Juniper Canyon, Wallula Gap: An "Oasis in the Desert"

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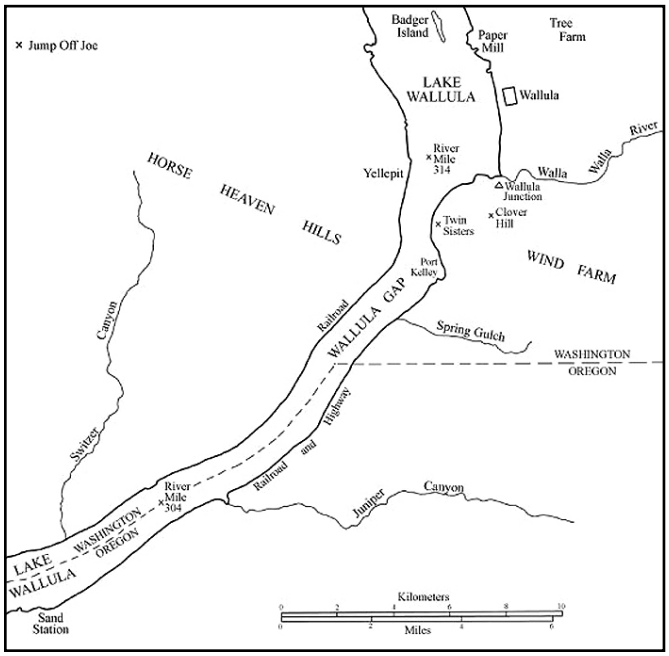
"Where the Great River bends" is where the mighty Columbia turns west toward the Pacific Ocean to form the boundary between Washington and Oregon. This locality, known as Wallula Gap, is unusually rich in natural and human history. On the southeast side is Juniper Canyon, where a creek enters the Columbia River in Umatilla County, just south of the Washington border. A popular destination for spring wildflower hikes for members of the Washington Native Plant Society, Juniper Canyon is not (yet) well known by Oregon botanists.

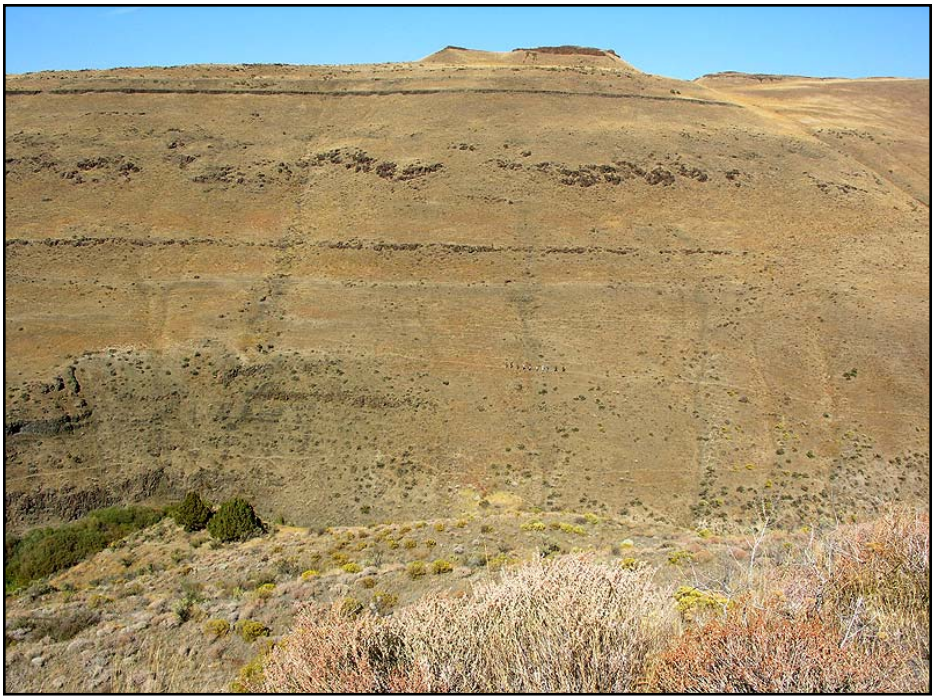
Carson (2008) described Wallula Gap as an "oasis in the desert" because the vegetation adjacent to Juniper Creek differs completely from the upland vegetation: "Wallula Gap is part of a desert, yet there are beavers. Wallula Gap has no mountains, yet there are bighorn sheep. The bedrock is all basalt, yet there are granitic boulders" (Carson 2008). This region of the Columbia Plateau receives an average of only six inches of precipitation a year. Although many people think of it as a desert, much of eastern Oregon and Washington is shrub steppe (dry grassland with a shrub overstory) or bunchgrass steppe. Here, low rainfall combined with high summer temperatures, cold winters, and desiccating winds have selected for plants adapted to survive in an arid environment.

The Columbia River at Wallula Gap has been known as Lake Wallula since it was impounded behind McNary Dam in 1954. When the McNary National Wildlife Refuge was established in 1956 to mitigate lost wildlife habitat, Juniper Canyon was selected as one of three parts of the Refuge. The stream and wetland provide critical habitat for migratory waterfowl, as well as a diverse array of plants, lichens, and other animals. Juniper Canyon is a patchwork of public and private land; the US Fish and Wildlife Service manages the bottom of the canyon for most of the lower six miles of Juniper Creek. The flanks of the canyon are privately owned and used for grazing. The current rancher allows public access across his land for hiking. Upstream, easements for a power line and a pipeline cross the canyon approximately 2.5 and 5 miles east of US Highway 730.



Map of Juniper Canyon area. Prepared by Bob Carson.

Juniper Canyon appears as a green "oasis in the desert" on Google Earth© imagery. Accessed online by Marin Axtell.



View looking north from the south side of Juniper Canyon. In the foreground are snow buckwheat and rabbitbrush, with two junipers growing on sandy soil farther down the north-facing slope. In the background, the relatively barren, hot south-facing slope has thin, silty soil over horizontal lava flows. The Missoula floods created scablands at the top of the highest basalt outcrops by scouring the soil away. Raging waters also left a granitic boulder resting just beneath the saddle between the two scabs. Look carefully to see the line of ten hikers. Photo by Bob Carson.

The plants, animals, and geology make this canyon a fascinating place for hiking and nature study. Carson and Denny have been studying and leading field trips into Juniper Canyon for decades and have written chapters for a book published by Keokee Press with a grant from the National Park Service, *Where the Great River Bends: a natural and human history of the Columbia at Wallula* (Carson 2008). Juniper Canyon has been the subject of three senior theses at Whitman College (Leslie 2008, Axtell 2014, Cordell 2014). The two recent ones are a floristic study under the guidance of Professor Heidi Dobson.

Because the underlying geology of Juniper Canyon is the basis for its ecological diversity, Carson begins this paper with an overview of its geologic history. Then Dobson, Axtell, and Cordell describe the plant communities in the canyon, and Denny's description of the natural history through one revolution around the sun completes the article.

Geology of Juniper Canyon: a landscape built by lava flows, sculpted by water and wind

The headwaters of Juniper Creek begin near Vansycle Canyon, about 15 miles east-southeast of Wallula Gap. The two forks of Juniper Creek originate at an elevation of approximately 2,000 feet,[1] where they carve into wind-deposited soil (loess). The creek works its way westward, gradually cutting down into the basalt flows, then into remnants of an immense gravel bar on both sides of the canyon, and finally into sand dunes that flank the south side of the canyon. In the final mile above its mouth, Juniper Creek forms a partially natural wetland augmented by water impounded by McNary Dam.

Lakes of lava

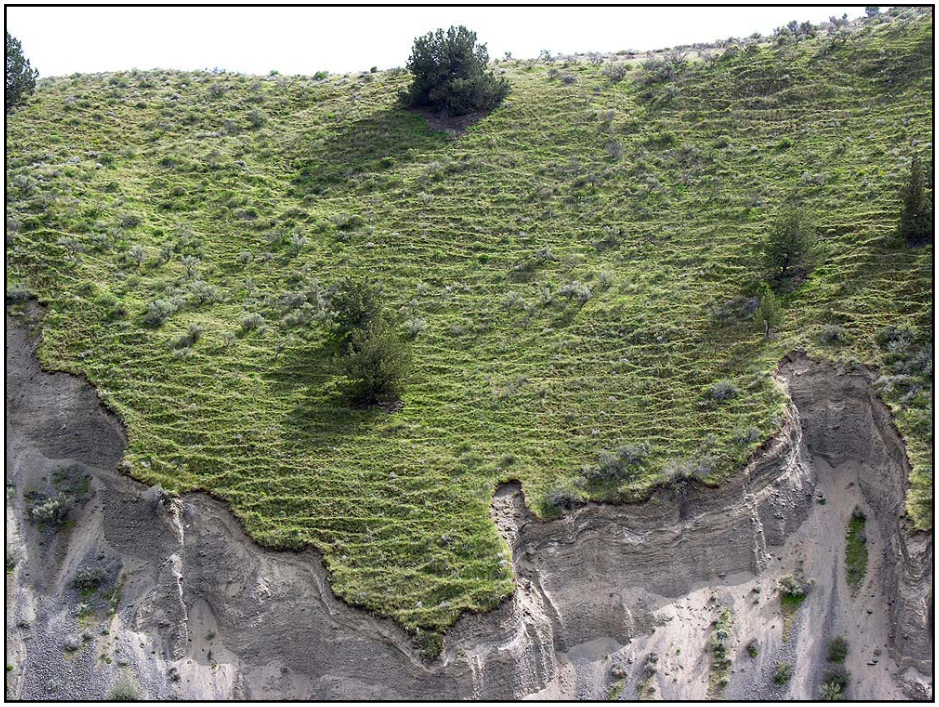
About 16 million years ago, large fissures opened and, until 6 million years ago, massive amounts of lava poured periodically across the landscape. The basalt flowed in a generally westward direction, filling the area between the Rockies and Cascades to make the Columbia Plateau. Movement of the earth's crust wrinkled these basalt flows into anticlines and synclines known as the Yakima Fold Belt.

Although the Columbia River now flows through Wallula Gap, 15 million years ago its course was farther west against the Cascades where lava flows had pushed it. The Clearwater-Salmon River flowed from the east across the basalt flows and crossed at the lowest point of the Horse Heaven Hills, an anticlinal ridge stretching all the way from the Cascades to the Blue Mountains. As this anticline grew upward, the Clearwater-Salmon River cut Wallula Gap. The evidence is at 1140 feet at the top the west rim of the gap where an 8.5 million-year-old lava flow lies over gravels that originated in the Clearwater and Salmon drainage basins. As the anticlines of the Yakima fold belt grew upward and eastward, the Columbia River was forced eastward, eventually being captured by the Clearwater-Salmon River. Much later, perhaps 2.5 million years ago, the Salmon River captured the Snake River, adding its discharge to the Columbia River that now flows through Wallula Gap.

Walls of water

The Pleistocene Ice Age began about 2 million years ago. Colder glaciations alternated with warmer interglaciations, during which the climate was like that of today. Every 100,000 years or so, glaciers from the mountains of British Columbia coalesced to form the Cordilleran Ice Sheet, which advanced south into northern Washington, Idaho, and Montana. Often, a lobe of this ice sheet dammed the Clarks Fork River, creating an enormous lake in western Montana known as Glacial Lake Missoula. Although this lake formed many times in the last million years, we know the most about the consequences of the last occurrence. When Lake Missoula reached a depth of about 2,000 feet, it floated the ice dam. This triggered a sudden release of massive amounts of impounded water, thus an enormous flood. This Missoula flood raced southwest across eastern Washington until it reached the bottleneck of Wallula Gap. About 900 feet of water poured through Wallula Gap at 60 miles per hour. Even so, the gap acted as a hydraulic dam that created a temporary lake with an elevation of 1200 feet in the Pasco Basin. At Wallula giant eddies swirled at the mouths of every tributary canyon, including Juniper Canyon, depositing huge gravel bars. Icebergs from the disintegrating ice dam rushed downstream, carrying rocks that had been plucked by glaciers crossing the landscape. Some of these icebergs were stranded in the tributary canyons, depositing boulders as they

1 Surface elevation of Lake Wallula is 340 ft.



Most of the gravel deposited in Juniper Canyon by the Missoula floods has been eroded or buried in sand. Here, at the outside of a bend of Juniper Creek, the gravels are exposed. Photo by Bob Carson.

melted. Two large granitic erratic boulders rest on the north side of Juniper Canyon, one near the east end of the wetland, the other at an elevation of about 1000 feet between two large outcrops of basalt.

Glacial Lake Missoula drained, but the ice re-advanced to block Clarks Fork again within 50 years. This ice dam created another lake, which then ruptured, sending another flood ravaging across eastern Washington. This cycle repeated 80 to 100 times from about 18,000 to 15,000 years ago. Gravel bars in the tributary canyons grew to 600 feet thick. Despite its small size, Juniper Creek eroded most of the gravel in its valley over the course of 15 thousand years. A good exposure of the remaining gravel exists on the outside of a meander bend of Juniper Creek near the beaver ponds; it is best seen from the north side of the creek.

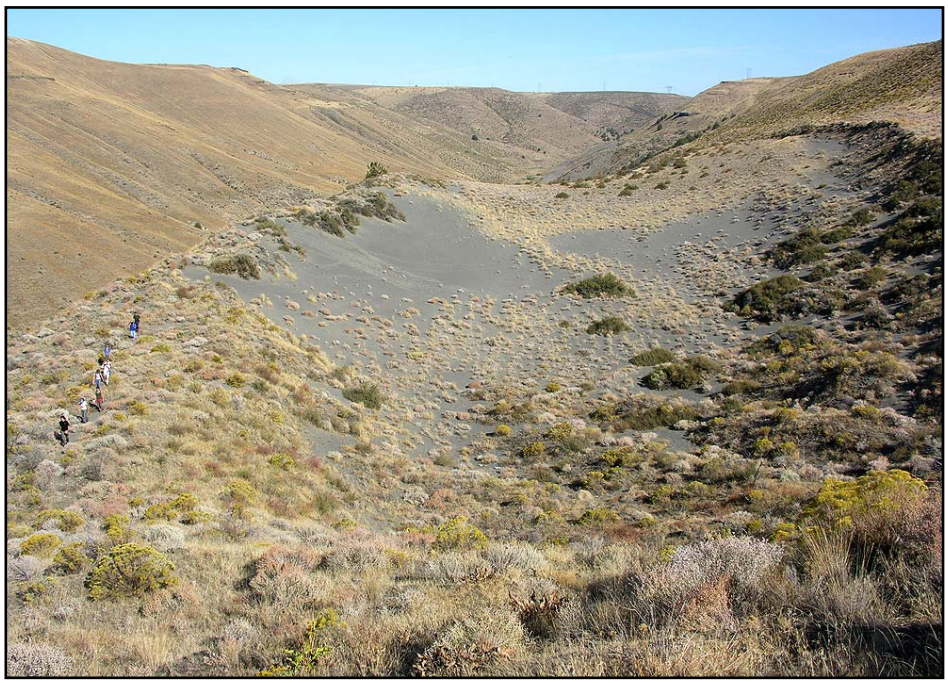
Soil from the sky

As the rocks at the bottom of the Cordilleran Ice Sheet were dragged over bedrock, abrasion made silt-size fragments of rock flour in the glacial meltwater. Much of this silt was deposited in the Pasco and Umatilla Basins, where it was picked up by the prevailing southwesterly winds and deposited as a blanket of loess on the Horse Heaven Hills and the Palouse Hills to the northeast. This is the source of the silt loam soil that caps the uplands north and south of Juniper Canyon.

The Missoula floods also deposited sand in the Pasco and Umatilla Basins. Prevailing southwesterly winds blew sand from the Umatilla Basin and from sandbars along the Columbia River toward the Horse Heaven Hills, leaving a large sand deposit on the south side of Juniper Canyon. Some of sand landforms are transitional between parabolic dunes and blowouts. The features resemble blowouts in that the wind has eroded hollows in the sand; the sandy ridges at the edges of the blowouts are like parabolic dunes. Unlike silt, which may become airborne, wind-blown heavier sand particles remain close to the ground. Even though wind moved the sand northeast, it fell into Juniper Creek before reaching the north side of the canyon.

About 7700 years ago, Mt. Mazama (now Crater Lake) in the southern Oregon Cascades erupted violently, spewing volumes of ash that was blown far to the northeast; some was deposited on the Horse Heaven Hills. Rain washed the ash off the hillsides and down into the channel of Juniper Creek.

As the water in the reservoir behind McNary Dam (downstream on the Columbia River in the Umatilla Basin) rose, it inundated the lowermost part of Juniper Canyon. This small arm of the reservoir became filled with sediment deposited by Juniper Creek and was colonized by plants. As beavers dammed Juniper Creek, the wetland extended upstream.



Naturalists hike along the north rim of a sand dune, a combination of an erosional blowout on the south side and a parabolic dune on the north side. In the distance sits another sand dune on the north-facing side of Juniper Canyon. Photo by Bob Carson.

The puzzle of the giant stairs

The trail along the south side of Juniper Canyon crosses five benches topped with a thick layer of sand (Carson 2014). These terrace-like landforms resemble a short flight of giant stairs. The treads are 120 to 200 feet wide and more than 1000 feet long; they slope upvalley 4 to 5% toward the northeast. The risers slope 24 to 43% to the northwest and are 40 to 60 feet high.

Several explanations of the origins of these giant steps don't survive careful scrutiny. These benches are not likely bedrock buried by sand because, while the basalt flows here are nearly horizontal, the benches are not. If the benches in Juniper Canyon are merely thin sand overlying eroded basalt flows, the benches would also be horizontal.

Nor is the explanation plausible that they are terraces that were deposited or eroded by the Missoula floods, because all known gravel eddy bars slope downvalley, not upvalley as these do. It is unlikely that they are strath or alluvial-fill terraces eroded or deposited by Juniper Creek, because stream terraces also slope downvalley.

Another possibility is that they are slumps (a type of landslide) caused as Juniper Creek cut its valley and reduced lateral support for the hillsides. Geologic materials like the basalts, gravels, and sands in Juniper Canyon are not usually susceptible to mass wasting, and the benches here seem too regular to be slump blocks. In addition, the headscarps of almost all slumps are convex upslope; no such landforms exist here.

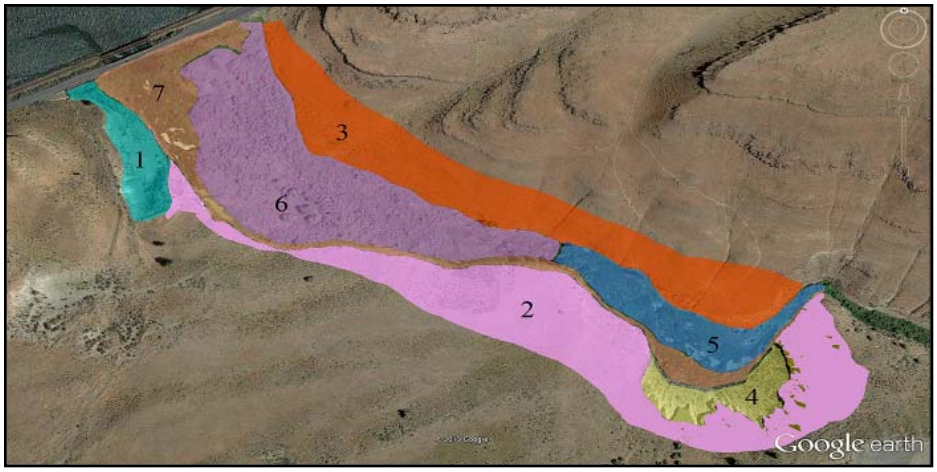
Sand dunes are common northeast of the Umatilla and Pasco basins; some are longitudinal dunes parallel to the prevailing wind. The long axes of the giant steps in Juniper Canyon have almost exactly the same orientation (N60°E) as the longitudinal dunes north and south of Wallula Gap. Longitudinal dunes are most commonly deposited on flat terrain. The longitudinal sand dunes of Juniper Canyon are unusual because they are draped across steep slopes.

The flora of Juniper Canyon

Given the geologic history, it isn't surprising that this small canyon harbors a variety of plant communities. The thick sand of the south side of the valley supports juniper trees, shrubs, bunchgrasses, a variety of wildflowers, and a cryptobiotic crust. The floodplain supports willow trees, cattails, tules, bulrushes and a variety of marsh-loving plants. Bunchgrasses dominate the thin, silt loam soil over basalt bedrock on the north side of the valley floor. Our survey of plant species, combined with previous collections and observations by coauthors (Dobson and Denny), totaled 168 species in 49 families (see Table at end of article). Until this survey no one had compiled a comprehensive list for the canyon. Other incomplete species lists for commonly visited sites in the Wallula Gap area (Juniper Canyon, Twin Sisters, and Telephone Hill (http://www.wnps.org/cbasin/hikes_lists.html) have been assembled by members of the Columbia Basin Chapter of the Washington Native Plant Society, but these were based solely on springtime hikes. Scientists at the Pacific Northwest National Laboratory published a complete vascular plant list (725 taxa) for the Hanford Site (Sackschewsky and Downs 2001), but that survey covers a much larger diverse area.

We (Cordell and Axtell) visited Juniper Canyon at three week intervals between February 2013 and April 2014. First, we mapped seven plant communities on a Google Earth image and developed two walking routes, one through the floodplain, and one through the uplands, along which we collected each plant species at its

Large slanted terraces covered by thick sand are present on the south side of lower Juniper Canyon. The most plausible theory for the origin of these terraces is that they are longitudinal dunes, oriented parallel to the dominant wind direction. Photo by Bob Carson.



Plant communities in Juniper Canyon, mapped on a Google Earth image. Codes are 1=Basin wildrye/saltgrass (disturbed grassland), 2=Western juniper/big sagebrush-bitterbrush, 3=Bluebunch wheatgrass/Sandberg bluegrass, 4=exposed gravel bar (Rock), 5=marsh, 6=willow riparian woodland, 7=narrowleaf cattail marsh. Prepared by Marin Axtell and Chelsea Cordell.

reproductive stage. Voucher specimens of all documented taxa have been deposited in the Whitman College Herbarium (WCW).

The seven communities in the canyon included the following: a disturbed grassland (basin wildrye/saltgrass), juniper/big sagebrush/bitterbrush, bluebunch wheatgrass/Sandberg bluegrass, rock, marsh, willow riparian woodland and a narrowleaf cattail marsh. We recorded in which communities each species occurred and its flowering period.

Upland communities

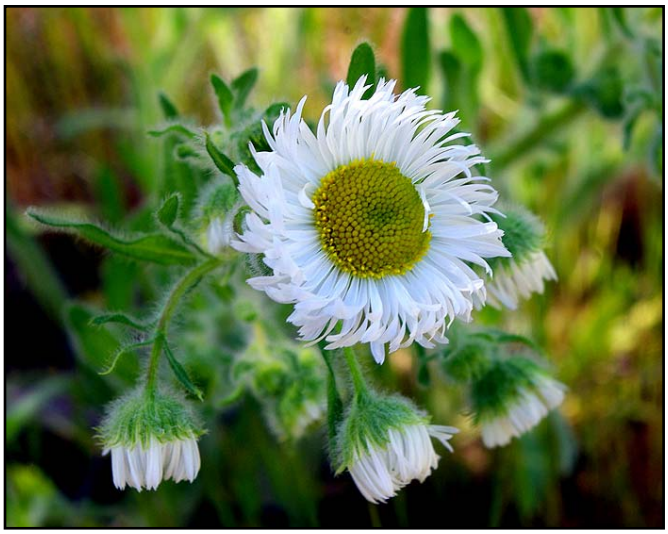
The four upland types of Juniper Canyon include a severely disturbed grassland at the mouth of the canyon (which probably supported Basin wildrye/saltgrass in presettlement time), western juniper/sagebrush/bitterbrush on the canyon flank south of the creek, bluebunch wheatgrass/Sandberg bluegrass on the north side of the creek, and a rocky area in the upper reach of the south side of the creek.

Basin wildrye/saltgrass

This heavily disturbed grassland lies at the entrance of Juniper Canyon, southeast of State Highway 730 (see area 1 on map, above).

Disturbed grassland in an old gravel pit that is currently used illegally as a shooting range. Photo by Marin Axtell.

Based on topographic position and soils, it is likely that this site originally supported a community of Basin wildrye (*Leymus cinereus*) and saltgrass (*Distichlis spicata*). Saltgrass is the only remnant of that association. Our working name for the site was "disturbed grassland," derived from the obvious human disturbance: trash (beer cans, clay pigeons, shotgun shells, animal bones), soil compaction, and dominance by non-native species. Of the current community, the three introduced perennial grasses, bulbous bluegrass (*Poa bulbosa*), intermediate wheatgrass (*Thinopyrum intermedium*) and creeping bentgrass (*Agrostis stolonifera*), as well as the introduced Canada thistle (*Cirsium arvense*), reproduce vegetatively and are highly tolerant of grazing and trampling. The remaining grasses are all weedy annuals that are unpalatable to livestock after inflorescences form: ripgut brome (*Bromus diandrus*), cheatgrass (*Bromus tectorum*), and rattail fescue (*Vulpia myuros*).



Shaggy fleabane (*Erigeron pumilus*) flowers in early May in the severely disturbed grassy area and on the north-facing slope. Photo by Marin Axtell.

The soil in this area is hard packed, rocky, and very disturbed. Scattered shrubs (*Artemisia tridentata, Ericameria nauseosa,* and *Purshia tridentata*) are surviving native plants. Our most noteworthy discovery in this community was salt heliotrope (*Heliotropium curassavicum*), a sensitive species in Oregon (List 2). Its presence has been reported to the Oregon Biodiversity Information Center (ORBIC).

Western juniper/Big sagebrush-Bitterbrush

The north-facing canyon wall supports a thriving shrub steppe community, characterized by a sparse overstory of western juniper with an understory of shrubs (principally bitterbrush, big sagebrush, and rabbitbrush) and native bunchgrasses (area 2 in map, above). Moving south along the ridge, shrubs become less dominant and the soil becomes slightly rockier. Native grasses include bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Elymus elymoides*), Basin wildrye,

Bastard toadflax (*Comandra umbellata*) flowered in early May on the north-facing slope. Photo by Chelsea Cordell.

and two sand-loving species, Indian ricegrass (*Achnatherum hymenoides*) and needle-and-thread (*Hesperostipa comata*). Evidence of grazing disturbance includes numerous non-native grasses: annual bromes (*Bromus tectorum, B. hordeaceus, B. commutatus*), longspine sandbur (*Cenchrus longispinus*), rabbitsfoot grass (*Polypogon monspeliensis*).

Daubenmire (1970) did not describe a western juniper shrub steppe community for eastern Washington[2], but western juniper communities with big sagebrush and bitterbrush are widespread in eastern Oregon (Franklin and Dyrness 1984). Two bitterbrush/bunchgrass communities are described at the Hanford Site west of Pasco, Washington (Sackschewsky and Downs 2001). Bitterbrush commonly grows on deep, sandy soils, so its occurrence on the south side of Juniper Canyon is characteristic. Here the soil is mapped as Quincy loamy fine sand and Rock outcrop-Xeric Torriorthents complex (Umatilla Area Soil Survey[3]). The Quincy series is eolian sand that has blown over the ridge from the south and migrated downslope. Orthents are soils that lack profile development other than an A horizon; in this case these are deep soils on unstable slopes characterized by fine sandy loam in the upper 10 inches and very cobbly loamy fine sand below that. These deep soils have a high water storage capacity which, combined with a cooler north-facing aspect, support a dense canopy of perennial vegetation and a scattered cryptobiotic crust.

Bluebunch wheatgrass/Sandberg bluegrass

This community is located on the north side of the canyon, facing south, with a gentle slope up from the bottom of the canyon (area 3 on map on previous page). It is characterized by a sparse cover of shrubs (gray rabbitbrush and big sagebrush) and remnants of the native bunchgrasses (bluebunch wheatgrass, Sandberg bluegrass, sand dropseed and red threeawn) growing on hard packed rocky silt loam soil. The soil is mapped as Lickskillet-Rock outcrop complex. The Lickskillet series are shallow, well drained soils that formed in stony colluvium consisting of loess, rock fragments, and residuum weathered from basalt and rhyolite.

Evidence of disturbance in this area is the compacted soil, terracettes (numerous livestock trails following the contour across the slope), and a variety of non-native grasses, ripgut brome, cheatgrass, rattail fescue, and bulbous bluegrass, which increase in abundance under grazing pressure. The fence along the property line was in disrepair, allowing grazing livestock to range freely through the area.

Goatheads or puncturevine (*Tribulus terrestris*), an invasive exotic weed with stout sharp spikes on its fruits, dominates the lower slope near the bottom of the canyon. The sprawling stems of this warm-season annual are well adapted to the hot, harsh conditions of summer and occur on the south-facing exposure.

Among the plants on the steep north-facing slope of Juniper Canyon are gray rabbitbrush (yellow flowers), big sagebrush (light green leaves), and juniper trees. One beaver pond is visible in the wetland on the valley floor. Sparse vegetation grows on thin, silty soil over lava flows on the north side of the canyon. In the distance are the Columbia River and the west side of Wallula Gap. Photo by Bob Carson.

Cliff, scree, and rock[4]

An area of sparse vegetation over a loose rock substrate is located on the south canyon wall on the outside of a meander of Juniper Creek (area 4 on map on previous page). It is the most barren of the communities, due to disturbance caused by the deterioration of an old gravel bar in the wall of the canyon. The steep, north-facing slope is a substrate of loose sand, pebbles and cobbles, mostly of basaltic composition, that shift down toward the canyon floor when disturbed. Cover in this community is sparse, consisting of a Russian olive (*Elaeagnus angustifolia*), a few big sagebrush, rabbitbrush, and cheatgrass.

Among the weedy species, bull thistle (*Cirsium vulgare*) and Russian thistle (*Salsola tragus*) are characteristic of the farmland above the canyon, while moth mullein (*Verbascum blattaria*) is characteristic of the canyon walls along the Snake and Columbia rivers. This is the only community in which we found silverleaf phacelia (*Phacelia hastata*).

2 The northernmost population of western juniper in North America lies only about 30 air miles north of Juniper Canyon; that population is protected by the Juniper Dunes Wilderness Area east of Pasco, Washington (http://www.blm.gov/or/resources/recreation/files/brochures/brochure-juniper.pdf).

3 http://websoilsurvey.nrcs.usda.gov/app/

4 nhttp://www1.usgs.gov/csas/nvcs/nvcsGetUnitDetails?elementGlobalId=849126

East of the beaver ponds, Juniper Creek has eroded the base of gravels deposited by the Missoula floods. Photo by Bob Carson.

A grassy marsh covers the upper half of the canyon floor (east of the willow riparian woodland), sandwiched between the north and south canyon walls. Here the stream is impounded by beaver dams, creating a lush environment. Photo by Bob Carson.

Floodplain communities

We mapped three types of vegetation in the floodplain of Juniper Creek: marsh, riparian woodland, and cattail marsh. The silt loam soil of these communities is classed as a xerofluvent, meaning a floodplain soil that developed in a semi-arid Mediterranean climate (moist cold winter, dry warm summer).

Marsh

Covering the upper half of the canyon floor that slopes gently westward (area 5 on map on page 5), the marsh formed where the stream was impounded by beaver dams, creating lush vegetation. It is sandwiched between the north and south canyon slopes east of the *Salix* Riparian Woodland, which is dominated by two willow species, peachleaf (*Salix amygdaloides*) and narrowleaf willow (*Salix exigua*), the latter appearing to be a favorite food of the beavers.

This community has a dense cover of grasses and rushes, both in the slow moving water and in the surrounding mud flats, attracting cattle grazing year-round. The wetter areas are dominated by narrowleaf cattail (*Typha angustifolia*), common reed (*Phragmites australis*), hardstem bulrush (*Schoenoplectus acutus*), and three-square bulrush (*S. americanus*).

Here we also found American licorice (*Glycyrrhiza lepidota*), a traditional medicine plant for Native Americans, and common cocklebur (*Xanthium strumarium*), a native species of floodplains that is often mistaken for an introduced noxious weed *(Xanthium spinosum*) because the spiny fruits of both species cling tenaciously to boots, pants, and backpacks.

Salix amygdaloides/Salix exigua Riparian woodland[5]

This community covers the relatively flat eastern portion of the canyon floor (area 6 on map on page 5), downstream from the marsh and bounded by the narrowleaf cattail community on the east and south. Because the channel of Juniper Creek is narrower and the water flows faster here, the silt loam soil is drier, and also more compacted than the marsh area.

As reflected by our name for this area, vegetation is dominated by narrowleaf willow. Two abundant species in this type are an introduced perennial, whitetop (*Lepidium draba*), which flowers from May to September, followed by a native annual, horned seablight (*Suaeda calceoliformis*), flowering from late August through early November.

Narrowleaf cattail marsh[6]

This community borders both sides of Juniper Creek extending upstream from the mouth at the Columbia River, on the south side of the marsh and *Salix* riparian woodland (area 7 on map on page 5). Due to a high water table, the soil in this community is wet

5 http://www1.usgs.gov/csas/nvcs/nvcsGetUnitDetails?elementGlobalId=689863
6 http://www1.usgs.gov/csas/nvcs/nvcsGetUnitDetails?elementGlobalId=684716

The willow riparian woodland covers the relatively flat eastern portion of the canyon floor, downstream from the marsh and bounded by the narrowleaf cattail community on the east and south. Photo by Marin Axtell.

Peachleaf willow (*Salix amygdaloides*) is one of two willows that grow in the floodplain. Photo by Marin Axtell.

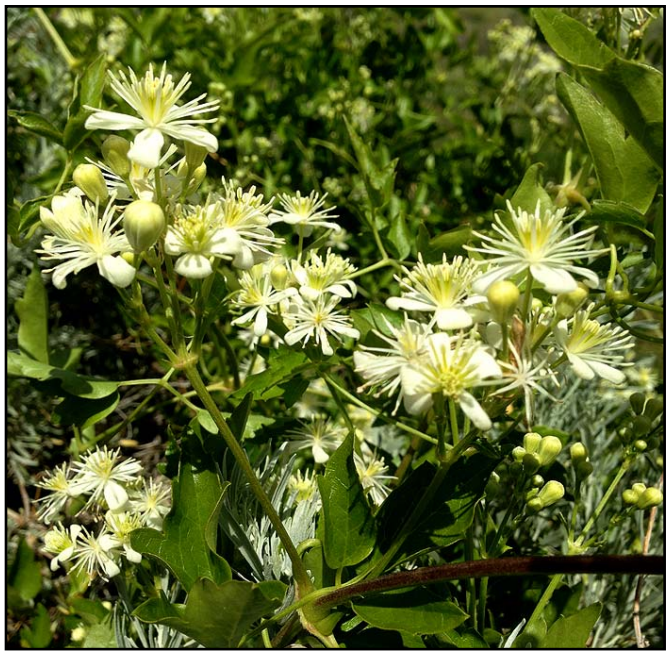
nearly year-round. During the colder part of the winter, ice forms over the water, particularly near the edges. Emergent vegetation, including tules, bulrushes, sedges, and cattails, creates a haven for frogs, herons, ducks, and numerous song birds. We found two aquatic species, common duckweed (*Lemna turionifera*) and Pacific mosquitofern (*Azolla filiculoides*).

Other native plants include narrowleaf willow, stinging nettle (*Urtica dioica*), Hall's willowherb (*Epilobium hallianum*), pale smartweed (*Persicaria lapathifolia*), and northern bugleweed (*Lycopus uniflorus*). A number of non-native species have invaded this wetland, including poison hemlock (*Conium maculatum*), yellow flag iris (*Iris pseudacorus*), false indigobush (*Amorpha fruticosa*), purple loosestrife (*Lythrum salicaria*) and, on the better drained edges of the community, whitetop, diffuse knapweed (*Centaurea diffusa*) and bull thistle (all Class B species on the Oregon Noxious Weed list).

Seasons in the sun: Juniper Canyon through a naturalist's eyes

Spring

Early spring starts in February, and in some years as early as mid-January, with the blooming of salt-and-pepper desert-parsley (*Lomatium gormanii*). As soon as the soils warm and the last few cool nights fade in early March, sagebrush buttercup (*Ranunculus glaberrimus*) appears, along with the delicate prairie starflower (*Lithophragma parviflora*), the spectacular yellow bell (*Fritillaria pudica*), and desert shooting star (*Dodecatheon conjugens*). The first native grasses to emerge from dormancy for the new growing season are Sandberg bluegrass, Indian ricegrass, and bluebunch wheatgrass. On the dunes, veiny dock (*Rumex venosus*) pushes its way up through the sandy soil; its thick leathery leaves attract the first shiny metallic blue leaf beetles that use the plant for breeding and feeding. Soon, low carpets of gold star (*Crocidium multicaule*) brighten the sage and bitterbrush stands. In April, the pale yellow flowers of bitterbrush bring the first mass bloom for pollinators in this canyon. Bitterbrush provides important seasonal thermal cover (shade) to animals that live in this hot environment, as well as being the favored forage of many native browsers. Patches of cryptobiotic soil crust, composed of lichens, mosses, and other microorganisms (cyanobacteria and algae), are evidence of recovery from decades of heavy grazing and trampling by cattle. Where they coat the surface of sandy soils that have stabilized enough to support sagebrush, rabbitbrush, bunchgrasses, and forbs, these soil crusts help conserve soil moisture by limiting evaporation



Western white clematis (*Clematis ligusticifolia*) flowered in late May in the floodplain. Photo by Chelsea Cordell.

and hinder invasive species by preventing seed contact with the soil. Early spring ends with the emergence of needle-and-thread, poisonous woolypod milkvetch (*Astragalus purshii*), and rough wallflower (*Erysimum capitatum*) from the sandy soils. The first native wasps, bees, butterflies, ants and flies also emerge under the warm sun, ready to pollinate the peak season flowers.

Desert shooting star (*Dodecatheon conjugens*). Photo by Mike Denny.

Yellow bells (*Fritillaria pudica*). Photo by Mike Denny.

Summer

In late May temperatures rise dramatically, drying the soil surface. Many early flowering plants have already produced seed. On the dunes, veiny dock is loaded with bright pink winged fruits that many mistake for large clumps of flowers. Desert paintbrush (*Castilleja chromosa*)**,** a hemiparsitic plant with a limited distribution in Juniper Canyon, flashes forth in fiery colors to light up the shrub-steppe communities. Gairdner's beardtongue (*Penstemon gairdneri*) attracts ants and native bees to its spectacular pale pink tubular flowers. Out of the dry soil also appears the low, thick-growing Munro's globemallow (*Sphaeralcea munroana*) with its vivid orange-red flowers emerging from gray-green buds; these plants create patches of brilliant orange in an otherwise drab gray/green sandy area. Northern wyethia (*Wyethia amplexicaulis*), now in full bloom, is a spectacular large composite flower named in honor of Nathaniel Wyeth, who passed by the mouth of Juniper Canyon on 19 October 1832 on his way to Fort Vancouver. Known to many as mule's ears, this resplendent native flower marks the start of the hot season in Juniper Canyon. The emergence of whitestem evening

Flat-topped broomrape (*Orobanche corymbosa* ssp. *corymbosa*) is a small native annual that is parasitic on roots of *Artemisia tridentata*. Photos by Mike Denny.

primrose (*Oenothera pallida*) creates opportunities for crepuscular pollinators such as moths, crickets, and rodents. Locoweed, biscuit root, buckwheat, and the cool season grasses are already fruiting. Along the riparian zone of Juniper Creek the growth is rank with black cottonwood, coyote and peachleaf willows, and a few American hackberry (*Celtis occidentalis*). There are many patches of common cattail, hardstem bulrush, and several sedge species (*Carex*). Invasive reed canarygrass (*Phalaris arundinacea*) grows in dense mats all along the creek. The hydrology of the valley floor is naturally managed by a beaver population whose dams create pools that extend the growing season through the hot summers typical of the canyon.

Autumn

From late August into early September, snow buckwheat (*Eriogonum niveum*) graces the sandy soils with its showy silver-green leaves and papery white flowers lightly tinged with pink. The foliage and flowers are naturally dry, so persist until battered by fall rainstorms and wind. When most plants have finished flowering and set seed, rabbitbrush comes into its full glory, giving a golden glow to the canyon. It is complemented by purple flowers of hoary tansyaster (*Dieteria canescens,* formerly *Machaeranthera*). Late-flowering Asteraceae set out the last great offering of pollen and nectar for the numerous insect pollinators that are getting ready to meet the arrival of winter. These shrubs and herbs provide food for a wide array of rodents, birds, and mammals also preparing for the cold winter months.

Winter

Winter can be short in this canyon, sometimes becoming intermittent by mid-January. But when Arctic air flow brings ice and snow, small birds and other animals seek food and cover in the dense evergreen foliage of the juniper trees. The round silvery-blue juniper "berries" provide winter forage for American Robins, Western Bluebirds, Townsend's Solitaire, and mule deer, and are also eaten by Cedar Waxwings, coyotes, and wood rats. The trunks of old mature junipers are host to numerous wintering spiders, insects, hibernating tree frogs, and many species of bats, along

Ice along Juniper Creek during the coldest part of the winter. Photo by Chelsea Cordell.

with seasonal nesting Ferruginous, Swainson's, and Red-tailed Hawks. Long-eared and Great Horned Owls depend on the nests of Black-billed Magpies in these trees.

Most native plants are dormant in the winter, but some of the native bunchgrasses (*e.g.*, bluebunch wheatgrass and Sandberg bluegrass) develop green leaves with fall rains and grow intermittently when temperatures rise above freezing. Introduced Mediterranean annuals, *e.g.*, cheatgrass and yellow starthistle (*Centaurea solstitialis*), germinate with the first rains of late fall and grow at temperatures just above freezing, extending their roots deep into the soil. This gives these invaders a competitive advantage over seedlings of native plants, especially when the weeds are less palatable to livestock. Some species pass the winter as seeds in the plant litter over the soil surface, providing a food source for small rodents and birds.

Acknowledgements

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Hiking in Juniper Canyon

Driving directions to Juniper Canyon: From Interstate 84 east of Boardman, turn north on US Highway 730 at Boardman Junction toward Irrigon and Umatilla. Continue northeast on 730 past Umatilla for 15 miles. Alternatively, take Exit 182 on Interstate 84 onto Highway 207 north (toward Hermiston), follow 207 for about 12 miles and turn right onto Highway 730. Follow Highway 730 east for about 7.5 miles to Juniper Canyon. Pull off at a turnout and park in the small parking area on the southeast side of Highway 730 between mileposts 198 and 199.

The bedrock here is all Columbia River basalt; outcrops by the creek are Wanapum Basalt, whereas the "scabs" at the top of the canyon are younger Saddle Mountains basalt. Two crude trails lead eastward along the sides of Juniper Canyon; both become faint in about a mile. However, numerous game and cattle trails provide easy access to the open country. The trail on the south side of Juniper Canyon starts at the gate and climbs up and over several sandy benches. A remnant of this Mazama ash deposit is exposed just to the left of and below the trail a short distance east of the parking lot. Within a few minutes of walking are two large juniper trees to the north and a patch of bare sand high to the south. At an elevation of 760 feet, small juniper trees grow on sand that overlies a giant gravel bar deposited by the Missoula floods. Below this hill Juniper Creek has undercut the eddy bar to expose the thick, steeply dipping gravels. Along the creek are beaver ponds and wetland vegetation. Farther east are dune complexes with patches of bare sand. The prevailing westerly winds have blown the sand here from the Umatilla Basin. Juniper Canyon is a sand trap as the creek prevents further transport northeast.

To access the trail on the north side of Juniper Canyon, one can also cross the bridge to the north side of Juniper Creek; a path goes east along the fence on the north side of the wetland. The creek is easily crossed by foot on a basalt outcrop at the east end of the wetland. The trail along the north side of Juniper Canyon stays close to the wetland and passes by the beaver dams. The scabland topography high above is due to erosion by the Missoula floods; on the south side of the 975-foot hill, and farther east up to an elevation of 1,030 feet, are granitic boulders up to 6 feet in diameter. These erratic boulders were deposited here during the melting of icebergs stranded at the shorelines of the Missoula floods. To the northeast, above the level of the Missoula floods, loess covers the basalt.

Continued public access across private land depends on responsible use. Visitors should reclose gates when entering and leaving (or leave the gates as they were found). Remember that both the floodplain and the privately owned slopes should be treated respectfully.

Russian olive (*Elaeagnus angustifolia*) is a non-native invader of wetlands and floodplains. Photo by Chelsea Cordell.

Marin P. Axtell

Marin Axtell is a native Idahoan and a recent graduate of Whitman College in Walla Walla, Washington, with a BA in Spanish and biology. She currently works with the Idaho Immunization Program and hopes to begin a Masters program in the near future.

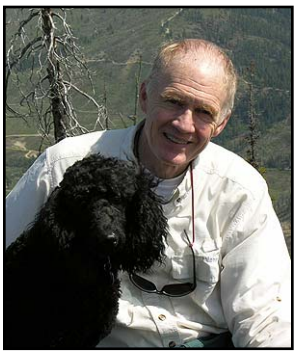
Chelsea C. Cordell

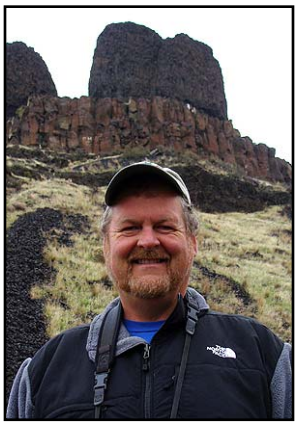
Chelsea grew up in the rainy forests of Olympia, Washington, and graduated from Whitman College in Walla Walla, Washington, with a BA in biology and anthropology. After a summer as a sea kayak tour guide in Ketchikan, Alaska, she is currently residing in San Francisco, California, spending her time hiking, backpacking, and getting to know the flora of the Bay Area and the Sierra Nevada.

Robert J. Carson

Bob Carson is Phillips Professor of Geology and Environmental Studies at Whitman College in Walla Walla, Washington. After he earned an AB in geology from Cornell University, he worked for Texaco, Inc. His other geology degrees are an MS from Tulane University and a PhD from the University of Washington. Summer employment included Washington's Department of Ecology and Division of Geology and Earth Resources.

His interests are in the earth and environmental sciences; his courses deal with resources and pollution, human interaction with the biosphere, glaciers, volcanoes, water, global climate change, landforms, and natural hazards. As a whitewater guide and member of the American Alpine Club, he has led field trips in Africa, Eurasia, South America, and throughout North America. His books include *Hiking Guide to Washington Geology*, *Where the Great River Bends*, *East of Yellowstone,* and *Many Waters.*





Michael E. Denny

Mike Denny was born in Oregon. He began studying natural history at age eight while growing up in southeast Africa, where he was in awe of all things living. After he returned to the US, he studied biology and art in college. He and his wife MerryLynn now live in Walla Walla. Mike illustrated the *Birders Guide to Idaho* (1998), and co-authored several books: *The Birds of the Inland Northwest and Northern Rockies* (2008), *Where the Great River Bends* (2008), *The Birds of Interior BC and the Rockies* (2009) and *Many Waters* (2015). Mike greatly enjoys hiking, birding, Lepidoptera and botanizing. He also taught adult education classes at Walla Walla Community College for fifteen years and guest lectured at Whitman College and Walla Walla University. He works for Walla Walla Community College, Water and Environmental Center as a grant writer.

Heidi E. M. Dobson

Heidi Dobson is Professor of Biology and Director of the Whitman College Herbarium, in Walla Walla, Washington. She earned her AB in botany and BS in agricultural science from the University of California Berkeley, her MS in entomology from the University of California, Davis, and her PhD in botany from the University of California Berkeley. As an undergraduate, she worked during the summers in Yosemite National Park conducting research on the ecological carrying capacity of the subalpine backcountry. Her expertise and passion lie at the intersection of botany and entomology, encompassing the biology of solitary bees and the factors underlying their associations with flowers and particularly with pollen. Her research has taken her from the California chaparral, to eastern Washington, the Mediterranean, and Sweden.

List of the plant species collected and observed in Juniper Canyon

Codes are 1=Basin wildrye/saltgrass (disturbed grassland), 2=Western juniper/big sagebrush-bitterbrush, 3=Bluebunch wheatgrass/ Sandberg bluegrass, 4=exposed gravel bar (Rock), 5=marsh, 6=willow riparian woodland, 7=narrowleaf cattail marsh. MD in the column under ** indicates taxa observed by Mike Denny. For all other taxa, voucher specimens have been deposited in the Whitman College Herbarium (WCW). Weed status indicates taxa on the Class B list of Oregon Noxious Weeds.

Family: Genus and Species	Family: Common Name	**	Community	Weed status	Origin	Lifespan	Dates seen in Flower
FLOWERING PLANTS: MONOCOTS							
ARACEAE							
Lemna turionifera	COMMON DUCKWEED		5, 7		NATIVE	PER	
ASPARAGACEAE							
Triteleia grandiflora	LARGEFLOWER TRITELEIA		2		NATIVE	PER	14-Apr
CYPERACEAE							
Carex sp.	SEDGES	MD	7		NATIVE	PER	
Eleocharis palustris	COMMON SPIKERUSH		5, 7		NATIVE	PER	5-Jul
Schoenoplectus acutus	COMMON TULE		5, 6, 7		NATIVE	PER	26-Jun
Schoenoplectus americanus	CHAIRMAKER'S BULRUSH		5, 6, 7		NATIVE	PER	5-Jul
IRIDACEAE							
Iris pseudacorus	YELLOW FLAG IRIS		7	B	INTROD	PER	30-May
JUNCACEAE							
Juncus saximontanus A. Nels.	ROCKY MOUNTAIN RUSH		5, 6, 7		NATIVE	PER	
Juncus torreyi	TORREY'S RUSH		5, 7		NATIVE	PER	
LILIACEAE							
Fritillaria pudica	YELLOW BELLS	MD	2		NATIVE	PER	30-May
POACEAE							
Achnatherum hymenoides	INDIAN RICEGRASS	MD	2		NATIVE	PER	
Agrostis stolonifera	CREEPING BENTGRASS		1, 2, 5		INTROD	PER	5 July - 21 July
Aristida purpurea var. *longiseta*	RED THREEAWN		2		NATIVE	PER	26-Jun (fruiting)
Bromus commutatus	HAIRY CHESS		1, 5		INTROD	ANN	
Bromus diandrus	RIPGUT GRASS		1, 3		INTROD	ANN	6-May
Bromus hordeaceus	SOFT BROME		2		INTROD	ANN	30-May
Bromus tectorum	CHEATGRASS		1, 2, 3,4		INTROD	ANN	14-Apr
Cenchrus longispinus	MAT SANDBUR		2		INTROD	ANN	21-Jul
Cynodon dactylon	BERMUDAGRASS		7		INTROD	PER	16 June - 21 July
Distichlis spicata	SALTGRASS		1, 5		NATIVE	PER	
Elymus elymoides	SQUIRRELTAIL		2		NATIVE	PER	30-May
Hesperostipa comata	NEEDLE-AND-THREAD	MD	2		NATIVE	PER	
Hordeum jubatum	FOXTAIL BARLEY		6		NATIVE	PER	16-Jun
Hordeum murinum	WALL BARLEY		6		INTROD	ANN	21-Jul
Leymus cinereus	BASIN WILDRYE		6		NATIVE	PER	16-Jun
Muhlenbergia asperifolia	ALKALI MUHLY		6		NATIVE	PER	21-Jul
Phalaris arundinacea	REED CANARYGRASS		5		INTROD	PER	16-Jun
Phragmites australis	COMMON REED		5, 6		INTROD/N	PER	10-Aug
Poa bulbosa	BULBOUS BLUEGRASS		1, 3		INTROD	PER	6-May
Poa secunda	SANDBERG BLUEGRASS		2		NATIVE	PER	29-Mar
Polypogon monspeliensis	ANNUAL RABBITSFOOT GRASS		5, 6		INTROD	ANN	16-Jun
Pseudoroegneria spicata	BLUEBUNCH WHEATGRASS		2, 3		NATIVE	PER	26-Jun
Schedonorus arundinaceus	TALL FESCUE		5, 6		INTROD	PER	6-May
Sporobolus cryptandrus	SAND DROPSEED		2		NATIVE	PER	16-Jun
Thinopyrum intermedium	INTERMEDIATE WHEATGRASS		1, 3		INTROD	PER	5-Jul
Thinopyrum ponticum	TALL WHEATGRASS		5, 6		INTROD	PER	5 July - 21 July
Vulpia myuros	RATTAIL FESCUE		1, 3, 6		INTROD	ANN	6-May
FLOWERING PLANTS: DICOTS							
ADOXACEAE							
Sambucus nigra	BLUE ELDERBERRY		5		NATIVE	PER	30-May
AMARANTHACEAE							
Atriplex canescens	FOURWING SALTBRUSH		3		NATIVE	PER	10-Aug
Amaranthus albus	PROSTRATE PIGWEED		3		INTROD	ANN	21-Jul
Chenopodium rubrum	RED GOOSEFOOT		6,7		NATIVE	ANN	10-Aug
Kochia scoparia var. *subvillosa*	KOCHIA		2	B	INTROD	ANN	15-Oct
Salsola tragus	RUSSIAN THISTLE		1,2,3,4,5,6,7		INTROD	ANN	10 Aug - 22 Sept
Suaeda calceoliformis	HORNED SEABLIGHT		5		NATIVE	ANN/PER	22-Sep

Family: Genus and Species	Family: Common Name	**	Community	Weed status	Origin	Lifespan	Dates seen in Flower
APIACEAE							
Anthriscus caucalis	BUR CHERVIL		2		INTROD	ANN	6 May - 30 May
Conium maculatum	POISON HEMLOCK		1,2,7	B	INTROD	BIEN	30-May
Cymopterus terebinthinus	TERPENTINE CYMOPTERUS		2		NATIVE	PER	26-Jun (fruiting)
Daucus carota	WILD CARROT		1		INTROD	BIEN	21-Jul
Lomatium gormanii	SALTANDPEPPER	MD	3		NATIVE	PER	
Lomatium grayi	GRAY'S BISCUITROOT		2,4,7		NATIVE	PER	14-Apr
APOCYNACEAE							
Asclepias speciosa	SHOWY MILKWEED		2, 4, 8		NATIVE	PER	16 June - 5 July
Asclepias fascicularis	NARROWLEAF MILKWEED	MD	5		NATIVE	PER	
ASTERACEAE							
Achillea millefolium	COMMON YARROW		1,2,3,7		NATIVE	PER	14-Apr
Acroptilon repens	RUSSIAN KNAPWEED		2,4	B	INTROD	PER	5-Jul
Agoseris grandiflora	LARGE FLOWERED AGOSERIS		2,3		NATIVE	PER	20-Jun
Ambrosia acanthicarpa	BUR RAGWEED		2		NATIVE	ANN	3-Sep
Arnica longifolia	SPEAR-LEAF ARNICA		7		NATIVE	PER	21 July - 10 August
Artemisia absinthium	ABSINTHE WORMWOOD	MD	3		INTROD	PER	
Artemisia rigida	SCABLAND SAGE	MD	3		NATIVE	PER	
Artemisia tridentata	BIG SAGEBRUSH		1,2,3,4		NATIVE	PER	21 July - 15 Oct
Balsamorhiza careyana var. *intermedia*	CAREY'S BALSAMROOT		2		NATIVE	PER	20-Jun
Balsamorhiza sagittata	ARROWLEAF BALSAMROOT		2		NATIVE	PER	14-Apr
Bidens cernua	NODDING BEGGARTICKS		2		NATIVE	ANN	3-Sep
Centaurea diffusa	DIFFUSE KNAPWEED		1	B	INTROD	BIEN	10-Aug
Centaurea solstitialis	YELLOW STARTHISTLE		1,3	B	INTROD	ANN	16-Jun
Chaenactis douglasii	DUSTY MAIDENS		2		NATIVE	BIEN/PER	30-May
Chondrilla juncea	RUSH SKELETONWEED		1,3		INTROD	PER	
Chrysothamnus viscidiflorus	YELLOW RABBITBRUSH		2,7		NATIVE	PER	10-Aug
Cirsium arvense	CANADA THISTLE		1	B	INTROD	PER	5-Jul
Cirsium undulatum	WAVY-LEAF THISTLE		2, 7		NATIVE	BIEN/PER	16-Jun
Cirsium vulgare	BULL THISTLE		4, 7	B	INTROD	BIEN	21-Jul
Conyza canadensis	MARESTAIL		2,3		NATIVE	ANN	
Crepis acuminata	TAPERTIP HAWKSBEARD		2		NATIVE	PER	30 May - 16 June
Crepis capillaris	SMOOTH HAWKSBEARD		7		INTROD	ANN/BIEN	21-Jul
Crocidium multicaule	GOLD STAR		2		NATIVE	ANN	29-Mar
Dieteria canescens	HOARY TANSYASTER		2,3		NATIVE	ANN/PER	15 Oct - 3 Nov
Ericameria nauseosa	RUBBER RABBITBRUSH		1,2,3,4		NATIVE	PER	10 Aug - 22 Sept
Erigeron pumilus	SHAGGY FLEABANE		1,2		NATIVE	PER	6-May
Euthamia occidentalis	WESTERN GOLDENTOP		2, 7		NATIVE	PER	3 Sept - 22 Sept
Helianthus annuus	ANNUAL SUNFLOWER	MD	1		NATIVE	ANN	late Aug-Sept
Heterotheca villosa	HAIRY FALSE GOLDENASTER		7		NATIVE	PER	5 July - 21 July
Lactuca serriola	PRICKY LETTUCE		2,3		INTROD	ANN/BIEN	5 July - 21 July
Solidago lepida	WESTERN CANADA GOLDENROD		8		NATIVE	PER	21-Jul
Sonchus arvensis	FIELD SOWTHISTLE		2		INTROD	PER	15-Oct
Stephanomeria paniculata	TUFTED WIRELETTUCE		3		NATIVE	ANN/PER	10-Aug
Symphyotrichum ascendens	WESTERN ASTER		1,2,3		NATIVE	PER	3-Sep
Tragopogon dubius	YELLOW SALSIFY		1		INTROD	ANN/BIEN	16-Jun
Wyethia amplexicaulis	NORTHERN MULESEARS	MD	2		NATIVE	PER	
Xanthium strumarium	COMMON COCKLEBUR		5, 7		NATIVE	ANN	3-Sep
BORAGINACEAE							
Amsinckia lycopsoides	TARWEED FIDDLENECK		2		NATIVE	ANN	26-Jun
Amsinckia menziesii var. *menziesii*	MENZIES FIDDLENECK		2		NATIVE	ANN	29-Mar
Cryptantha flaccida	WEAKSTEM CRYPTANTHA		3		NATIVE	ANN	14-Apr
Heliotropium curassavicum	SALT HELIOTROPE		1		NATIVE	ANN/PER	30-May
Phacelia hastata	SILVERLEAF PHACELIA		4		NATIVE	PER	6 May - 16 June
Phacelia linearis	THREADLEAF PHACELIA		2		NATIVE	ANN	14-Apr
BRASSICACEAE							
Descurainia pinnata	WESTERN TANSYMUSTARD		2,7		NATIVE	ANN/PER	29-Mar
Draba verna	SPRING DRABA		1		INTROD	ANN	24 Feb - 19 March
Erysimum capitatum	WALLFLOWER	MD	2		NATIVE	BIEN/PER	
Lepidium chalepense	ASIAN WHITETOP		2	B	INTROD	PER	6 May - 30 May
Lepidium draba	WHITETOP		1,6,7	B	INTROD	PER	30-May
Nasturtium officinale	WATERCRESS		5,6		INTROD	PER	30-May
Sisymbrium altissimum	TALL TUMBLE MUSTARD		1,2,3		INTROD	ANN/BIEN	14-Apr
CANNABACEAE							
Celtis reticulata	NETLEAF HACKBERRY		6		NATIVE	PER	14-Apr

Family: Genus and Species	Family: Common Name	**	Community	Weed status	Origin	Lifespan	Dates seen in Flower
CARYOPHYLLACEAE							
Arenaria serpyllifolia	THYMELEAF SANDWORT		1		INTROD	ANN	29-Mar
Stellaria media	COMMON CHICKWEED		7		INTROD	ANN	29-Mar
COMANDRACEAE							
Comandra umbellata	BASTARD TOADFLAX		1,2		NATIVE	PER	6-May
CRASSULACEAE							
Sedum lanceolatum var. *lanceolatum*	LANCELEAF STONECROP	MD	2		NATIVE	PER	
DIPSACACEAE							
Dipsacus fullonum	FULLER'S TEASEL		6,7		INTROD	BIEN	5-Jul
ELAEGNACEAE							
Elaeagnus angustifolia	RUSSIAN OLIVE		4		INTROD	PER	
EUPHORBIACEAE							
Chamaesyce serpyllifolia	THYME LEAVED SPURGE		5		NATIVE	ANN	5-Jul
FABACEAE							
Amorpha fruticosa	FALSE INDIGOBUSH		7	B	INTROD	PER	5-Jul
Astragalus purshii	WOOLLYPOD MILKVETCH		2, 3		NATIVE	PER	29-Mar
Astragalus whitneyi	BALLOONPOD MILKVETCH		2		NATIVE	PER	16-Jun
Glycyrrhiza lepidota	AMERICAN LICORICE		2		NATIVE	PER	5-Jul
Laedeania lanceolata	SCURFPEA		2		NATIVE	PER	30-May
Melilotus officinalis	YELLOW SWEETCLOVER		1		INTROD	ANN/PER	16 June - 5 July
GERANIACEAE							
Erodium cicutarium	REDSTEM STORK'S BILL		1		INTROD	ANN/BIEN	14-Apr
GROSSULARIACEAE							
Ribes aureum	GOLDEN CURRENT		6		NATIVE	PER	29 Mar - 30 May
LAMIACEAE							
Lycopus uniflorus	NORTHERN BUGLEWEED		5,6,7		NATIVE	PER	3-Sep
Mentha spicata	SPEARMINT		6,7		INTROD	PER	21 July - 10 Aug
Nepeta cataria	CATNIP		7		INTROD	PER	5-Jul
Salvia dorrii	PURPLE SAGE		2,3		NATIVE	PER	6 May - 30 May
LYTHRACEAE							
Lythrum salicaria	PURPLE LOOSESTRIFE		7	B	INTROD	PER	5-Jul
MALVACEAE							
Sphaeralcea munroana	GLOBEMALLOW	MD			NATIVE	PER	
MONTIACEAE							
Claytonia perfoliata	MINERS LETTUCE		1,2		NATIVE	ANN/PER	29-Mar
ONAGRACEAE							
Clarkia pulchella	PINKFAIRIES		2		NATIVE	ANN	30-May
Epilobium hallianum	HALL'S WILLOWHERB		7		NATIVE	PER	3-Sep
Oenothera pallida	PALE EVENING-PRIMROSE		2		NATIVE	BIEN/PER	16-Jun
OROBANCHACEAE							
Castilleja chromosa	DESERT PAINTBRUSH	MD	2		NATIVE	PER	
Orobanche corymbosa ssp. *corymbosa*	FLAT TOPPED BROOMRAPE	MD	2		NATIVE	ANN	
PLANTAGINACEAE							
Collinsia parviflora	MAIDEN BLUE EYED MARY		2		NATIVE	ANN	29 March - 14 April
Penstemon gairdneri	GAIRDNER'S BEARDTONGUE	MD	2		NATIVE	PER	
Plantago patagonica	WOOLLY PLANTAIN		1,3		NATIVE	ANN	6 May - 30 May
Veronica anagallis-aquatica	WATER SPEEDWELL		7		NATIVE	BIEN/PER	30 May - 5 July
POLEMONIACEAE							
Navarretia capillaris	SMOOTH LEAVED GILIA		1		NATIVE	ANN	3-Sep
Phlox diffusa	SPREADING PHLOX	MD	2		NATIVE	PER	9-Apr
Phlox longifolia	LONGLEAF PHLOX		2		NATIVE	PER	19-May
POLYGONACEAE							
Eriogonum strictum	BLUE MOUNTAIN BUCKWHEAT		1,2		NATIVE	PER	3-Sep
Persicaria lapathifolia	PALE SMARTWEED		7		NATIVE	ANN	21 July - 10 Aug
Polygonum douglasii	DOUGLAS' KNOTWEED		7		NATIVE	ANN	30-May
Polygonum majus	LARGE KNOTWEED		2		NATIVE	ANN	22-Sep
Rumex crispus	CURLY DOCK		5		INTROD	PER	20-Jun
Rumex occidentalis	WESTERN DOCK		2, 7		NATIVE	PER	6-May
Rumex venosus	VEINY DOCK		1, 2, 4		NATIVE	PER	14-Apr
PRIMULACEAE							
Dodecatheon conjugens	DESERT SHOOTINGSTAR	MD	7		NATIVE	PER	
RANUNCULACEAE							
Clematis ligusticifolia	WESTERN WHITE CLEMATIS		1, 6, 7		NATIVE	PER	30-May
Delphinium nuttallianum	TWO-LOBE LARKSPUR		2		NATIVE	PER	14-Apr
Ranunculus glaberrimus	SAGEBRUSH BUTTERCUP	MD	2		NATIVE	PER	

Family: Genus and Species	Family: Common Name	**	Community	Weed status	Origin	Lifespan	Dates seen in Flower
ROSACEAE							
Prunus americana	AMERICAN PLUM		5		NATIVE	PER	14-Apr
Prunus virginiana	CHOKECHERRY		2		NATIVE	PER	6 May - 30 May
Purshia tridentata	ANTELOPE BITTERBRUSH		1, 2		NATIVE	PER	14 April - 30 May
RUBIACEAE							
Galium parisiense	WALL BEDSTRAW		1, 2		INTROD	ANN	14-Apr
SALICACEAE							
Populus trichocarpa	BLACK COTTONWOOD		7		NATIVE	PER	
Salix amygdaloides	PEACH-LEAF WILLOW		5		NATIVE	PER	6-May
Salix exigua	NARROW-LEAF WILLOW		5, 6, 7		NATIVE	PER	29 March - 14 April
SAXIFRAGACEAE							
Lithophragma glabrum	BULBOUS WOODLAND-STAR		2		NATIVE	PER	24 Feb - 29 March
Heuchera cylindrica	DESERT ALUMROOT	MD	2		NATIVE	PER	
SCROPHULARIACEAE							
Verbascum blattaria	MOTH MULLEIN		7		INTROD	BIEN	16-Jun
Verbascum thapsus	COMMON MULLEIN		4, 7		INTROD	BIEN	5-Jul
SOLANACEAE							
Solanum dulcamara	CLIMBING NIGHTSHADE		7		INTROD	PER	30-May
Solanum triflorum	CUT-LEAF NIGHTSHADE		2		NATIVE	ANN	22-Sep
TYPHACEAE							
Typha angustifolia	NARROW-LEAF CATTAIL		5, 7		NATIVE	PER	30-May
URTICACEAE							
Urtica dioica	STINGING NETTLE		6, 7		NATIVE	PER	5 July - 21 July
VALERIANACEAE							
Plectritis macrocera	LONGHORN PLECTRITIS		1, 7		NATIVE	ANN	29 March - 14 April
ZYGOPHYLLACEAE							
Tribulus terrestris	PUNCTURE-VINE		4	B	INTROD	ANN	10-Aug
GYMNOSPERMS							
CUPRESSACEAE							
Juniperus occidentalis	WESTERN JUNIPER		1, 2		NATIVE	PER	
SEEDLESS VASCULAR							
EQUISETACEAE							
Equisetum arvense	FIELD HORSETAIL		7		NATIVE	PER	
Equisetum variegatum	VARIEGATED SCOURINGRUSH		2, 7		NATIVE	PER	
SALVINIACEAE							
Azolla filiculoides ?	PACIFIC MOSQUITOFERN ?		5, 6, 7		NATIVE	ANN	
WOODSIACEAE							
Woodsia scopulina	WOODSIA	MD			NATIVE	PER	