
***Cedar City Field Office Resource Management
Plan/Environmental Impact Statement:
Analysis of the Management Situation***

Appendix B

Vegetative Communities

APPENDIX B. VEGETATIVE COMMUNITIES

Sparsely Vegetated/Barren Classes

Colorado Plateau Mixed Bedrock Canyon and Tableland: Comprised of barren and sparsely vegetated landscapes (generally less than 10 percent plant cover) of steep faces, narrow canyons, and open tablelands of predominantly sedimentary rocks such as sandstone, shale, and limestone. The vegetation is characterized by a very open tree canopy or scattered trees and shrubs with a sparse herbaceous layer. Common species includes pinyon pine (*Pinus edulis*), ponderosa pine (*Pinus ponderosa*), juniper (*Juniperus spp.*), littleleaf mountain mahogany (*Cercocarpus intricatus*), and other short-shrub and herbaceous species.

Inter-Mountain Basins Active and Stabilized Dune: Comprised of unvegetated to moderately vegetated (generally less than 10 plant cover, but up to 30 percent), active and stabilized dunes and sandsheets. Species occupying these environments are often adapted to the shifting, coarse-textured substrate and form patch or open grasslands, shrublands, or steppe composed of Indian ricegrass (*Achnatherum hymenoides*), sand sagebrush (*Artemisia filifolia*), Wyoming big sagebrush (*Artemisia tridentate*), fourwing saltbush (*Atriplex canescens*), Mormon tea (*Ephedra spp.*), blackbrush (*Coleogyne ramosissima*), rubber rabbitbrush (*Ericameria nauseosa*), chokecherry (*Prunus virginiana*), antelope bitterbrush (*Purshia tridentate*), alkali sacaton (*Sporobolus airoides*), or spineless horsebrush (*Tetradymia spp.*). This system is distinguished by its generally low vegetative cover and distinct eolian geomorphic features.

Inter-Mountain Basins Cliff and Canyon: Includes barren and sparsely vegetated landscapes (generally less than 10 percent plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Widely scattered trees and shrubs can include white fir (*Abies concolor*), pinyon pine (*Pinus edulis*), singleleaf pinyon (*Pinus monophylla*), juniper (*Juniperus spp.*), Wyoming big sagebrush (*Artemisia tridentate*), antelope bitterbrush (*Purshia tridentate*), currleaf mountain-mahogany (*Cercocarpus ledifolius*), Mormon tea (*Ephedra spp.*), ocean spray (*Holodiscus discolor*), and other species often common in adjacent plant communities.

Inter-Mountain Basins Volcanic Rock and Cinder Land: Limited to barren and sparsely vegetated volcanic substrates (generally less than 10 percent plant cover). Vegetation is variable and includes a variety of species, including ponderosa pine (*Pinus ponderosa*) or juniper (*Juniperus spp.*). Shrubs, including Mormon tea (*Ephedra spp.*), four wing saltbush (*Atriplex canescens*), buckwheat (*Eriogonum spp.*) and Apache plume (*Fallugia paradoxa*), are often present on some lava flows and cinder fields.

Rocky Mountain Cliff and Canyon: Comprised of barren and sparsely vegetated landscapes (generally less than 10 percent plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops. There can be small patches of dense vegetation, but it typically includes scattered trees and/or shrubs. Trees include Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), quaking aspen (*Populus tremuloides*), white fir (*Abies concolor*), subalpine fir (*Abies lasiocarpa*), pinyon pine (*Pinus edulis*), and Juniper (*Juniperus spp.*). At lower elevations, there can be scattered shrubs, including oceanspray (*Holodiscus*), currant (*Ribes*), Juniper (*Juniperus spp.*), fivepetal cliffbrush (*Jamesia Americana*), creeping barberry (*Mahonia repens*), skunkbush sumac (*Rhus trilobata*), and serviceberry (*Amelanchier alnifolia*).

Deciduous Forest Classes

Rocky Mountain Aspen Forest and Woodland: Elevations generally range from 5,000 to 10,000 feet, but there are occurrences at lower elevations in some regions. Distribution is limited by adequate soil moisture that is required to meet a high evapotranspiration demand, and can be limited by the length of the growing season or low temperatures. These are upland forests and woodlands dominated by quaking aspen (*Populus tremuloides*) without a significant conifer component (less than 25 percent relative tree cover). The herbaceous layer can be dense or sparse, and dominated by graminoids or forbs. Associated shrub species include snowberry (*Symphoricarpos* spp.) and serviceberry (*Amelanchier alnifolia*).

Evergreen Forest Classes

Colorado Plateau Pinyon-Juniper Woodlands: These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Soils supporting this system vary in texture from stony, cobbly, gravelly sandy loams to clay loam or clay. Pinyon pine (*Pinus edulis*) and/or Utah juniper (*Juniperus osteosperma*) dominate the tree canopy. Understory layers are variable and can be dominated by shrubs, graminoids, or be absent. Associated species include Wyoming big sagebrush (*Artemisia tridentata*), littleleaf mountain mahogany (*Cercocarpus intricatus*), alderleaf mountain mahogany (*Cercocarpus montanus*), blackbrush (*Coleogyne ramosissima*), cliffrose (*Purshia stansburiana*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), blue gramma (*Bouteloua gracilis*), galleta (*Pleuraphis jamesii*), and mutton grass (*Poa fendleriana*).

Great Basin Pinyon-Juniper Woodland: These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Woodlands are dominated by a mix of singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*), pure or nearly pure on mountainsides. Understory layers are variable. Associated species include shrubs such as greenleaf manzanita (*Arctostaphylos patula*), low sagebrush (*Artemisia arbuscula*), black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*Artemisia tridentata*), currleaf mountain-mahogany (*Cercocarpus ledifolius*), littleleaf mountain mahogany (*Cercocarpus intricatus*), blackbrush (*Coleogyne ramosissima*), Gambel oak (*Quercus gambelii*), oak (*Quercus turbinell*) and bunch grasses, including needle-and-thread (*Hesperostipa comata*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Great Basin wildrye (*Leymus cinereus*), and muttongrass (*Poa fendleriana*).

Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland: These open woodlands are typically found on high-elevation ridges and rocky slopes above the subalpine forests and woodlands. Areas are dominated by limber pine (*Pinus flexilis*) and/or bristlecone pine (*Pinus longaeva*). If present, shrub and herbaceous layers are generally sparse and composed of xeric shrubs, graminoids, and cushion plants. Associated species can include rosy pussytoes (*Antennaria rosea*), sandwort (*Arenaria kingii*), Wyoming big sagebrush (*Artemisia tridentata*), littleleaf mountain mahogany (*Cercocarpus intricatus*), fernbush (*Chamaebatiaria millefolium*), gray springparsley (*Cymopterus cinerarius*), bottlebrush squirreltail (*Elymus elymoides*), dwarf daisy (*Erigeron pygmaeus*), buckwheat (*Eriogonum* spp.), alpine fescue (*Festuca brachyphylla*), junegrass (*Loelera macrantha*), prairie junegrass (*Koeleria macrantha*), prickly phlox (*Leptodactylon pungens*), and currant (*Ribes* spp.).

Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland: Sites include lower and middle slopes of ravines, along stream terraces, moist, concave topographic positions, and north- and east-facing slopes that burn somewhat infrequently. Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*) are the most common canopy dominants, but Engelmann spruce (*Picea engelmannii*), blue spruce (*Picea pungens*), or ponderosa pine (*Pinus ponderosa*) can be present. This system includes mixed conifer/quaking aspen (*Populus tremuloides*) stands. A number of cold-deciduous shrub species can occur, including mountain maple (*Acer glabrum*), bigtooth maple (*Acer grandidentatum*), mountain alder (*Alnus incana*), water birch (*Betula occidentalis*), dogwood (*Cornus sericea*), and fivepetal cliffbush (*Jamesia Americana*). Herbaceous species include fringed brome grass (*Bromus ciliates*), sedge (*Carex spp.*), and bluebunch wheatgrass (*Pseudoroegneria spicata*). Naturally occurring fires are of variable return intervals, and mostly light, erratic, and infrequent due to the cool, moist conditions.

Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland: Sites in this system are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and can be common in restricted topographic basins and benches. Despite their wide distribution, the tree canopy characteristics are remarkably similar, with Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) dominating either mixed or alone. Lodgepole pine (*Pinus contorta*) is common in many occurrences (patches of pure lodgepole pine (*Pinus contorta*) are not uncommon), as well as mixed conifer/quaking aspen (*Populus tremuloides*) stands. Xeric species can include common juniper (*Juniperus communis*), twinflower (*Linnaea borealis*), or creeping barberry (*Mahonia repens*). Disturbance includes occasional blow-down, insect outbreaks, and stand-replacing fire.

Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland: Occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. They can extend down in elevation below the subalpine zone in places where cold-air ponding occurs; northerly and easterly aspects predominate. These forests are found on gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateaulike surfaces, basins, alluvial terraces, well-drained benches, and inactive stream terraces. Mesic understory shrubs include serviceberry (*Amelanchier alnifolia*) and willow (*Salix spp.*). Herbaceous species include bunchberry dogwood (*Cornus Canadensis*), yellowdot saxifrage (*Saxifraga bronchialis*), smooth woodrush (*Luzula glabrata var. hitchcockii*), and bluejoint (*Calamagrostis canadensis*). Disturbances include occasional blow-down, insect outbreaks, and stand-replacing fire.

Mixed Forest Classes

Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland: Occurrences are typically on gentle to steep slopes on any aspect, but are often found on clay-rich soils in intermontane valleys. Soils are derived from alluvium, colluvium, and residuum from a variety of parent materials, but most typically occur on sedimentary rocks. The tree canopy is composed of a mix of deciduous and coniferous species, codominated by quaking aspen (*Populus tremuloides*) and conifers, including Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), blue spruce (*Picea pungens*), lodgepole pine (*Pinus contorta*) and ponderosa pine (*Pinus ponderosa*). As the occurrences age, quaking aspen (*Populus tremuloides*) is slowly reduced until the conifer species become dominant. Common shrubs include serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus*

virginiana), bigtooth maple (*Acer grandidentatum*), mountain snowberry (*Symphoricarpos oreophilus*), common juniper (*Juniperus communis*), Wood's rose (*Rosa woodsii*), common snowberry (*Symphoricarpos albus*), and creeping barberry (*Mahonia repens*). Herbaceous species include mountain brome grass (*Bromus carinatus*), sedge (*Carex spp.*), bluegrass (*Poa spp.*), needle-and-thread (*Stipa spp.*), yarrow (*Achillea millefolium*), aster (*Asteraceae spp.*), daisy (*Erigeron spp.*), sticky purple geranium (*Geranium viscosissimum*), perennial pea (*Lathyrus spp.*), silvery lupine (*Lupinus argenteus*), aspen bluebells (*Mertensia arizonica*), and prairie bluebells (*Mertensia lanceolat*). Most occurrences at present represent a late-seral stage of aspen changing to a pure conifer occurrence. Nearly a hundred years of fire suppression and livestock grazing have converted much of the pure aspen occurrences to the present-day aspen-conifer forest and woodland ecological system.

Shrub/Scrub Classes

Colorado Plateau Mixed Low Sagebrush Shrubland: This ecological system occurs in canyons, gravelly draws, hilltops, and dry flats at elevations generally below 5,900 feet. Soils are often rocky, shallow, and alkaline. It includes open shrublands and steppe dominated by black sagebrush (*Artemisia nova*) with Wyoming big sagebrush (*Artemisia tridentata spp. wyomingensis*) codominant. Semi-arid grasses such as Indian ricegrass (*Achnatherum hymenoides*), purple threeawn (*Aristida purpurea*), blue gramma (*Bouteloua gracilis*), needle-and-thread (*Hesperostipa comate*), galleta (*Pleuraphis jamesii*), or muttongrass (*Poa fendleriana*) are often present and can form a graminoid layer with more than 25 percent cover.

Great Basin Semi-Desert Chaparral: This system includes chaparral on sideslopes transitioning from low-elevation desert landscapes up into pinyon-juniper woodlands. These are typically fairly open-canopy shrublands with open spaces either bare or supporting patchy grasses and forbs. Characteristic species can include desert ceanothus (*Ceanothus greggii*), alderleaf mountain mahogany (*Cercocarpus montanus var. glaber*), littleleaf mountain mahogany (*Cercocarpus intricatus*), buckwheat (*Eriogonum spp.*), ashy silttassel (*Garrya flavescens*), scrub oak (*Quercus turbinella*), cliffrose (*Purshia stansburiana*), and skunkbush sumac (*Rhus trilobata*). Currleaf mountain-mahogany (*Cercocarpus ledifolius*) is generally absent. Typical fire regime in these systems varies with the amount of organic accumulation.

Great Basin Xeric Mixed Sagebrush Shrubland: This ecological system occurs on dry flats and plains, alluvial fans, rolling hills, rocky hill slopes, saddles, and ridges. Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Shrublands are dominated by black sagebrush (*Artemisia nova*) (mid and low elevations) low sagebrush (*Artemisia arbuscula*) (higher elevations), and can be codominated by Wyoming big sagebrush (*Artemisia tridentata ssp. Wyomingensis*) or Green rabbitbrush (*Chrysothamnus viscidiflorus*). Other shrubs that can be present include shadscale (*Atriplex confertifolia*), Mormon tea (*Ephedra spp.*), rubber rabbitbrush (*Ericameria spp.*), spiny hopsage (*Grayia spinosa*), bud sagebrush (*Picrothamnus desertorum*), greasewood (*Sarcobatus vermiculatus*), and spineless horsebrush (*Tetradymia spp.*) The herbaceous layer is likely sparse and composed of perennial bunch grasses such as Indian ricegrass (*Achnatherum hymenoides*), needlegrass (*Achnatherum speciosum*), Thurber's needlegrass (*Achnatherum thurberianum*), bottlebrush squirreltail (*Elymus elymoides*), or Sandberg bluegrass (*Poa secunda*).

Inter-Mountain Basins Big Sagebrush Shrubland: This ecological system occurs in broad basins between mountain ranges, plains, and foothills. Soils are typically deep, well-drained

and non-saline. These shrublands are dominated by big sagebrush (*Artemisia tridentata* ssp.) and/or Wyoming big sagebrush (*Artemisia tridentata* ssp. *Wyomingensis*). Scattered greasewood (*Sarcobatus vermiculatus*) and saltbush (*Atriplex* spp.) can be present in some stands. Rubber rabbitbrush (*Ericameria nauseosa*) or green rabbitbrush (*Chrysothamnus viscidiflorus*) can codominate disturbed stands. Perennial herbaceous components typically contribute less than 25 percent vegetative cover. Common graminoid species include Indian ricegrass (*Achnatherum hymenoides*), blue gramma (*Bouteloua gracilis*), Thickspike wheatgrass (*Elymus lanceolatus*), Idaho fescue (*Festuca idahoensis*), needle-and-thread (*Hesperostipa comata*), Great Basin wildrye (*Leymus cinereus*), galleta (*Pleuraphis jamesii*), western wheatgrass (*Pascopyrum smithii*), Sandberg bluegrass (*Poa secunda*), and bluebunch wheatgrass (*Pseudoroegneria spicata*).

Inter-Mountain Basins Mixed Salt Desert Scrub: This extensive ecological system includes open-canopied shrublands of typically saline desert basins, alluvial slopes, and plains. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species such as shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), alkali saltbush (*Atriplex polycarpa*), and spiny saltbush (*Atriplex spinifera*). Other shrubs present to codominate can include Wyoming big sagebrush (*Artemisia tridentata* ssp. *Wyomingensis*), green rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Ericameria nauseosa*), Mormon tea (*Ephedra* spp. *nevadensis*), spiny hopsage (*Grayia spinosa*), winterfat (*Krascheninnikovia lanata*), *Lycium* spp., bud sagebrush (*Picrothamnus desertorum*), and spineless horsebrush (*Tetradymia* spp.). Greasewood (*Sarcobatus vermiculatus*) is generally absent, but if present does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as Indian ricegrass (*Achnatherum hymenoides*), blue gramma (*Bouteloua gracilis*), thickspike wheatgrass (*Elymus lanceolatus*), western wheatgrass (*Pascopyrum smithii*), galleta (*Pleuraphis jamesii*), big galleta (*Pleuraphis rigida*), Sandberg bluegrass (*Poa secunda*), and alkali sacaton (*Sporobolus airoides*). Various forbs are also present.

Inter-Mountain Basins Mountain-Mahogany Woodland and Shrubland: This ecological system occurs in hills and mountain ranges on rocky outcrops or escarpments and forms small-to large-patch stands in forested areas. Most stands occur as shrublands on ridges and steep rimrock slopes, but it can occur as a small tree in steppe areas. This system includes both woodlands and shrublands dominated by currleaf mountain-mahogany (*Cercocarpus ledifolius*), mountain big sagebrush (*Artemisia tridentata* ssp. *Vaseyana*), and antelope bitterbrush (*Purshia tridentata*), with species of currant (*Ribes*) or snowberry (*Symphoricarpos* spp.) often present. Scattered junipers or pines can also occur. Currleaf mountain-mahogany (*Cercocarpus ledifolius*) is a slow-growing, drought-tolerant species that generally does not re-sprout after burning and needs the protection from fire that rocky sites provide.

Mogollon Chaparral: This ecological system occurs on foothills, mountain slopes, and canyons in dryer habitats below the ponderosa pine (*Pinus ponderosa*) woodlands. Stands are often associated with more xeric and coarse-textured substrates such as limestone, basalt, and alluvium, especially in transition areas with more mesic woodlands. The moderate to dense shrub canopy includes species such as scrub oak (*Quercus turbinella*), alderleaf mountain mahogany (*Cercocarpus montanus*), crucifixion thorn (*Canotia holacantha*), desert ceanothus (*Ceanothus greggii*), cliffrose (*Purshia stansburiana*), and skunkbush sumac (*Rhus trilobata*). Most chaparral species are fire-adapted, re-sprouting vigorously after burning or producing fire-resistant seeds. Stands in montane woodlands are seral and a result of recent fires.

Grassland/Herbaceous Classes

Inter-Mountain Basins Big Sagebrush Steppe: This ecological system is found at slightly higher elevations farther south. Soils are typically deep and non-saline, often with a microphytic crust. This shrub-steppe is dominated by perennial grasses and forbs (more than 25 percent cover) with big sagebrush (*Artemisia tridentata* ssp. *Tridentate*), big sagebrush (*Artemisia tridentata* ssp. *Xericensis*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *Wyomingensis*), threetip sagebrush (*Artemisia tripartita* ssp. *tripartite*), and/or antelope bitterbrush (*Purshia tridentate*) dominating or co-dominating the open to moderately dense (10 to 40 percent cover) shrub layer. Shadscale (*Atriplex confertifolia*), green rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Ericameria nauseosa*), spineless horsebrush (*Tetradymia* spp.), and prairie sagewort (*Artemisia frigid*) can be common, especially in disturbed stands. Associated graminoids include Indian ricegrass (*Achnatherum hymenoides*), thickspike wheatgrass (*Elymus lanceolatus*), Idaho fescue (*Festuca idahoensis*), prairie junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*), and bluebunch wheatgrass (*Pseudoroegneria spicata*). Common forbs are spiny phlox (*Phlox hoodii*) and milkvetch (*Astragalus* spp.). Areas with deeper soils more commonly support big sagebrush (*Artemisia tridentata* ssp. *tridentate*), but have largely been converted for other land uses. Microphytic crust is very important in this ecological system. The natural fire regime of this ecological system likely maintains patchy distribution of shrubs, so the general aspect of the vegetation is grassland.

Inter-Mountain Basins Montane Sagebrush Steppe: This ecological system includes sagebrush communities occurring in cool, semi-arid, subhumid climates. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. In general this system shows an affinity for mild topography, fine soils, and some source of subsurface moisture. It is composed primarily of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and related taxa such as big sagebrush (*Artemisia tridentata* ssp. *spiciformis*), non-riparian silver sagebrush (*Artemisia cana* ssp. *viscidula*), and low sagebrush (*Artemisia arbuscula*). Antelope bitterbrush (*Purshia tridentate*) can co-dominate or even dominate some stands. Other common shrubs include snowberry (*Symphoricarpos* spp.), serviceberry (*Amelanchier* spp.), rubber rabbitbrush (*Ericameria nauseosa*), squaw apple (*Peraphyllum ramosissimum*), currant (*Ribes cereum*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Most stands have an abundant perennial herbaceous layer (more than 25% cover), but this system also includes mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) shrublands. Common graminoids include Idaho fescue (*Festuca idahoensis*), needle-and-thread (*Hesperostipa comate*), muttongrass (*Poa fendleriana*), slender wheatgrass (*Elymus trachycaulus*), mountain brome grass (*Bromus carinatus*), Sandberg bluegrass (*Poa secunda*), spike fescue (*Leucopoa kingie*), tufted hairgrass (*Deschampsia caespitosa*), and bluebunch wheatgrass (*Pseudoroegneria spicata*). Frequent wildfire maintains an open herbaceous-rich steppe condition.

Inter-Mountain Basins Semi-Desert Grassland: This ecological system occurs on dry plains and mesas. These grasslands occur in lowland and upland areas and can occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often well-drained sandy- or loamy-textured soils derived from sedimentary parent materials, but are quite variable and can include fine-textured soils derived from igneous and metamorphic rocks. When they occur near foothills grasslands, they will be at lower elevations. The dominant perennial bunch grasses and shrubs in this system are all very drought-resistant. These grasslands are typically dominated or codominated by Indian

ricegrass (*Achnatherum hymenoides*), *Aristida* spp., blue gramma (*Bouteloua gracilis*), needle-and-thread (*Hesperostipa comata*), muhly (*Muhlenbergia torreyana*), or galleta (*Pleuraphis jamesii*), and can include scattered shrubs and dwarf-shrubs of species of *Artemisia*, *Atriplex*, *Coleogyne*, Mormon tea (*Ephedra* (*Ephedra* spp.)), broom snakeweed (*Gutierrezia*), and winterfat (*Krascheninnikovia lanata*).

Inter-Mountain Basins Semi-Desert Shrub-Steppe: This ecological system occurs at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe is typically dominated by graminoids (more than 25 percent cover) with an open shrub layer, but includes sparse mixed shrublands without a strong graminoid layer. Characteristic grasses include Indian ricegrass (*Achnatherum hymenoides*), blue gramma (*Bouteloua gracilis*), inland saltgrass (*Distichlis spicata*), needle-and-thread (*Hesperostipa comata*), galleta (*Pleuraphis jamesii*), Sandberg bluegrass (*Poa secunda*), and alkali sacaton (*Sporobolus airoides*). The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include fourwing saltbush (*Atriplex canescens*), sand sagebrush (*Artemisia filifolia*), green rabbitbrush (*Chrysothamnus viscidiflorus*), Mormon tea (*Ephedra* (*Ephedra* spp.)), rubber rabbitbrush (*Ericameria nauseosa*), broom snakeweed (*Gutierrezia sarothrae*), and winterfat (*Krascheninnikovia lanata*). Scattered Wyoming big sagebrush (*Artemisia tridentata*) can be present but does not dominate. The general aspect of occurrences can be either open shrubland with patchy grasses or patchy open herbaceous layer. Disturbance can be important in maintaining the woody component. Microphytic crust is very important in some occurrences.

Southern Rocky Mountain Montane Grassland: This ecological system typically occurs on flat to rolling plains or on lower sideslopes that are dry. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acid, and usually well drained. An occurrence usually consists of a mosaic of two or three plant associations with one of the following dominant bunch grasses: Oatgrass (*Danthonia* spp.), Idaho fescue (*Festuca idahoensis*), Thurber's fescue (*Festuca thurberi*) or bluebunch wheatgrass (*Pseudoroegneria spicata*). The subdominants include mountain muhly (*Muhlenbergia montana*), blue gramma (*Bouteloua gracilis*), and Sandberg bluegrass (*Poa secunda*). Locally shrubland patches such as snowberry (*Symphoricarpos* spp.) can occur in this predominantly grassland system. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests.

Rocky Mountain Gambel Oak-Mixed-Montane Shrubland: These shrublands are most commonly found along dry foothills and lower mountain slopes and are often situated above pinyon-juniper woodlands. Substrates are variable and include soil types ranging from calcareous, heavy, fine-grained loams to sandy loams, gravelly loams, clay loams, deep alluvial sand, or coarse gravel. The vegetation is typically dominated by Gambel oak (*Quercus gambelii*) alone or codominant with serviceberry (*Amelanchier alnifolia*), Wyoming big sagebrush (*Artemisia tridentata*), alderleaf mountain mahogany (*Cercocarpus montanus*), chokecherry (*Prunus virginiana*), cliffrose (*Purshia stansburiana*), antelope bitterbrush (*Purshia tridentata*), and snowberry (*Symphoricarpos* spp.). There can be inclusions of other mesic montane shrublands with Gambel oak (*Quercus gambelii*) absent or as a relatively minor component. This ecological system intergrades with the lower montane-foothills shrubland system and shares many of the same site characteristics. Density and cover of Gambel oak (*Quercus gambelii*) and serviceberry (*Amelanchier* spp.) often increase after fire.

Woody Wetlands Classes

Great Basin Foothill and Lower Montane Riparian Woodland and Shrubs: This system often occurs as a mosaic of multiple communities that are tree-dominated and have a diverse shrub component. The variety of plant associations connected to this system reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees can include white fir (*Abies concolor*), mountain alder (*Alnus incana*), water birch (*Betula occidentalis*), narrowleaf cottonwood (*Populus angustifolia*), black cottonwood (*Populus balsamifera ssp. trichocarpa*), Fremont cottonwood (*Populus fremontii*), willow (*Salix spp.*), and Douglas-fir (*Pseudotsuga menziesii*). Dominant shrubs include silver sagebrush (*Artemisia cana*), dogwood (*Cornus sericea*), and narrowleaf willow (*Salix spp.*). Herbaceous layers are often dominated by species of sedge (*Carex spp.*) and rush (*Juncus*), and perennial grasses and mesic forbs such as tufted hairgrass (*Deschampsia caespitosa*), slender wheatgrass (*Elymus trachycaulus*), and Rocky Mountain iris (*Iris missouriensis*). Introduced forage species such as Kentucky bluegrass (*Poa pratensis*) and timothy (*Phleum pratense*), and the weedy annual cheatgrass (*Bromus tectorum*) are often present in disturbed stands. These are disturbance-driven systems that require flooding, scour, and deposition for germination and maintenance. Livestock grazing is a major influence in altering structure, composition, and function of the community.

Inter-Mountain Basins Greasewood Flat: This ecological system typically occurs near drainages on stream terraces and flats or can form rings around playas. Sites typically have saline soils, a shallow water table, and flood intermittently, but remain dry for most growing seasons. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*). Fourwing saltbush (*Atriplex canescens*), shadscale (*Atriplex confertifolia*), or winterfat (*Krascheninnikovia lanata*) can be present to codominant. Occurrences are often surrounded by mixed salt desert scrub. The herbaceous layer, if present, is usually dominated by graminoids. There can be inclusions of alkali sacaton (*Sporobolus airoides*), inland saltgrass (*Distichlis spicata*) (where water remains ponded the longest), or common spikerush (*Eleocharis palustris*) herbaceous types.

Rocky Mountain Lower Montane Riparian Woodland and Shrubland: This system often occurs as a mosaic of multiple communities that are tree-dominated and have a diverse shrub component. This system depends on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found in the flood zones of rivers, on islands, sand or cobble bars, and immediate streambanks. They can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches. Dominant trees can include box elder (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), black cottonwood (*Populus balsamifera*), eastern cottonwood (*Populus deltoids*), Fremont cottonwood (*Populus fremontii*), Douglas-fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), willow (*Salix spp.*), and Rocky Mountain juniper (*Juniperus scopulorum*). Dominant shrubs include mountain maple (*Acer glabrum*), mountain alder (*Alnus incana*), mountain birch (*Betula occidentals*), dogwood (*Cornus sericea*), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), willow (*Salix spp.*), silver buffaloberry (*Shepherdia argentea*), and snowberry (*Symphoricarpos spp.*). Exotic trees of Russian olive (*Elaeagnus angustifolia*) and salt cedar (*Tamarix spp.*) are common in some stands. Generally, the upland vegetation surrounding this riparian system is different and ranges from grasslands to forests.

Rocky Mountain Subalpine-Mountain Riparian Shrubland: These systems are montane to subalpine riparian shrublands occurring as narrow bands of shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. This system often occurs as a mosaic of multiple communities that are shrub and herb dominated, and includes above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. The dominant shrubs reflect the large elevational gradient and include mountain alder (*Alnus incana*), dwarf birch (*Betula nana*), water birch (*Betula occidentalis*), dogwood (*Cornus sericea*), and willow (*Salix spp.*). Generally, the upland vegetation surrounding these riparian systems is conifer or aspen forests.

Rocky Mountain Subalpine-Montane Riparian Woodland: This system contains the conifer and aspen woodlands that line montane streams. These are communities tolerant of periodic flooding and high water tables. Snowmelt moisture in this system can create shallow water tables or seeps for a portion of the growing season. Stands typically are confined to specific riparian environments occurring on floodplains or terraces of rivers and streams, in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, occurrences are found in moderate-wide valley bottoms on large floodplains along broad, meandering rivers, and on pond or lake margins. Dominant tree species include subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), Douglas-fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), quaking aspen (*Populus tremuloides*), and Rocky Mountain juniper (*Juniperus scopulorum*). Other trees that can be present include mountain alder (*Alnus incana*), white fir (*Abies concolor*), lodgepole pine (*Pinus contorta*), narrowleaf cottonwood (*Populus angustifolia*), box elder (*Acer negundo*), and Utah juniper (*Juniperus osteosperma*).

Emergent Wetland Classes

Rocky Mountain Alpine-Montane Wet Meadow: These are high-elevation communities dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. These types occur as large meadows in montane or subalpine valleys, as narrow strips bordering ponds, lakes, and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but can also occur on sub-irrigated sites with slopes up to 10 percent. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds. Soils of this system can be mineral or organic. In either case, soils show typical hydric soil characteristics, including high organic content and/or low chroma and redoximorphic features. This system often occurs as a mosaic of several plant associations, often dominated by graminoids, including sedge (*Carex spp.*), tufted hairgrass (*Deschampsia caespitosa*), fewflower spikerush (*Eleocharis quinqueflora*), Drummond's rush (*Juncus drummondii*), arrowleaf ragwort (*Senecio triangularis*), Parry's clover (*Trifolium parryi*), and buttercup (*Trollius laxus*). Often alpine dwarf-shrublands, especially those dominated by willow (*Salix spp.*), are immediately adjacent to the wet meadows. Wet meadows are tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding.

Altered or Disturbed Classes

Invasive Annual and Biennial Forbland: Site is comprised of Russian thistle (*Salsola spp.*), fireweed (*Kochia scoparia*), or halogeton (*Halogeton glomeratus*).

Invasive Annual Grassland: Site is comprised of wild oats (*Avena spp.*), brome grass (*Bromus spp.*), and Russian thistle (*Schismus spp.*)

Invasive Perennial Grassland: Site is comprised of fountaingrass (*Pennisetum spp.*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), Lehmann lovegrass (*Eragrostis lehmannianna*), and intermediate wheatgrass (*Thinopyrum intermedium*) and includes crested wheatgrass (*Agropyron cristatum*).

Recently Burned: Burned vegetation visible on imagery for time of image acquisition (1999-2001).

Recently Chained Pinyon-Juniper Areas: Site has areas of chained pinyon pine and juniper larger than 5 acres.

Recently Mined or Quarried: Open-pit mining or quarries visible on imagery that are 5 acres or larger.

Other Classes

Developed, Medium to High Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surface accounts for 50 to 79 percent of the total cover. These areas most commonly include single-family housing units.

Developed, High Intensity: Includes highly developed areas where large numbers of people reside or work. Examples include apartment complexes, row houses, and commercial/industrial areas. Impervious surfaces account for 80 to 100 percent of the total cover.

Developed, Open Space – Low Intensity: Includes areas with a mixture of some construction materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Developed, Low intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas most commonly include single-family housing units.

Open Water: All areas of open water, generally with less than 25 percent cover of vegetation or soil.