vegetation by exotic shrubs has occurred, it is not nearly to the extent that *Distichlis spicata* and *Sporobolus airoides* stands are undergoing invasion. This may be due to the fact that soils are slightly drier in western wheatgrass stands.

**Global Vegetation:** This association is characterized by a moderate to dense (40-100% cover) mixedgrass herbaceous canopy that grows 0.5-1 m tall and is strongly dominated by *Pascopyrum smithii*. Other graminoids that co-occur and may achieve local dominance are *Koeleria macrantha*, *Eleocharis palustris*, and *Poa* spp. Many other species common in midgrass prairies are also found in this community. These include *Artemisia frigida*, *Artemisia ludoviciana*, *Achillea* sp., *Carex* spp., *Eriogonum* spp., *Bouteloua gracilis*, *Nassella viridula*, and *Hesperostipa comata*. Shrubs and dwarf-shrubs are

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rare in this community, but occasional woody plants such as *Symphoricarpos* spp., *Ericameria nauseosa*, or *Krascheninnikovia lanata* may be present. Introduced species, such as *Bromus tectorum*, *Bromus inermis*, *Poa pratensis*, *Melilotus* spp., *Cirsium arvensis*, *Taraxacum officinale*, or *Salsola kali*, are common in some stands, especially where disturbed.

**Dynamics:** In semi-arid climates, this association is found in relatively mesic topographic positions such as swales, river terraces, floodplains and basins that may be temporarily or intermittently flooded. In some cases, it grows on fine textured soils perched above the water table (Hansen et al. 1995, Hansen and Hall 1997). In more mesic climates it is found in extensive upland areas.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Tamarix ramosissima</i>
Herbaceous	<i>Pascopyrum smithii</i> , <i>Eleocharis palustris</i> , <i>Iva axillaris</i> , <i>Malvella leprosa</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Pascopyrum smithii</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Species</u>
<i>Pascopyrum smithii</i> , <i>Eleocharis palustris</i> , <i>Iva axillaris</i>

#### *Global*

<u>Species</u>
<i>Pascopyrum smithii</i>

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

*Pascopyrum smithii* - *Bouteloua gracilis* Herbaceous Vegetation (CEGL001578)--association of the southern Great Plains and Chihuahuan Desert.

*Pascopyrum smithii* - *Bouteloua gracilis* - *Carex filifolia* Herbaceous Vegetation (CEGL001579)--northern Great Plains.

*Pascopyrum smithii* - *Distichlis spicata* Herbaceous Vegetation (CEGL001580)--northern Great Plains.

*Pascopyrum smithii* - *Eleocharis* spp. Herbaceous Vegetation (CEGL001581)--northern Great Plains.

*Pascopyrum smithii* - *Hordeum jubatum* Herbaceous Vegetation (CEGL001582)--northern Great Plains.

*Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation (CEGL001583)--northern Great Plains.

### SYNONYMY:

Wheatgrass (Aldous and Shantz 1924)

*Agropyron smithii* Great Basin Grassland (Baker and Kennedy 1985)

*Agropyron smithii* Natural Vegetation (Baker 1984a)

Brown's Meadow grassland (Christensen and Welsh 1963) included in Wasatch Mountain meadow.

*Agropyron smithii* Habitat Type (Hansen et al. 1995) included in Wasatch Mountain meadow.

*Agropyron smithii* Habitat Type (Hall and Hansen 1997) included in Wasatch Mountain meadow.

Western Wheatgrass (*Elymus smithii*) Dominance Type (Jones and Walford 1995) included in Wasatch Mountain meadow.

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*Agropyron* association (Ramaley 1916b) included in Wasatch Mountain meadow.  
Wheat Grass Association (Ramaley 1919b) included in Wasatch Mountain meadow.  
Grassland and Sedgeland (Ramaley 1942) B. included in Wasatch Mountain meadow.  
*Agropyron smithii* Sodgrass steppe (Thilenius et al. 1995) included in Wasatch Mountain meadow.

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This community is similar to several others that are dominated or codominated by *Pascopyrum smithii*. As currently defined, it represents a western Great Plains and foothills version of the western wheatgrass types in the central Great Plains. Further work needs to be done to refine the differences in composition and environmental characteristics. See recent descriptions by Thilenius et al. (1995) (*Pascopyrum smithii* sodgrass steppe, a more playa-like wheatgrass type) and by Steinauer and Rolfsmeier (2000). In Nebraska, Steinauer and Rolfsmeier (2000) suggest that their stands may resemble *Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation (CEGL001583).

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Pascopyrum smithii* Herbaceous Vegetation is limited to portions of Leota Bottom and Wyasket Bottom on undisturbed terraces of the Green River floodplain.

**Global Range:** This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, intermountain western United States and possibly Canada, ranging from North Dakota and possibly Saskatchewan, south to Nebraska and Colorado, west to northern Arizona, Utah and Idaho.

**Nations:** CA US

**States/Provinces:** AZ CO ID MT NE SD SK UT WY

**TNC Ecoregions:** 10:C, 11:C, 21:C, 26:C, 27:C, 6:C, 9:C

**USFS Ecoregions:** 313D:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 341C:CC, 342F:CC, M313A:CC, M331A:CC, M332E:CC

**Federal Lands:** NPS (Sunset Crater); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001577 **Confidence:** 3 **Conservation Rank:** G3G5Q

**REFERENCES:** Aldous and Shantz 1924, Baker 1983c, Baker and Kennedy 1985, Bunin 1985, Christensen and Welsh 1963, Godfread 1994, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Marr and Buckner 1974, Ramaley 1916b, Ramaley 1919b, Ramaley 1942, Shanks 1977, Soil Conservation Service 1978, Steinauer and Rolfsmeier 2000, Thilenius et al. 1995, Von Loh 2000.



**V.A.5.N.D. MEDIUM-TALL BUNCH TEMPERATE OR SUBPOLAR GRASSLAND**

**V.A.5.N.d.27. HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE**

**Needle-and-Thread Bunch Herbaceous Alliance**

**Alliance Identifier:** A.1270

***Hesperostipa comata* Great Basin Herbaceous Vegetation**

**Needle-and-Thread Great Basin Herbaceous Vegetation**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This grassland occurs on the Colorado Plateau and Great Basin. Elevation ranges from 1450-2320 m. Stands are found on plains, gentle hillslopes, knolls and bluffs, mesa tops, and plateau parks. Substrates are variable and include sand, cobbles, clay loams and silty clay. This association is characterized by a relatively sparse to moderate herbaceous layer (10-30% cover) that is strongly dominated by the cool-season bunchgrass *Hesperostipa comata*. Low cover of other grasses, such as *Achnatherum hymenoides*, *Achnatherum lettermanii*, *Aristida purpurea*, *Elymus elymoides*, *Pleuraphis jamesii*, *Poa fendleriana*, or *Sporobolus cryptandrus*, may be present. *Bouteloua eriopoda* is not present. Forb cover ranges from sparse to moderate and may be diverse. Associated species may be diverse and include species of *Artemisia*, *Balsamorhiza*, *Cirsium*, *Gilia*, *Hymenopappus*, *Lappula*, *Machaeranthera*, and *Vicia*. Scattered shrubs and dwarf-shrubs may be present with less than 5% total cover. The widespread introduced annual grass *Bromus tectorum* often contributes significant cover in disturbed stands. Some stands have high cover of cryptogams on the soil.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** UPLAND

**Ouray National Wildlife Refuge Environment:** *Hesperostipa comata* is distributed on a variety of substrates, including sand, cobble, and silty clay. For some stands, it appears that *Hesperostipa comata* is the beneficiary of fires which have removed the overstory shrub community. Most vegetation stand aspects are to the north or west and the slopes vary from 1-3%. Wind erosion is common on sandy soils, resulting in pedestalled plants. Pronghorn, cottontail rabbit, and small mammal use is evident in the type.

**Global Environment:** This grassland occurs in the Colorado Plateau and Great Basin. Elevation ranges from 1450-2320 m. Stands are found on plains, gentle hillslopes, knolls and bluffs, mesa tops, and plateau parks. Substrates are variable and include sand, cobbles, clay loams and silty clay. Fires may be important in maintaining these grasslands by reducing woody cover, but burning during the growing season could also damage the *Hesperostipa comata* plants.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Hesperostipa comata* Herbaceous Vegetation occupies predominantly north- and west-facing exposures on knolls, bluff edges and gentle hillslopes along the western portion of the Refuge. This is a short-statured (0.5-1 m) and relatively sparse community, rarely exceeding 25-30% foliar cover. *Hesperostipa comata* typically contributes approximately 20% foliar cover, the remainder is provided primarily by *Achnatherum hymenoides*, *Pleuraphis jamesii*, *Sporobolus cryptandrus*, *Aristida purpurea*, *Gutierrezia sarothrae*, *Ericameria nauseosa*, and *Opuntia polyacantha*. Associated species are determined by the substrate, e.g., *Pleuraphis jamesii* is present on silty clay and cobble substrate, while *Achnatherum hymenoides* and *Sporobolus cryptandrus* are present on sandy soils.

**Global Vegetation:** This association is characterized by a relatively sparse to moderate herbaceous layer (10-30% cover) that is strongly dominated by the cool-season bunchgrass *Hesperostipa comata*. Low cover of other grasses, such as *Achnatherum hymenoides*, *Achnatherum lettermanii*, *Aristida purpurea*, *Elymus elymoides*, *Pleuraphis jamesii*, *Poa fendleriana*, or *Sporobolus cryptandrus*, may be present. *Bouteloua eriopoda* is not present. Forb cover ranges from sparse to moderate and may be diverse. Associated species include *Artemisia campestris*, *Artemisia dracuncululus*, *Artemisia ludoviciana*, *Balsamorhiza sagittata*, *Cirsium arizonicum*, *Hymenopappus filifolius*, *Machaeranthera canescens*, *Vicia americana*, and species of *Eriogonum*, *Gilia*, and *Lappula*. Scattered shrubs and dwarf-shrubs may be present with less than 5% total cover. *Artemisia tridentata* ssp. *vaseyana*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Opuntia polyacantha*, *Gutierrezia sarothrae*, and *Symphoricarpos oreophilus* have been reported from this grassland. The widespread introduced annual grass *Bromus tectorum* often contributes significant cover in disturbed stands. Several other exotic species like *Salsola kali*, *Kochia scoparia*, and *Sisymbrium altissimum* may be present to abundant. Some stands

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have high cover of cryptogams on the soil including *Collema tenax*, *Tortula ruralis*, *Bellia papillata*, and *Fulgensia bracteata* (Kleiner and Harper 1977).

**Dynamics:** These grasslands are dominated by relatively deep-rooted grasses that use soil moisture below 0.5 m during the typically dry summers. The coarse-textured soils allow for rapid infiltration and storage of winter and summer precipitation (Daubenmire 1970, Kleiner 1968, Kleiner and Harper 1977, Thilenius et al. 1995). Fires when the grasses are dormant may be important in maintaining these grasslands by reducing woody cover. However, burning during the growing season generally kills or severely damages *Hesperostipa comata* plants. After fire, regeneration of this non-rhizomatous bunchgrass is by seed and may take many years to reach prefire densities (FEIS 1998).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

Dwarf Shrub  
Herbaceous

##### Species

*Chrysothamnus viscidiflorus*, *Gutierrezia sarothrae*, *Opuntia polyacantha*  
*Hesperostipa comata*, *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Sporobolus cryptandrus*,  
*Aristida purpurea*

#### *Global*

##### Stratum

Graminoid

##### Species

*Hesperostipa comata*

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

##### Species

*Hesperostipa comata*, *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Gutierrezia sarothrae*, *Chrysothamnus viscidiflorus*

#### *Global*

##### Species

*Hesperostipa comata*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

N/A

##### Species

#### *Global*

##### Stratum

N/A

##### Species

### GLOBAL SIMILAR ASSOCIATIONS:

Muhlenbergia montana - *Hesperostipa comata* Herbaceous Vegetation (CEGL001647)  
Pseudoroegneria spicata - *Hesperostipa comata* Herbaceous Vegetation (CEGL001679)  
*Hesperostipa comata* - *Carex filifolia* Herbaceous Vegetation (CEGL001700)  
*Hesperostipa comata* - *Achnatherum hymenoides* Herbaceous Vegetation (CEGL001703)  
*Hesperostipa comata* - *Poa secunda* Herbaceous Vegetation (CEGL001704)  
*Elymus lanceolatus* - *Hesperostipa comata* Herbaceous Vegetation (CEGL001746)

### SYNONYMY:

*Hesperostipa comata* dominated grassland (Kleiner and Harper 1977)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This association is composed of relatively pure *Hesperostipa comata* grasslands in the Intermountain West. The similar associations are distinguished by the codominance of other grass species or a shrub layer.

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### **ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Hesperostipa comata* Herbaceous Vegetation occurs as patches and stands throughout the western one-third of the Refuge.

**Global Range:** N/A

**Nations:** US

**States/Provinces:** CO UT

**TNC Ecoregions:** 10:C, 18:C, 19:C

**USFS Ecoregions:** 313A:CC, 341B:CC, 341C:CC, 342G:??, M341C:CC

**Federal Lands:** NPS (Canyonlands, Zion); USFWS (Ouray)

### **ELEMENT SOURCES**

**Identifier:** CEG001705 **Confidence:** 2 **Conservation Rank:** G2G4

**REFERENCES:** Daubenmire 1970, FEIS 1998, Kleiner 1968, Kleiner 1983, Kleiner and Harper 1977, Thilenius et al. 1995, Thompson 2001, Von Loh 2000.

### V.A.5.N.d.19. *ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE* Indian Ricegrass Herbaceous Alliance

#### ALLIANCE CONCEPT

**Summary:** Stands of this alliance occur in two distinctively different habitats (sandy areas and shale barrens) in different geographic areas. Sandy areas include 'blowouts' in the Great Plains, and in arid and semi-arid dune systems in the Chihuahuan Desert, San Luis Valley, Colorado Plateau and Great Basin. The shale barrens sites have been described from a high-elevation mountain in north-central Colorado and a lower elevation site (1415 m) ridgetop in western Colorado. Substrates are sand or shale. This alliance is characterized by a sparse to moderately dense herbaceous layer that is dominated by *Achnatherum hymenoides*. Many species are associated with this grassland depending on habitat and geography. Sandy habitats may include the graminoids *Redfieldia flexuosa*, *Muhlenbergia pungens*, *Hesperostipa comata*, *Schizachyrium scoparium*, *Calamovilfa gigantea*, and forbs *Heliotropium convolvulaceum*, *Polanisia dodecandra ssp. trachysperma*, *Polanisia jamesii*, *Psoralidium lanceolatum*, *Reverchonia arenaria*, *Sophora stenophylla*, *Wyethia scabra*, *Abronia angustifolia*, *Senecio flaccidus var. flaccidus*. In shaley sites, *Pleuraphis jamesii*, *Hesperostipa comata*, *Pascopyrum smithii*, and *Eriogonum brevicaule* are common. Scattered shrubs or dwarf-shrubs, such as *Ericameria nauseosa*, *Sarcobatus vermiculatus* or *Krascheninnikovia lanata*, may be present on some stands. Diagnostic of this grassland alliance is the dominance of *Achnatherum hymenoides* in the herbaceous layer and that cover of *Ephedra viridis* will not be significant.

#### ENVIRONMENTAL DESCRIPTION

##### USFWS WETLAND SYSTEM: TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** The *Achnatherum hymenoides* Herbaceous Vegetation type occupies a ridge of sandy soil that is susceptible to wind erosion. This site has probably burned historically, eliminating some of the dwarf shrub foliar cover. Also, some grazing has occurred here, as horse and elk manure was present; the stand also has numerous small mammal burrows. *Agropyron cristatum* occurred as a co-dominant on an approximately 10 m wide corridor, disturbed for pipeline introduction, then reclaimed using both native and non-native grass species. The soils in this area are sand with a few cobbles present on the surface. Small mammal burrows, trails, and scat are common within the corridor.

**Global Environment (Alliance):** Stands of this alliance occur in two distinctively different habitats and in different geographic areas. All sites have arid or semi-arid climates. Elevations range from 900-2400 m. Substrates are sand or shale.

In sandy areas in the Great Plains it occurs on 'blowout' sites where sandy plains or stabilized dunes have been disturbed (Ramaley 1939). This pioneer community will eventually succeed to a *Artemisia filifolia*- or *Andropogon hallii*-dominated community depending on the amount of precipitation at the site. Elevations are typically below 1500 m. Climate is semi-arid with most of the highly variable precipitation occurring during the growing season. Mean annual precipitation ranges from 30-60 cm. Drought is not uncommon and contributes to the formation of blowouts. Soils are generally deep sands typically with 90% or more bare ground. These areas are usually relatively small, surrounded by finer-textured substrates that support short grasses and other mid grasses.

In the San Luis Valley in Colorado, approximately 2400 m elevation, stands occur on a sandsheet on the windward side of dunes (Renee Rondeau, CONHP, pers. comm.). In arid and semi-arid dune systems in the Chihuahuan Desert, Colorado Plateau and Great Basin stands of this alliance occur in active dunes (Bowers 1982, Burgess and Northington 1977, Castle 1954, Reid 1980, Van Pelt 1978). They are early seral communities that colonize bare sand in interdune valleys. The plants adapt to sand deposition by stem elongation, but eventually will be buried or dug up as the dunes move. On dune margins, stabilization may occur as other sand adapted species colonize, eventually succeeding into the adjacent desertscrub community.

Another association in this alliance occurs on shale barrens in a high-elevation mountain basin between 2200 and 2300 m elevation in north-central Colorado (Francis 1983, Tiedemann et al. 1983). The basin is surrounded by mountain ranges of the southern Rockies. Additionally, another shale site has been found on a gently sloping (<10%) ridgetop at lower elevations (1415 m) in western Colorado where it was described as a large island surrounded by agricultural fields (Peggy

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Lyons, CONHP, pers. comm.). Climate is semi-arid. Mean annual precipitation is approximately 35 cm. This association is described as a topo-edaphic climax, occurring on soils derived from shales or mudstones. It occupies stabilized badlands with rolling topography, commonly on ridgetops exposed to wind, desiccation and sheet erosion. Soils derived from shale and mudstone are typically shallow, calcareous, alkaline and clayey, often capped by a thin gravel layer. Total vegetative cover is relatively sparse and bare soil ranges from 75% to near 100%.

Communities adjacent to the shale site were dominated by *Pleuraphis jamesii* on lower slopes, *Sarcobatus vermiculatus* on bottomlands, and *Atriplex confertifolia* / *Leymus salinus* on north-facing hillsides.

### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** *Achnatherum hymenoides* Herbaceous Vegetation has become established along a ridge of sandy soil near the western Refuge boundary. The slope is gradual, approximately 2%, and the stand is oriented to the northwest. Since surrounding areas support dwarf shrublands, this grassland association probably exists because of a past fire diminishing the shrub cover. The *Achnatherum hymenoides* Herbaceous Vegetation stand is less than 0.5 m tall, and has a foliar cover of approximately 45%. *Achnatherum hymenoides* provides approximately 40% foliar cover, with *Hesperostipa comata*, *Opuntia polyacantha* and *Chrysothamnus viscidiflorus* providing the remaining foliar cover. Some exotic plant species are present, including *Bromus tectorum*, *Salsola kali*, and *Sisymbrium altissimum*. The reclaimed pipeline corridor supported foliar cover of approximately 30%, and about 20% of that cover is provided by *Achnatherum hymenoides*. Non-native species introduced to the site, including *Agropyron cristatum*, *Elymus* sp., *Bromus tectorum*, *Salsola kali*, and *Sisymbrium altissimum*, contribute from 5-10% foliar cover in the corridor. Other species present include *Ericameria nauseosa*, *Ambrosia acanthicarpa*, *Helianthus annuus*, and *Sphaeralcea coccinea*.

**Global Vegetation (Alliance):** Stands in this widespread alliance are found growing in two different habitats, sandy and shaley sites. Both habitats have a sparse to moderately dense graminoid layer dominated by the perennial bunchgrass *Achnatherum hymenoides*. A sparse forb layer may also be present. Codominants will vary by habitat and geography. Other characteristic species of the sandy plains blowout sites or sandsheets are *Heliotropium convolvulaceum*, *Muhlenbergia pungens*, *Hesperostipa comata*, *Polanisia dodecandra* ssp. *trachysperma*, *Polanisia jamesii*, *Psoralidium lanceolatum* (Ramaley 1939). In the San Luis Valley, *Ericameria nauseosa* may codominate where fires are suppressed, *Redfieldia flexuosa* in loose sands, and *Psoralidium lanceolatum* where more stabilized (Renee Rondeau, CONHP, pers. comm.).

On the Colorado Plateau, active dune sites have codominants such as *Calamovilfa gigantea*, *Psoralidium lanceolatum*, *Reverchonia arenaria*, *Sophora stenophylla*, and *Wyethia scabra* (Bowers 1982, Castle 1954). Reid (1980 as reported by Bowers 1982) described Chihuahuan Desert dune flats vegetation in this alliance that included codominants such as *Abronia angustifolia*, *Senecio flaccidus* var. *flaccidus*, and *Schizachyrium scoparium*.

Van Pelt (1978) described a sandy loam woodland park on the Colorado Plateau with canopy cover of 16% *Achnatherum hymenoides*, 1% *Hesperostipa comata*, and a trace of *Elymus elymoides*. The high elevation shaley hills sites in Colorado are codominated by the low, mat-forming, suffrutescent perennial forb *Eriogonum brevicaulis*. Other associated species may include the dwarf-shrub *Krascheninnikovia lanata*, and the forb *Stenotus armerioides*, and the grass *Pascopyrum smithii*. As many as 40 species may occur in this association, but no species list is available. The lower elevation, shaley ridge site in western Colorado had cover of 5-25% *Achnatherum hymenoides*, 5-25% *Gutierrezia sarothrae*, 10% *Pleuraphis jamesii*, 5% *Krascheninnikovia lanata*, and 1% each for *Sarcobatus vermiculatus*, *Ericameria nauseosa*, and *Tetradymia spinosa*. Other associated species were *Eriogonum contortum* and the exotic annual grass *Bromus tectorum* (Peggy Lyons, CONHP, pers. comm.). Cover data were not available for the other sites, but cover is expected to be more sparse.

**Dynamics (Alliance):** *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. and occurs on a variety of xeric sites (USFS 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USFS 1937).

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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Chrysothamnus viscidiflorus</i> , <i>Opuntia polyacantha</i> , <i>Atriplex canescens</i>
Graminoid	<i>Achnatherum hymenoides</i> , <i>Hesperostipa comata</i> , <i>Pleuraphis jamesii</i> , <i>Bromus tectorum</i> , <i>Agropyron cristatum</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Achnatherum hymenoides</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Achnatherum hymenoides*, *Hesperostipa comata*, *Chrysothamnus viscidiflorus*, *Opuntia polyacantha*

#### *Global*

Species  
*Achnatherum hymenoides*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

**GLOBAL SIMILAR ASSOCIATIONS:** N/A

**SYNONYMY:** N/A

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments (Alliance):** Vegetation in this alliance may be too sparse in sandy sites to be classified as grassland. Stands occur in two very different habitats, sandy plains and shale barrens, which may justify splitting the alliance. Renee Rondeau (CONHP pers. comm.) reported that *Ericameria nauseosa* is codominant in fire-suppressed stands in the San Luis Valley in Colorado. These stands may be better classified in the *Achnatherum hymenoides* Shrub Herbaceous Alliance (A.1543). More investigation is needed.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Achnatherum hymenoides* Herbaceous Vegetation occurs as one large stand on the western edge of the Refuge, and as smaller patches nearer the badlands bluff formations. The *Achnatherum hymenoides* – *Agropyron cristatum* variation was only observed in a pipeline corridor, northwest of Headquarters, where a reclamation seed mix had been introduced to provide soil erosion control.

**Global Range (Alliance):** Stands of this grassland alliance occur on sandy sites in the Great Plains, Chihuahuan Desert, Colorado Plateau and Great Basin, and on shaley sites in central Colorado and on the Colorado Plateau.

**Nations:** CA US

**States/Provinces:** CO ID SK? UT WY

**TNC Ecoregions:** 10:C, 11:C, 19:C, 20:C, 6:C

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**USFS Ecoregions:** 313:C, 341:C, 342D:CC, 342G:C?, M331I:CC

**Federal Lands:** USFWS (Ouray)

### **ALLIANCE SOURCES**

**Identifier:** A.1262 **Confidence:** N/A **Conservation Rank:** N/A

**REFERENCES:** Bowers 1982, Bowers 1984, Burgess and Northington 1977, Castle 1954, Francis 1983, Hickman 1993, Marr et al. 1980, Martin et al. 1981, Neher and Bailey 1976, Pammel 1924, Ramaley 1937, Ramaley 1939b, Ramaley 1942, Reid 1980, Reid et al. 1994, Strong 1980, Terwilliger and Tiedemann 1978, Tiedemann et al. 1987, U.S. Forest Service (USFS) 1937, Von Loh 2000, Van Pelt 1978.

### V.A.5.N.d.24. *SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE* Alkali Sacaton Herbaceous Alliance

**Alliance Identifier:** A.1267

*Sporobolus airoides* Southern Plains Herbaceous Vegetation

Alkali Sacaton Southern Plains Herbaceous Vegetation

*Alkali Sacaton Southern Plains Grassland*

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This alkali sacaton mesic grassland community is found in the southwestern Great Plains, in the southwestern United States, and Mexico. Stands occur on slightly to moderately saline, nearly level bottomlands and terraces. Substrates are shallow, moderately well- to poorly drained, silty clay soils formed in alluvium. The community is dominated by medium-tall and short grasses. *Sporobolus airoides* is a dominant, often accompanied by *Symphyotrichum subulatum* (= *Aster subulatus*), *Pascopyrum smithii*, *Buchloe dactyloides*, *Distichlis spicata*, *Hordeum jubatum*, and *Bouteloua gracilis*.

#### ENVIRONMENTAL DESCRIPTION

**USFWS WETLAND SYSTEM:** TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** Alkali sacaton occupies deposits of silty clay left following overbank flooding of the Green River. These soils lie over near-to-surface ground water, typically just outside the riparian tree zone. Because of its habitat preference, *Sporobolus airoides* Herbaceous Vegetation is invaded by exotic species, including salt-cedar, giant whitetop, and Russian-olive throughout the Refuge.

**Global Environment:** This grassland community occurs on alluvial toeslopes and flats, floodplain depressions, and on sandy streambanks in bottomlands throughout the southern Great Plains and Colorado Plateau. Elevations range from below 1000 m to over 2000 m. Sites are nearly level, and soils are typically fine-textured silts or clays often derived from shale. Substrates are shallow to moderately deep, moderately well- to poorly drained, alkaline, and often saline.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** The *Sporobolus airoides* Herbaceous Vegetation type is relatively tall (0.5-1 m) and extremely dense, with foliar cover values ranging from 60-90%. Alkali sacaton provides foliar cover from 60-70% for each plot sampled. Other herbaceous species common to this type include *Distichlis spicata*, *Pascopyrum smithii*, *Muhlenbergia asperifolia*, *Eleocharis palustris*, *Iva axillaris*, and *Lepidium latifolia*. Shrubs tend to invade this type, particularly the exotics *Tamarix ramosissima* and *Elaeagnus angustifolia*. Native shrubs and trees are also invasive into this community, e. g., *Sarcobatus vermiculatus* and *Populus fremontii*.

**Global Vegetation:** This association is characterized by a sparse to moderately dense (20-60% cover), medium-tall graminoid layer dominated by *Sporobolus airoides*. Associated species include *Symphyotrichum subulatum* (= *Aster subulatus*), *Buchloe dactyloides*, *Distichlis spicata*, *Hordeum jubatum*, *Bouteloua gracilis*, *Panicum obtusum*, *Pleuraphis jamesii*, *Sporobolus cryptandrus*, and *Pascopyrum smithii* (Lauver et al. 1999). Scattered *Atriplex canescens* or *Sarcobatus vermiculatus* shrubs may be present. Forb cover is minor.

**Dynamics:** This is an early-seral community that occurs on floodplains and depressions with moderately saline soils (Aldous and Shantz 1924 as cited in Johnston 1987). While the stand sampled may be flooded infrequently, other stands of *Sporobolus airoides* (alkali sacaton) are reported to occur on soils not flooded but with often high water tables because of land position. The intermittent flood regime affects soil moisture and salinity which can alter species composition. Sudden increases in salinity will result in a decrease in cover of *Sporobolus airoides*. With no change in salinity, this plant association will form hummocks that accumulate sand. Gradually the sites will decrease in salinity, and moisture and invasion by other grasses will follow (Ungar 1974a as cited in Johnston 1987). Soils are non-saline to moderately saline to usually alkaline. *Sporobolus airoides* will decrease in abundance with increased soil salinity.



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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Tamarix ramosissima</i> , <i>Elaeagnus angustifolia</i> , <i>Populus fremontii</i> , <i>Sarcobatus vermiculatus</i>
Herbaceous	<i>Sporobolus airoides</i> , <i>Muhlenbergia asperifolia</i> , <i>Pascopyrum smithii</i> , <i>Distichlis spicata</i> , <i>Lepidium latifolium</i> , <i>Iva axillaris</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Sporobolus airoides</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Sporobolus airoides*, *Distichlis spicata*, *Pascopyrum smithii*, *Muhlenbergia asperifolia*, *Iva axillaris*

#### *Global*

Species  
*Sporobolus airoides*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Distichlis spicata* Herbaceous Vegetation

### GLOBAL SIMILAR ASSOCIATIONS:

*Sporobolus airoides* - *Bouteloua gracilis* Herbaceous Vegetation (CEGL001686)--found only in New Mexico.  
*Sporobolus airoides* Northern Plains Herbaceous Vegetation (CEGL002274)--occurs in the northwestern Great Plains.  
*Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042)--found in the southeastern Great Plains.  
*Sporobolus airoides* - *Distichlis spicata* Herbaceous Vegetation (CEGL001687)--found in the southeastern Great Plains.  
*Sporobolus airoides* Monotype Herbaceous Vegetation (CEGL001688)--found in the southeastern Great Plains.  
*Sporobolus airoides* - *Muhlenbergia porteri* Herbaceous Vegetation (CEGL001689)--found in the southeastern Great Plains.  
*Sporobolus airoides* - *Scleropogon brevifolius* Herbaceous Vegetation (CEGL001692)--found in the southeastern Great Plains.  
*Gutierrezia sarothrae* / *Sporobolus airoides* - *Pleuraphis jamesii* Shrub Herbaceous Vegetation (CEGL001776)--found in the southeastern Great Plains.  
*Pleuraphis jamesii* - *Sporobolus airoides* Herbaceous Vegetation (CEGL001778)--found in the southeastern Great Plains.

### SYNONYMY:

*Sporobolus airoides* Plant Community (Francis 1986)  
*Sporobolus airoides* - *Elytrigia smithii* Plant Association (Johnston 1987)  
*Sporobolus airoides* Herbaceous Vegetation [Provisional] (Kittel et al. 1999)  
*Sporobolus airoides* (Lauver et al. 1999)

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** Compare this association with *Sporobolus airoides* - *Bouteloua gracilis* Herbaceous Vegetation (CEGL001686) and *Pleuraphis jamesii* - *Sporobolus airoides* Herbaceous Vegetation (CEGL001778). Stands in Montana are placed with *Sporobolus airoides* Northern Plains Herbaceous Vegetation (CEGL002274), which occurs in the northwestern Great Plains, and this type is restricted to the southwestern Great Plains and southwestern United States. In the southeastern Plains see *Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042).

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Sporobolus airoides* Herbaceous Vegetation grows on undisturbed floodplain terraces of the Green River.

**Global Range:** This alkali sacaton mesic grassland community is found in the southwestern Great Plains and elsewhere in the southwestern United States and Mexico, ranging from Kansas and Colorado south to Texas, New Mexico (Rio Puerco, Otero County, in Ecoregion 24), and possibly California.

**Nations:** MX US

**States/Provinces:** CA? CO KS MXCO NM TX

**TNC Ecoregions:** 10:C, 19:C, 20:C, 24:C, 27:C

**USFS Ecoregions:** 262:P, 313B:CC, 321A:CC, 322:P, 331F:C?, 331G:C?, 331I:CC, 341C:CC, M331G:CC, M331I:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL001685 **Confidence:** 3 **Conservation Rank:** G3Q

**REFERENCES:** Aldous and Shantz 1924, Francis 1986, Johnston 1987, Kittel and Lederer 1993, Kittel et al. 1999, Lauver et al. 1999, Lindauer 1970, Soil Conservation Service 1978, Steward 1982, Von Loh 2000.

### V.A.5.N.d.9. *SPOROBOLUS CRYPTANDRUS HERBACEOUS ALLIANCE* Sand Dropseed Herbaceous Alliance

**Alliance Identifier:** A.1252

*Sporobolus cryptandrus* Great Basin Herbaceous Vegetation  
Sand Dropseed Great Basin Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This plant association is described from the Uinta Basin and Colorado Plateau where it occurs on alluvial terraces of major rivers and on sand deposits on mesas and plains. Soils are loamy sands and sandy loams derived from alluvium, aeolian deposits or sandstone residuum. Sites have generally been disturbed by flooding, shifting sands, livestock grazing, or human recreation. The vegetation is dominated by the warm-season perennial graminoid *Sporobolus cryptandrus*. *Pleuraphis jamesii*, *Hesperostipa comata*, or *Equisetum variegatum* often occur in low abundance. Native forbs such as *Sphaeralcea grossulariifolia* or *Chamaesyce fendleri* may be present. The introduced annual grass *Bromus tectorum* and several other exotic species like *Bromus rigidus*, *Salsola kali*, *Helianthus annuus*, *Sisymbrium altissimum*, or *Tribulus terrestris* may be present to abundant, especially on disturbed riparian stands. Occasional *Brickellia* spp. or other shrubs may occur, but they are not dense enough to form a shrub layer .

#### ENVIRONMENTAL DESCRIPTION

**USFWS WETLAND SYSTEM:** TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** The plain occupied by *Sporobolus cryptandrus* Herbaceous Vegetation has sandy loam soils and abuts slightly more elevated plains supporting *Achnatherum hymenoides* Herbaceous Vegetation and *Ericameria nauseosa* Dwarf-shrubland. This site has been grazed at some time in the past, as cattle droppings are still evident.

**Global Environment:** This grassland is described from the Uinta Basin and Colorado Plateau where it occurs on alluvial terraces of large rivers and on sand deposits on mesas and plains. Elevation ranges from 1243-1450 m. Sites are flat to gently sloping valley bottoms, plains or plateaus. Soils are loamy sands and sandy loams derived from alluvium, aeolian deposits or sandstone residuum. Stands have generally been disturbed by flooding, shifting sands, livestock grazing, or human recreation.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** One nearly pure stand of *Sporobolus cryptandrus* Herbaceous Vegetation is present on sandy loam soil on the western edge of the Refuge. This stand is dominated by *Sporobolus cryptandrus*, a bunchgrass that provides most of the foliar cover of approximately 20% for the stand. A small amount of *Hesperostipa comata* is also present, in addition to a few forb species. *Helianthus annuus* and *Salsola kali* are annual forbs that provide from 1-5% foliar cover over site soils. All of the plant species present on this site are disturbance tolerant and tend to increase following disturbance. This fact, the presence of cattle droppings, and the proximity of the site to a boundary fence line would suggest a grazing history for this stand. Along the edge of this grassland type, sparse *Chrysothamnus viscidiflorus* and *Opuntia polyacantha* are present. A more mixed stand dominated by *Sporobolus cryptandrus* was observed in Wyasket Bottom; the stand included a sparse shrub component, e.g., *Sarcobatus vermiculatus*, *Artemisia spinescens*, and *Gutierrezia sarothrae*. Also present in this stand were *Bromus tectorum*, *Elymus elymoides*, *Sporobolus airoides*, and *Salsola kali*.

**Global Vegetation:** This plant association is found on alluvial terraces of large rivers and on sand deposits on mesas and plains. The sparse to moderately dense (10-30% cover) herbaceous layer is characterized by the dominance of the warm-season perennial graminoid *Sporobolus cryptandrus*. *Pleuraphis jamesii*, *Hesperostipa comata*, or *Equisetum variegatum* often occur in low abundance. Native forbs such as *Sphaeralcea grossulariifolia* or *Chamaesyce fendleri* typically have low cover and do not form a layer. The widespread introduced annual grass *Bromus tectorum* and several other exotic species like *Bromus rigidus*, *Salsola kali*, *Helianthus annuus*, *Sisymbrium altissimum*, or *Tribulus terrestris* may be present to abundant, especially on disturbed riparian stands. An occasional *Brickellia* spp or other shrubs may occur, but they are not dense enough to form a shrub layer. Moss is important in some stands.

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**Dynamics:** Disturbance is present and appears to be important in the maintenance of this vegetation. *Sporobolus cryptandrus* occurs throughout the western U.S. as a minor species, occasionally becoming locally dominant in disturbed or sandy sites in the midgrass prairie (Weaver and Albertson 1956). This perennial grass produces prolific seeds that are long-lived in the soil (20 years), and is observed to increase in abundance on disturbed and grazing-depleted ranges (USFS 1937).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Sporobolus cryptandrus, Helianthus annuus, Salsola kali</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Bromus tectorum</i>
Graminoid	<i>Sporobolus cryptandrus</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Sporobolus cryptandrus, Helianthus annuus, Salsola kali*

#### *Global*

Species  
*Sporobolus cryptandrus*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Bromus tectorum</i>

### GLOBAL SIMILAR ASSOCIATIONS:

*Sporobolus cryptandrus* Shrub Herbaceous Vegetation (CEGL001514)--similar vegetation except with significant shrub component.

*Aristida purpurea* var. *longiseta* - *Sporobolus cryptandrus* Herbaceous Vegetation (CEGL001515)--similar vegetation and environmental conditions except codominated by *Aristida purpurea* var. *longiseta*.

*Sporobolus cryptandrus* - *Poa secunda* Herbaceous Vegetation (CEGL001516)--similar vegetation and environmental conditions except codominated by *Poa secunda*.

*Artemisia tridentata* / *Sporobolus cryptandrus* - *Achnatherum hymenoides* Shrub Herbaceous Vegetation (CEGL001545)--similar vegetation and environmental conditions except codominated by *Poa secunda*.

*Aristida purpurea* var. *longiseta* - *Pseudoroegneria spicata* - *Sporobolus cryptandrus* Herbaceous Vegetation (CEGL001589)--similar vegetation and environmental conditions except codominated by *Aristida purpurea* var. *longiseta* - *Pseudoroegneria spicata*.

*Ephedra viridis* / *Achnatherum hymenoides* - *Sporobolus cryptandrus* Shrub Herbaceous Vegetation (CEGL001649)--sandy site grasslands with shrub layer.

*Bouteloua gracilis* - *Sporobolus cryptandrus* Herbaceous Vegetation (CEGL001761)--sandy site grasslands with shrub layer.

*Schizachyrium scoparium* - *Aristida basiramea* - *Sporobolus cryptandrus* - *Eragrostis trichodes* Herbaceous Vegetation (CEGL005221)--central Great Plains type.

**SYNONYMY:** N/A

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** The association is broadly defined to include *Sporobolus cryptandrus*-dominated stands from both riparian and sandy upland sites. This plant association is similar to the threatened, regionally endemic *Sporobolus cryptandrus* plant associations from the Columbia Basin and lower Snake River that have declined significantly due to loss of habitat from hydroelectric dam construction and conversion of land to cultivation. Many of the riparian stands in these associations are in poor condition because of past management and invasion of introduced species.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** Only one stand of *Sporobolus cryptandrus* Herbaceous Vegetation was observed and sampled; it occurs near the western boundary fence of the Refuge.

**Global Range:** The association is found on terraces of large rivers in the Colorado Plateau and likely occurs elsewhere in the southwestern U.S.

**Nations:** US

**States/Provinces:** UT

**TNC Ecoregions:** 10:C, 19:C

**USFS Ecoregions:** 313A:CC, 341C:CC

**Federal Lands:** NPS (Zion); USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL002691 **Confidence:** 1 **Conservation Rank:** G?

**REFERENCES:** Thompson 2001, USFS 1937, Von Loh 2000.

**V.A.5.N.E. SHORT SOD TEMPERATE OR SUBPOLAR GRASSLAND**

**V.A.5.N.e.14. PLEURAPHIS JAMESII HERBACEOUS ALLIANCE**

**James' Galleta Herbaceous Alliance**

**Alliance Identifier:** A.1287

***Pleuraphis jamesii* Herbaceous Vegetation**

**James' Galleta Herbaceous Vegetation**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This widespread grassland association is found on alluvial flats, plateau parks and plains in the Colorado Plateau and elsewhere in the southwestern U.S. Topography varies from mesa tops, slopes, and basin floors. Stands may be small woodland parks or more extensive grasslands on the plains. Soils in bottomland stands tend to be fine-textured; however, stands also occur on sandy loams. Vegetation is characterized by a relatively sparse to moderately dense (10-60% cover) herbaceous layer that is strongly dominated by the warm-season bunchgrass *Pleuraphis jamesii*. Low cover of other grasses, such as *Achnatherum hymenoides*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Hesperostipa comata*, *Muhlenbergia porteri*, *Sporobolus airoides*, or *Sporobolus cryptandrus*, may be present. Forb cover is usually sparse and includes species of *Plantago*, *Gilia*, *Lappula*, and prickly pear cacti (*Opuntia*). Many species of shrubs and dwarf-shrubs may be present; however, they are not dense enough to form a shrub layer. Some stands have high cover of cryptogams on the soil.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM: TERRESTRIAL**

**Ouray National Wildlife Refuge Environment:** *Pleuraphis jamesii* Herbaceous Vegetation has become established on gravel, silty clay, and sandy loam soils within the Refuge. As the soils become deeper and more structured, *Pleuraphis jamesii* increases in foliar cover. Slopes within the galleta type vary from nearly flat to moderately steep (1-20%) and are found on all aspects. Sites with *Pleuraphis jamesii* Herbaceous Vegetation are subject to wind and water erosion. Wildlife use includes many ant hills and burrowing small mammals; it is in this type that numerous prairie dog burrows/towns are located.

**Global Environment:** This widespread grassland association is found on alluvial flats, plateau parks and plains in the Colorado Plateau and elsewhere in the southwestern U.S. Elevation ranges from 1220-1660 m. Topography varies from mesa tops, slopes, and basin floors. Stands may be small woodland parks or more extensive on the plains. Soils in bottomland stands tend to be fine-textured; however, stands also occur on sandy loams.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Pleuraphis jamesii* Herbaceous Vegetation is the most widespread, but variable grassland type in the Refuge. On gravel and shallow soils, galleta foliar cover ranges from 10-20%, while on deeper soils foliar cover for galleta may exceed 30%. The range of foliar cover for the type is 10-40%. Commonly associated species include *Hesperostipa comata*, *Achnatherum hymenoides*, *Aristida purpurea*, *Bromus tectorum*, and *Salsola kali* in the herbaceous layer. Dwarf shrubs also observed include *Gutierrezia sarothrae*, *Opuntia polyacantha*, *Tetradymia spinosa*, and *Atriplex confertifolia*, but they are rarely over 5% foliar cover in a stand. A number of prairie dog towns were observed in this grassland type, occupying areas with deeper soils. Prairie dogs may alter the plant association of a site and their activity will be mapped on the final project vegetation map, either as sparse burrow density on grassland vegetation or as a separate map unit.

**Global Vegetation:** This association is characterized by a relatively sparse to moderately dense herbaceous layer (10-60% cover) that is strongly dominated by the warm-season bunchgrass *Pleuraphis jamesii*. Low cover of other grasses such as *Achnatherum hymenoides*, *Bouteloua eriopoda*, *Bouteloua gracilis*, *Hesperostipa comata*, *Muhlenbergia porteri*, *Sporobolus airoides*, or *Sporobolus cryptandrus* may be present. Forb cover is usually sparse and includes species of *Plantago*, *Gilia*, *Lappula*, and prickly pear cacti (*Opuntia*). Many species of shrubs and dwarf-shrubs may be present, but they are not abundant enough to form a shrub layer. Woody species may include *Artemisia filifolia*, *Atriplex canescens*, *Atriplex confertifolia*, *Ephedra torreyana*, *Ericameria nauseosa*, *Gutierrezia* spp., *Tetradymia* spp., and occasional *Juniperus monosperma* trees. The widespread introduced annual grass *Bromus tectorum* and several other exotic species

## Ouray National Wildlife Refuge Vegetation Mapping Project

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like *Salsola kali*, *Kochia scoparia*, *Sisymbrium altissimum* may be present to abundant, especially on disturbed sites. Some stands have high cover of cryptogams on the soil including *Collema tenax*, *Tortula ruralis*, *Bellia papillata*, and *Fulgensia bracteata*.

**Dynamics:** *Pleuraphis jamesii* is both drought- and grazing-resistant (USFS 1937, Weaver and Albertson 1956, West et al. 1972). This grass is favored in mixedgrass stands because it is only moderately palatable to livestock; however, it decreases when heavily grazed during drought and in the more arid portions of its range where it is the dominant grass (West et al. 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil binding properties (USFS 1937, Weaver and Albertson 1956, West et al. 1972).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Dwarf Shrub	<i>Gutierrezia sarothrae</i> , <i>Opuntia polyacantha</i> , <i>Atriplex confertifolia</i>
Graminoid	<i>Pleuraphis jamesii</i> , <i>Bromus tectorum</i> , <i>Hesperostipa comata</i> , <i>Achnatherum hymenoides</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Pleuraphis jamesii</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Pleuraphis jamesii*, *Hesperostipa comata*, *Gutierrezia sarothrae*, *Opuntia polyacantha*

#### *Global*

Species  
*Pleuraphis jamesii*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

### GLOBAL SIMILAR ASSOCIATIONS:

*Atriplex canescens* / *Pleuraphis jamesii* Shrubland (CEGL001288)  
*Atriplex confertifolia* / *Pleuraphis jamesii* Shrubland (CEGL001304)  
*Krascheninnikovia lanata* / *Pleuraphis jamesii* Dwarf-shrubland (CEGL001322)  
*Coleogyne ramosissima* / *Pleuraphis jamesii* Shrubland (CEGL001334)  
*Artemisia nova* / *Pleuraphis jamesii* Dwarf-shrubland (CEGL001420)  
*Atriplex gardneri* / *Pleuraphis jamesii* Dwarf-shrubland (CEGL001441)  
*Bouteloua eriopoda* - *Pleuraphis jamesii* Herbaceous Vegetation (CEGL001751)  
*Bouteloua gracilis* - *Pleuraphis jamesii* Herbaceous Vegetation (CEGL001759)  
*Atriplex obovata* / *Pleuraphis jamesii* - *Sporobolus airoides* Dwarf-shrub Herbaceous Vegetation (CEGL001775)  
*Gutierrezia sarothrae* / *Sporobolus airoides* - *Pleuraphis jamesii* Shrub Herbaceous Vegetation (CEGL001776)  
*Pleuraphis jamesii* - *Sporobolus airoides* Herbaceous Vegetation (CEGL001778)

### SYNONYMY:

Pure *Pleuraphis jamesii* (Cannon 1960) . reported from northwestern New Mexico.  
*Hilaria jamesii* cover type (Collins 1984) . reported from northwestern New Mexico.  
*Hilaria jamesii* Habitat Type (Francis and Aldon 1983) . needs review - may be a mixed type.

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*Hilaria jamesii* Series (Francis 1986) B. need review; no "Pure" *Pleuraphis jamesii* community type was described. *Hilaria jamesii* dominated stands (Kleiner and Harper 1977) . need review; no "Pure" *Pleuraphis jamesii* community.

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This association is defined by the dominance of *Pleuraphis jamesii* in the graminoid layer without codominance of other grass species or the presence of a shrub layer.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Pleuraphis jamesii* Herbaceous Vegetation is generally distributed across the Refuge, above the Green River floodplain, on a variety of soils, slopes, and aspects.

**Global Range:** This widespread grassland association is found on alluvial flats, plateau parks and plains in the Colorado Plateau and elsewhere in the southwestern U.S.

**Nations:** US

**States/Provinces:** AZ CA CO NV UT

**TNC Ecoregions:** 10:C, 11:C, 17:C, 19:C

**USFS Ecoregions:** 313A:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC

**Federal Lands:** NPS (Canyonlands, Wapatki, Zion); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEG001777 **Confidence:** 2 **Conservation Rank:** G2G4

**REFERENCES:** Cannon 1960, Collins 1984, Francis 1986, Francis and Aldon 1983, Helm 1981, Kleiner 1968, Kleiner 1983, Kleiner and Harper 1972, Kleiner and Harper 1977, Marr et al. 1973a, Nichol 1937, Stewart et al. 1940, Thompson 2001, USFS 1937, Utah Environmental and Agricultural Consultants 1973, Von Loh 2000, Weaver and Albertson 1956, West et al. 1972, Von Loh 2000



**V.A.5.N.1. INTERMITTENTLY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND**

**V.A.5.N.i.5. *DISTICHLIS SPICATA* INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE**

**Saltgrass Intermittently Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1332

*Distichlis spicata* Herbaceous Vegetation

Saltgrass Herbaceous Vegetation

*Inland Saltgrass Saline Prairie*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** These grasslands occur in semi-arid and arid western North America from southern Saskatchewan to Mexico. Stands are found in lowland habitats such as playas, swales and terraces along washes that are typically intermittently flooded. The flooding is usually the result of highly localized thunderstorms which can flood one basin and leave the next dry. However, this association may also occur in other flood regimes (temporarily, seasonally, and semipermanently). Soil texture ranges from clay loam to sandy clay. These soils are often deep, saline and alkaline. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations. Salinity is likely more important than flooding as an environmental factor. Vegetation cover is sparse to dense and is dominated by *Distichlis spicata*, occurring in nearly pure stands. Minor cover of associated graminoids may include *Muhlenbergia asperifolia*, *Hordeum jubatum*, *Pascopyrum smithii*, *Sporobolus airoides*, *Carex filifolia*, *Eleocharis palustris*, *Puccinellia nuttalliana*, and *Juncus balticus*. Associated forbs, such as *Iva axillaris*, *Helianthus* spp., *Aster* spp. (from lower salinity sites), *Salicornia rubra*, *Triglochin maritima*, and *Suaeda* spp., may also be present. Shrubs are rare, but scattered *Atriplex canescens* and *Sarcobatus vermiculatus* may be present.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** LACUSTRINE, PALUSTRINE

**Ouray National Wildlife Refuge Environment:** Saltgrass Herbaceous Vegetation occupies alkaline, silty clay soils of low channels, depressions, and dike and levee embankments. These areas also receive surface water run-in following precipitation events. Cottontail rabbit and deer scat are commonly observed in this habitat.

**Global Environment:** These grasslands occur in the semi-arid and arid western North America from southern Saskatchewan to Mexico. Elevation ranges from 1000-2300 m. Stands are found in lowland habitats such as playas, swales and terraces along washes that are typically intermittently flooded. The flooding is usually the result of highly localized thunderstorms which can flood one basin and leave the next dry. However, this association may also occur in other flood regimes (temporarily, seasonally, and semipermanently). Soil texture ranges from clay loam to sandy clay (Johnston 1987). These soils are often deep, saline and alkaline. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations. Salinity is likely more important than flooding as an environmental factor.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** Saltgrass Herbaceous Vegetation occupies alkaline, floodplain flats and depressions that have near-to-surface ground water. *Distichlis spicata* is more resilient than *Sporobolus airoides* following disturbance and can re-invade sites, such as dikes and levees. This resilience is probably related to the saltgrass' ability to produce long rhizomes, while alkali sacaton is a bunchgrass. Total foliar cover for *Distichlis spicata* Herbaceous Vegetation stands ranges from 70-90%, saltgrass comprises 40-60% of that cover value. Other species associated with saltgrass include *Sporobolus airoides*, *Muhlenbergia asperifolia*, *Iva axillaris*, *Lepidium latifolium*, and *Kochia scoparia*. These stands are typically short-statured, less than 0.5 m in height, and are often invaded by salt-cedar.

**Global Vegetation:** Vegetation included in this association occurs in lowland sites throughout much of the semi-arid and arid western U.S. This is an intermittently flooded grassland of playas and intermittent and ephemeral streams. Cover is sparse to dense and is dominated by *Distichlis spicata*, occurring in nearly pure stands. Stands have higher diversity and cover during wet years and near boundaries with other vegetation types. Higher soil salinity favors *Distichlis spicata* over less salt-tolerant species. However, very high salinity will dwarf the *Distichlis spicata* and reduce cover. Generally, vegetation height and cover and species diversity tend to vary inversely with salinity on the plains, but may increase on

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very saline sites (Brotherson 1987). Minor cover of associated graminoids may include *Muhlenbergia asperifolia*, *Hordeum jubatum*, *Pascopyrum smithii*, *Sporobolus airoides*, *Carex filifolia*, *Eleocharis palustris*, *Puccinellia nuttalliana*, and *Juncus balticus*. Associated forbs, such as *Iva axillaris*, *Helianthus* spp. and *Aster* spp. (from lower salinity sites), *Salicornia rubra*, *Triglochin maritima*, and *Suaeda* spp., may also be present. Shrubs are rare, but scattered *Atriplex canescens* and *Sarcobatus vermiculatus* may be present. Introduced species are present in some stands and may include *Elymus repens*, *Lepidium latifolium*, *Lepidium perfoliatum*, *Bassia scoparia* (= *Kochia scoparia*), and occasionally *Tamarix* spp.

**Dynamics:** The intermittent flooding regime combined with the high evaporation rate in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species and more robust growth of *Distichlis spicata*. As the saturated soils dry, the salt concentrates until it precipitates on the soil surface (Dodd and Coupland 1966, Ungar 1968). This osmotic stress of growing in alkaline and saline soils is compensated by the accumulation of proline by some halophytic species including *Distichlis spicata*. This aids the plants' water uptake by increasing the osmotic potential of the plant (Shupe et al. 1986). Vegetation forms zones at some saline sites, where species abundance is stratified by salt tolerance (Shupe et al. 1986, Ungar et al. 1969). In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1970, Ungar et al. 1969). Microtopography can also affect vegetation structure. Where soil accumulates to form hummocks, less salt- and alkali-tolerant plants can occur (Ungar 1972, Johnston 1987).

Brotherson (1987) studied species in a saline meadow adjacent to the Great Salt Lake in Utah and found 5 vegetation zones all with *Distichlis spicata* present. The meadow sloped down and away from the shoreline for the first 4 zones, then up for the last. Soil pH and soluble salts levels followed the slope pattern with the lowest zone (4) having lower pH and salt concentrations and the highest cover of *Distichlis spicata* (99%) almost exclusively. The other higher salt zones were codominated by other species such as *Suaeda calceoliformis* (= *Suaeda depressa*), *Puccinellia nuttalliana*, *Salicornia rubra*, *Triglochin maritima*, *Glaux maritima*, or *Eleocharis palustris*. Zone 5 was dominated by *Eleocharis palustris* and had additional moisture from a nearby seep. The salts were concentrated in the higher elevation zones because of evaporation of the salt-laden water that was leached from the lower lying areas.

The warm-season grass *Distichlis spicata* is rhizomatous, tolerant of moderate grazing, and its roots resist trampling. Although relatively unpalatable, it can provide valuable winter forage for livestock, if needed. When grazed, *Distichlis spicata* generally increases because of reduced competition from other less grazing-tolerant species. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as tumblegrass (*Schedonnardus paniculatus*), or *Hordeum jubatum* (Costello 1944b, Jones and Walford 1995). Weeds are generally not a problem because few grow well in saline soils. However, severely disturbed sites are susceptible to invasion by introduced species such as *Bromus tectorum*, *Lepidium latifolium*, *Lepidium perfoliatum*, and *Bassia hyssopifolia* (Franklin and Dyrness 1973).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Tamarix ramosissima</i> , <i>Sarcobatus vermiculatus</i>
Herbaceous	<i>Distichlis spicata</i> , <i>Sporobolus airoides</i> , <i>Iva axillaris</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Distichlis spicata</i>

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

##### Species

*Distichlis spicata*, *Sporobolus airoides*, *Iva axillaris*

#### *Global*

##### Species

*Distichlis spicata*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

##### Species

N/A

#### *Global*

##### Stratum

##### Species

N/A

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Sporobolus airoides* Herbaceous Vegetation occupies similar habitats

### GLOBAL SIMILAR ASSOCIATIONS:

*Leymus cinereus* - *Distichlis spicata* Herbaceous Vegetation (CEGL001481)

*Pascopyrum smithii* - *Distichlis spicata* Herbaceous Vegetation (CEGL001580)

*Sporobolus airoides* - *Distichlis spicata* Herbaceous Vegetation (CEGL001687)

*Distichlis spicata* Mixed Herb Herbaceous Vegetation (CEGL001771)

*Distichlis spicata* - *Lepidium perfoliatum* Herbaceous Vegetation (CEGL001772)

*Distichlis spicata* - (*Scirpus nevadensis*) Herbaceous Vegetation (CEGL001773)

*Eleocharis palustris* - *Distichlis spicata* Herbaceous Vegetation (CEGL001834)

*Distichlis spicata* - *Hordeum jubatum* - (*Poa arida*, *Iva annua*) Herbaceous Vegetation (CEGL002031)--currently described only from the Great Plains.

*Polygonum* spp. - *Echinochloa* spp. - *Distichlis spicata* Playa Lake Herbaceous Vegetation (CEGL002039)--currently described only from the Great Plains.

*Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042)--currently described only from the Great Plains.

*Distichlis spicata* - *Schoenoplectus maritimus* - *Salicornia rubra* Herbaceous Vegetation (CEGL002043)--currently described only from the Great Plains.

*Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273)--currently described only from the Great Plains.

*Distichlis spicata* - *Spartina* spp. Herbaceous Vegetation (CEGL002275)--currently described only from the Great Plains.

*Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Plantago maritima* Herbaceous Vegetation (CEGL002551)--currently described only from the Great Plains.

### SYNONYMY:

*Distichlis stricta* Habitat Type (Daubenmire 1970)

*Distichlis spicata* ssp. *stricta* Salt Meadow Plant Association (Baker 1984a) B

Saltgrass Zone (4) (Brotherson 1987)

*Distichlis stricta* Associations on Saline-Alkaline Soils (Franklin and Dyrness 1973) B

*Distichlis* Meadow (Graham 1937) B

*Distichlis spicata* Habitat Type (Hansen et al. 1995)

Inland Saltgrass (*Distichlis spicata*) Dominance Type (Jones and Walford 1995)

*Distichlis spicata* Herbaceous Vegetation Association (Kittel et al. 1999)

*Distichlis spicata*/Monotype Community Type (Muldavin et al. 2000a)

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*Distichlis spicata* Vegetation Zone I, in part (Ralston 1969)  
Saltgrass Series B (Sawyer and Keeler-Wolf 1995)  
The Salt-grass Association (Vestal 1914)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This graminoid association is characteristically dominated by *Distichlis spicata*. Closely related communities include *Pascopyrum smithii* - *Distichlis spicata* Herbaceous Vegetation (CEGL001580), *Sporobolus airoides* - *Distichlis spicata* Herbaceous Vegetation (CEGL001687), and several others.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Distichlis spicata* Herbaceous Vegetation occupies flats on floodplain terraces within the Green River floodplain. This vegetation type is readily invaded by salt-cedar, and the most open stands observed were in Brennan Flats, Leota Bottom, and Sheppard Bottom.

**Global Range:** This grassland association occurs in low areas in semi-arid and arid western North America from southern Saskatchewan to Mexico.

**Nations:** CA MX? US

**States/Provinces:** AZ CA CO ID MT NM NV OR SK UT WA WY

**TNC Ecoregions:** 10:C, 11:C, 17:C, 19:C, 20:C, 26:C, 27:C, 6:C

**USFS Ecoregions:** 313D:CC, 315A:CC, 321A:CC, 322A:CC, 322B:CC, 322C:CC, 331A:CC, 331B:CC, 331C:C?, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 341B:CC, 341C:CC, 341D:CC, 341E:CC, 342A:CC, 342B:CC, 342C:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M332E:CC, M341B:CC

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001770 **Confidence:** 2 **Conservation Rank:** G5

**REFERENCES:** Baker 1984a, Beatley 1976, Brotherson 1987, Bunin 1985, Costello 1944b, Crouch 1961a, Daniels 1911, Daubenmire 1970, Dodd and Coupland 1966, Franklin and Dyrness 1973, Graham 1937, Hansen et al. 1991, Hansen et al. 1995, Hyder et al. 1966, Johnston 1987, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Klipple and Costello 1960, Muldavin et al. 2000a, Osborn 1974, Ralston 1969, Ramaley 1942, Rogers 1953, Shanks 1977, Shupe et al. 1986, Soil Conservation Service 1978, Stearns-Roger Inc. 1978, Tuhy and Jensen 1982, Ungar 1967, Ungar 1968, Ungar 1970, Ungar et al. 1969, Vestal 1914, Von Loh 2000, Weaver and Albertson 1956

**V.A.5.N.J. TEMPORARILY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND**

**V.A.5.N.j.22. HORDEUM JUBATUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE**

**Foxtail Barley Temporarily Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1358

*Hordeum jubatum* Herbaceous Vegetation

Foxtail Barley Herbaceous Vegetation

*Foxtail Barley Meadow*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This foxtail barley community type is found in the northern and central Great Plains of the United States and Canada, Utah and may occur elsewhere in the interior western U.S. Stands are found in lowlands with moderately to strongly saline soils. The topography is flat and the soils are often flooded or saturated in the spring. The vegetation is dominated by short and medium tall graminoids with a total vegetation cover of nearly 100%. Shrubs are usually absent. *Hordeum jubatum* dominates the community. Other common species in this community are *Elymus trachycaulus*, *Distichlis spicata*, *Pascopyrum smithii*, *Poa arida*, *Poa compressa*, and *Rumex crispus*.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** *Ouray National Wildlife Refuge*

Foxtail Barley Herbaceous Vegetation has become established on the upper edge of the natural basin in Wyasket Bottom, which is filled with water early in the growing season and dries by mid-July. *Hordeum jubatum* and *Pascopyrum smithii* are nearly co-dominant on the clay soils of the basin edge; these soils exhibit cracking as drying occurs. In Sheppard Bottom the drained basin soils are silty clay and exhibit cracking following drying.

**Global Environment:** This association has been reported from lowlands across the northern Great Plains, in intermountain parks in Colorado and northeastern Utah. The climate is semi-arid continental with mean annual precipitation of 25-48 cm. Elevation generally ranges from 750-1600 m, and up to 2600 m in South Park, Colorado. Stands are located in lowlands with moderately to strongly saline soils (Barnes and Tieszen 1978). The topography is flat, and the soils are often flooded or saturated in the spring (Redmann 1972). *Hordeum jubatum* is often found dominating disturbed areas such as roadsides and over-grazed bottomland.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** Foxtail Barley Herbaceous Vegetation was only rarely observed in stands or patches in the Refuge. Typically, the species is an associate of other emergent wetland vegetation types. The small stand observed in Sheppard Bottom was estimated to have 50% foliar cover, of which *Hordeum jubatum* provided approximately 30%. Associated species were typical of other basin floras and included *Malvella leprosa*, *Kochia scoparia*, and *Atriplex patula*. In Wyasket Bottom, *Hordeum jubatum* was present at approximately 40% foliar cover and *Pascopyrum smithii* was present at approximately 30% foliar cover. The total foliar cover for this stand was approximately 80% in the densest portion, the remaining vegetative cover was provided by *Ambrosia tomentosa*, *Atriplex rosea*, *Lepidium latifolium*, and other common forbs.

**Global Vegetation:** The typically dense vegetation is dominated by short and medium-tall graminoids with a total vegetation cover of nearly 100%, but may occur in sparser stands (25-30% cover) (Barnes and Tieszen 1978, Von Loh 2000). Shrubs are usually absent. *Hordeum jubatum* dominates the community. Other common species in this community are *Elymus trachycaulus*, *Distichlis spicata*, *Pascopyrum smithii*, *Poa arida*, *Poa compressa*, *Rumex crispus*, *Ambrosia tomentosa*, and *Malvella leprosa*. Introduced species may be common in some stands including *Bassia scoparia* (= *Kochia scoparia*), *Sonchus arvensis*, and *Lepidium latifolium*.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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**Dynamics:** Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated, allowing the growth of less salt-tolerant species and more robust growth (Ungar 1967). *Hordeum jubatum* will replace *Distichlis spicata* in those communities when heavily grazed (Jones and Walford 1995).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

Herbaceous

##### Species

*Hordeum jubatum*, *Pascopyrum smithii*, *Malvella leprosa*, *Ambrosia tomentosa*, *Lepidium latifolium*

#### *Global*

##### Stratum

Graminoid

##### Species

*Hordeum jubatum*

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

##### Species

*Hordeum jubatum*, *Pascopyrum smithii*, *Ambrosia tomentosa*, *Malvella leprosa*

#### *Global*

##### Species

*Hordeum jubatum*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

N/A

##### Species

#### *Global*

##### Stratum

N/A

##### Species

### GLOBAL SIMILAR ASSOCIATIONS:

*Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273)

*Pascopyrum smithii* - *Hordeum jubatum* Herbaceous Vegetation (CEGL001582)

*Distichlis spicata* - *Hordeum jubatum* - (*Poa arida*, *Iva annua*) Herbaceous Vegetation (CEGL002031)

*Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042)

*Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Plantago maritima* Herbaceous Vegetation (CEGL002551)

*Schoenoplectus robustus* - *Juncus gerardii* - *Hordeum jubatum* - *Atriplex patula* Herbaceous Vegetation (CEGL006234)

### SYNONYMY:

*Hordeum* Type (Redmann 1972) . uncertain if equivalent

Foxtail Barley Community (Barnes and Tieszen 1978) . uncertain if equivalent

*Hordeum jubatum* Plains Grassland (Baker 1984a) . uncertain if equivalent

*Hordeum jubatum* Community Type (Hansen et al. 1995) . uncertain if equivalent

*Hordeum jubatum* Association (Vestal 1914) . uncertain if equivalent

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

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**Global Comments:** This type is poorly defined. This abstract is based on two descriptions of *Hordeum jubatum*-dominated stands which are assumed to be examples of this community. These stands may be variants of *Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273) and *Pascopyrum smithii* - *Hordeum jubatum* Herbaceous Vegetation (CEGL001582). The relationship between *Hordeum jubatum* Herbaceous Vegetation (CEGL001798) and these types is unclear. Both communities usually contain *Hordeum jubatum* and *Distichlis spicata* or *Pascopyrum smithii* in varying amounts. The presence of *Puccinellia nuttalliana* or *Suaeda calceoliformis* may be distinguishing factors. They appear to be more characteristic of strongly saline areas while *Hordeum jubatum* can dominate on less saline sites (Redmann 1972). Classification problems may arise on intermediate sites when *Hordeum jubatum* is the dominant species and *Distichlis spicata*, *Pascopyrum smithii*, *Puccinellia nuttalliana*, and *Suaeda calceoliformis* are present in more than minor amounts.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** Small stands of *Hordeum jubatum* annual grasslands were observed in the natural basin of Wyasket Bottom and a drained basin in Sheppard Bottom. *Hordeum jubatum* is a common associate of most emergent wetland vegetation types within the Refuge.

**Global Range:** This foxtail barley community type is found in the northern and central Great Plains of the United States and Canada, ranging from Colorado to Saskatchewan. It is also described from Utah and may occur elsewhere in the interior West.

**Nations:** CA US

**States/Provinces:** CO MT ND SD? SK UT

**TNC Ecoregions:** 10:C, 26:C, 35:C

**USFS Ecoregions:** 251Aa:CCC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 332:?, 341C:CC, M332C:CC, M332D:CC, M332E:CC

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001798 **Confidence:** 3 **Conservation Rank:** G4

**REFERENCES:** Barnes and Tieszen 1978, Bunin 1985, Hansen et al. 1991, Jones and Walford 1995, Redmann 1972, Reid 1974, Ungar 1967, Vestal 1914, Von Loh 2000.

**V.A.5.N.k. SEASONALLY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND**

**V.A.5.N.k.61. ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE**

**Marsh Spikesedge Seasonally Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1422

*Eleocharis palustris* Herbaceous Vegetation

Marsh Spikerush Herbaceous Vegetation

*Creeping Spikerush Wet Meadow*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This spikerush wet meadow community is found in the central Great Plains of the United States and Canada and in the western United States. Stands occur in small depressions in intermittent streambeds or depression ponds that flood early in the season and may dry out by summer. Stands are composed of submerged and emergent rooted vegetation under 1 m tall that is dominated by *Eleocharis palustris*, often in nearly pure stands. Soils are generally fine-textured.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** *Eleocharis palustris* Herbaceous Vegetation occupies small playas or basins on floodplain terraces. These swales are remnants of former channels or side channels of the river. It is unknown if the wetland hydrology results primarily from a high ground water table or if it is from surface inflow for this type. The soils are fine clays, exhibiting large surface cracks due to drying during a drought year. Both cottontail rabbit and deer scat/tracks were observed in the common spikerush stands.

**Global Environment:** This wetland occurs across the central and northwestern Great Plains and western United States. Elevations range from near sea level to 3050 m (in Colorado). In eastern Washington and Idaho it occurs in valleys and canyon bottoms with low-gradient streams, sloughs, and along the margins of ponds and lakes (Kovalchik 1993). In northwest Nebraska and southwest South Dakota, this community occurs in small depressions in intermittent streambeds and depression ponds that flood early in the season and dry out by summer. Soils are silty clay formed from weathered siltstone and shale (Steinauer and Rolfmeier 1997). In southwestern South Dakota, the type occupies depression ponds in prairies (H. Marriott pers. comm. 1999). In Utah stands are described from small playas on floodplain terraces of a large river (Von Loh 2000).

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Eleocharis palustris* grows in dense stands, with 70-90% total foliar cover. Common spikerush accounts for 60-70% of the foliar cover for the stands sampled, while *Pascopyrum smithii*, *Iva axillaris*, *Typha latifolia*, and *Xanthium strumarium* contribute approximately 10-15% additional foliar cover. In the stand in Wyasket Bottom, *Tamarix ramosissima* is beginning to invade the site.

**Global Vegetation:** This wetland association is dominated by submersed and emergent rooted vegetation under 1 m tall and occurs across the northwestern Great Plains and western U.S. within a wide elevational range. The species composition can be quite variable, but this community is easy to recognize by the bright green, nearly pure stands of *Eleocharis palustris*. Vegetation cover can be sparse to dense (10-90%), but *Eleocharis palustris* is the dominant species, and the only species with 100% constancy. Other species, when present, can contribute as much as 40% cover, but never exceed that of the *Eleocharis palustris* cover. Some of this variation is described from Colorado (Kittel et al. 1999, Baker and Kennedy 1985). Co-occurring species in low-elevation stands on the western slope can include *Phalaris arundinacea*, *Juncus balticus*, *Hordeum jubatum*, *Pascopyrum smithii*, *Schoenoplectus americanus*, *Sparganium angustifolium*, species of *Lemna* and *Potamogeton*, as well as the introduced *Melilotus officinalis* and *Bromus inermis*. On the eastern plains of Colorado co-occurring species can include *Leersia oryzoides*, *Schoenoplectus pungens*, *Panicum virgatum*, *Carex pellita* (= *Carex lanuginosa*), and *Spartina pectinata*. At montane elevations, other graminoids, such as *Carex aquatilis*, *Carex utriculata*, and *Deschampsia caespitosa* are present. Forb cover is typically low, but can be occasionally abundant (30%) in some stands. Forb species include *Pedicularis groenlandica*, *Rhodiola integrifolia*, and *Caltha leptosepala*.



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In stands from eastern Washington, associates include *Carex utriculata*, *Cicuta douglasii*, and species of *Glyceria* and *Potamogeton*. In northwestern Nebraska, stands are dominated *Eleocharis acicularis* and *Eleocharis palustris* which commonly cover the bottoms of the pools and emerge above the water as the pools dry out. Ephemeral submersed aquatics, such as *Callitriche palustris* (= *Callitriche verna*), *Potamogeton diversifolius* and *Marsilea vestita*, may be present. As the pools dry out in mid-summer, ephemeral annual forbs, such as *Limosella aquatica* and *Plagiobothrys scouleri*, may appear. By late summer *Amaranthus californicus* and *Gnaphalium palustre* may dominate in the lowest parts of the depression (Steinauer and Rolfsmeier 1997). In southwestern South Dakota, vegetation is composed of nearly homogeneous stands of *Eleocharis palustris*. Other emergents, such as *Polygonum amphibium*, *Marsilea vestita*, and *Eleocharis ovata*, are occasionally found. Herbaceous cover is greater than 75% except in areas of deeper open water where floating and submerged aquatic plants occur, including *Bacopa rotundifolia* and *Heteranthera limosa* (H. Marriott pers. comm. 1999). In lower elevation Utah stands *Glaux maritima*, *Distichlis spicata*, and *Juncus balticus* were important associates (Brotherson and Barnes 1984).

**Dynamics:** The hydrological regime is critically important to this association. Most stands are seasonally to permanently flooded, although some in the Great Plains occur under intermittently to temporarily flooded conditions.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Tamarix ramosissima</i>
Herbaceous	<i>Eleocharis palustris</i> , <i>Pascopyrum smithii</i> , <i>Iva axillaris</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Eleocharis palustris</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Species</u>
<i>Eleocharis palustris</i> , <i>Pascopyrum smithii</i> , <i>Iva axillaris</i>

#### *Global*

<u>Species</u>
<i>Eleocharis palustris</i>

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

- Eleocharis palustris - Distichlis spicata Herbaceous Vegetation (CEGL001834)
- Eleocharis palustris - Juncus balticus Herbaceous Vegetation (CEGL001835)
- Eleocharis palustris - (Eleocharis compressa) - Leptochloa fusca ssp. fascicularis Herbaceous Vegetation (CEGL002259)

### SYNONYMY:

- Eleocharis palustris* Wetland (Baker and Kennedy 1985) =
- Spikerush Community (Brotherson and Barnes 1984) =
- Eleocharis palustris* Habitat Type (Hall and Hansen 1997) =
- Eleocharis palustris* (Hansen et al. 1995) =
- Eleocharis palustris* Herbaceous Vegetation (Kittel et al. 1999) =
- Creeping Spikerush Association (Kovalchik 1993) =
- Eleocharis palustris* Community Type (Padgett et al. 1989) =

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Zone of Spikerush of the Vegetation surrounding San Luis Lakes (Ramaley 1942) =

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** N/A

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Eleocharis palustris* occurs as an understory species in many wetland plant associations within the Refuge and as a narrow fringe on the north edge of the lake in Woods Bottom. Only two stands large enough to map were observed near Leota Bottom and in Wyasket Bottom; in both stands *Pascopyrum smithii* is an associate.

**Global Range:** This spikerush wet meadow community is found in the central Great Plains of the United States and Canada and in the western United States.

**Nations:** CA US

**States/Provinces:** CA? CO ID MT NE NV OR SD SK UT WA WY

**TNC Ecoregions:** 10:C, 19:C, 20:C, 25:C, 26:C, 2:C, 6:C

**USFS Ecoregions:** 331D:CC, 331F:CC, 331G:CC, 341B:CC, 341C:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342G:CC, 342I:C?, M242C:CC, M261G:CC, M331A:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341B:CC

**Federal Lands:** NPS (Wind Cave); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001833 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Baker 1983c, Baker and Kennedy 1985, Brotherson and Barnes 1984, Bunin 1985, Ellis et al. 1979, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kovalchik 1987, Kovalchik 1993, Mutel 1973, Mutel and Marr 1973, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley 1942, Stearns-Roger Inc. 1978, Steinauer and Rolfsmeier 2000, Stewart 1940, Von Loh 2000, Youngblood et al. 1985a

**V.A.5.N.k.13. JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE**  
**Baltic Rush Seasonally Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1374

*Juncus balticus* Herbaceous Vegetation

Baltic Rush Herbaceous Vegetation

*Baltic Rush Wet Meadow*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This Baltic rush wet meadow community is found widely throughout the western United States. This wet meadow vegetation occurs as small, dense patches on flat stream benches, along overflow channels, and near springs. Soils are usually sandy clay loam or fine sands and mottled or gleyed. Stands are characterized by a dense sward of *Juncus balticus* and often minor cover of *Carex* species, including *Carex aquatilis*, *Carex praegracilis*, *Carex nebrascensis*, or *Carex utriculata*. Other common species include *Deschampsia caespitosa*, *Distichlis spicata*, *Glyceria striata*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Phleum alpinum*, and *Sporobolus airoides*. The introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera* codominate some stands. Forb cover is generally low and includes wetland species like *Caltha leptosepala* and *Dodecatheon pulchellum*. Shrubs are not common. This association is often considered to be a grazing-induced community since it increases with disturbance.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** *Juncus balticus* Herbaceous Vegetation occupies the edge of a broad drainage, adjacent to stands of *Phalaris arundinacea* and *Phragmites communis*. The soil is moist, silty clay with a slight seleniferous odor. Hydrology for the stand is apparently near-to-surface ground water.

**Global Environment:** This widespread herbaceous wetland community is found throughout western North America. Elevation ranges from 1420-3500 m. Stands usually occur as small, dense patches on flat to gently sloping sites near seeps and streams. Stream channels are highly variable in size and type ranging from narrow to moderately wide, and deeply entrenched to very sinuous (Kittel et al. 1999). Soils are also variable and range from alluvial sandy and well-drained, to poorly drained silty clay loam, to organic; however, soils tend to be finer-textured, alkaline and may be saline (Brotherson and Barnes, Kittel et al. 1999, Padgett et al. 1989). Cobbles and gravel are common on many sites, and gleyed and mottled horizons are often present because of flooding or high water tables (Kittel et al. 1999).

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** This small stand has approximately 80% foliar cover and is dominated by *Juncus balticus*. The vegetation is short-statured, less than 0.5 m tall. In addition to Baltic rush, *Muhlenbergia asperifolia*, *Hordeum jubatum*, *Sonchus asper*, *Lactuca serriola*, and *Agropyron intermedium* is present in the stand. Typically, Baltic rush is not found in pure stands in the Refuge, rather it is a fairly rare associate of other emergent wetland stands.

**Global Vegetation:** This association is characterized by a low (<50 cm), dense graminoid layer dominated by the rhizomatous perennial *Juncus balticus*. Minor cover of *Carex* species, including *Carex aquatilis*, *Carex praegracilis*, *Carex nebrascensis* or *Carex utriculata*, is often present. Other common graminoids include *Deschampsia caespitosa*, *Distichlis spicata*, *Glyceria striata*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Phleum alpinum*, and *Sporobolus airoides*. Forb cover is generally low but may include *Caltha leptosepala*, *Glaux maritima*, *Maianthemum stellatum*, and *Dodecatheon pulchellum*. Shrubs are not common, but occasional *Salix* spp. may occur. Some stands may be codominated by the introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera*. Other introduced species, such as *Taraxacum officinale*, *Trifolium* spp., *Cirsium arvense*, *Lactuca serriola*, *Phleum pratense*, and *Thinopyrum intermedium*, may occur in disturbed stands.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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**Dynamics:** This association is considered by some to be a grazing-induced community because *Juncus balticus* is tolerant of grazing (low palatability when mature) and increases with grazing disturbance (Hansen et al. 1995, Padgett et al. 1989). Nearly pure stands of *Juncus balticus* may indicate that the site was heavily grazed in the past (Hansen et al. 1995). However, this association also occurs as a stable, late-seral community in areas with low disturbance (Kittel and Lederer 1993).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

Graminoid

##### Species

*Juncus balticus*, *Muhlenbergia asperifolia*, *Hordeum jubatum*

#### *Global*

##### Stratum

Graminoid

##### Species

*Carex nebrascensis*, *Carex praegracilis*, *Juncus balticus*

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

##### Species

*Juncus balticus*, *Muhlenbergia asperifolia*, *Hordeum jubatum*

#### *Global*

##### Species

*Carex nebrascensis*, *Carex praegracilis*, *Juncus balticus*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

##### Stratum

N/A

##### Species

#### *Global*

##### Stratum

N/A

##### Species

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Scirpus pungens* Herbaceous Vegetation occupies similar habitats

### GLOBAL SIMILAR ASSOCIATIONS:

*Eleocharis palustris* - *Juncus balticus* Herbaceous Vegetation (CEGL001835)

*Juncus balticus* - *Carex rossii* Herbaceous Vegetation (CEGL001839)

### SYNONYMY:

*Juncus balticus* Wetland Plant Association (Baker 1984a)

Saline Meadow (Brotherson and Barnes 1984)

*Juncus balticus* Herbaceous Vegetation (Faber-Langendoen 2001)

*Juncus balticus* Community Type (Hansen et al. 1995)

*Juncus balticus* Community Type (Hall and Hansen 1997)

Baltic Rush (*Juncus balticus*) Dominance Type (Jones and Walford 1995)

*Juncus arcticus*/*Carex* spp. Plant Association (Johnston 1987)

*Juncus balticus* Herbaceous Vegetation Association (Kittel et al. 1999)

Baltic Rush Alliance (Muldavin et al. 2000a) B. includes 5 similar *Juncus balticus* community types.

*Juncus balticus* Vegetation Type (Mutz and Graham 1982) includes 5 similar *Juncus balticus* community types.

*Juncus balticus*/*Carex* spp. Habitat Subtype (Olson and Gerhart 1982) includes 5 similar *Juncus balticus* community types.

*Juncus balticus* Community Type (Padgett et al. 1989) includes 5 similar *Juncus balticus* community types.

*Juncus balticus* dominated (Zone 3) (Shupe et al. 1986) Zone 3 is the outer zone of the Great Basin playa.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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*Juncus balticus* Community Type (Tuhy and Jensen 1982) Zone 3 is the outer zone of the Great Basin playa.

*Juncus balticus/Carex* spp. Habitat Type (Wasser and Hess 1982) . Zone 3 is the outer zone of the Great Basin playa.

*Juncus balticus* Community Type (Youngblood et al. 1985a) . Zone 3 is the outer zone of the Great Basin playa.

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This association is often considered to be a grazing-induced community since it increases with grazing disturbance.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** One patch of *Juncus balticus* Herbaceous Vegetation was observed in the large drainage near the Refuge entryway. *Juncus balticus* is only a minor component of some emergent wetlands within the Refuge.

**Global Range:** This Baltic rush wet meadow community is found widely throughout the western United States, ranging from South Dakota and Montana west to Washington, south to possibly California, and east to New Mexico.

**Nations:** US

**States/Provinces:** CA? CO ID MT NM NV OR SD UT WA WY

**TNC Ecoregions:** 10:C, 11:C, 17:C, 18:C, 19:C, 20:C, 25:C, 26:C, 27:C, 2:C, 6:C

**USFS Ecoregions:** 313A:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 341B:CC, 341C:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342F:CC, 342G:CC, 342I:C?, M261G:CC, M262:C, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341B:CC, M341C:CC

**Federal Lands:** NPS (Zion); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001838 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Baker 1984a, Brotherson and Barnes 1984, Bunin 1985, Faber-Langendoen 2001, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Johnston 1987, Jones and Walford 1995, Kartesz 1994, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999, Komarkova 1986, Manning 1988, Muldavin et al. 2000a, Mutel 1973, Mutz and Graham 1982, Olson and Gerhart 1982, Padgett 1982, Padgett et al. 1989, Rector 1979, Richard et al. 1996, Shupe et al. 1986, Stewart 1940, Thompson 2001, Tuhy and Jensen 1982, Von Loh 2000, Wasser and Hess 1982, Youngblood et al. 1985a.

**V.A.5.N.k.20. PHALARIS ARUNDINACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE**  
**Reed Canary Grass Seasonally Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1381

*Phalaris arundinacea* Western Herbaceous Vegetation

Reed Canary Grass Western Herbaceous Vegetation

*Reed Canary Grass Wet Meadow*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This association is reported from throughout Montana, Idaho, northeastern Utah, and the Columbia Basin of Washington, but is likely more widespread in the western United States. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in wetlands and riparian areas, displacing the local flora. Elevations range from near sea level to 1700 m. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Soils are commonly fine-textured and may be flooded for brief to extended periods. The vegetation is characterized by a dense, tall herbaceous layer (often >80% canopy cover and 1.5-2 m tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species may include *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus*, and many other species in trace amounts where disturbed. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, and *Phleum pratense* are common in some stands.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE / RIPARIAN

**Ouray National Wildlife Refuge Environment:** The two stands of *Phalaris arundinacea* Western Herbaceous Vegetation occupy an intermittent drainage, just inside the Refuge boundary. Both stands are located in the bottom of the drainage and are characterized by the strong odor of selenium. In years prior to this study, water was ponded in this drainage to provide waterfowl habitat, but the practice has been discontinued because high levels of selenium were/are present. Both stands are nearly monotypic and consist of very tall plants which serve as bedding/resting areas for deer. Both stands of *Phalaris arundinacea* Western Herbaceous Vegetation lie adjacent to *Typha angustifolia* stands which occupy slightly deeper water in the drainage.

**Global Environment:** This association is reported from throughout Montana, Idaho, Washington and northeastern Utah, but is likely more widespread in the western United States. Elevations range from near sea level to 1700 m. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Sites are flat to rolling. Soils are commonly fine-textured, but can be coarser in texture. Subsoil is often mottled and gleyed (Crawford 2001). Sites are generally flooded during the growing season, but flooding can vary from brief to extended periods.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Phalaris arundinacea* is the dominant species in both nearly monotypic stands. This grass is very tall, exceeding 2 meters in height, and dense, approaching 90% foliar cover. Only *Schoenoplectus acutus* and *Muhlenbergia asperifolia* are present in the stands in any quantity, e.g., from 1-5% foliar cover. Other species noted in the stands, but in trace amounts, include *Polypogon monspeliensis*, *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, and *Lactuca serriola*, all relatively weedy plant species. All of these additional species are present in the smaller *Phalaris arundinacea* stand, which is located south of the Hatchery Road approximately 0.5 miles.

**Global Vegetation:** This association is characterized by a dense, tall herbaceous layer (often >90% canopy cover and 1.5-2 m tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species such as *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus*, *Polygonum amphibium*, *Euthamia canadensis*, *Urtica dioica*, and many other species may be present in trace amounts especially where disturbed. Occasional *Populus tremuloides*, *Salix exigua*, *Rubus idaeus*, or *Symphoricarpos albus* may be present in some stands. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, *Poa pratensis*, and *Phleum pratense* are common in some disturbed stands.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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**Dynamics:** *Phalaris arundinacea* produces abundant herbage and is planted for livestock forage. It is tolerant of moderate grazing by livestock, although heavy grazing will reduce density (Hansen et al. 1995). *Phalaris arundinacea* is a threat to riparian and wetland areas because it spreads rapidly from rhizomes, dominating the sites, and is extremely difficult to remove once established (Hansen et al. 1995). Fire has been used with limited success to control the spread of *Phalaris arundinacea*, but the high water table where it grows makes it difficult to burn during the growing season (Hansen et al. 1995).

Von Loh (2000) found stands growing on selenium-rich sites. It is not known if selenium is translocated into the plant tissue.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phalaris arundinacea</i> , <i>Scirpus acutus</i> , <i>Muhlenbergia asperifolia</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phalaris arundinacea</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Phalaris arundinacea*, *Muhlenbergia asperifolia*, *Schoenoplectus acutus*

#### *Global*

Species  
*Phalaris arundinacea*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

*Calamagrostis canadensis* - *Phalaris arundinacea* Herbaceous Vegetation (CEGL005174)  
*Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044)

### SYNONYMY:

*Phalaris arundinacea* Habitat Type (Hansen et al. 1995)  
*Phalaris arundinacea* Habitat Type (Hall and Hansen 1997)  
*Phalaris arundinacea* Association (Crawford 2001)  
*Phalaris arundinacea* Monotype (Muldavin et al. 2000a)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** Other natural associations included in this alliance are found throughout the northeastern United States, but this western association's distribution as a natural type is not clear because of extensive planting as a forage crop (Hansen et al. 1995, Hall and Hansen 1997). Further work is required to resolve the natural versus introduced nature of this type in western North America.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Phalaris arundinacea* plants are found intermixed with other emergent wetland species, particularly *Typha* spp., at various sites around the Refuge; a small stand was observed in Leota Bottom. However, two stands, which meet the minimum mapping unit of 0.5 hectares, are present in the unnamed drainage near the main Refuge entryway, near State Highway 88.

**Global Range:** This association is reported from throughout Montana and Idaho and into northeastern Utah and is likely more widespread in the western United States. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in many wetlands and riparian areas.

**Nations:** US

**States/Provinces:** ID MT NM UT

**TNC Ecoregions:** 10:C, 19:C, 26:C, 6:C

**USFS Ecoregions:** 313B:C?, 313E:C?, 331D:CC, 331G:CC, 331J:C?, 341C:CC, 342I:CC, M332D:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL001474 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Cooper et al. 1995, Crawford 2001, Hall and Hansen 1997, Hansen et al. 1995, Muldavin et al. 2000a, Von Loh 2000.



## Ouray National Wildlife Refuge Vegetation Mapping Project

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### V.A.5.N.k.31. *TYPHA DOMINGENSIS* SEASONALLY FLOODED TEMPERATE HERBACEOUS ALLIANCE Southern Cattail Seasonally Flooded Temperate Herbaceous Alliance

**Alliance Identifier:** A.1392

*Typha domingensis* Western Herbaceous Vegetation

Southern Cattail Western Herbaceous Vegetation

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This wetland association is widespread across the southwestern United States and Great Basin. These marshes occur in bottomlands along drainages, in river floodplain depressions, oxbow lakes, and below seeps. Substrates are variable but are generally fine-textured alkaline alluvial soil. Flood regimes range from seasonal inundation with the soils drying out and cracking in late summer to permanently flooded marshes. The vegetation is characterized by a dense, 2- to 4-m tall herbaceous layer of *Typha domingensis* that dominates the site as a monoculture or codominates with *Schoenoplectus acutus* or species of *Carex*. Associated graminoids include *Carex nebrascensis*, *Eleocharis palustris*, *Eleocharis macrostachya*, *Juncus balticus*, *Schoenoplectus maritimus*, *Schoenoplectus pungens*, and under drier conditions *Hordeum jubatum* and *Distichlis spicata* may be present. During extended inundation aquatic plant like *Stuckenia pectinata* may flourish. Other forbs such as *Euthamia occidentalis*, *Polygonum lapathifolium*, *Chenopodium* spp., and *Sagittaria* spp. may also be present.

#### ENVIRONMENTAL DESCRIPTION

##### USFWS WETLAND SYSTEM: PALUSTRINE

**Ouray National Wildlife Refuge Environment:** This type occupies fairly alkaline basins constructed along the Green River, which is tolerated by *Typha domingensis*. These basins tend to dry during the course of the growing season leaving thick mats of dead or dying vegetation. Soils of the basins are clay, and were dry and cracked at the time of data collection. Some deer bedding sites were evident in the stands.

**Global Environment:** This wetland association is widespread across the southwestern United States and Great Basin. Elevations range from 300-1450 m. These marshes occur in bottomlands along drainages, in river floodplain depressions, oxbow lakes, and below seeps. Substrates are variable but are generally fine-textured alkaline alluvial soil. Flood regimes range from seasonal inundation with the soils drying out and cracking in late summer to permanently flooded marshes.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** Because the *Typha* spp. type is tolerant of alkaline waters and seasonal drawdown, it is associated with species of like tolerance, e.g., *Eleocharis palustris*, *Polygonum lapathifolium*, *Euthamia occidentalis*, *Schoenoplectus maritimus*, *Kochia scoparia*, *Lepidium latifolium*, and *Schoenoplectus acutus*. Cattails are tall, ranging from 2-4 m in height. Foliar cover is high, ranging from 80-90% and cattail provides from 40-60 % of that cover.

**Global Vegetation:** The vegetation is characterized by a dense, 2- to 4-m tall herbaceous layer of *Typha domingensis* that dominates the site as a monoculture or codominates with *Schoenoplectus acutus* or species of *Carex*. Associated graminoids include *Carex nebrascensis*, *Eleocharis palustris*, *Eleocharis macrostachya*, *Juncus balticus*, *Schoenoplectus maritimus*, *Schoenoplectus pungens*, and under drier conditions *Hordeum jubatum* and *Polypogon monspeliensis*. During extended inundation aquatic plants like *Stuckenia pectinata* may flourish. Other forbs such as *Euthamia occidentalis*, *Polygonum lapathifolium*, *Chenopodium* spp., and *Sagittaria* spp. may be present. Introduced species such as *Bassia scoparia*, *Lepidium latifolium*, and *Polypogon monspeliensis* may be abundant on disturbed sites.

**Dynamics:** N/A

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Typha domingensis</i> , <i>Polygonum lapathifolium</i> , <i>Euthamia occidentalis</i> , <i>Eleocharis palustris</i> , <i>Schoenoplectus acutus</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Schoenoplectus acutus</i>
Forb	<i>Typha domingensis</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Typha domingensis*, *Schoenoplectus acutus*

#### *Global*

Species  
*Schoenoplectus acutus*, *Typha domingensis*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

*Typha* (*angustifolia*, *domingensis*, *latifolia*) - *Schoenoplectus americanus* Herbaceous Vegetation (CEGL002032)--is only reported from the southeastern U.S.

*Typha domingensis* Semipermanently Flooded Tropical Herbaceous Vegetation (CEGL003987)--is only reported from the southeastern U.S.

*Typha domingensis* - *Pontederia cordata* Herbaceous Vegetation (CEGL003988)--is only reported from the southeastern U.S.

*Typha domingensis* Seasonally Flooded Gulf Coastal Plain Herbaceous Vegetation (CEGL004137)--is only reported from the southeastern U.S.

*Typha domingensis* - *Setaria magna* Herbaceous Vegetation (CEGL004138)--is only reported from the southeastern U.S.

*Typha domingensis* Tidal Herbaceous Vegetation (CEGL008456)--is only reported from the southeastern U.S.

### SYNONYMY:

*Typha domingensis* Riparian Wetland (Baker 1983b)

*Typha domingensis* Association (Bundy et al. 1996)

*Typha domingensis* - *Scirpus acutus* Association (Bundy et al. 1996)

*Typha* community (Haase 1972)

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** There are six *Typha domingensis* associations described from the southeastern U.S., and only one from the western U.S. It is likely that there are associations yet to be classified in the West. The concept of this association is broad and currently includes both *Typha domingensis* monoculture and mixed stands with seasonally or permanently flooded hydrological regimes. More classification work needs to be done to fully characterize this wetland in the West.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** The *Typha domingensis* Herbaceous Vegetation type covers more area within the Refuge, than does the Broad-leaved Cattail Herbaceous Vegetation type. It occupies flooded basins, primarily, which have been constructed in the various bottoms of the Green River. These basins tend to be more alkaline, which is tolerated by *Typha domingensis*, and they usually dry during the course of the growing season. Soils of the basins are clay, and were dry and cracked at the time of data collection. Some deer bedding sites were evident in the stands.

**Global Range:** This wetland association is widespread across the southwestern United States and Great Basin.

**Nations:** US

**States/Provinces:** CA CO NV UT

**TNC Ecoregions:** 10:C, 11:C, 19:C

**USFS Ecoregions:** 341A:CC, 341C:CC, 341D:CC, 341E:CC, 341F:CC, 341G:CC, M341B:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL001845 **Confidence:** 3 **Conservation Rank:** G5?

**REFERENCES:** Baker 1982b, Baker 1983b, Bundy et al. 1996, Haase 1972, Von Loh 2000.

**V.A.5.N.L. SEMIPERMANENTLY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND**

**V.A.5.N.L.4. PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE**

**Common Reed Semipermanently Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1431

*Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation

Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation

*Western Reed Marsh*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This reed marsh type is found across the west-temperate regions of the United States and Canada. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity. The vegetation is often variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present. In Colorado, this reed marsh often occurs in small wet patches in seeps and backwater areas of large floodplains, around the fringes of irrigation ponds, ditches, and along railroad embankments that have poor drainage. Stands have a dense, 1- to 1.5-m tall herbaceous layer dominated by the perennial graminoid *Phragmites australis*. Minor cover of associates such as *Agrostis stolonifera*, *Carex* spp., *Conyza canadensis*, *Glycyrrhiza lepidota*, *Iva axillaris*, *Mentha arvensis*, *Schoenoplectus acutus*, and *Typha latifolia* may be present.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** One patch of *Phragmites australis* Herbaceous Vegetation occurs along the edge of a saturated drainage and the other along the edge of a dike. Both sites have saturated clay soils, but neither site appears to be inundated at any time. The site near the entryway has a seleniferous odor, typical of this large drainage. Both appear to be individual clones that are roughly circular in shape.

**Global Environment:** This association is widespread in the western U.S. and Canada. Elevation ranges from 640-1980 m. Stands occur in temporarily to semipermanently flooded marshes, ditches, impoundments, pond and lake margins, swales, and wet meadows that often have been disturbed by human activity. Sites are usually flooded during the growing season, but the soil surface may dry out in late summer. Soils are often fine-textured silts and clays. In Colorado and Utah, this reed marsh often occurs in small wet patches in seeps and backwater areas of large floodplains, around the fringes of irrigation ponds, ditches, and along railroad embankments that have poor drainage.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** Clones of *Phragmites australis* are dense, e. g., approximately 90% foliar cover, and common reed provides nearly 80% of the foliar cover in a stand or patch. Common reed is a tall grass, usually between 3-4 m in height, and the shade produced tends to limit understory species. Associated species are typically found growing in and around the edge of common reed patches; these species include *Typha latifolia*, *Schoenoplectus acutus*, *Iva axillaris*, *Conyza canadensis*, and *Lepidium latifolium*.

**Global Vegetation:** The vegetation is often variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present. Stands have a dense, 1- to 3-m tall herbaceous layer dominated by the perennial graminoid *Phragmites australis* usually with over 80% cover. Associates include *Agrostis stolonifera*, *Carex* spp., *Conyza canadensis*, *Glycyrrhiza lepidota*, *Iva axillaris*, *Mentha arvensis*, *Schoenoplectus acutus* (= *Scirpus acutus*), and *Typha latifolia*. Introduced species such as *Lepidium latifolium* and *Cirsium arvense* may be present and compete well against *Phragmites australis* in disturbed sites.

## Ouray National Wildlife Refuge Vegetation Mapping Project

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**Dynamics:** *Phragmites australis* generally requires seasonal flooding in the spring with water table fluctuating from 0.6 m above to 0.6 m below the surface (Johnston 1987). This rhizomatous species can out compete all but the most aggressive weedy species. With heavy disturbance, however, introduced species such as *Cirsium arvense* or *Lepidium latifolium* may invade this plant association (Hansen et al. 1995, Von Loh 2000).

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Phragmites australis</i> , <i>Typha latifolia</i> , <i>Schoenoplectus acutus</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Phragmites australis</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Species</u>
<i>Phragmites australis</i> , <i>Typha latifolia</i> , <i>Schoenoplectus acutus</i> , <i>Lepidium latifolium</i>

#### *Global*

<u>Species</u>
<i>Phragmites australis</i>

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141)

### SYNONYMY:

*Phragmites australis* Wetland (Baker 1984a) =  
*Phragmites australis* Habitat Type (Hall and Hansen 1997) =  
*Phragmites australis* Habitat Type (Hansen et al. 1995) =  
*Phragmites communis* / *Carex lacustris* Plant Association (Johnston 1987) =  
*Phragmites australis* Herbaceous Vegetation (Kittel et al. 1999) =

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This vegetation has variable hydrology and is often treated as part of other marshes and meadows. The geographic distribution of the type is arbitrarily limited to Bailey's Dry and Humid Temperate Domain in western North America (Bailey 1997, 1998). Compare with *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141). The two types need to be better distinguished, both conceptually and nomenclaturally.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** Only two large patches of *Phragmites australis* Herbaceous Vegetation were observed in the Refuge, one in the large drainage near the entryway and the other in Wyasket Bottom. *Phragmites australis* is observed occasionally in the Refuge, intermixed with other emergent plant species, or growing along dikes and levees.

## **Ouray National Wildlife Refuge Vegetation Mapping Project**

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**Global Range:** This reed marsh type is found across the west-temperate regions of the United States and Canada, ranging from western North Dakota and Saskatchewan to Oregon, south to California and Texas. Its distribution is somewhat incomplete as not all states have listed semi-natural types in their state.

**Nations:** CA US

**States/Provinces:** CA CO ID MT ND NV OK OR SK TX? UT WY

**TNC Ecoregions:** 10:C, 11:C, 17:C, 19:C, 26:C, 27:C, 28:?, 33:?, 35:C, 48:C, 6:C

**USFS Ecoregions:** 212Ja:PPP, 251Aa:CCC, 322A:CC, 331C:CC, 331D:CC, 331G:CC, 331I:CC, 341A:CC, 341C:CC, 341E:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342I:C?, M331D:CC, M331H:CC, M332A:CC, M332D:CC, M332E:CC, M332F:CC, M333B:CC, M333D:CC, M341A:CC

**Federal Lands:** USFWS (Ouray)

### **ELEMENT SOURCES**

**Identifier:** CEGL001475 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Bailey 1997, Bailey 1998, Baker 1982a, Baker 1984a, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Johnston 1987, Kittel et al. 1995, Kittel et al. 1999, Von Loh 2000.

### V.A.5.N.I.16. *SCHOENOPLECTUS ACUTUS* - (*SCHOENOPLECTUS TABERNAEMONTANI*) *SEMI-PERMANENTLY FLOODED HERBACEOUS ALLIANCE*

#### Hardstem Bulrush - (Softstem Bulrush) Semipermanently Flooded Herbaceous Alliance

**Alliance Identifier:** A.1443

*Schoenoplectus acutus* Herbaceous Vegetation

Hardstem Bulrush Herbaceous Vegetation

*Bulrush Marsh*

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#### ELEMENT CONCEPT

**GLOBAL SUMMARY:** This association is a common emergent herbaceous wetland found mostly in the interior western U.S. ranging from the Puget Sound of Washington to Montana south to California, Nevada and Utah. Stands occur along low-gradient, meandering, usually perennial streams, river floodplain basins, and around the margins of ponds and shallow lakes especially in backwater areas. Some sites are flooded most of the year with about 1 m of fresh to somewhat saline or alkaline water. Other sites, however, dry up enough in late summer to where the water table drops below the ground surface, though the soils are still partially saturated. Soils are generally deep, organic, alkaline, poorly drained and fine-textured, but range in soil textures from sand to clay to organic muck. The soils may be normal or saline. Vegetation is characterized by a dense tall herbaceous vegetation layer 1-3 m tall that is dominated by *Schoenoplectus acutus*, often occurring as a near monoculture. Associated species include low cover of *Mentha arvensis*, *Polygonum amphibium*, *Sagittaria latifolia*, and species of *Carex*, *Eleocharis*, *Rumex*, and *Typha*. Early in the growing season or at permanently flooded sites, aquatic species such as *Potamogeton* spp. and *Lemna minor* may be present to abundant. Stands of this association contain no tree or shrub layer, but a few sites have been invaded by the introduced shrub *Tamarix* spp.

#### ENVIRONMENTAL DESCRIPTION

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** *Schoenoplectus acutus* Herbaceous Vegetation has become established on inundated sites and in saturated soils. Some of these sites are basins managed by releasing water through canal, ditch, and dike systems, while others are natural tributary drainages and side channels of the Green River. Soils associated with these stands are saturated muck.

**Global Environment:** This association is a common emergent herbaceous wetland found mostly in the interior western U.S. Elevations range from near sea level to 2030 m. Stands occur along low-gradient, meandering, usually perennial streams, river floodplain basins and around the margins of ponds and shallow lakes especially in backwater areas. Some sites are flooded most of the year with about 1 m of fresh to somewhat saline or alkaline water. Other sites, however, dry up enough in late summer to where the water table drops below the ground surface, though the soils are still partially saturated. Soils are generally deep, organic, alkaline, poorly drained and fine-textured, but range in soil textures from sand to clay to organic muck. The soils may be normal or saline.

#### VEGETATION DESCRIPTION

**Ouray National Wildlife Refuge Vegetation:** Stands of *Schoenoplectus acutus* Herbaceous Vegetation are largely monotypic, with diversity occurring at the edge of the clones. In some situations there is a nearly equal mix of *Typha* spp., particularly where stands are growing adjacent to one another. Foliar cover by *Schoenoplectus acutus* is difficult to evaluate because of its narrow, upright stems. However, approximately 60% foliar cover was estimated for hardstem bulrush in each stand sampled. Total foliar cover with other species included ranged from approximately 60-90%. These stands are tall, because hardstem bulrush exceeds three m in height within the Refuge. Other species recorded with hardstem bulrush included seedling *Tamarix ramosissima*, and *Typha angustifolia* (*Typha domingensis*), *Typha latifolia*, *Lepidium latifolium*, *Atriplex rosea*, and *Rumex stenophyllous*.

**Global Vegetation:** This wetland association is characterized by a dense tall herbaceous vegetation layer 1-3 m tall that is dominated by *Schoenoplectus acutus*, often occurring as a near monoculture. Associated species include low cover of *Mentha arvensis*, *Polygonum amphibium*, *Sagittaria latifolia*, and species of *Carex*, *Eleocharis*, *Rumex*, and *Typha*. Early in the growing season or at the more permanently flooded sites, aquatic species such as *Potamogeton* spp. and *Lemna minor* may be present to abundant. Stands of this association contain no tree or shrub layer, but a few sites have been invaded by the introduced shrub *Tamarix* spp.

**Dynamics:** N/A

**MOST ABUNDANT SPECIES**

***Ouray National Wildlife Refuge***

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Tamarix ramosissima</i>
Herbaceous	<i>Schoenoplectus acutus</i>

***Global***

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Schoenoplectus acutus</i>

**CHARACTERISTIC SPECIES**

***Ouray National Wildlife Refuge***

<u>Species</u>
<i>Schoenoplectus acutus</i>

***Global***

<u>Species</u>
<i>Schoenoplectus acutus</i>

**OTHER NOTEWORTHY SPECIES**

***Ouray National Wildlife Refuge***

<u>Stratum</u>	<u>Species</u>
N/A	

***Global***

<u>Stratum</u>	<u>Species</u>
N/A	

**GLOBAL SIMILAR ASSOCIATIONS:**

*Schoenoplectus acutus* - *Typha latifolia* - (*Schoenoplectus tabernaemontani*) Sandhills Herbaceous Vegetation (CEGL002030)

*Schoenoplectus acutus* - (*Schoenoplectus fluviatilis*) Freshwater Herbaceous Vegetation (CEGL002225)

*Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)

**SYNONYMY:**

*Scirpus acutus* community type (Kunze 1994) . (p.24,81) Kunze (1994) use both *Schoenoplectus acutus* and *Schoenoplectus validus* as indicator species.

*Scirpus acutus* community type (Dethier 1990) . (p.36)

*Scirpus acutus* Dominance Type (Evans 1989a) . (p.30)

*Scirpus acutus* Habitat Type (Hansen et al. 1995) B. Hansen et al. (1995) put stands dominated by *Scirpus validus* in this Habitat Type (p.458).

*Scirpus pungens* Plant Association (Bundy et al. 1996) . (p.F21)

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This association appears to be somewhat variable in flood regime. It is flooded less time than some of the other *Schoenoplectus acutus* associations in this semipermanently flooded alliance with some stands included in this association occurring in a seasonally flooded hydrologic regime. However, stands described by Kunze (1994) from western Washington were permanently flooded with shallow water (about 1 m deep). Additional research is needed to determine if the different hydrological regimes indicate a need to split out new associations.



**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Schoenoplectus acutus* Herbaceous Vegetation occurs as nearly monotypic stands in managed Green River floodplain bottoms, tributary drainages, and in wetland depressions within the Refuge.

**Global Range:** This association is a common emergent wetland found mostly in the interior western U.S. from Washington to Montana south to California, Nevada and Utah.

**Nations:** US

**States/Provinces:** CA ID MT NV OR UT WA

**TNC Ecoregions:** 10:C, 11:C, 17:C, 2:C, 6:C

**USFS Ecoregions:** 242A:CC, 262A:??, 331:C, 341C:CC, 341E:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342F:CC, 342H:CC, 342I:CC, M242A:CC, M242B:CC, M242C:CC, M261:C, M331A:CC, M331D:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL001840 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Bundy et al. 1996, Dethier 1990, Evans 1989a, Hansen et al. 1991, Hansen et al. 1995, Kunze 1994, Von Loh 2000.

**V.A.5.N.1.6. *SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE*  
Threesquare Semipermanently Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1433

*Schoenoplectus pungens* Herbaceous Vegetation

Threesquare Herbaceous Vegetation

*Bulrush Wet Meadow*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This bulrush wet meadow community is found in the western United States in the intermountain basins, as well as in western parts of the Great Plains. Stands are found along low-gradient, meandering, usually perennial streams and around the margins of ponds and marshes. *Schoenoplectus pungens* dominates the dense, 0.3- to 0.6-m tall herbaceous vegetation layer. Other species that often are present include *Schoenoplectus maritimus*, *Spartina gracilis*, *Hordeum jubatum*, *Pascopyrum smithii*, *Juncus balticus*, *Eleocharis palustris*, *Lemna minor*, *Sagittaria latifolia*, and *Typha* spp. Stands of this association contain no tree or shrub layer, but a few scattered trees and shrubs may be present, most commonly *Populus deltoides*, *Salix amygdaloides*, *Salix exigua*, *Symphoricarpos occidentalis*, or *Sarcobatus vermiculatus*. Substrates are generally dark, organic, fine-textured soils derived from alluvium.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM: PALUSTRINE**

**Ouray National Wildlife Refuge Environment:** This stand of *Schoenoplectus pungens* Herbaceous Vegetation occurs as a narrow band along a *Typha latifolia* marsh, that extends onto adjacent land administered by the U. S. Bureau of Land Management. The soils are saturated clay and a slight odor of selenium is present.

**Global Environment:** Stands of this widespread association are found throughout much of the western U.S. in appropriate wetland habitat. Elevations range from 1000-2400 m. Stands occur along low-gradient, meandering, usually perennial streams, around the margins of ponds and marshes, in low-lying swales, and abandoned or overflow channels where the soils remain saturated. (Hansen et al. 1995, Kittel et al. 1999, Jones and Walford 1995, Walford 1996). It also occurs on silt and sand bars within the active channel. Soils are generally derived from alluvium and are fine-textured, black, alkaline, organic anoxic with gleying. Soils range from normal to saline with pH ranging from 7.4-9.1.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** This small stand of *Schoenoplectus pungens* Herbaceous Vegetation is very dense, providing approximately 90% foliar cover. Of this amount, *Schoenoplectus pungens* has foliar cover of approximately 50%, while the remainder results from *Schoenoplectus acutus*, *Distichlis spicata*, *Juncus balticus*, *Typha latifolia*, *Lepidium latifolium*, and *Sarcobatus vermiculatus*.

**Global Vegetation:** This widespread wetland association is characterized by a dense, 0.3- to 0.6-m tall herbaceous vegetation layer that is dominated by *Schoenoplectus pungens*. Associated species include *Schoenoplectus maritimus*, *Spartina gracilis*, *Hordeum jubatum*, *Pascopyrum smithii*, *Juncus balticus*, *Eleocharis palustris*, *Lemna minor*, *Sagittaria latifolia*, and *Typha* spp. Stands of this association contain no tree or shrub layer, but a few scattered trees and shrubs may be present, most commonly *Populus deltoides*, *Salix amygdaloides*, *Salix exigua*, *Symphoricarpos occidentalis*, or *Sarcobatus vermiculatus*.

**Dynamics:** Stands of this association are flooded in the spring (Larson 1993).

## Ouray National Wildlife Refuge Vegetation Mapping Project

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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Short Shrub	<i>Sarcobatus vermiculatus</i>
Graminoid	<i>Schoenoplectus pungens</i> , <i>Schoenoplectus acutus</i> , <i>Distichlis spicata</i> , <i>Juncus balticus</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Distichlis spicata</i> , <i>Schoenoplectus pungens</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Schoenoplectus pungens*, *Schoenoplectus acutus*, *Distichlis spicata*

#### *Global*

Species  
*Schoenoplectus pungens*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum                      Species  
N/A

#### *Global*

Stratum                      Species  
N/A

### GLOBAL SIMILAR ASSOCIATIONS:

*Schoenoplectus americanus* Western Herbaceous Vegetation (CEGL001841)--stands are dominated by *Schoenoplectus americanus* instead of *Schoenoplectus pungens*.

*Spartina pectinata* - *Schoenoplectus pungens* Herbaceous Vegetation (CEGL001478)--should probably be split into a *Spartina* type and a *Schoenoplectus pungens* type.

### SYNONYMY:

*Scirpus pungens* habitat type (Hansen et al. 1995) B. includes vegetation dominated by all combinations of *Schoenoplectus pungens* and *S. americanus*.

*Scirpus pungens* series (MTNHP 1988) B. apparently includes a wider range of vegetation types than does this association.

*Scirpus pungens* Community (Jones and Walford 1995) . described from eastern Wyoming; synonymous

*Scirpus pungens* community (Walford 1996) . described from Wyoming's Bighorn Basin; synonymous

*Scirpus pungens* Herbaceous Vegetation (Kittel et al. 1999) . described from Wyoming's Bighorn Basin; synonymous

*Scirpus pungens* Monotype Community Type (Muldavin et al. 2000a) B. This association can be dominated by either *Schoenoplectus pungens* or *Schoenoplectus americanus*, which include *Scirpus olneyi*.

*Scirpus pungens* Association (Bundy et al. 1996) B. This association can be dominated by either *Schoenoplectus pungens* or *Schoenoplectus americanus*, which include *Scirpus olneyi*.

### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** Muldavin et al. (2000a) described 5 *Schoenoplectus pungens* community types from New Mexico. Most are codominated with an associated species listed in the vegetation description, e.g., *Eleocharis palustris*, *Distichlis spicata*, *Paspalum distichum*, and *Equisetum laevigatum*, with one being a *Schoenoplectus pungens* Monotype Community Type reported from the Gila River basin. Muldavin et al.'s (2000a) concept of this community type states that it can be

## Ouray National Wildlife Refuge Vegetation Mapping Project

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dominated by *Schoenoplectus pungens* or *Schoenoplectus americanus* (= *Scirpus americanus*, = *Scirpus olneyi*). Hansen et al. (1995) also include *Schoenoplectus americanus* in their *Scirpus pungens* Habitat Type. This association needs further review to clarify whether to include stands where *Schoenoplectus pungens* is not the dominant species.

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** One small patch of *Schoenoplectus pungens* Herbaceous Vegetation was observed in the large drainage near the northwestern boundary of the Refuge. *Schoenoplectus pungens* is only an occasional to rare associate of emergent wetlands within the Refuge.

**Global Range:** This community is found in the western United States in the intermountain basins, as well as in western parts of the Great Plains, from Montana south to Colorado, and west into Nevada, Utah, and Wyoming.

**Nations:** US

**States/Provinces:** CO KS MT ND NM NV SD UT WY

**TNC Ecoregions:** 10:C, 11:C, 19:C, 20:C, 26:C, 27:C

**USFS Ecoregions:** 331:C, 341B:CP, 341C:CC, 341E:CC, 342G:CC, M331H:CC

**Federal Lands:** USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEGL001587 **Confidence:** 2 **Conservation Rank:** G3G4

**REFERENCES:** Brotherson and Barnes 1984, Gleason and Cronquist 1991, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999, Larson 1993, Lauver et al. 1999, MTNHP 1988, Muldavin et al. 2000a, Von Loh 2000, Walford 1996.

**V.A.5.N.I.9. TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE**

**(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1436

***Typha latifolia* Western Herbaceous Vegetation**

**Broadleaf Cattail Western Herbaceous Vegetation**

***Broadleaf Cattail* Marsh**

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This association is widespread across the western United States and western Great Plains occurring near streams, rivers, and ponds. The soil is flooded or saturated for at least part of the growing season. The dominant species, *Typha latifolia*, often forms dense, almost monotypic stands. *Carex* spp. and *Schoenoplectus* spp. are often found in this community, especially on the margins.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** PALUSTRINE

**Ouray National Wildlife Refuge Environment:** *Typha latifolia* Herbaceous Vegetation grows best where active seeps and springs, or surface and/or ground water flow is available. As a result, broad-leaved cattail are less abundant on the Refuge than are narrow-leaved cattail, which tolerate sites with standing and more alkaline waters. Broad-leaved cattail stands on the Refuge occupied sites with active seeps and flowing water, and the soils were inundated muck. These stands are dissected by mule deer trails and bedding sites are present.

**Global Environment:** This widespread community is found along streams, rivers, canals, and the banks of ponds and lakes. Elevations range from near sea level to 2000 m. Sites are nearly level. The soil is saturated or flooded for much of the year from freshwater sources such as springs or streams. The alluvial soils have variable textures ranging from sand to clay and usually with a high organic content.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** Broad-leaved cattail stands are nearly monotypic, approaching 90% foliar cover. Of this amount, from 70-80% foliar cover is provided by *Typha latifolia*, while the remainder is contributed by *Epilobium ciliatum*, *Lepidium latifolium*, *Lemna minor*, *Muhlenbergia asperifolia*, *Veronica anagallis-aquatica*, *Mentha arvensis*, *Sonchus oleraceus*, and *Onopordum acanthium*. Broad-leaved cattail are very tall on the Refuge, reaching from 3-4 m in height.

**Global Vegetation:** This community is dominated by hydrophytic macrophytes, especially *Typha latifolia*, which grow from approximately 2-3 m tall. *Typha latifolia* often forms dense, near-monotypic stands (70-98% cover), almost to the exclusion of other species. Other species typical of wetlands may be found in lesser amounts in this community; among these are shallower water emergents such as *Carex* spp., *Eleocharis macrostachya*, *Eleocharis palustris*, *Glyceria* spp., *Juncus balticus*, *Juncus torreyi*, *Mentha arvensis*, *Schoenoplectus acutus*, and *Veronica* spp. In deeper water, *Lemna minor*, *Potamogeton* spp., *Sagittaria* spp., *Azolla filiculoides*, and other aquatics may be present in trace amounts. Trace amounts of grasses like *Agrostis stolonifera*, *Beckmannia syzigachne*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, and *Phalaris arundinacea* may also be present.

**Dynamics:** This association is dependent on flooding and high water tables from flowing freshwater sources, such as streams and seeps, and does not grow well in alkaline or stagnant water (Von Loh 2000). Disturbance greatly increases the total number of species present (Hansen et al. 1995). *Typha* spp. produce abundant wind-dispersed seeds that allow them to colonize wet bare soil sites quickly and to survive under wet conditions (Muldavin et al. 1999, Hansen et al. 1995).

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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Typha latifolia</i> , <i>Lepidium latifolium</i> , <i>Epilobium ciliatum</i> , <i>Lemna minor</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Typha latifolia</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Typha latifolia*, *Epilobium ciliatum*, *Veronica anagallis-aquatica*, *Muhlenbergia asperifolia*, *Lemna minor*

#### *Global*

Species  
*Typha latifolia*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Typha domingensis* Herbaceous Vegetation

### GLOBAL SIMILAR ASSOCIATIONS:

*Schoenoplectus acutus* - *Typha latifolia* - (*Schoenoplectus tabernaemontani*) Sandhills Herbaceous Vegetation (CEGL002030)--occurs in Great Plains, but is codominated by *Schoenoplectus* spp.

*Typha* (*angustifolia*, *domingensis*, *latifolia*) - *Schoenoplectus americanus* Herbaceous Vegetation (CEGL002032)--occurs in Great Plains, but is codominated by *Schoenoplectus* spp.

*Typha latifolia* - *Equisetum hyemale* - *Carex* (*hystericina*, *pellita*) Seep Herbaceous Vegetation (CEGL002033)--occurs in Great Plains, but is codominated by *Equisetum* and *Schoenoplectus* spp.

*Typha latifolia* Southern Herbaceous Vegetation (CEGL004150)--occurs in the southern Great Plains and is very similar, but has not been reported further west than Arkansas, Oklahoma and Texas; further review is needed to clarify differences.

### SYNONYMY:

*Typha latifolia* Community (Kovalchik 1993)

*Typha latifolia* Community (Crowe and Clausnitzer 1997)

*Typha latifolia* wetlands (Titus et al. 1996)

*Typha latifolia* community type (Kunze 1994) B

*Typha latifolia* community type (Dethier 1990)

*Typha latifolia* Wetland (Baker 1984a)

*Typha latifolia* Plant Association (Bundy et al. 1996)

*Typha latifolia* Habitat Type (Hansen et al. 1995)

Coastal and Valley Freshwater Marsh (Holland 1986b)

Cattail (*Typha* sp.) Dominance Type (Jones and Walford 1995)

*Typha angustifolia* - *Typha latifolia* Plant Association (Kittel et al. 1999)

*Typha latifolia/Sagittaria latifolia* plant association (Johnston 1987)

*Typha latifolia* Community Type (Padgett et al. 1989)

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** N/A

**Global Comments:** This community is a common element found in many wetland systems, but has received little attention. Consequently, the diagnostic features and species of this community are not well known. Some ecologists (Hansen et al. 1995, Kittel et al. 1999) have included *Typha angustifolia* as a codominant in this association. More classification work is needed to clarify the concept of this association.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Typha latifolia* Herbaceous Vegetation is present in drainages, canals, ditches, basins, side channels, on seeps, and along the Green River channel throughout the Refuge. Broad-leaved cattail grows best on/in fresh to slightly alkaline water sources, particularly when flowing water and active seeps are present.

**Global Range:** *Typha latifolia* Herbaceous Vegetation is widely distributed, occurring across the western United States and western Great Plains.

**Nations:** CA? US

**States/Provinces:** AZ BC? CA CO ID MT NM NV OR UT WA WY

**TNC Ecoregions:** 10:C, 11:C, 17:C, 19:C, 20:C, 27:C, 2:C, 6:C

**USFS Ecoregions:** 261A:CC, 262A:CC, 263A:CC, 331C:CC, 331H:CC, 331I:CC, 341C:CC, 342:C, M331F:CC, M333C:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL002010 **Confidence:** 2 **Conservation Rank:** G5

**REFERENCES:** Baker 1984a, Bundy et al. 1996, Bunin 1985, Christy 1973, Crowe and Clausnitzer 1997, Dethier 1990, Hansen et al. 1991, Hansen et al. 1995, Holland 1986b, Kittel et al. 1996, Kovalchik 1993, Kunze 1994, Lindauer 1978, Lindauer and Christy 1972, Masek 1979, McEachern 1979, Muldavin et al. 1993b, Padgett et al. 1989, Ramaley 1939b, Titus et al. 1996, Tolstead 1942, Von Loh 2000, Youngblood et al. 1985a.

**V.C.2.N.A. PERMANENTLY FLOODED TEMPERATE OR SUBPOLAR HYDROMORPHIC ROOTED  
VEGETATION**

***V.C.2.N.a.22. POLYGONUM AMPHIBIUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE***  
**Water Smartweed Permanently Flooded Herbaceous Alliance**

**Alliance Identifier:** A.1762

***Polygonum amphibium Permanently Flooded Herbaceous Alliance***

**Water Smartweed Permanently Flooded Herbaceous Alliance**

***Water Smartweed Wetland***

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This alliance-level community is found primarily in the western United States and one province in Canada. It occurs over a wide elevational range from near sea level to over 2700 m. Stands are found in permanently flooded depressions, such as margins of lake shores and oxbow lakes in river floodplains. The vegetation is characterized by the dominance or codominance of *Polygonum amphibium*, a hydromorphically rooted emergent forb. Associates may include species of *Potamogeton* and other aquatic plants.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** LACUSTRINE, PALUSTRINE

**Ouray National Wildlife Refuge Environment:** In Woods Bottom, a natural basin, much of the *Polygonum amphibium* Herbaceous Vegetation stand was found inundated by up to 5 cm of water, fully saturating the fine clay soil. At this site, near equal vegetative cover was provided by pondweed (*Potamogeton* spp.) and total vegetative cover exceeded 90%. At the upper margin of this water smartweed stand, coyote willow (*Salix exigua*) became the dominant shrub with water smartweed occurring as an understory forb. In Leota Bottom, an artificial pool, the basin was entirely dry, the fine clay soil exhibiting large cracks, but the water smartweed present appeared bright green and healthy. It is apparent that water levels fluctuate more in this pool than in Woods Bottom, because no pondweed or other aquatic vegetation was present, rather only a few plants of *Atriplex rosea* a coarse annual forb. Under the drier conditions of Leota Bottom, water smartweed plants were taller and denser than those in Woods Bottom; the plants nearly exceeded one m in height and 90% foliar cover.

**Global Environment:** This wetland occurs in shallow water around the edges of ponds and lakes in western North America. Elevation varies depending on geographical location. Stands reported along the Columbia River are located just above sea level, in Montana between 640-1080 m, in northeastern Utah at 1420 m, and in Colorado from 2050-2700 m. Sites include oxbow lakes and backwater areas of the Columbia floodplains, seasonally flooded basins in the floodplains of the Green River, in glacial ponds or prairie potholes in northern Montana, and in shallow lakes in the mountains of Colorado. Stands are located in standing water that is permanent or present at least during the growing season. The pond bottoms are composed of finer sediments, organic muck, clay, or silt.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** In the natural basin of Woods Bottom, with a more stable water level, *Polygonum amphibium* grows in a band around the upper margin, where it is co-dominant with *Potamogeton natans* and *Potamogeton pectinatus* on the lower, deeper edge and is understory to *Salix exigua* shrubs at the upper edge. In the constructed basins of Leota and Johnson Bottoms, *Polygonum amphibium* grows in a monotypic stand which occupies the deepest portion of the basins, where water and/or saturated soils persist for the longest period of time. In these constructed basins, water smartweed may be inundated all or part of the year, or the basin may dry completely by the end of summer. Water smartweed plants are taller, up to one meter in height, in the constructed basins, than in the natural basin where they are typically below 0.5 meters in height. Foliar cover is also greater in the constructed basins, exceeding 90%, while it is in the range of about 50% in the more evenly saturated conditions at Woods Bottom.

**Global Vegetation:** This wetland vegetation type occurs in shallow water along the edges of ponds and lakes. Floating-leaved aquatic forbs cover at least 30% of the water's surface (Kunze 1994). *Polygonum amphibium* often forms dense, nearly monotypic stands. *Lemna minor*, *Potamogeton natans*, *Sagittaria* spp., *Spirodela polyrrhiza*, and *Wolffia* spp. are occasionally present.



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**Dynamics:** Johnson (1939, 1941) found this community in Colorado montane lakes with significant sediment deposition, but not in lakes with rocky bottoms. Kunze (1994) suggested that this community may have occurred at higher elevations along the Columbia River Gorge, but *Phalaris arundinacea*, which occupies similar environments, may have displaced the *Polygonum amphibium*.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Forb	<i>Polygonum amphibium</i> , <i>Potamogeton natans</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Forb	<i>Polygonum amphibium</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

Species  
*Polygonum amphibium*, *Potamogeton natans*, *Atriplex rosea*

#### *Global*

Species  
*Polygonum amphibium*

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

Stratum Species  
N/A

#### *Global*

Stratum Species  
N/A

### OURAY NATIONAL WILDLIFE REFUGE SIMILAR ASSOCIATIONS:

*Polygonum lapathifolium* Herbaceous Vegetation in Wyasket Bottom shares a common habitat and some traits with *Polygonum amphibium* Herbaceous Vegetation stands growing in constructed basins. However, Wyasket Bottom is even more ephemeral than the basins in Leota and Johnson Bottoms, resulting in the habitat supporting the annual *P. lapathifolium* rather than the perennial *P. amphibium*.

**GLOBAL SIMILAR ASSOCIATIONS:** N/A

### SYNONYMY:

*Polygonum amphybium* community type (Kunze 1994)  
*Persicaria amphibia* Association (Cooper and Severn 1992)  
Freshwater Aquatic Beds (Chappell et al. 1997)  
*Polygonum amphibium* Community (Christy 1993)  
*Polygonum amphibium* Community Type (Hansen et al. 1995)  
Lake Zone (Johnson 1932b)  
Lake Area Zone (Johnson 1936)  
Lake Area Zone (Johnson 1939)  
Lake Area Zone (Johnson 1941)  
Water Zone: *Persicaria coccinea* within Pond, sloughs and seepage areas of the *Sarcobatus - Ericameria* Association (Ramaley 1942)

**CLASSIFICATION COMMENTS**

**Ouray National Wildlife Refuge:** Monotypic stands of *Polygonum amphibium* Herbaceous Vegetation persist in constructed basins that are seasonally flooded. This type is also a component of dike and levee embankments, where the embankments are saturated much of the growing season. If these basins would have a more permanent source of water, a *Potamogeton* spp. association would likely develop either displacing water smartweed or reducing its abundance and foliar cover.

**Global Comments:** This vegetation type is only classified to the alliance level. More work is needed to describe associations.

**ELEMENT DISTRIBUTION**

**Ouray National Wildlife Refuge Range:** *Polygonum amphibium* Herbaceous Vegetation was observed in Leota Bottom on the west side of the Green River and in Woods Bottom and Johnson Bottom on the east side of the river. All of the stands observed occupy basins that had been flooded early in the growing season; the basins are located on terraces of oxbow bends in the Green River. It appears that the basin in Woods Bottom is natural and maintains a relatively stable hydrologic regime. The other two basins are filled with water and dry if environmental conditions warrant.

**Global Range:** This alliance is found primarily in the western United States and Canada, but may extend further east.

**Nations:** US

**States/Provinces:** CA? CO ID MT OR UT WA

**TNC Ecoregions:** 10:C, 20:C, 26:C, 2:C, 6:C

**USFS Ecoregions:** 242A:CC, 331D:CC, 331G:CC, 341C:CC, 342B:CC, 342C:C?, M242A:CC, M242B:CC, M242C:CC

**Federal Lands:** USFWS (Ouray)

**ELEMENT SOURCES**

**Identifier:** CEGL002002 **Confidence:** 1 **Conservation Rank:** G5

**REFERENCES:** Christy and Putera 1993, Hansen et al. 1991, Hansen et al. 1995, Johnson 1932a, Johnson 1932b, Johnson 1936, Johnson 1939, Johnson 1941, Kunze 1994, Ramaley 1930, Ramaley 1942, Von Loh 2000.

**V.D.2.N.D. SHORT TEMPERATE ANNUAL GRASSLAND**

**V.D.2.N.d.2. BROMUS TECTORUM SEMI-NATURAL HERBACEOUS ALLIANCE**

**Cheatgrass Semi-natural Herbaceous Alliance**

**Alliance Identifier:** A.1814

*Bromus tectorum Semi-natural Herbaceous Alliance*

**Cheatgrass Herbaceous Semi-natural Alliance**

*Cheatgrass Annual Grassland*

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**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This alliance-level herbaceous vegetation type is found throughout much of western North America from the western Great Plains to Intermountain West. Elevation ranges from sea level to 2200 m. It occurs after disturbance of a natural shrub- or grass-dominated community that results in the replacement of the natural vegetation by non-native, annual grass species of *Bromus*. *Bromus tectorum* typically dominates the community with over 80-90% of the total vegetation cover, making it difficult to determine what natural community was formerly present. This alliance also includes grasslands dominated or codominated by other Eurasian introduced annual *Bromus* species such as *Bromus hordeaceus*, *Bromus madritensis*, *Bromus japonicus*, *Bromus rigidus*, or *Bromus rubens*. It is distinct from the annual *Bromus* communities found along the Pacific Coast typical of the Mediterranean or maritime climates.

**ENVIRONMENTAL DESCRIPTION**

**USFWS WETLAND SYSTEM:** TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** *Bromus tectorum* Semi-natural Herbaceous Alliance vegetation grows mostly on the fine sediments that have washed from badlands formations and have deposited as deltas or fans at the base of badlands bluffs. In some instances, cheatgrass has become established among river cobble that is eroding from the badlands formations, as well. In most sites dominated by cheatgrass, the soils are very fine silty clay.

**Global Environment:** This alliance-level herbaceous vegetation type is found throughout much of western North America from the western Great Plains to intermountain and southwestern U.S. Elevation ranges from sea level to 2200 m. Stands occur after disturbance of a natural shrub- or grass-dominated community resulting in the replacement of the natural vegetation by non-native, annual grass species of *Bromus*. At Wind Cave National Park in South Dakota, weedy non-native graminoid vegetation occurs on recently disturbed areas, most commonly along roads. Small stands also occur in prairie dog towns (H. Marriott pers. comm. 1999). In the Great Basin, *Bromus tectorum* grasslands has invaded large areas of burned-over sagebrush steppe. *Bromus tectorum* increases the fire frequency of steppe communities, which eventually eliminates sagebrush (FEIS 2001).

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** The *Bromus tectorum* Semi-natural Herbaceous Alliance is a sparse annual grass/forbland that rarely exceeds 10% foliar cover. This short-statured type is usually less than 15 cm in height. Sites supporting this type are usually disturbed through wind and water erosion, or some type of on-going human disturbance. While *Bromus tectorum* is normally the type dominant, some sites such as prairie dog towns may be dominated by *Halogeton glomeratus* and have little or no cheatgrass present. This situation was noted more when soils were clayey (depressions and shallow drainages), as cheatgrass was more successful establishing on sandy to loamy soils.

**Global Vegetation:** This alliance-level vegetation type is characterized by a sparse to dense short annual graminoid layer that is typically dominated by *Bromus tectorum* with over 80-90% of the total vegetation cover. Other Eurasian introduced annual species of *Bromus* which may alternatively dominate or codominate are *Bromus carinatus*, *Bromus hordeaceus*, *Bromus madritensis*, *Bromus japonicus*, *Bromus rigidus*, or *Bromus rubens*. Although there may be remnant species of the former native vegetation, the high cover of annual bromes makes it difficult to determine what natural community was

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formerly present. At Wind Cave National Park in South Dakota, this weedy non-native graminoid vegetation is usually dominated by several perennial and annual brome grasses, including *Bromus inermis*, *Bromus japonicus*, and cheatgrass *Bromus tectorum*. Cover is variable (H. Marriott pers. comm. 1999).

**Dynamics:** *Bromus tectorum* is an annual grass and is able to complete its lifecycle in the spring before drying out in mid-summer. Its fine structure makes it extremely flammable when dry, and it will increase the fire frequency of a site (FEIS 2001). Frequent fires favor *Bromus tectorum* because they eliminate competing perennial vegetation, but do not kill all the *Bromus tectorum* seeds, which survive in the unburned organic material (FEIS 2001). This altered ecological process has promoted the spread of *Bromus tectorum* and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. (Daubenmire 1975, Young and Evans 1973, 1978).

This type is most common where disturbances have eliminated or largely set back the native vegetation. Where the brome grasses are invading native vegetation, the types may still be tracked as native types, since the native species may still persist. A recent study (Karl et al. 1999) found that despite strong seed and seedling production by the exotic brome grasses (*Bromus japonicus*, *Bromus tectorum*), the large amount of herbaceous biomass produced by the two vegetatively propagating native grasses, *Bouteloua gracilis* and *Pascopyrum smithii*, suggests that these native grasses may well maintain their ecological importance in the stands.

In Nevada, Beatley (1976) found dense stands the introduced winter annual grass *Bromus tectorum* growing in disturbed *Artemisia* shrublands. *Bromus rubens* is more common in lower elevation sites, and *Bromus tectorum* is most common in higher elevation sagebrush and pinyon-juniper communities.

### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Herbaceous	<i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>B. japonicus</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Graminoid	<i>Bromus tectorum</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Species</u>
<i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>Salsola kali</i>

#### *Global*

<u>Species</u>
<i>Bromus tectorum</i>

### OTHER NOTEWORTHY SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
N/A	

#### *Global*

<u>Stratum</u>	<u>Species</u>
N/A	

### GLOBAL SIMILAR ASSOCIATIONS:

#### SYNONYMY:

Cheatgrass series (Sawyer and Keeler-Wolf 1995)

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### CLASSIFICATION COMMENTS

**Ouray National Wildlife Refuge:** In a year with higher precipitation during the growing season, this alliance may be more dense and lush. Cheatgrass as an understory species in other associations would probably have a higher cover value under wetter conditions.

**Global Comments:** This alliance also includes grasslands dominated or codominated by other Eurasian introduced annual *Bromus* species, but is distinct from the annual *Bromus* communities found along the Pacific Coast with Mediterranean or maritime climates because it does not have the introduced annual oatgrass (*Avena barbata* and *Avena fatua*), or other species typical of the California annual grassland (Sawyer and Keeler-Wolf 1995).

### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** The *Bromus tectorum* Semi-natural Herbaceous Alliance is dominant on badland slopes comprised of river cobble and erosion fans along the base of badlands bluffs. Cheatgrass is sometimes a component of prairie dog towns and other disturbed sites; it is also widely distributed as a minor component of many upland sites. Near Woods Bottom and on the uplands of Johnson Bottom, sites disturbed by early settlers and for oil exploration have become dominated by cheatgrass and other annual species.

**Global Range:** This alliance-level herbaceous vegetation type is found throughout much of western North America from the western Great Plains to intermountain and southwestern U.S.

**Nations:** US

**States/Provinces:** AZ CA UT

**TNC Ecoregions:** 10:C, 18:C, 19:C, 21:C

**USFS Ecoregions:** 262A:CC, 313A:CC, 341C:CC, 342:C, M261:C, M313A:CC, M341C:CC

**Federal Lands:** NPS (Walnut Canyon, Zion); USFWS (Ouray)

### ELEMENT SOURCES

**Identifier:** CEG003019 **Confidence:** 2 **Conservation Rank:** GW

**REFERENCES:** Beatley 1976, Daubenmire 1975, FEIS 2001, Karl et al. 1999, Sawyer and Keeler-Wolf 1995, Thompson 2001, Von Loh 2000, Young and Evans 1973, Young and Evans 1978.

**XX. HIERARCHY PLACEMENT UNDETERMINED**

**VII.C.XX. ERICAMERIA NAUSEOSA SAND DEPOSIT SPARSE VEGETATION [PROVISIONAL]**

**Rubber Rabbitbrush Slide Deposit Sparse Vegetation [Provisional]**

**Rubber Rabbitbrush Slide Deposit Sparse Vegetation [Provisional]**

**ELEMENT CONCEPT**

**GLOBAL SUMMARY:** This association has only been described from Zion National Park and Ouray National Wildlife Refuge in Utah, but is likely more common in similar habitats throughout the interior western U.S. At Zion, a stand was described from a colluvial slope below a sandstone cliff in sandy soil derived from sandstone residuum. Whereas, at Ouray it was described from sand dunes on slopes below the bluff along the river and on sand sheets in flatter areas. Sites are generally gentle to moderately sloping, but range from flat to steep and may occur on any aspect. The vegetation is characterized by a typically sparse short shrub layer 5-20% cover (but may range up to 30% cover) that is dominated by *Ericameria nauseosa* (at least half the cover). Other shrubs or dwarf-shrubs may include *Artemisia dracunculus*, *Atriplex canescens*, *Chrysothamnus viscidiflorus*, *Ephedra torreyana*, *Eriogonum corymbosum*, *Ipomopsis congesta*, *Gutierrezia sarothrae*, *Opuntia polyacantha*, or *Yucca elata* var. *utahensis*. The herbaceous layer is generally sparse and is dominated by perennial graminoids such as *Achnatherum hymenoides*, *Aristida purpurea*, *Hesperostipa comata*, and *Sporobolus cryptandrus*. Forb cover is sparse.

**USFWS Wetland System:** TERRESTRIAL

**Ouray National Wildlife Refuge Environment:** Sand is deposited into dunes on the midslopes and knolls of badlands bluffs, which are present on both sides of the Green River Valley. Short-statured *Ericameria nauseosa* shrubs dominate these sites, serving to stabilize the dunes from blow-out formation. Dune erosion still occurs, on one site the shrubs were described as pedestaled due to sand removal by wind. Typically the dunes are moderately steep, to 5% slope, but one site of 20% slope was also sampled.

**Global Environment:** This association has only been described from Ouray National Wildlife Refuge and Ouray National Wildlife Refuge in Utah, but is likely more common in similar habitats throughout the interior western U.S. Elevation ranges from 1430-1920 m (4700-6300 feet). At Zion, a stand was described from a colluvial slope below a sandstone cliff in sandy soil derived from sandstone residuum. Whereas, at Ouray it was described from sand dunes on slopes below the bluff along the river and on sand sheets in flatter areas. Sites are generally gentle to moderately sloping, but range from flat to steep and may occur on any aspect.

**VEGETATION DESCRIPTION**

**Ouray National Wildlife Refuge Vegetation:** *Ericameria nauseosa* Sand Deposit Sparse Vegetation vegetation typically provides from 10-30% foliar cover, about 50% of that is provided by *Ericameria nauseosa*. Where this type occurs on knolls extending from bluff edges dominated by *Ephedra torreyana* Dwarf-shrubland, *Ephedra torreyana*, *Artemisia dracunculus*, and *Leptodactylon pungens* comprise a portion (up to 5%) of the foliar cover of the stand. Shrub associates of *Ericameria nauseosa* include *Chrysothamnus viscidiflorus*, *Atriplex canescens*, *Gutierrezia sarothrae*, and *Opuntia polyacantha*. Common grass species of the sand dunes are bunchgrasses, including *Achnatherum hymenoides*, *Sporobolus cryptandrus*, and *Aristida purpurea*. *Sophora stenophylla* is a common forb on these sites.

**Global Vegetation:** This association is characterized by a typically sparse short shrub layer 5-20% cover (but may range up to 30% cover) that is dominated by *Ericameria nauseosa* (at least half the cover). Other shrubs or dwarf-shrubs may include *Artemisia dracunculus*, *Atriplex canescens*, *Chrysothamnus viscidiflorus*, *Ephedra torreyana*, *Eriogonum corymbosum*, *Ipomopsis congesta*, *Gutierrezia sarothrae*, *Opuntia polyacantha*, or *Yucca elata* var. *utahensis*. The herbaceous layer is generally sparse and is dominated by perennial graminoids such as *Achnatherum hymenoides*, *Aristida purpurea*, *Hesperostipa comata*, and *Sporobolus cryptandrus*. Forb associates may include *Chamaesyce glyptosperma*, *Cirsium* spp., *Heterotheca villosa*, *Penstemon palmeri*, *Phacelia heterophylla*, and *Sophora stenophylla*.

**Global Dynamics:** The sandy substrate is an important environmental variable whether created by active eolian processes or from sandstone residuum.

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### MOST ABUNDANT SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Ericameria nauseosa</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Ephedra torreyana</i>
Graminoid	<i>Achnatherum hymenoides</i> , <i>Sporobolus cryptandrus</i> , <i>Aristida purpurea</i> ,
Forb	<i>Sophora stenophylla</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Ericameria nauseosa</i> , <i>Atriplex canescens</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Ephedra torreyana</i> , <i>Gutierrezia sarothrae</i> , <i>Opuntia polycantha</i> .
Graminoid	<i>Achnatherum hymenoides</i> , <i>Aristida purpurea</i> , <i>Hesperostipa comata</i> , <i>Sporobolus cryptandrus</i>
Forb	<i>Heterotheca villosa</i> , <i>Sophora stenophylla</i>

### CHARACTERISTIC SPECIES

#### *Ouray National Wildlife Refuge*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Ericameria nauseosa</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Achnatherum hymenoides</i> , <i>Sporobolus cryptandrus</i> , <i>Sophora stenophylla</i>

#### *Global*

<u>Stratum</u>	<u>Species</u>
Shrub	<i>Ericameria nauseosa</i> , <i>Chrysothamnus viscidiflorus</i> ,
Graminoid	<i>Achnatherum hymenoides</i> , <i>Hesperostipa comata</i> , <i>Sporobolus cryptandrus</i>

### OTHER NOTEWORTHY SPECIES

#### *Global*

<u>Stratum</u>	<u>Species</u>
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### GLOBAL SIMILAR ASSOCIATIONS:

#### GLOBAL STATUS AND CLASSIFICATION COMMENTS

**Global Conservation Status Rank:** G?.

**Global Comments:** This association has been described from only 2 areas but is likely more common.

#### ELEMENT DISTRIBUTION

**Ouray National Wildlife Refuge Range:** *Ericameria nauseosa* Sand Deposit Sparse Vegetation occupies sand dunes and deep, sandy soils within the Refuge. These sites typically occur on the knolls or midslopes below bluffs where wind-blown sand (eolian deposits) collects and forms dunes. *Ericameria nauseosa* also occupies deep sandy deposits on more even terrain on the west side of the Refuge, but here it often does not supply sufficient foliar cover to be considered a shrubland type.

**Global Range:** This association has only been described from Ouray National Wildlife Refuge and Ouray National Wildlife Refuge in Utah, but is likely more common in similar habitats throughout the interior western U.S.

**Nations:** US

**States/Provinces:** UT

#### ELEMENT SOURCES

**Ouray National Wildlife Refuge Inventory Notes:**

**Classification Confidence:** 3 **Identifier:** CEG002980

**REFERENCES:** (n/a)

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**APPENDIX F: A LIST OF VASCULAR PLANT SPECIES FOUND AT ONWR**

## Ouray National Wildlife Refuge Vegetation Mapping Project

### SPECIES LIST - SORTED by FAMILY

Genus - Species - Authority	Common Name	Reference
<b>AGAVACEAE</b> <b>Common:</b> Agave Family		
<i>Yucca</i> spp.	Yucca (Soapweed)	
<b>AIZOACEAE</b> <b>Common:</b> Carpetweed Family		
<i>Sesuvium sessile</i> Pers.	Lowland purslane	2,3
<i>Sesuvium verrucosum</i> Raf.	Sea purslane	1,4
<b>ALISMATACEAE</b> <b>Common:</b> Water Plantain Family		
<i>Alisma gramineum</i> Lej. ( <i>A. geyeri</i> Torr.)	Narrowleaf water plantain	1,2,4
<i>Echinodorus bertoroi</i> (Spreng.) Fass.	Burhead	2,3
<i>Echinodorus rostratus</i> (Nutt.) Engelm.	Burhead	1,2
<i>Sagittaria cuneata</i> Sheldon	Wapato	1,2,3,4
<b>AMARANTHACEAE</b> <b>Common:</b> Amaranth Family		
<i>Amaranthus retroflexus</i> L.	Redroot pigweed	1,2
<b>ANACARDIACEAE</b> <b>Common:</b> Sumac Family		
<i>Rhus</i> ( <i>R. aromatica</i> Aiton ssp.) <i>trilobata</i> Nutt. Weber	Skunkbush, Three-leaved	1,2,3,4
<b>APIACEAE</b> <b>Common:</b> Carrot Family		
<i>Cymopterus acaulis</i> (Pursh) Raf.	Spring-parsley	1,2
<i>Cymopterus bulbosus</i> A. Nels.	Onion spring-parsley	1,2
<i>Cymopterus duchenensis</i> Jones	Uinta Basin spring-parsley	1,2
<i>Cymopterus purpurascens</i> (Gray) Jones	Purple spring-parsley	1,2
<b>APOCYNACEAE</b> <b>Common:</b> Dogbane Family		
<i>Apocynum cannabinum</i> L.	Hemp dogbane	1,2,4
<b>ASCLEPIADACEAE</b> <b>Common:</b> Milkweed Family		
<i>Asclepias cryptoceras</i> Wats.	Pallid milkweed	1,2,4
<i>Asclepias labrififormis</i> Jones	Milkweed	1,2,3
<i>Asclepias speciosa</i> Torr.	Showy milkweed	1,2,3,4
<b>ASTERACEAE</b> <b>Common:</b> Sunflower Family		
<i>Ambrosia acanthicarpa</i> Hook.	Annual burweed	1,4
<i>Ambrosia tomentosa</i> (Franseria <i>discolor</i> ) Nutt.	Bur ragweed	1,2,4
<i>Ambrosia trifida</i> L.	Giant ragweed	4
<i>Artemisia biennis</i> Willd.	Biennial wormwood	1,2
<i>Artemisia dracunculus</i> L.	Tarragon	1,2,4
<i>Artemisia ludoviciana</i> Nutt.	Western mugwort	1,2,3,4
<i>Artemisia nova</i> A. Nels.	Black sagebrush	1,2,4
<i>Artemisia spinescens</i> D.C. Eaton in Wats.	Bud sagebrush	1,2,4
<i>Artemisia tridentata</i> Nutt. ssp. <i>tridentata</i>	Big sagebrush	1,2,3,4
<i>Aster frondosus</i> (Nutt.) T. & G.	Leafy aster	1,2
<i>Aster</i> sp.	Aster	1,4
<i>Bahia dissecta</i> (Gray) Britt.	Ragleaf bahia	1,3
<i>Bidens cernua</i> L.	Nodding beggartick	1,2
<i>Brickellia oblongifolia</i> Nutt.	Mohave brickellbush	1,2
<i>Centaurea repens</i> L.	Russian knapweed	1,2,4
<i>Chaenactis douglassii</i> (Hook.) H. & A.	Douglas chaenactis	1,2,4

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<i>Chaenactis stevioides</i> H. & A.	Chaenactis	1,2,3
<i>Chrysothamnus viscidiflorus</i> (Hook.) Nutt.	Low rabbitbrush	1,2,4
<i>Cirsium arvense</i> (L.) Scop.	Canada thistle	1,2,4
<i>Cirsium vulgare</i> (Savi) Ten.	Bull thistle	1,2
<i>Conyza canadensis</i> (L.) Cronq.	Horseweed	1,4
<i>Crepis runcinata</i> (James) T. & G. var. <i>glauca</i> (Nutt.) Welsh	Dandelion hawkbeard	1,2
<i>Enceliopsis nutans</i> (Eastw.) A. Nels.	Enceliopsis	1,2
<i>Ericameria nauseosa</i> (Pallas) Britt.	Rubber rabbitbrush	1,2,3,4
<i>Ericameria parryi</i> (Gray) Greene	Parry rabbitbrush	1,4
<i>Erigeron bellidiastrum</i> Nutt. var. <i>typicus</i> Cronq.	Fleabane	3
<i>Erigeron pumilus</i> Nutt.	Low fleabane	1,2
<i>Gnaphalium palustre</i> Nutt.	Lowland cudweed	1,2,3,4
<i>Grindelia squarrosa</i> (Pursh) Dunal.	Curlycup gumweed	1,2,3,4
<i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rusby	Broom snakeweed	1,2,3,4
<i>Helenium autumnale</i> L.	Orange sneezeweed	1,2
<i>Helianthus annuus</i> L.	Common sunflower	1,2,4
<i>Helianthus petiolaris</i> Nutt.	Sunflower	1,2,3
<i>Heliomeris multiflora</i> Nutt.	Showy goldeneye	1,2
<i>Heterotheca villosa</i> (Pursh) Shinnery	Hairy goldaster	1,4
<i>Hymenopappus filifolius</i> Hook. var. <i>luteus</i> (Nutt.) Turner	Fineleaf hymenopappus	1,2,3,4
<i>Iva axillaris</i> Pursh	Poverty sumpweed	1,2,3,4
<i>Lactuca serriola</i> L.	Prickly lettuce	1,4
<i>Lactuca tatarica</i> (L.) C. A. Mey	Chicory lettuce	1,2
<i>Leucelene ericoides</i> (Torr.) Greene (Aster <i>leucelene</i> Blake)	Heath aster	1,2,3
<i>Lygodesmia grandiflora</i> (Nutt.) T. & G.	Skeleton plant	1,2,3
<i>Machaeranthera canescens</i> (Pursh) Gray	Purple tansyaster	1,2
<i>Machaeranthera grindelioides</i> (Nutt.) Shinnery	Discoid tansyaster	1,2
<i>Malacothrix sonchoides</i> (Nutt.) T. & G.	Desert dandelion	1,2,3
<i>Onopordum acanthum</i> L.	Scotch thistle	1,4
<i>Platyschukria integrifolia</i> (Gray) Rydbg. ( <i>Bahia nudicaulis</i> Gray)	Platyschukria	1,2,3
<i>Prenanthes exigua</i> (Gray) Rydbg.	Skeletonweed	1,2
<i>Euthamia canadensis</i> L.	Canada goldenrod	1,2,3
<i>Euthamia missouriensis</i> Nutt.	Missouri goldenrod	1,2,3
<i>Euthamia occidentalis</i> (Nutt.) T. & G.	Western goldenrod	1,2,4
<i>Sonchus arvensis</i> L.	Field sowthistle	1,2
<i>Sonchus asper</i> (L.) Hill	Prickly sowthistle	1,2
<i>Sonchus oleraceous</i> L.	Common sowthistle	1,4
<i>Stephanomeria pauciflora</i> (Torr.) Hall	Wire lettuce	3
<i>Stephanomeria runcinata</i> Nutt.	Wire lettuce	1,2
<i>Tetradymia nuttallii</i> T. & G.	Nuttall horsebrush	1,2,3
<i>Tetradymia spinosa</i> T. & G.	Cottonthorn horsebrush	1,2,4
<i>Townsendia grandiflora</i> Nutt.	Townsendia	3
<i>Townsendia incana</i> Nutt.	Townsendia	1,2
<i>Tragopogon dubius</i> Scop.	Yellow salsify	1,2,3,4
<i>Xanthium strumarium</i> L. ( <i>X. italicum</i> Moretti)	Cocklebur	1,2,3,4
<i>Xylorhiza venusta</i> (Jones) Heller	Desert daisy	1,2,4

### **BORAGINACEAE** Common: Borage Family

#### **Genus - Species - Authority**

<i>Cryptantha ambigua</i> (Gray) Greene
<i>Cryptantha flava</i> (A. Nels.) Payson
<i>Cryptantha paradoxa</i> (A. Nels.) Payson
<i>Heliotropium curassavicum</i> L.
<i>Lappula redowskii</i> (Hornem.) Greene
<i>Tiquilia nuttallii</i> (Hook.) A. Richardson

#### **Common Name**

Catseye
Yellow catseye
Catseye
Salt heliotrope
Desert stickseed
Nuttall's crinklemat

#### **Reference**

1,2,3
1,2,3
1,2
1,4
1,2,3
1,2

### **BRASSICACEAE** Common: Mustard Family

#### **Genus - Species - Authority**

<i>Arabis pulchra</i> Jones
<i>Descurainia pinnata</i> (Walt.) Britt.
<i>Descurainia sophia</i> (L.) Webb ex Prantl.
<i>Erysimum asperum</i> (Nutt.) DC.

#### **Common Name**

Beauty rockcress
Blue tansy mustard
Flixweed
Rough wallflower

#### **Reference**

1,2
1,4
1,4
1,2,3,4

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<i>Lepidium densiflorum</i> Schrad.	Prairie pepperweed	1,2,3
<i>Lepidium latifolium</i> L.	Giant whitetop	1,2,4
<i>Lepidium montanum</i> Nutt. in T. & G.	Mountain pepperweed	1,2
<i>Malcolmia africana</i> R. Br. in Ait.	African mustard	1,2
<i>Physaria acutifolia</i> Rydb.	Common twinpod	1,4
<i>Rorippa curvipes</i> Greene	Yellowcress	1,2
<i>Rorippa islandica</i> (Oeder) Borbas	Marsh yellowcress	1,2
<i>Rorippa lyrata</i> (Nutt.) Rydbg.	Yellowcress	3
<i>Rorippa tenerrima</i> Greene	Yellowcress	1
<i>Schoenocrambe linifolia</i> (Nutt.) Greene	Flaxleafed plains mustard	1,2
<i>Sisymbrium altissimum</i> L.	Jim Hill mustard	1,2,3,4
<i>Stanleya pinnata</i> (Pursh) Britt.	Bushy stanleya	1,4
<i>Thelipodiopsis elegans</i> (Jones) Rydbg.	Thelypodopsis	1,2

### CACTACEAE

**Common:** Cactus Family

**Genus - Species - Authority**

*Coryphantha vivipara* (Nutt.) Britt. & Rose

*Opuntia polyacantha* (Haw.) (O. *rutila* Nutt.)

*Sclerocactus whipplei* (Engelm.) Britt. & Rose var. *glaucus* (J. A. Purpus)

**Common Name**

Pincushion cactus

Plains pricklypear

Uinta Basin hookless cactus

**Reference**

1,2

1,2,3,4

1,2,4

### CAPPARIDACEAE

**Common:** Caper Family

**Genus - Species - Authority**

*Cleome lutea* Hook.

*Cleome serrulata* Pursh

*Polanisia dodecandra* (L.) DC.

**Common Name**

Yellow spiderflower

Rocky Mountain bee-plant

Roughseed clammyweed

**Reference**

1,2,3

1,2,3,4

1,4

### CAPRIFOLIACEAE:

**Common:** Honeysuckle Family

**Genus - Species - Authority**

*Symphoricarpos occidentalis* Hook

**Common Name**

Western snowberry

**Reference**

1,4

### CARYOPHYLLACEAE

**Common:** Pink Family

**Genus - Species - Authority**

*Arenaria fendleri* Gray

**Common Name**

Fendler sandwort

**Reference**

1,2

### CHENOPODIACEAE

**Common:** Goosefoot Family

**Genus - Species - Authority**

*Atriplex argentea* Nutt.

*Atriplex canescens* (Pursh) Nutt.

*Atriplex confertifolia* (Torr. & Frem.) Wats.

*Atriplex corrugata* Wats.

*Atriplex gardneri* (Moq.) Dietr. var. *cuneata* A. Nels.

*Atriplex heterosperma* Bunge

*Atriplex patula* L.

*Atriplex rosea* L.

*Bassia hyssopifolium* (Pall.) Kuntze

*Ceratoides lanata* (Pursh) J. T. Howell

*Chenopodium album* L.

*Chenopodium atrovirens* Rydb.

*Chenopodium glaucum* L.

*Grayia spinosa* (Hook.) Moq. In DC.

*Halogeton glomeratus* (Bieb.) C. A. Mey. in Ledeb.

*Kochia americana* Wats.

*Kochia scoparia* (L.) Schrad.

*Monolepis nuttalliana* (Schult.) Greene

*Salicornia europaea* L.

*Salsola iberica* Sennen & Pau (S. *kali* L.)

*Sarcobatus vermiculatus* (Hook.) Torr.

*Suaeda torreyana* Wats.

**Common Name**

Silverscale

Four-wing saltbush

Shadscale

Mat saltbush

Gardner's saltbush

Orache

Spearscale

Red orache

Fivehook bassia

Winterfat

Lambsquarters

Goosefoot

Oakleaf goosefoot

Spiny hopsage

Halogeton

Green molly

Kochia

Nuttall povertyweed

Marshfire glasswort

Russian-thistle

Black greasewood

Bush seepweed

**Reference**

1,2,4

1,2,3,4

1,2,3,4

1,2,4

1,2,3,4

1,2

1,4

1,4

1,2,3,4

1,2,3,4

1,4

1,4

1,3

1,2,4

1,4

1,3,4

1,4

1,3

1,4

1,2,3,4

1,2,3,4

1,4

### CONVOLVULACEAE

**Common:** Morning-glory Family

**Genus - Species - Authority**

*Convolvulus arvensis* L.

**Common Name**

Field bindweed

**Reference**

1,2,3,4

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*Cuscuta sp.* Dodder 1,2,3

### CYPERACEAE

**Common:** Sedge Family

**Genus - Species - Authority**

*Carex sp.*  
*Cyperus aristatus* Rottb.  
*Eleocharis acicularis* (L.) R. & S.  
*Eleocharis palustris* (L.) R. & S.  
*Eleocharis parvula* (R. & S.) Link  
*Schoenoplectus acutus* Muhl.  
*Schoenoplectus maritimus* L.  
*Schoenoplectus pungens* Vahl.  
*Schoenoplectus saximontanus* Fernald  
*Schoenoplectus surpinus* L.  
*Schoenoplectus validus* Vahl.

<b>Common Name</b>	<b>Reference</b>
Sedge	1,4
Awned flatsedge	1,2,3
Needle spikerush	1,2,3,4
Common spikerush	1,2,3,4
Dwarf spikerush	1,2
Hardstem bulrush	1,2,4
Alkali bulrush	1,2,3,4
Common threesquare	1,4
Bulrush	2,3
Bulrush	1
Softstem bulrush	1,4

### ELAEAGNACEAE

**Common:** Oleaster Family

**Genus - Species - Authority**

*Elaeagnus angustifolia* L.  
*Shepherdia argentea* (Pursh) Nutt.

<b>Common Name</b>	<b>Reference</b>
Russian-olive	1,2,4
Silver buffaloberry	1,2,3,4

### EPHEDRACEAE:

**Common:** Ephedra Family

**Genus - Species - Authority**

*Ephedra torreyana* S. Wats.

<b>Common Name</b>	<b>Reference</b>
Torrey Mormon-tea	1,2,3,4

### EQUISETACEAE

**Common:** Horsetail Family

**Genus - Species - Authority**

*Equisetum arvense* L.  
*Equisetum laevigatum* A. Br. (*E. kansanum* Schaffn.)

<b>Common Name</b>	<b>Reference</b>
Field horsetail	1,4
Smooth scouring-rush	1,2,3,4

### EUPHORBIACEAE

**Common:** Spurge Family

**Genus - Species - Authority**

*Euphorbia albomarginata* T. & G.  
*Euphorbia fendleri* T. & G.  
*Euphorbia glyptosperma* Engelm. in Torr.

<b>Common Name</b>	<b>Reference</b>
Snow-on-the-mountain	1,2,3
Fendler spurge	1,2
Ridgeseed spurge	1,4

### FABACEAE

**Common:** Pea Family

**Genus - Species - Authority**

*Astragalus chamaeleuce* Gray in Ives (*A. amphioxys* Gray)  
*Astragalus convallarius* Greene  
*Astragalus duchesnensis* Jones  
*Astragalus flavus* Nutt. in T. & G.  
*Astragalus geyeri* Gray  
*Astragalus hamiltonii* C. L. Porter  
*Astragalus mollissimus* Torr.  
*Astragalus spatulatus* Sheld.  
*Glycyrrhiza lepidota* Pursh  
*Lupinus pusillus* Pursh  
*Medicago lupulina* L.  
*Medicago sativa* L.  
*Melilotus alba* Medicus  
*Melilotus officinalis* (L.) Pallas  
*Oxytropis sp.*  
*Sophora stenophylla* Gray in Ives  
*Sphaerophysa salsula* (Pallas) DC.

<b>Common Name</b>	<b>Reference</b>
Cicada milkvetch	1,2,3
Lesser rushy milkvetch	1,2
Duchesne milkvetch	1,2
Yellow milkvetch	1,2
Geyer milkvetch	1,2
Hamilton milkvetch	1,2
Woolly milkvetch	1,2
Draba milkvetch	1,2
Wild licorice	1,2,3,4
Dwarf lupine	1,2,3
Black medic	1,4
Alfalfa	1,4
White sweetclover	1,4
Yellow sweetclover	1,2,3,4
Locoweed	1,4
Silvery sophora	1,2,4
Salt globepea	1,4

### GENTIANACEAE

**Common:** Gentian Family

**Genus - Species - Authority**

*Centaurium exaltatum* (Griseb.) Wight.

<b>Common Name</b>	<b>Reference</b>
Exalted centaury	1,2

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<b>HYDROPHYLLACEAE</b>	<b>Common:</b> Waterleaf Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Nama densum</i> Lemmon		Nama	1,2
<i>Phacelia crenulata</i> Torr. in Wats. ( <i>P. corrugata</i> A. Nels.)		Scorpionweed	1,2,3
<i>Phacelia ivesiana</i> Torr. in Ives		Scorpionweed	1,2
<b>JUNCACEAE</b>	<b>Common:</b> Rush Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Juncus alpinus</i> Vill.		Alpine rush	1,2
<i>Juncus arcticus</i> Willd.		Baltic rush	1,2,4
<i>Juncus bufonius</i> L.		Toad rush	1,2
<i>Juncus torreyi</i> Cov.		Torrey rush	1,2
<b>LAMIACEAE</b>	<b>Common:</b> Mint Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Mentha arvensis</i> L.		Field mint	1,4
<i>Stachys palustris</i> L. var. <i>pilosa</i> (Nutt.) Fernald		Marsh hedge nettle	1,2,3
<b>LEMNACEAE</b>	<b>Common:</b> Duckweed Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Lemna miniscula</i> Herter		Duckweed	1,4
<b>LILIACEAE</b>	<b>Common:</b> Lily Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Allium geeyeri</i> Wats.		Geyer onion	1,2
<i>Allium textile</i> Nels. & Macbr.		Textile onion	1,2
<i>Asparagus officinalis</i> L.		Asparagus	1,2,3,4
<i>Calochortus nuttallii</i> T. & G. in Beckwith		Sego lily	1,2,3
<i>Smilacina stellata</i> (L.) Desf.		False (Starry) Solomon's seal	1,2,3,4
<b>LOASACEAE</b>	<b>Common:</b> Loasa Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Mentzelia albicaulis</i> Dougl. In Hook.		Whitestem mentzelia	1,2
<i>Mentzelia dispersa</i> Wats.		Brushy mentzelia	1,2,3
<i>Mentzelia pterosperma</i> Eastw.		Wingseed mentzelia	1,2
<b>LYTHRACEAE</b>	<b>Common:</b> Loosestrife Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>robusta</i> Heer & Regel		Purple ammannia	1,2,3,4 <i>Ammannia</i>
<b>MALVACEAE</b>	<b>Common:</b> Cotton Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Malvella leprosa</i> (Ortega) Krapov.		Alkali-mallow	1,2,4
<i>Sphaeralcea coccinea</i> (Nutt.) Rydb.		Scarlet globemallow	1,2,3
<i>Sphaeralcea parvifolia</i> A. Nels.		Nelson globemallow	1,2,3,4
<b>NYCTAGINACEAE</b>	<b>Common:</b> Four-o'clock Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Abronia elliptica</i> A. Nels.		Sandverbena	1,2,3
<i>Mirabilis linearis</i> (Pursh) Heimerl.		Narrowleaf umbrellawort	1,2,3,4
<i>Tripterocalyx micranthus</i> (Torr.) Hook.		Sandverbena	1,2
<b>ONAGRACEAE:</b>	<b>Common:</b> Evening Primrose Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Camissonia scapoidea</i> (T. & G.) Raven		Barestem camissonia	1,2
<i>Epilobium ciliatum</i> Raf.		Common willowherb	1,4
<i>Gaura parviflora</i> Dougl. In Hook.		Small-flowered gaura	1,2,3,4
<i>Oenothera biennis</i> L.		Common evening-primrose	1,4
<i>Oenothera caespitosa</i> Nutt.		Tufted evening-primrose	1,2
<i>Oenothera elata</i> H. B. K..		Evening-primrose	1,2
<i>Oenothera pallida</i> Lindl.		Pale evening-primrose	1,2,3



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<b>OROBANCHACEAE</b>	<b>Common:</b> Broomrape Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Orobanche ludoviciana</i> Nutt.		Louisiana broomrape	1,4
<b>PLANTAGINACEAE</b>	<b>Common:</b> Plantain Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Plantago asiatica</i>		Plantain	2,3
<i>Plantago major</i> L.		Common plantain	1,2,4
<i>Plantago patagonica</i> Jacq. ( <i>P. purshii</i> R. & S.)		Woolly plantain	1,2,3,4
<b>POACEAE</b>	<b>Common:</b> Grass Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Agropyron cristatum</i> (L.) Gaertn.		Crested wheatgrass	1,2,4
<i>Agropyron smithii</i> Rydbg. ( <i>Pascopyrum smithii</i> (Rydbg.) Love)		Western wheatgrass	1,2,3,4
<i>Agrostis stolonifera</i> L.		Creeping bentgrass	1,2,4
<i>Aristida purpurea</i> Nutt.		Purple threeawn	1,2,3,4
<i>Beckmannia syzigachne</i> (Steud.) Fern.		American sloughgrass	1,2,3,4
<i>Bouteloua gracilis</i> (H. B. K.) Lag.		Blue grama	1,4
<i>Bromus inermis</i> Leyss.		Smooth brome	1,4
<i>Bromus tectorum</i> L.		Cheatgrass	1,2,3,4
<i>Crypsis schoenoides</i> (L.) Lam.		Annual timothy	4
<i>Distichlis spicata</i> (L.) Greene		Saltgrass	1,2,3,4
<i>Echinochloa crus-galli</i> (L.) Beauv.		Barnyard grass	1,2,3,4
<i>Elymus canadensis</i> L.		Canada wildrye	1,2,4
<i>Elymus simplex</i> (Scribn. & Williams) D. R. Dewey		Low creeping wildrye	1,2,3
<i>Elymus trachycaulus</i> (Link) Gould ex. Shinners		Slender wheatgrass	1,2,3
<i>Festuca octoflora</i> Walter		Six-weeks fescue	1,2,3,4
<i>Hesperostipa comata</i> Trin. & Rupr.		Needle-and-thread	1,2,3,4
<i>Pleuraphis jamesii</i> (Torr.) Benth.		Galleta	1,2,3,4
<i>Hordeum jubatum</i> L.		Foxtail barley	1,2,3,4
<i>Leptochloa fascicularis</i> (Lam.) Gray		Sprangletop	1,4
<i>Muhlenbergia asperifolia</i> (Nes & Mey.) Parodi		Alkali muhly	1,2,3,4
<i>Muhlenbergia pungens</i> Thurb. in Gray		Sandhill muhly	1,4
<i>Achnatherum hymenoides</i> (R. & S.) Ricker		Indian ricegrass	1,2,3,4
<i>Panicum capillare</i> L.		Witchgrass	1,2,3,4
<i>Phalaris arundinacea</i> L.		Reed Canary grass	1,4
<i>Phragmites australis</i> (Cav.) Trin.		Common reed	1,2,4
<i>Poa annua</i> L.		Annual bluegrass	1,4
<i>Poa secunda</i> Presl.		Sandberg bluegrass	1,2,3
<i>Polypogon monspeliensis</i> (L.) Desf.		Rabbit-foot grass	1,2,3,4
<i>Sitanion hystrix</i> (Nutt.) J. G. Smith ( <i>Elymus elymoides</i> (Raf.) Swezey)		Squirreltail	1,2,3,4
<i>Sporobolus airoides</i> (Torr.) Torr.		Alkali sacaton	1,2,3,4
<i>Sporobolus cryptandrus</i> (Torr.) Gray		Sand dropseed	1,2,4
<b>POLEMONIACEAE</b>	<b>Common:</b> Phlox Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Gilia congesta</i> Hook.		Ballhead gilia	1,2
<i>Gilia leptomeria</i> Gray		Gilia	1,2
<i>Gilia polycladon</i> Torr. in Emory		Gilia	1,2
<i>Gilia pumila</i> Nutt.		Dwarf gilia	1,2,3
<i>Leptodactylon pungens</i> (Torr.) Nutt.		Common prickly phlox	1,2,3,4
<i>Phlox hoodii</i> Rich.		Hood phlox	1,2,3,4
<i>Phlox longifolia</i> Nutt.		Longleaf phlox	1,2
<b>POLYGONACEAE</b>	<b>Common:</b> Buckwheat Family		
<b>Genus - Species - Authority</b>		<b>Common Name</b>	<b>Reference</b>
<i>Eriogonum batemanii</i> Jones		Wild buckwheat	1,2
<i>Eriogonum cernuum</i> Nutt.		Nodding wild buckwheat	1,2
<i>Eriogonum corymbosum</i> Benth. in DC.		Big wild buckwheat	1,2
<i>Eriogonum flexum</i> Jones		Wild buckwheat	1,2
<i>Eriogonum gordonii</i> Benth. in DC.		Gordon wild buckwheat	1,2

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<i>Eriogonum hookeri</i> Wats.	Hooker wild buckwheat	1,2
<i>Eriogonum inflatum</i> Torr. & Frem. in Frem.	Desert trumpet	1,2,3,4
<i>Eriogonum microthecum</i> Nutt.	Slenderbush eriogonum	1,2,4
<i>Eriogonum salsuginosum</i> (Nutt.) Hook.	Wild buckwheat	1,2
<i>Eriogonum schockleyi</i> Wats.	Schockley's buckwheat	1,2,3,4
<i>Eriogonum viridulum</i> Reveal	Green eriogonum	1,2
<i>Polygonum amphibium</i> L.	Water smartweed	1,2,3,4
<i>Polygonum aviculare</i> L.	Prostrate knotweed	1,2,3,4
<i>Polygonum lapathifolium</i> L.	Pale smartweed	1,2,3,4
<i>Polygonum ramosissimum</i> Michx.	Bushy knotweed	1,4
<i>Rumex crispus</i> L.	Curly dock	1,2,3,4
<i>Rumex hymenosepalus</i> Torr.	Canaigre	1,2,3
<i>Rumex maritimus</i> L.	Golden dock	1,2,3,4
<i>Rumex obtusifolius</i> L.	Bitter dock	1,2
<i>Rumex occidentalis</i> Wats.	Western dock	1,2
<i>Rumex stenophyllus</i> Ledeb.	Dock	1,4
<b>POTAMOGETONACEAE</b>	<b>Common:</b> Pondweed Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Potamogeton natans</i> L.	Floatingleaf pondweed	1,4
<i>Potamogeton nodosus</i> Poir.	Longleaf pondweed	1,2,3
<i>Potamogeton pectinatus</i> L.	Sago pondweed	1,2,3,4
<b>RANUNCULACEAE</b>	<b>Common:</b> Buttercup Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Clematis ligusticifolia</i> Nutt. in T. & G.	Western virgin's bower	1,2,4
<i>Delphinium nuttallianum</i> Pritz. ex Walp.	Nuttall larkspur	1,2
<i>Ranunculus aquatilis</i> L.	Hairleaf water buttercup	1,2
<i>Ranunculus cymbalaria</i> Pursh	Shore buttercup	1,2,3,4
<i>Thalictrum</i> sp.	Meadowrue	1,2,3
<b>ROSACEAE</b>	<b>Common:</b> Rose Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Amelanchier alnifolia</i> Nutt.	Saskatoon serviceberry	1,4
<i>Potentilla biennis</i> Greene	Biennial cinquefoil	1,2,3
<i>Potentilla rivalis</i> Nutt.	River cinquefoil	1,2
<i>Rosa woodsii</i> Lindl.	Woods' rose	1,2,3,4
<b>SALICACEAE</b>	<b>Common:</b> Willow Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Populus fremontii</i> Wats.	Fremont cottonwood	1,2,3,4
<i>Salix amygdaloides</i> Andress.	Peachleaf willow	1,2,3,4
<i>Salix exigua</i> Nutt.	Coyote or Sandbar willow	1,2,3,4
<i>Salix lasiandra</i> Benth.	Whiplash willow	1,2
<i>Salix lutea</i> Nutt.	Yellow willow	1,4
<b>SCROPHULARIACEAE</b>	<b>Common:</b> Figwort Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Castilleja chromosa</i> A. Nels.	Desert paintbrush	1,2,3
<i>Castilleja exilis</i> A. Nels.	Marsh paintbrush	1,2,4
<i>Gratiola neglecta</i> Torr.	Hedge hyssop	1,2,3
<i>Limosella aquatica</i> L.	Mudwort	1,2
<i>Veronica anagallis-aquatica</i> L.	Water speedwell	1,2
<i>Verbascum thapsis</i>	Mullein	
<b>SOLANACEAE</b>	<b>Common:</b> Potato Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Solanum nigrum</i> L.	Black nightshade	1,2
<b>TAMARICACEAE</b>	<b>Common:</b> Tamarisk Family	
<b>Genus - Species - Authority</b>	<b>Common Name</b>	<b>Reference</b>
<i>Tamarix ramosissima</i> Ledeb.	Tamarisk or Saltcedar	1,2,3,4

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### TYPHACEAE

**Common:** Cattail Family

**Genus - Species - Authority**

*Typha domingensis* Pers. (*T. angustifolia* L.)

*Typha latifolia* L.

**Common Name**

Narrow-leaved cattail

Broad-leaved cattail

**Reference**

1,4

1,2,3,4

### ULMACEAE

**Common:** Elm Family

**Genus - Species - Authority**

*Ulmus pumila* L.

**Common Name**

Siberian elm

**Reference**

1,4

### VERBENACEAE

**Common:** Verbena Family

**Genus - Species - Authority**

*Phyla cuneifolia* (Torr.) Greene

*Verbena bracteata* Lag. & Rodr.

**Common Name**

Fogfruit

Prostrate verbena

**Reference**

1,2,3,4

1,2,3,4

*References: (1) Uinta Basin Flora, 1986; (2) ONWR CCP, 2000; (3) ONWR Species List, 1963; (4) USBR-ONWR Veg. Study, 2000*