

APPENDIX E: VEGETATION COMMUNITY DESCRIPTIONS OF OURAY NWR

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

Table of Contents

I. FOREST.....	97
I.B.2.N.A. LOWLAND OR SUBMONTANE COLD-DECISUOUS FOREST.....	97
I.B.2.N.a.400. ELAEANGUS ANGUSTIFOLIA SEMI-NATURAL WOODLAND ALLIANCE.....	97
Elaeagnus angustifolia Semi-natural Woodland.....	97
I.B.2.N.D. TEMPORARILY FLOODED COLD-DECISUOUS FOREST.....	100
I.B.2.N.d.38. POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE.....	100
II. WOODLAND.....	103
II.B.2.N.B. TEMPORARILY FLOODED COLD-DECISUOUS WOODLAND.....	103
II.B.2.N.b.12. POPULUS FREMONTII TEMPORARILY FLOODED WOODLAND ALLIANCE.....	103
II.B.2.N.b.13. SALIX AMYGDALOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE.....	106
Salix amygdaloides / Salix exigua Woodland.....	106
III. SHRUBLAND.....	109
III.A.4.N.A. LOWLAND MICROPHYLLOUS EVERGREEN SHRUBLAND.....	109
III.A.4.N.a.17. ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE.....	109
Artemisia tridentata Shrubland.....	109
III.A.4.N.C. TEMPORARILY FLOODED MICROPHYLLOUS SHRUBLAND.....	112
III.A.4.N.c.1. TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED FOREST ALLIANCE.....	112
Tamarix spp. Temporarily Flooded Shrubland.....	112
III.A.5.N.B. FACULTATIVELY DECIDUOUS EXTREMELY XEROMORPHIC SUBDESERT SHRUBLAND.....	115
III.A.5.N.b.6. ATRIPLEX CANESCENS SHRUBLAND ALLIANCE.....	115
Atriplex canescens / Pleuraphis jamesii Shrubland.....	115
III.A.4.N.b.7. ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE.....	118
Atriplex confertifolia / Pleuraphis jamesii Shrubland.....	118
III.B.2.N.C. INTERMITTENTLY FLOODED COLD-DECIDUOUS SHRUBLAND.....	121
III.B.2.N.c.7. RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE.....	121
Rhus trilobata – Salix exigua Shrubland.....	121
III.B.2.N.D. TEMPORARILY FLOODED COLD-DECIDUOUS SHRUBLAND.....	124
III.B.2.N.d.6. SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE.....	124
Salix exigua / Barren Shrubland.....	124
III.B.3.N.B. INTERMITTENTLY FLOODED EXTREMELY XEROMORPHIC DECIDUOUS SUBDESERT SHRUBLAND.....	127
III.B.3.N.b.3. SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE.....	127
Sarcobatus vermiculatus / Atriplex gardneri Shrubland.....	127
Sarcobatus vermiculatus / Distichlis spicata Shrubland.....	130
IV. DWARF-SHRUBLAND.....	133
IV.A.2.N.A. EXTREMELY XEROMORPHIC EVERGREEN SUBDESERT DWARF-SHRUBLAND.....	133
IV.A.2.N.a.9. ARTEMISIA NOVA DWARF-SHRUBLAND ALLIANCE.....	133
Artemisia nova Dwarf-shrubland.....	133
IV.A.2.N.a.8. KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE.....	136
Krascheninnikovia lanata / Pleuraphis jamesii Dwarf-shrubland.....	136
IV.A.2.N.B. FACULTATIVELY DECIDUOUS EXTREMELY SUBDESERT DWARF-SHRUBLAND.....	139
IV.A.2.N.b.2. ATRIPLEX CORRUGATA DWARF-SHRUBLAND ALLIANCE.....	139
Atriplex corrugata Dwarf-shrubland.....	139
IV.A.2.N.b.3. ATRIPLEX GARDNERI DWARF-SHRUBLAND ALLIANCE.....	142
Atriplex gardneri Dwarf-shrubland.....	142
IV.B.2.N.A. CAESPITOSE COLD-DECIDUOUS DWARF-SHRUBLAND.....	145
IV.B.2.N.a.200. GUTIERREZIA SAROTHRAE DWARF-SHRUBLAND ALLIANCE.....	145
Gutierrezia sarothrae – (Opuntia spp.) / Pleuraphis jamesii Dwarf-shrubland.....	145

V. HERBACEOUS VEGETATION.....	148
V.A.5.N.C. MEDIUM-TALL SOD TEMPERATE OR SUBPOLAR GRASSLAND	148
V.A.5.N.c.27. PASCOPYRUM SMITHII HERBACEOUS ALLIANCE	148
Pascopyrum smithii Herbaceous Vegetation.....	148
V.A.5.N.D. MEDIUM-TALL BUNCH TEMPERATE OR SUBPOLAR GRASSLAND.....	151
V.A.5.N.d.27. HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE	151
Hesperostipa comata Great Basin Herbaceous Vegetation	151
V.A.5.N.d.19. ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE	154
V.A.5.N.d.24. SPOROBOLUS CRYPTANDRUS HERBACEOUS ALLIANCE	158
Sporobolus airoides Southern Plains Herbaceous Vegetation.....	158
V.A.5.N.d.9. SPOROBOLUS CRYPTANDRUS HERBACEOUS ALLIANCE	161
Sporobolus cryptandrus Great Basin Herbaceous Vegetation.....	161
V.A.5.N.E. SHORT SOD TEMPERATE OR SUBPOLAR GRASSLAND.....	164
V.A.5.N.e.14. PLEURAPHIS JAMESII HERBACEOUS ALLIANCE	164
Pleuraphis jamesii Herbaceous Vegetation.....	164
V.A.5.N.I. INTERMITTENTLY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND	167
V.A.5.N.i.5. DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE	167
Distichlis spicata Herbaceous Vegetation.....	167
V.A.5.N.J. TEMPORARILY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND.....	171
V.A.5.N.j.22. HORDEUM JUBATUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE	171
Hordeum jubatum Herbaceous Vegetation	171
V.A.5.N.K. SEASONALLY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND.....	174
V.A.5.N.k.61. ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE.....	174
Eleocharis palustris Herbaceous Vegetation	174
V.A.5.N.k.13. JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE	177
Juncus balticus Herbaceous Vegetation	177
V.A.5.N.k.20. PHALARIS ARUNDINACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE.....	180
Phalaris arundinacea Western Herbaceous Vegetation	180
V.A.5.N.k.31. TYPHA DOMINGENSIS SEASONALLY FLOODED TEMPERATE HERBACEOUS ALLIANCE	183
Typha domingensis Western Herbaceous Vegetation.....	183
V.A.5.N.L. SEMIPERMANENTLY FLOODED TEMPERATE OR SUBPOLAR GRASSLAND	186
V.A.5.N.l.4. PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE	186
Phragmites australis Western North America Temperate Semi-natural Herbaceous Vegetation.....	186
V.A.5.N.l.16. SCHOENOPECTUS ACUTUS – (SCHOENOPECTUS TABERNAEMONTANI SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE	189
Schoenoplectus acutus Herbaceous Vegetation	189
V.A.5.N.l.16. SCHOENOPECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE	192
Schoenoplectus pungens Herbaceous Vegetation	192
V.A.5.N.l.9. TYPHA (ANGUSTIFOLIA, LATIFOLIA) – (SCHOENOPECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE	195
Typha latifolia Herbaceous Vegetation.....	195
V.C.2.N.A. PERMANENTLY FLOODED TEMPERATE OR SUBPOLAR HYDROMORPHIC ROOTED VEGETATION	198
V.C.2.N.a.22. POLYGONUM AMPHIBIUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE	198
Polygonum amphibium Permanently Flooded Herbaceous Alliance.....	198
V.D.2.N.D. SHORT TEMPERATE ANNUAL GRASSLAND	201
V.D.2.N.d.2. BROMUS TECTORUM SEMI-NATURAL HERBACEOUS ALLIANCE.....	201
Bromus tectorum Semi-natural Herbaceous Alliance.....	201
xx. HEIRARCHY PLACEMENT UNDETERMINED.....	204
VII.C.XX. ERICAMERIA NAUSEOSA SAND DEPOSIT SPARSE VEGETATION [PROVISIONAL].....	204
REFERENCES.....	206

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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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

Species
Elaeagnus angustifolia, *Tamarix ramosissima*

Ouray National Wildlife Refuge Vegetation Mapping Project

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 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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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

Ouray National Wildlife Refuge Vegetation Mapping Project

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge
Stratum **Species**
N/A

Global
Stratum **Species**
TALL SHRUB *Elaeagnus angustifolia*
TALL SHRUB *Tamarix* spp.
FORB *Melilotus officinalis*

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*.

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

StratumSpecies

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>
HERBACOUES	<i>Distichlis spicata</i> , <i>Hordeum jubatum</i> , <i>Iva axillaris</i> , <i>Lepidium latifolium</i>

Global

Stratum

Species

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 SUB-CANOPY	<i>Elaeagnus angustifolia</i>
TALL SHRUB	<i>Tamarix</i> spp.
GRAMINOID	<i>Cynodon dactylon</i>
FORB	<i>Melilotus officinalis</i>

GLOBAL SIMILAR ASSOCIATIONS: N/A

SYNONYMY: N/A

Ouray National Wildlife Refuge Vegetation Mapping Project

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 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*

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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 MICROPHYLOUS 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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

StratumSpecies

SHRUB

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

HERBACEOUS

Elymus elymoides

Global

Stratum

SHORT SHRUB

Species

Artemisia tridentata

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

N/A

Species

Global

Stratum

N/A

Species

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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*

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum

SHRUB

Tamarix ramosissima, *Populus fremontii*, *Salix exigua*

HERBACEOUS

Distichlis spicata, *Sporobolus airoides*, *Polypogon monspeliensis*, *Iva axillaris*, *Lepidium latifolium*

Global

Stratum

TALL SHRUB

Species

Tamarix 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

N/A

Species

Global

Stratum

N/A

Species

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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*

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

Dynamics: Ecological processes vary with landscape type.

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum	Species
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

Stratum	Species
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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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: CEGL001288 **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

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

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

HERBACEOUS

Species

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

Pleuraphis jamesii, *Bromus tectorum*

Ouray National Wildlife Refuge Vegetation Mapping Project

Global

Stratum	Species
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

Stratum Species

N/A

Global

Stratum Species

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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: CEGL001304 **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

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, 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

Ouray National Wildlife Refuge Vegetation Mapping Project

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*, *Coryza 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

Stratum	Species
TALL SHRUB	<i>Rhus trilobata</i>
HERBACEOUS	<i>Lepidium latifolium</i> , <i>Iva axillaris</i> , <i>Hordeum jubatum</i>

Global

Stratum	Species
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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
TALL SHRUB	<i>Salix exigua</i> , <i>Populus fremontii</i> , <i>Salix amygdaloides</i> , <i>Tamarix ramosissima</i>

Global

Stratum	Species
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

Stratum	Species
HERBACEOUS	<i>Lepidium latifolium</i>

Global

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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: CEG001200 **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

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*, *Machaeranthera canescens*, and *Allium textile*.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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 of a special attribute code.

Ouray National Wildlife Refuge Vegetation Mapping Project

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 stands. *Juncus balticus* and *Leymus cinereus* are also present in some stands. The forb

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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

Species
Sarcobatus vermiculatus, *Ericameria nauseosa*, *Distichlis spicata*, *Gutierrezia sarothrae*, *Hordeum jubatum*, *Bromus tectorum*, *Lepidium latifolium*

Global

Species
Distichlis spicata, *Sarcobatus vermiculatus*

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge

Stratum **Species**
N/A

Ouray National Wildlife Refuge Vegetation Mapping Project

Global Stratum	Species
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

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 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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
DWARF SHRUB	<i>Artemisia nova</i> , <i>Atriplex confertifolia</i> , <i>Eriogonum schockleyi</i>
HERBACEOUS	<i>Hesperostipa comata</i>

Global

Stratum	Species
DWARF SHRUB	<i>Artemisia nova</i>

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge

Species
Artemisia nova, *Atriplex confertifolia*, *Hesperostipa comata*

Global

Species
Artemisia nova

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge

Stratum	Species
N/A	

Global

Stratum	Species
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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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

IV.A.2.N.a.8. KRASCHEINNIKOVIA 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

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, convectional 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*.

Dynamics: N/A

Ouray National Wildlife Refuge Vegetation Mapping Project

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum	Species
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

Stratum	Species
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 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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 *Haloptylon 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* (= *Suaeda depressa*), and *Krascheninnikovia lanata*. The herbaceous layer is very sparse.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
DWARF SHRUB	<i>Atriplex corrugata</i> , <i>Atriplex gardneri</i>
HERBACEOUS	<i>Atriplex argentea</i> , <i>Elymus elymoides</i>

Global

Stratum	Species
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.

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

Atriplex corrugata (Ibrahim et al. 1972) referred to Branson 1966.

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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* – *Distichlis 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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 the herbaceous layer of some disturbed stands.

Ouray National Wildlife Refuge Vegetation Mapping Project

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	Species
DWARF SHRUB	<i>Gutierrezia sarothrae</i> , <i>Atriplex confertifolia</i> , <i>Opuntia polyacantha</i> , <i>Eriogonum microthecum</i>
HERBACEOUS	<i>Pleuraphis jamesii</i> , <i>Aristida purpurea</i> , <i>Salsola kali</i>

Global

Stratum	Species
DWARF SHRUB	<i>Gutierrezia sarothrae</i>
GRAMINOID	<i>Pleuraphis jamesii</i>

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 **Species**
N/A

Global

Stratum **Species**
N/A

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
SHRUB	<i>Tamarix ramosissima</i>
HERBACEOUS	<i>Pascopyrum smithii</i> , <i>Eleocharis palustris</i> , <i>Iva axillaris</i> , <i>Malvella leprosa</i>

Global

Stratum	Species
GRAMINOID	<i>Pascopyrum smithii</i>

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge

Species
Pascopyrum smithii, *Eleocharis palustris*, *Iva axillaris*

Global

Species
Pascopyrum smithii

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge

Stratum **Species**
N/A

Global

Stratum **Species**
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.

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 playalike 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

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 have high cover of cryptogams on the soil including *Collema*

Ouray National Wildlife Refuge Vegetation Mapping Project

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	Species
DWARF SHRUB	<i>Chrysothamnus viscidiflorus</i> , <i>Gutierrezia sarothrae</i> , <i>Opuntia polyacantha</i>
HERBACEOUS	<i>Hesperostipa comata</i> , <i>Pleuraphis jamesii</i> , <i>Achnatherum hymenoides</i> , <i>Sporobolus cryptandrus</i> , <i>Aristida purpurea</i>

Global

Stratum	Species
GRAMINOID	<i>Hesperostipa comata</i>

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	Species
N/A	

Global

Stratum	Species
N/A	

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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: CEGL001705 **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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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 shaly sites, *Pleuraphis jamesii*, *Hesperostipa comata*, *Pascopyrum smithii*, and *Eriogonum brevicaulum* 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 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

Ouray National Wildlife Refuge Vegetation Mapping Project

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).

Ouray National Wildlife Refuge Vegetation Mapping Project

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum	Species
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</i> <i>cristatum</i>

Global

Stratum	Species
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

Ouray National Wildlife Refuge Vegetation Mapping Project

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 *Symphotrichum 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 *Symphotrichum 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.

Ouray National Wildlife Refuge Vegetation Mapping Project

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum **Species**

SHRUB *Tamarix ramosissima, Elaeagnus angustifolia, Populus fremontii, Sarcobatus vermiculatus*

HERBACEOUS *Sporobolus airoides, Muhlenbergia asperifolia, Pascopyrum smithii, Distichlis spicata, Lepidium latifolium, Iva axillaris*

Global

Stratum **Species**

GRAMINOID *Sporobolus airoides*

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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 fenceline 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.

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
GRAMINOID	<i>Sporobolus cryptandrus</i> , <i>Helianthus annuus</i> , <i>Salsola kali</i>

Global

Stratum	Species
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

Stratum	Species
N/A	

Global

Stratum	Species
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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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 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*.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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: CEGL001777 **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.I. 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

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 very saline sites (Brotherson 1987). Minor cover of associated graminoids may include

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
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

Stratum	Species
GRAMINOID	<i>Distichlis spicata</i>

Ouray National Wildlife Refuge Vegetation Mapping Project

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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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**

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*.

Ouray National Wildlife Refuge Vegetation Mapping Project

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 Stratum Species

SHORT SHRUB
HERBACEOUS

Tamarix ramosissima
Eleocharis palustris, *Pascopyrum smithii*, *Iva axillaris*

Global Stratum Species

GRAMINOID

Eleocharis palustris

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge Species

Eleocharis palustris, *Pascopyrum smithii*, *Iva axillaris*

Global Species

Eleocharis palustris

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge Stratum Species

N/A

Global Stratum Species

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) =

Zone of Spikerush of the Vegetation surrounding San Luis Lakes (Ramaley 1942) =

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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*, *Glauca 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

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	Species
GRAMINOID	<i>Juncus balticus</i> , <i>Muhlenbergia asperifolia</i> , <i>Hordeum jubatum</i>

Global

Stratum	Species
GRAMINOID	<i>Carex nebrascensis</i> , <i>Carex praegracilis</i> , <i>Juncus balticus</i>

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	Species
N/A	

Global

Stratum	Species
N/A	

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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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

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
Stratum **Species**

GRAMINOID *Phalaris arundinacea, Scirpus acutus, Muhlenbergia asperifolia*

Global
Stratum **Species**

GRAMINOID *Phalaris arundinacea*

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge
Species

Phalaris arundinacea, Muhlenbergia asperifolia, Schoenoplectus acutus

Global
Species

Phalaris arundinacea

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge
Stratum **Species**

N/A

Global
Stratum **Species**

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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

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

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum	Species
HERBACEOUS	<i>Typha domingensis</i> , <i>Polygonum lapathifolium</i> , <i>Euthamia occidentalis</i> , <i>Eleocharis palustris</i> , <i>Schoenoplectus acutus</i>

Global

Stratum	Species
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

Stratum	Species
N/A	

Global

Stratum	Species
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 Vegetation Mapping Project

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

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

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

Stratum	Species
HERBACEOUS	<i>Phragmites australis</i> , <i>Typha latifolia</i> , <i>Schoenoplectus acutus</i> , <i>Lepidium latifolium</i>

Global

Stratum	Species
GRAMINOID	<i>Phragmites australis</i>

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge

Species
Phragmites australis, *Typha latifolia*, *Schoenoplectus acutus*, *Lepidium latifolium*

Global

Species
Phragmites australis

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge

Stratum	Species
N/A	

Global

Stratum	Species
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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

V.A.5.N.I.16. *SCHOENOPLECTUS ACUTUS* - (*SCHOENOPLECTUS TABERNAEMONTANI*) SEMIPERMANENTLY 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

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
Stratum **Species**
SHRUB *Tamarix ramosissima*
HERBACEOUS *Schoenoplectus acutus*

Global
Stratum **Species**
GRAMINOID *Schoenoplectus acutus*

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge
Species
Schoenoplectus acutus

Global
Species
Schoenoplectus acutus

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge
Stratum **Species**
N/A

Global
Stratum **Species**
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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum	Species
SHORT SHRUB	<i>Sarcobatus vermiculatus</i>
GRAMINOID	<i>Schoenoplectus pungens</i> , <i>Schoenoplectus acutus</i> , <i>Distichlis spicata</i> , <i>Juncus balticus</i>

Global

Stratum	Species
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 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*

Ouray National Wildlife Refuge Vegetation Mapping Project

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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).

Ouray National Wildlife Refuge Vegetation Mapping Project

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

Stratum Species

HERBACEOUS *Typha latifolia, Lepidium latifolium, Epilobium ciliatum, Lemna minor*

Global

Stratum Species

HERBACEOUS *Typha latifolia*

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

Stratum Species

N/A

Global

Stratum Species

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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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.

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
FORB	<i>Polygonum amphibium</i> , <i>Potamogeton natans</i>

Global

Stratum	Species
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)

Ouray National Wildlife Refuge Vegetation Mapping Project

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

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

Ouray National Wildlife Refuge Vegetation Mapping Project

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

Stratum	Species
HERBACEOUS	<i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>B. japonicus</i>

Global

Stratum	Species
GRAMINOID	<i>Bromus tectorum</i>

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge

Species
<i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>Salsola kali</i>

Global

Species
<i>Bromus tectorum</i>

OTHER NOTEWORTHY SPECIES

Ouray National Wildlife Refuge

Stratum	Species
N/A	

Global

Stratum	Species
N/A	

GLOBAL SIMILAR ASSOCIATIONS:

SYNONYMY:

Cheatgrass series (Sawyer and Keeler-Wolf 1995)

Ouray National Wildlife Refuge Vegetation Mapping Project

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: CEGL003019 **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 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 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 slope 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 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.

Ouray National Wildlife Refuge Vegetation Mapping Project

MOST ABUNDANT SPECIES

Ouray National Wildlife Refuge

<i>Stratum</i>	<i>Species</i>
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

<i>Stratum</i>	<i>Species</i>
SHRUB	<i>Ericameria nauseos</i> , <i>Atriplex canescens</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Ephedra torreyana</i> , <i>Gutierrezia sarothrae</i> , <i>Opuntia polykantha</i>
GRAMINOID	<i>Achnatherum hymenoides</i> , <i>Aristida purpurea</i> , <i>Hesperostipa comata</i> , <i>Sporobolus</i> <i>cryptandrus</i>
FORB	<i>Heterotheca villosa</i> , <i>Sophora stenophylla</i>

CHARACTERISTIC SPECIES

Ouray National Wildlife Refuge

<i>Stratum</i>	<i>Species</i>
SHRUB	<i>Ericameria nauseosa</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Achnatherum hymenoides</i> , <i>Sporobolus</i> <i>cryptandrus</i> , <i>Sophora stenophylla</i>

Global

<i>Stratum</i>	<i>Species</i>
SHRUB	<i>Ericameria nauseos</i> , <i>Chrysothamnus viscidiflorus</i>
GRAMINOID	<i>Achnatherum hymenoides</i> , <i>Hesperostipa comata</i> , <i>Sporobolus cryptandrus</i>

OTHER NOTEWORTHY SPECIES

Global

<i>Stratum</i>	<i>Species</i>
----------------	----------------

GLOBAL SIMILAR ASSOCIATIONS:

GLOBAL STATUS AND CLASSIFICATION COMMENTS

Global Conservation Status Rank: G?.

Global Comments: This association has only 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:** CEGL002980

REFERENCES: (n/a)

REFERENCES

- Aldous, A. E., and H. L. Shantz. 1924. Types of vegetation in the semiarid portion of the United States and their economic significance. *Journal of Agricultural Research* 28(2):99-128.
- Allard, D. J. 1990. Southeastern United States ecological community classification. Interim report, Version 1.2. The Nature Conservancy, Southeast Regional Office, Chapel Hill, NC. 96 pp.
- Annable, C. R. 1985. Vegetation and flora of the Funeral Mountains, Death Valley National Monument. California-Nevada Cooperative National Park Resources Studies Unit, National Park Service/University of Nevada Contribution 016/07. Las Vegas, NV. 188 pp.
- Bailey, R. 1997. Map: Ecoregions of North America (rev.). Washington, DC: USDA Forest Service in cooperation with The Nature Conservancy and the U.S. Geological Survey. 1:15,000,000.
- Bailey, R. 1998. Ecoregion map of North America: Explanatory note. Miscellaneous Publication Number 1548, USDA Forest Service. 10 pp.
- Baker, W. L. 1982a. Vegetation description in Colorado-where are the gaps? *Journal of the Colorado-Wyoming Academy of Science* 14(1):39. [Abstract]
- Baker, W. L. 1982b. Natural vegetation of the Piceance Basin, Colorado. Appendix D, pages 1-113 in: J. S. Peterson and W. L. Baker, editors. Inventory of the Piceance Basin, Colorado. Unpublished report for the Bureau Land Management, Craig, CO.
- Baker, W. L. 1983b. Some aspects of the presettlement vegetation of the Piceance Basin, Colorado. *Great Basin Naturalist* 43(4):687-699.
- Baker, W. L. 1983c. Natural vegetation of part of northwestern Moffat County, Colorado. Unpublished report prepared for the State of Colorado Natural Areas Program, Department of Natural Resources, Denver by Colorado Natural Heritage Inventory, Denver.
- Baker, W. L. 1984a. A preliminary classification of the natural vegetation of Colorado. *Great Basin Naturalist* 44(4):647-676.
- Baker, W. L., and S. C. Kennedy. 1985. Presettlement vegetation of part of northwestern Moffat County, Colorado, described from remnants. *Great Basin Naturalist* 45(4):747-777.
- Barnes, P. W., and L. L. Tieszen. 1978. A phytosociological study of 14 selected communities at the Samuel H. Ordway Prairie. Unpublished Paper. Undergraduate Research Project, Augustana College, Sioux Falls, SD.
- Barrows, J. S., E. W. Mogren, K. Rowdabaugh, and R. Yancik. 1977. The role of fire in ponderosa pine and mixed conifer ecosystems. Final report, Cooperative report between the National Park Service and Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 101 pp.
- Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1968c. Vegetation and soils of the Duckwater Watershed. Nevada Agricultural Experiment Station Bulletin R-40. Reno. 76 pp.
- BLM [Bureau of Land Management]. 1979a. Pages 2-6 to 2-15 in: Grand Junction Resource Area grazing management-draft environmental statement.
- BLM [Bureau of Land Management]. 1979b. Final environmental impact statement, proposed development of coal resources in Eastern Powder River, WY. 67 pp.
- Boles, P. H., and W. A. Dick-Peddie. 1983. Woody riparian vegetation patterns on a segment of the Mimbres River in southwestern New Mexico. *Southwestern Naturalist* 28:81-87.
- Bowers, J. E. 1982. The plant ecology of inland dunes in western North America. *Journal of Arid Environments* 5:199-220.
- Bowers, J. E. 1984. Plant geography of southwestern sand dunes. *Desert Plants* 6(1):31-42, 51-54.
- Branson, F. A. 1966. Geographic distribution and factors affecting the distribution of salt desert shrubs in the U.S. Pages 13-43 in *Proceedings from the Salt Desert Shrub Symposium, 1- 4 August 1966*. USDI Bureau of Land Management, Cedar City, Utah.
- Branson, F. A., and J. B. Owen. 1970. Plant cover, runoff, and sediment yield relationships on Mancos shale in western Colorado. *Water Resources Research* 6:783-790.

Ouray National Wildlife Refuge Vegetation Mapping Project

- Branson, F. A., R. F. Miller, and I. S. McQueen. 1967. Geographic distribution and factors affecting the distribution of salt desert shrubs in the United States. *Journal of Range Management* 29(5):287-296.
- Branson, F. A., R. F. Miller, and I. S. McQueen. 1976. Moisture relationships in twelve northern desert shrub communities near Grand Junction, Colorado. *Ecology* 57:1104-1124.
- Brotherson, J. D. 1987. Plant community zonation in response to soil gradients in a saline meadow near Utah Lake, Utah County, Utah. *Great Basin Naturalist* 47(2):322-333.
- Brotherson, J. D., and S. J. Barnes. 1984. Habitat relationships of *Glaux maritima* in central Utah. *Great Basin Naturalist* 44(2):299-309.
- Brown, D. E., editor. 1982. Biotic communities of the American Southwest-United States and Mexico. *Desert Plants Special Issue* 4(1-4):1-342.
- Bundy, R. M., J. V. Baumgartner, M. S. Reid, P. S. Bourgeron, H. C. Humphries, and B. L. Donohue. 1996. Ecological classification of wetland plant associations in the Lahontan Valley, Nevada. Prepared for Stillwater National Wildlife Refuge and USDI Fish & Wildlife Service. 53 pp. not including inventories, tables and graphs.
- Bunin, J. E. 1985. Vegetation of the City of Boulder, Colorado open space lands. Report prepared for the City of Boulder, Real Estate/Open Space, Boulder, CO. 114 pp.
- Burgess, T. L., and D. K. Northington. 1977. Desert vegetation of the Guadalupe Mountains region. Pages 229-243 in: R. H. Wauer and D. H. Riskind, editors. Transactions of the symposium on the biological resources of the Chihuahuan Desert region, United States and Mexico. USDI National Park Service. Transaction Proceedings Series No. 3. Washington, DC. Beatley, J. C. 1976. Vascular plants of the Nevada Test Site and central-southern Nevada: Ecological and geographic distributions. Technical Information Center, Energy Research and Development Administration. TID-26881. Prepared for Division of Biomedical and Environmental Research. 297 pp.
- Campbell, C. J., and W. A. Dick-Peddie. 1964. Comparison of phreatophyte communities on the Rio Grande in New Mexico. *Ecology* 45:492-501.
- Campbell, V. O. 1977. Certain edaphic and biotic factors affecting vegetation in the shadscale community of the Kaiparowitz area. Unpublished thesis. Brigham Young University, Provo, UT. 59 pp.
- Cannon, H. L. 1960. The development of botanical methods of prospecting for uranium on the Colorado Plateau. USDI Geological Survey Bulletin 1085-A. Washington, DC. 50 pp.
- Castle, E. S. 1954. The vegetation and its relationship to the dune soils of Kane County, Utah. Unpublished thesis. Brigham Young University, Provo, UT.
- Christensen, E. M., and S. L. Welsh. 1963. Presettlement vegetation of the valleys of western Summit and Wasatch counties, Utah. *Proceedings of the Utah Academy of Science, Arts and Letters* 40:163-174.
- Christy, J. A., and J. A. Putera. 1993. Lower Columbia River Natural Area Inventory, 1992. Oregon Natural Heritage Program, Portland. 75 pp.
- Christy, S. 1973. An analysis of the woody vegetation on the South Platte River flood plain in northeastern Colorado. Unpublished thesis. University of Northern Colorado, Greeley. 82 pp.
- Collins, E. I. 1984. Preliminary classification of Wyoming plant communities. Unpublished classification prepared for the Wyoming Natural Heritage Program, The Nature Conservancy, Laramie, WY.
- Cooper, S. V., P. Lesica, R. L. DeVelice, and T. McGarvey. 1995. Classification of southwestern Montana plant communities with emphasis on those of Dillon Resource Area, Bureau of Land Management. Montana Natural Heritage Program, Helena, MT. 154 pp.
- Costello, D. F. 1944b. Important species of the major forage types in Colorado and Wyoming. *Ecological Monographs* 14:107-134.
- Crawford, R. C. 2001. Initial riparian and wetland classification and characterization of the Columbia Basin in Washington. Prepared for: Environmental Protection Agency and Bureau of Land Management, Spokane District. Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia. 83 pp.
- Crouch, G. L. 1961a. Wildlife populations and habitat conditions on grazed and ungrazed bottomlands in Logan County, Colorado. Unpublished thesis. Colorado State University, Fort Collins.

Ouray National Wildlife Refuge Vegetation Mapping Project

- Crowe, E. A., and R. R. Clausnitzer. 1997. Mid-montane wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman national forests. USDA Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-22-97.
- Daniels, F. P. 1911. The flora of Boulder, Colorado and vicinity. University of Missouri Studies, Science Series II(2):8-48.
- Dastrup, B. C. 1963. Vegetational changes of the Uinta Basin since settlement. Unpublished thesis. Brigham Young University, Provo, UT. 118 pp.
- Daubenmire, R. 1975. Floristic plant geography of eastern Washington and northern Idaho. *Journal of Biogeography* 2:1-18.
- Daubenmire, R. F. 1970. Steppe vegetation of Washington. Washington State University Agricultural Experiment Station Technical Bulletin No. 62. 131 pp.
- Dethier, M. N. 1990. A marine and estuarine habitat classification system for Washington State. Washington Natural Heritage Program, Department of Natural Resources, Olympia, WA. 56 pp.
- DeVelice, R. L., and P. Lesica. 1993. Plant community classification for vegetation on BLM lands, Pryor Mountains, Carbon County, Montana. Unpublished report by Montana Natural Heritage Program, Helena, MT. 78 pp.
- DeVelice, R. L., J. Lichthardt, and P. S. Bourgeron. 1991. A preliminary classification of the plant communities of northeastern Montana. Prepared for the Montana Natural Heritage Program. Helena, MT. 144 pp.
- DeVelice, R. L., S. V. Cooper, J. T. McGarvey, J. Lichthardt, and P. S. Bourgeron. 1995. Plant communities of northeastern Montana: A first approximation. Montana Natural Heritage Program, Helena, MT. 116 pp.
- Diamond, D. D. 1993. Classification of the plant communities of Texas (series level). Unpublished document. Texas Natural Heritage Program, Austin. 25 pp.
- Diamond, D., B. Amos, T. Cook, R. Edwards, W. Elliot, R. Evans, and K. Kennedy. 1992. Endangered, threatened, and watchlist of natural communities of Texas. Texas Organization for Endangered Species. Austin, TX. 14 pp.
- Dick-Peddie, W. A. 1993. New Mexico vegetation: Past, present, and future. University of New Mexico Press, Albuquerque. 244 pp.
- Dodd, J. D., and R. T. Coupland. 1966. Vegetation of saline areas in Saskatchewan. *Ecology* 47(6):958-968.
- Dorn, R. D. 1997. Rocky Mountain region willow identification field guide. Renewable Resources R2-RR-97-01. USDA Forest Service, Rocky Mountain Region, Denver, CO. 107 pp.
- Ellis, S. L., T. Shoemaker, and R. Sanz. 1979. Inventories of plants, birds, mammals, reptiles, and amphibians of the Unaweep Canyon Springs, Mesa County, Colorado. Unpublished report prepared for Colorado Natural Areas Program, Department of Natural Resources, Denver.
- Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
- Evans, S. 1989a. Riparian survey of Washington's Columbia Basin. Unpublished report prepared for The Nature Conservancy Washington Natural Heritage Program, Olympia, Washington.
- Faber-Langendoen, D., editor. 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA 61 pp.+ appendix (705 pp.).
- FEIS [Fire Effects Information System]. 1998. USDA Forest Service. URL <http://www.fs.fed.us/database/feis/>.
- Flowers, S. 1962. Vegetation of Morrow Point and Blue Mesa Reservoir basins of the upper Gunnison River, Colorado. Pages 47-102 in: A. M. Woodbury, editor. *Ecological studies of the flora and fauna of the Curecanti Reservoir Basins, western Colorado*. University of Utah, Anthropological Papers No. 59 (Upper Colo. Series No. 8).
- Francis, R. E. 1986. Phyto-edaphic communities of the Upper Rio Puerco Watershed, New Mexico. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-272. Fort Collins, CO. 73 pp.
- Francis, R. E., and E. F. Aldon. 1983. Preliminary habitat types of a semiarid grassland. Pages 62-66 in: W. H. Moir and L. Hendzel, technical coordinators. *Proceedings of the workshop on southwestern habitat types*, 6-8 April 1983, Albuquerque, NM. USDA Forest Service, Southwestern Region, Albuquerque, NM.
- Franklin, J. F., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA Forest Service, Pacific

Ouray National Wildlife Refuge Vegetation Mapping Project

- Northwest Forest and Range Experiment Station. General Technical Report PNW-8. Portland, OR. 417 pp.
- Gates, D. H., L. A. Stoddart, and C. W. Cook. 1956. Soil as a factor influencing plant distribution on salt-deserts of Utah. *Ecological Monographs* 26(2):155-175.
- Gleason, H. A., and A. Cronquist. 1991. *Manual of vascular plants of northeastern United States and adjacent Canada*. New York Botanical Garden, Bronx, NY. 910 pp.
- Godfread, C. 1994. The vegetation of the Little Missouri Badlands of North Dakota. Pages 17-24 in: *Proceedings of the Leafy Spurge Strategic Planning Workshop, March 29-30, Dickinson, ND*.
- Graham, E. H. 1937. Botanical studies in the Uinta Basin of Utah and Colorado. *Annals of the Carnegie Museum* 26:28-432.
- Great Plains Flora Association. 1986. *Flora of the Great Plains*. University Press of Kansas, Lawrence. 1402 pp.
- Haase, E. F. 1972. Survey of floodplain vegetation along the lower Gila River in southwestern Arizona. *Journal of the Arizona Academy of Science* 7:75-81.
- Hall, J. B., and P. L. Hansen. 1997. A preliminary riparian habitat type classification system for the Bureau of Land Management districts in southern and eastern Idaho. Riparian and Wetland Research Program, School of Forestry, University of Montana. Idaho Bureau of Land Management, Technical Bulletin No. 97-11. 381 pp.
- Hamner, R. W. 1964. An ecological study of *Sarcobatus vermiculatus* communities of the Big Horn Basin, Wyoming. Unpublished thesis. University of Wyoming, Laramie.
- Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Miscellaneous Publication No. 54. 646 pp.
- Hansen, P. L., S. W. Chadde, and R. D. Pfister. 1988b. Riparian dominance types of Montana. University of Montana Miscellaneous Publication 49. Montana Forest and Conservation Experiment Station, Missoula. 411 pp.
- Hansen, P., K. Boggs, and R. Pfister. 1991. Classification and management of riparian and wetland sites in Montana. Unpublished draft version prepared for Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula. 478 pp.
- Harper, K. T., and R. A. Jaynes. 1986. Some edaphic and compositional characteristics of *Artemisia tridentata* and associated plant communities in southeastern Utah. Pages 265-272 in: E. D. McArthur and B. L. Welch, compilers. *Proceedings-Symposium on the Biology of Artemisia and Chrysothamnus, 9-13 July, Provo, UT*. USDA Forest Service, General Technical Report INT-200. Intermountain Research Station, Ogden, UT.
- Heinze, D. H., R. E. Eckert, and P. T. Tueller. 1962. The vegetation and soils of the Steptoe Watershed. Unpublished report prepared for the USDI Bureau of Land Management. 40 pp.
- Helm, D. J. 1981. Vegetation diversity indexes in several vegetation types of western Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 113 pp.
- Henry, R. J. 1981. Riparian vegetation of two mountain ranges in southwestern New Mexico. Unpublished thesis. New Mexico State University, Las Cruces.
- Hess, K. 1981. Phyto-edaphic study of habitat types of the Arapaho-Roosevelt National Forest, Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 558 pp.
- Hickman, J. C. 1993. *The Jepson Manual: Higher plants of California*. University of California Press, Ltd., Berkeley, CA. 1400 pp.
- Hinschberger, M. S. 1978. Occurrence and relative abundance of small mammals associated with riparian and upland habitats along the Columbia River. Unpublished thesis. Oregon State University, Corvallis. 78 pp.
- Hoagland, B. W. 1997. Preliminary plant community classification for Oklahoma. Unpublished draft document, version 35629. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 47 pp.
- Holland, R. F. 1986b. Preliminary descriptions of the terrestrial natural communities of California. Unpublished report prepared for the California Department of Fish and Game, Nongame-Heritage Program and Natural Diversity Database, Sacramento. 156 pp.
- Hyder, D. N., R. E. Bement, E. E. Remmenga, and C. Terwilliger, Jr. 1966. Vegetation-soils and vegetation-grazing

Ouray National Wildlife Refuge Vegetation Mapping Project

- relations from frequency data. *Journal of Range Management* 19:11-17.
- Ibrahim, K. M. , N. E. West, and D. L. Goodwin. 1972. Phytosociological characteristics of perennial *Atriplex*-dominated vegetation of southeastern Utah. *Vegetatio* 24:13-22.
- Jankovsky-Jones, M. 2000. Unpublished Community Characterization Abstract (Global) for *Rhus trilobata* Shrubland Community, 00-01-20. Idaho Conservation Data Center, Boise.
- Johnson, K. R. 1932. Ecology of a glacial lake in central Colorado. Unpublished thesis. University of Colorado, Boulder. 30 pp.
- Johnson, K. R. 1932a. Plant ecology of a glacial lake. *Journal of the Colorado-Wyoming Academy of Science* 1(4):13. [Abstract]
- Johnson, K. R. 1936. Ecology of a glacial lake in central Colorado. *University of Colorado Studies* 23(3):235-243.
- Johnson, K. R. 1939. Plant ecology of northwestern Colorado lakes and surrounding areas. Unpublished dissertation. University of Colorado, Boulder. 138 pp.
- Johnson, K. R. 1941. Vegetation of some mountain lakes and shores in northwestern Colorado. *Ecology* 22:306-316.
- Johnston, B. C. 1987. Plant associations of Region Two: Potential plant communities of Wyoming, South Dakota, Nebraska, Colorado, and Kansas. R2-ECOL-87-2. USDA Forest Service, Rocky Mountain Region. Lakewood, CO. 429 pp.
- Jones, G. P., and G. M. Walford. 1995. Major riparian vegetation types of eastern Wyoming. Submitted to Wyoming Department of Environmental Quality, Water Quality Division. Wyoming Natural Diversity Database, Laramie, WY. 245 pp.
- Karl, M. G., R. K. Heitschmidt, and M. R. Haferkamp. 1999. Vegetation biomass dynamics and patterns of sexual reproduction in a northern mixed-grass prairie. *The American Midland Naturalist* 141:227-237.
- Kartesz, J. T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Second edition. Volume 1--Checklist. Timber Press, Portland, OR. 622 pp.
- Keeler-Wolf, T. 2000. Draft descriptions of vegetation alliance for the Mojave Mapping project. California Natural Diversity Database. California Department of Fish and Game.
- Kettler, S., and A. McMullen. 1996. Routt National Forest riparian vegetation classification. Report prepared for Routt National Forest by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.
- Kittel, G. M., and N. D. Lederer. 1993. A preliminary classification of the riparian vegetation of the Yampa and San Miguel/Dolores river basins. Unpublished report prepared for Colorado Department of Health and the Environmental Protection Agency by The Nature Conservancy, Colorado Field Office, Boulder.
- Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, and J. Sanderson. 1999. A classification of the riparian plant associations of the Rio Grande and Closed Basin watersheds, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.
- Kittel, G., R. Rondeau, and A. McMullen. 1996. A classification of the riparian vegetation of the Lower South Platte and parts of the Upper Arkansas River basins, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Prepared by Colorado Natural Heritage Program, Fort Collins. 243 pp.
- Kittel, G., R. Rondeau, and S. Kettler. 1995. A classification of the riparian vegetation of the Gunnison River Basin, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Prepared by Colorado Natural Heritage Program, Fort Collins. 114 pp.
- Kittel, G., R. Rondeau, N. Lederer, and D. Randolph. 1994. A classification of the riparian vegetation of the White and Colorado River basins, Colorado. Final report submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Colorado Natural Heritage Program, Boulder. 166 pp.
- Kleiner, E. F. 1968. Comparative study of grasslands of Canyonlands National Park. Unpublished dissertation. University of Utah, Salt Lake City. 58 pp.
- Kleiner, E. F. 1983. Successional trends in an ungrazed, arid grassland over a decade. *Journal of Range Management* 36(1):114-118.

Ouray National Wildlife Refuge Vegetation Mapping Project

- Kleiner, E. F., and K. T. Harper. 1972. Environment and community organization in grasslands of Canyonlands National Park. *Ecology* 53(2):299-309.
- Kleiner, E. F., and K. T. Harper. 1977. Occurrence of four major perennial grasses in relation to edaphic factors in a pristine community. *Journal of Range Management* 30(4):286-289.
- Klippel, G. E., and D. F. Costello. 1960. Vegetation and cattle responses to different intensities of grazing on short-grass ranges of the central Great Plains. USDA Forest Service Technical Bulletin 1216. 82 pp.
- Komarkova, V. 1986. Habitat types on selected parts of the Gunnison and Uncompahgre national forests. Unpublished final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 270 pp. plus appendices.
- Kovalchik, B. L. 1987. Riparian zone associations - Deschutes, Ochoco, Fremont, and Winema national forests. USDA Forest Service Technical Paper 279-87. Pacific Northwest Region, Portland, OR. 171 pp.
- Kovalchik, B. L. 1993. Riparian plant associations on the national forests of eastern Washington - Draft version 1. USDA Forest Service, Colville National Forest, Colville, WA. 203 pp.
- Kunze, L. M. 1994. Preliminary classification of native, low elevation, freshwater wetland vegetation in western Washington. Washington State Department of Natural Resources, Natural Heritage Program. 120 pp.
- Larson, G. E. 1993. Aquatic and wetland vascular plants of the northern Great Plains. USDA Forest Service General Technical Report RM-238. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 681 pp.
- Lauver, C. L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. *The Southwestern Naturalist* 44:421-443.
- Leary, K. D., and P. M. Peterson. 1984. Soil analyses in relation to vegetation in the Cottonwood Mountains, Death Valley National Monument. University of Nevada Cooperative National Park Resources Studies Unit Report 036/01, Las Vegas.
- Lindauer, I. E. 1970. The vegetation of the flood plain of the Arkansas River in southeastern Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 92 pp.
- Lindauer, I. E. 1978. A comparison of the vegetative communities of the South Platte and Arkansas River drainages in eastern Colorado. Pages 56-72 in: W. D. Graul and S. J. Bissel, editors. *Lowland River and Stream Habitat in Colorado: A Symposium*, 4-5 October 1978. Colorado Chapter of Wildlife Society and Audubon Council.
- Lindauer, I. E., and S. J. Christy. 1972. An analysis of the woody vegetation on the South Platte River floodplain in northeastern Colorado. Unpublished report to the U.S. Bureau of Reclamation, Denver, CO, by the University of Northern Colorado, Biology Department, Greeley.
- Lusby, G. C., G. T. Turner, J. R. Thompson, and V. H. Reid. 1963. Hydrologic and biotic characteristics of grazed and ungrazed watersheds of the Badger Wash Basin in western Colorado, 1953-1958. U.S. Geological Survey Water-Supply Paper 1532-B.
- Manning, M. 1988. Ecology and rooting characteristics of four intermountain meadow community types. Unpublished thesis. University of Nevada, Reno.
- Marr, J. W., and D. L. Buckner. 1974. Colorado to Wyoming pipeline corridor study. Unpublished report for Colony Development Operation, Atlantic Richfield Co., Denver by Thorne Ecological Institute, Boulder, CO. 79 pp.
- Marr, J. W., D. M. Armstrong, H. Chronic, J. Chronic, R. W. Pennak, W. A. Weber, R. E. Marr, D. Steward, and J. C. Meyer. 1980. Natural landmarks of the southern Rocky Mountain region. Unpublished report prepared for USDI Heritage Conservation and Recreation Service, Denver, CO, by Thorne Ecological Institute, Boulder, CO. 736 pp.
- Martin, W., R. Fletcher, and P. Knight. 1981. An analysis of the flora of the Canadian River Canyon-Mills Canyon section. Unpublished report prepared for the USDA Forest Service, Range Management Division. 79 pp.
- Masek, J. 1979. Vegetation community descriptions for the South Platte River in Colorado and Nebraska. Unpublished report prepared for the Water and Power Resources Service, Denver, CO. 23 pp.
- McEachern, K. 1979. Population biology of *Populus sargentii* in northeastern Colorado. Unpublished thesis. University of Northern Colorado, Greeley. 41 pp.
- Metcalf, O. B. 1902. Flora of Mesilla Valley. Unpublished thesis. New Mexico State University, Las Cruces. 22 pp.

Ouray National Wildlife Refuge Vegetation Mapping Project

- Miller, D. A., D. A. Mouat, and B. D. Treadwell. 1977. Remote sensing analysis and literature survey pertaining to the vegetation of the Petrified Forest National Park. Report of work performed under NASA and the National Park Service. 48 pp.
- Milton, N. M., and T. L. Purdy. 1983. Plant and soil relationships in two hydrothermally altered areas of the Great Basin. *Great Basin Naturalist* 43(3):457-469.
- Mitchell, J. E., N. E. West, and R. W. Miller. 1966. Soil physical properties in relation to plant community patterns in the shadscale zone of northwestern Utah. *Ecology* 47(4):627-630.
- Montana Natural Heritage Program. 1988. Draft guide to the natural vegetation of Montana. Montana Natural Heritage Program, Helena. 389 pp.
- Montana Natural Heritage Program. No date. Unpublished data on file. Helena, MT.
- Mueggler, W. F., and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service, General Technical Report INT-66. Intermountain Forest and Range Experiment Station. Ogden, UT. 154 pp.
- Muldavin, E. 1987. Gila Riparian Preserve Design. Unpublished report prepared for The Nature Conservancy, New Mexico Field Office by New Mexico Natural Heritage Program, Albuquerque.
- Muldavin, E., R. Wallace, and P. Mehlhop. 1993a. Riparian ecological site inventory for New Mexico Bureau Land Management lands. Final Report COOP Agreement F91070-0003, USDI Bureau of Land Management, New Mexico State Office, Santa Fe. Marr, J. W., D. Buckner, and C. Mutel. 1973a. Ecological analyses of potential shale oil products pipeline corridors in Colorado and Utah. Unpublished report prepared for Colony Development Operation, Atlantic Richfield Company, Denver, by Thorne Ecological Institute and University of Colorado, Boulder. 96 pp. plus appendices. Medicine Bow Mine Application. No date. Application No. 331-T1, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.
- Muldavin, E., B. Sims, and L. Johnson. 1993b. Pecos wild and scenic river in stream flow report. Final Report prepared for the USDA National Forest Service, Santa Fe National Forest, Santa Fe, NM.
- Muldavin, E., P. Durkin, M. Bradley, M. Stuever, and P. Mehlhop. 2000a. Handbook of wetland vegetation communities of New Mexico: Classification and community descriptions (volume 1). Final report to the New Mexico Environment Department and the Environmental Protection Agency prepared by the New Mexico Natural Heritage Program, University of New Mexico, Albuquerque, NM.
- Mutel, C. F. 1973. An ecological study of the plant communities of certain montane meadows in the Front Range of Colorado. Unpublished thesis. University of Colorado, Boulder. 77 pp.
- Mutel, C., and J. W. Marr. 1973. A vegetative study of three montane herbaceous basins. *Journal of the Colorado-Wyoming Academy of Science* 7(4):28. (Abstract)
- Mutz, K. M., and R. Graham. 1982. Riparian community type classification-Big Piney Range District, Wyoming. Unpublished report prepared for USDA Forest Service, Intermountain Region under contract 53-84M8-1-974, by Meiji Resource Consultants, Layton, UT. 88 pp.
- Nachlinger, J. L., and G. A. Reese. 1996. Plant community classification of the Spring Mountains National Recreation Area, Clark and Nye counties, Nevada. Unpublished report submitted to USDA Forest Service, Humboldt-Toiyabe National Forest, Spring Mountains National Recreation Area, Las Vegas, NV. The Nature Conservancy, Northern Nevada Office, Reno, NV. 85 pp. plus figures and appendices.
- Neher, R. E., and O. F. Bailey. 1976. Soil survey of White Sands Missile Range, New Mexico, parts of Dona Ana, Lincoln, Otero, Sierra, and Socorro counties. USDA Soil Conservation Service in cooperation with U.S. Army and New Mexico Agriculture Experiment Station.
- New Mexico Natural Heritage Program. No date. Unpublished data on file. Albuquerque, NM.
- Nichol, A. A. 1937. The natural vegetation of Arizona. University of Arizona Agricultural Experiment Station Technical Bulletin 68:177-222.
- Olson, R. A., and W. A. Gerhart. 1982. A physical and biological characterization of riparian habitat and its importance to wildlife in Wyoming. Unpublished report prepared for Wyoming Fish and Game Department, Cheyenne, WY. 188 pp.
- Osborn, L. W. 1974. Soil-plant relationships in a saltgrass meadow. Unpublished thesis. Colorado State University,

Ouray National Wildlife Refuge Vegetation Mapping Project

- Fort Collins. 41 pp.
- Padgett, W. G. 1982. Ecology of riparian plant communities in southern Malheur National Forest. Unpublished thesis. Oregon State University, Corvallis. 143 pp.
- Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1988b. Riparian community type classification of Utah. USDA Forest Service, Intermountain Region Publication R4-ECOL-88-01. Ogden, UT.
- Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. USDA Forest Service, Intermountain Region. Report R4-ECOL-89-01. Ogden, UT. 191 pp.
- Pammel, L. H. 1924. Ecological notes in the Arapahoe Mountains near Fraser, Colorado. Proceedings of the Iowa Academy of Science 31:133. (Abstract)
- Paysen, T. E., J. A. Derby, H. Blake, Jr., V. C. Bleich, and J. W. Mincks. 1980. A vegetation classification system applied to southern California. USDA Forest Service General Technical Report PSW-45. USDA Forest Service, Pacific Southwest Research Station, Berkeley, CA.
- Peterson, P. M. 1984. Flora and physiognomy of the Cottonwood Mountains, Death Valley National Monument, California. University of Nevada Cooperative National Park Resources Studies Unit Report CPSU/UNLV 022/06. Las Vegas, NV.
- Potter, L. D., R. C. Reynolds, and E. T. Louderbough. 1985. Mancos shale and plant community relationships: Analysis of shale, soil, and vegetation transects. *Journal of Arid Environments* 9:147-165.
- Ralston, G. L. 1969. Plant zonation on dune sands of Washoe Lake, Washoe County, Nevada. Unpublished thesis. University of Nevada, Reno.
- Ramaley, F. 1916b. Dry grassland of a high mountain park in northern Colorado. *The Plant World* 19(4):249-270.
- Ramaley, F. 1919a. The role of sedges in some Colorado plant communities. *American Journal of Botany* 6:120-130.
- Ramaley, F. 1919b. Some mountain plant communities of sandy soil. *The Plant World* 22(11):313-329.
- Ramaley, F. 1930. Zonation at the San Luis Lakes, near Alamosa, Colorado. *Journal of the Colorado-Wyoming Academy of Science* 1(2):19-20. (Abstract)
- Ramaley, F. 1937. Sand-hill vegetation in northwest-central Colorado. *Journal of the Colorado-Wyoming Academy of Science* 2(2):32-33.
- Ramaley, F. 1939b. Sand-hill vegetation of northeastern Colorado. *Ecological Monographs* 9:1-51.
- Ramaley, F. 1942. Vegetation of the San Luis Valley in southern Colorado. *University of Colorado Studies, Series D*, 1:231-277.
- Rector, C. D. 1979. Lower Gunnison River Basin wetland inventory and evaluation. Unpublished thesis. University of Colorado, Boulder. 71 pp.
- Redmann, R. E. 1972. Plant communities and soils of an eastern North Dakota prairie. *Bulletin of the Torrey Botanical Club* 99(2):65-76.
- Reid, M. S., L. S. Engelking, and P. S. Bourgeron. 1994. Rare plants communities of the conterminous United States, Western Region. Pages 305-620 in: D. H. Grossman, K. L. Goodin, and C. L. Reuss, editors. *Rare plant communities of the conterminous United States, a initial survey*. The Nature Conservancy, Arlington, VA.
- Reid, W. H. 1974. Analysis of plant ecological systems through simulation of individual organisms. Unpublished dissertation. University of Colorado, Boulder. 265 pp.
- Reid, W. H. 1980. Vegetative structure, physical environment and disturbance in White Sands National Monument, New Mexico. Pages 71-85 in: *Proceedings of the Second Conference on Scientific Research in the National Parks, Volume 9. Human Impact on Natural Resources*.
- Richard, C., G. Kittel, and S. Kettler. 1996. A classification of the riparian vegetation of the San Juan National Forest. Draft 1 report. Colorado Natural Heritage Program, Colorado State University, Fort Collins.
- Rogers, C. M. 1953. The vegetation of the Mesa de Maya region of Colorado, New Mexico, and Oklahoma. *Lloydia* 16(4):257-290.
- Romme, W. H., K. D. Heil, J. M. Porter, and R. Fleming. 1993. Plant communities of Capitol Reef National Park,

Ouray National Wildlife Refuge Vegetation Mapping Project

- Utah. USDI National Park Service, Technical Report NPS/NAUCARE/NRTER-93/02. Cooperative Park Studies Unit, Northern Arizona University. 37 pp.
- Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento. 471 pp.
- Shanks, D. L. 1977. Aerial photo densitometry for rangeland planning and evaluation. Unpublished thesis. Colorado State University, Fort Collins. 66 pp.
- Shantz, H. L. 1925. Plant communities in Utah and Nevada. Pages 15-23 in: I. Tidestrom. Flora of Utah and Nevada. Contributions of the U.S. National Herbarium 25, Washington, DC.
- Shupe, J. B., J. D. Brotherson, and S. R. Rushforth. 1986. Patterns of vegetation surrounding springs in Goshen Bay, Utah County, Utah, U.S.A. *Hydrobiologia* 139:97-107.
- Shute, D., and N. E. West. 1977. The application of ECOSYM vegetation classifications to rangelands near Price, Utah. Appendix reports 14 and 16 in: J. A. Henderson, L. S. Davis, and E. M. Ryberg, editors. ECOSYM: A classification and information system for wildland resource management. Utah State University, Logan. 53 pp.
- Singh, T., and N. E. West. 1971. Comparison of some multivariate analyses of perennial *Atriplex* vegetation in southeastern Utah. *Vegetatio* 23(5-6):289-313.
- Smith, T. L. 1989. An overview of old-growth forests in Pennsylvania. *Natural Areas Journal* 9:40-44.
- Soil Conservation Service. 1978. Range site descriptions for Colorado. Technical Guide, Section II-E. USDA Soil Conservation Service, Colorado State Office, Denver.
- Stearns-Roger, Inc. 1978. Rawhide Energy Project. Transmission system, ecological investigations. Volume II. Technical baseline report to Platte River Power Authority. 51 pp.
- Steinauer, G., and S. Rolfsmeier. 2000. Terrestrial natural communities of Nebraska. Unpublished report of the Nebraska Game and Parks Commission. Lincoln, NE. 143 pp.
- Steward, L. H. 1982. Desert grassland communities on Otero Mesa, Otero County, New Mexico. Unpublished thesis. New Mexico State University, Las Cruces.
- Stewart, B. K. 1940. Plant ecology and paleoecology of the Creede Valley, Colorado. Unpublished dissertation. University of Colorado, Boulder. 154 pp.
- Stewart, G., W. P. Cottam, and S. S. Hutchings. 1940. Influence of unrestricted grazing on northern salt desert plant associations in western Utah. *Journal of Agricultural Research* 60(5):289-317.
- Stromberg, J. 1995b. *Populus fremontii* - *Salix goodingii* Riparian Forest. Element Stewardship Abstract prepared for The Nature Conservancy, AZ. 30 pp.
- Stromberg, J. C. 1993a. Fremont cottonwood-Goodding willow riparian forests: A review of their ecology, threats, and recovery potential. *Journal of the Arizona-Nevada Academy of Science* 27(1):97-110.
- Stromberg, J. C., D. T. Patten, and B. D. Richter. 1991. Flood flows and dynamics of Sonoran riparian forests. *Rivers* 2(3):221-235.
- Strong, L. L. 1980. Estimating phytomass production of habitat types on sagebrush steppe. Unpublished thesis. Colorado State University, Fort Collins. 133 pp.
- Stubbendieck, J., S. L. Hatch, and C. H. Butterfield. 1992. North American range plants, 4th ed. University of Nebraska Press, Lincoln. 493 pp.
- Sweetwater Uranium Project. 1978. Application No. 481, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.
- Szaro, R. C. 1989. Riparian forest and scrubland community types of Arizona and New Mexico. *Desert Plants Special Issue* 9(3-4):70-139.
- Terwilliger, C., Jr., and J. A. Tiedemann. 1978. Habitat types of the mule deer critical winter range and adjacent steppe region of Middle Park, Colorado. Unpublished report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 108 pp.
- Thilenius, J. F., G. R. Brown, and A. L. Medina. 1995. Vegetation on semi-arid rangelands, Cheyenne River Basin, Wyoming. USDA Forest Service. General Technical Report RM-GTR-263. Rocky Mountain Forest and Range

Ouray National Wildlife Refuge Vegetation Mapping Project

- Experiment Station, Fort Collins, CO. 60 pp.
- Thompson, J. 2001. Draft vegetation associations of Zion National Park, Utah. Prepared for Association for Biodiversity Information, Boulder.
- Tiedemann, J. A., R. E. Francis, C. Terwilliger, Jr., and L. H. Carpenter. 1987. Shrub-steppe habitat types of Middle Park, Colorado. USDA Forest Service Research Paper RM-273. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 20 pp.
- Titus, J. H., J. A. Christy, D. Vander Schaaf, J. S. Kagan, and E. R. Alverson. 1996. Native wetland, riparian, and upland plant communities and their biota in the Willamette Valley, Oregon. Report to the Environmental Protection Agency, Region X, Seattle, WA. Willamette Basin Geographic Initiative. Oregon Natural Heritage Program, The Nature Conservancy, Portland, OR.
- TNC [The Nature Conservancy]. 1992. Element stewardship abstract for Florida scrub. The Nature Conservancy, Florida Region, Winter Park, FL. 15 pp.
- Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. *Ecological Monographs* 12(3):257-292.
- Tuhy, J. S., and J. A. MacMahon. 1988. Vegetation and relict communities of Glen Canyon National Recreation Area. Unpublished final report prepared for USDI National Park Service, Rocky Mountain Region, Lakewood, CO. Utah State University, Logan. 299 pp.
- Tuhy, J. S., and S. Jensen. 1982. Riparian classification for the Upper Salmon and Middle Fork Salmon River drainages, Idaho. Unpublished report prepared for the USDA Forest Service, Intermountain Region by White Horse Associates, Smithfield, UT. 183 pp.
- U.S. Bureau of Reclamation. 1976. Flora and terrestrial vertebrate studies of the Grand Valley, Colorado. Pages 56-85 and 283-354 in: Final report to the U.S. Bureau of Reclamation by Ecology Consultants, Inc., Fort Collins, CO.
- Ungar, I. A. 1967. Vegetation-soil relationships on saline soils in northern Kansas. *The American Midland Naturalist* 78(1):98-121.
- Ungar, I. A. 1968. Species-soil relationships on the Great Salt Plains of northern Oklahoma. *The American Midland Naturalist* 80(2):392-407.
- Ungar, I. A. 1970. Species-soil relationships on sulfate dominated soils of South Dakota. *The American Midland Naturalist* 83(2):343-357.
- Ungar, I. A., W. Hogan, and M. McClelland. 1969. Plant communities of saline soils at Lincoln, Nebraska. *The American Midland Naturalist* 82(2):564-577.
- USFS [U.S. Forest Service]. 1937. Range plant handbook. Dover Publications Inc., New York. 816 pp.
- Utah Environmental and Agricultural Consultants. 1973. Pages 2-38 in: Environmental setting, impact, mitigation and recommendations for a proposed oil products pipeline between Lisbon Valley, Utah and Parachute Creek, Colorado. Unpublished report for Colony Development Operation, Atlantic Richfield Company, Denver, CO.
- Van Pelt, N. S. 1978. Woodland parks in southeastern Utah. Unpublished thesis. University of Utah, Salt Lake City.
- Vestal, A. G. 1914. Prairie vegetation of a mountain-front area in Colorado. *Botanical Gazette* 58(5):377-400.
- Von Loh, J. 2000. Draft local descriptions of the vegetation associations of Ouray National Wildlife Refuge. USGS Bureau of Reclamation, Remote Sensing and GIS Group, Denver Federal Center, Denver.
- Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Badlands National Park, South Dakota. USDI Bureau of Reclamation. Technical Memorandum No. 8260-99-02. Denver, CO.
- Walford, G. M. 1996. Statewide classification of riparian and wetland dominance types and plant communities - Bighorn Basin segment. Report submitted to the Wyoming Department of Environmental Quality, Land Quality Division by the Wyoming Natural Diversity Database. 185 pp.
- Wasser, C. H., and K. Hess. 1982. The habitat types of Region II. USDA Forest Service: A synthesis. Final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 140 pp.

Ouray National Wildlife Refuge Vegetation Mapping Project

- Watson, J. R. 1912. Plant geography of north central New Mexico: Contributions from the Hull Botanical Laboratory. *Botanical Gazette* 54:194-217.
- Weaver, J. E., and F. W. Albertson. 1956. *Grasslands of the Great Plains: Their nature and use*. Johnsen Publishing Co., Lincoln, NE. 395 pp.
- Webb, G. M., and J. D. Brotherson. 1988. Elevational changes in woody vegetation along three streams in Washington County, Utah. *Great Basin Naturalist* 48:512-529.
- Welsh, S. L. 1957. An ecological survey of the vegetation of the Dinosaur National Monument, Utah. Unpublished thesis. Brigham Young University, Provo, UT. 86 pp.
- West, N. E., and K. I. Ibrahim. 1968. Soil-vegetation relationships in the shadscale zone of southeastern Utah. *Ecology* 49(3):445-456.
- West, N. E., R. T. Moore, K. A. Valentine, L. W. Law, P. R. Ogden, F. C. Pinkney, P. T. Tueller, and A. A. Beetle. 1972. *Galleta: Taxonomy, ecology and management of *Pleuraphis jamesii* on western rangelands*. Utah Agricultural Experiment Station. Bulletin 487. Logan, UT. 38 pp.
- Young, J. A. and R. A. Evans. 1973. Downy brome-intruder in the plant succession of big sagebrush communities in the Great Basin. *Journal of Range Management* 26:410-415.
- Young, J. A. and R.A. Evans. 1978. Population dynamics after wildfires in sagebrush grasslands. *Journal of Range Management* 31:283-289.
- Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985a. Riparian community type classification of eastern Idaho-western Wyoming. USDA Forest Service, Intermountain Region. R4-Ecol-85-01. Ogden, UT. 78 pp.