Section 7.0
Vegetation

Summary

Most of the land above the South Arkansas River project corridor is managed by federal agencies, while most of the land adjacent to the river is privately owned. Each area encompasses different plant communities that present different issues. On federal lands, erodible soils, aging forests, drought, fire, and insects reflect potential impacts to the watershed and river. In the project corridor below, streamside (riparian) vegetation in several areas is degraded by changes in stream flows, development, and land use practices. These changes compromise the riparian zone's ability to adequately anchor stream banks, sustain water quality, and provide wildlife habitat. Some solutions are difficult and expensive, such as moving existing development away from the river, while others are fairly easy, such as modifying grazing practices.

This section discusses the major native plant communities in the South Arkansas River watershed, habitats adjacent to the river, rare plants, and non-native plant (weeds).

Plant Communities in the South Arkansas River Watershed and Project Corridor

The South Arkansas River watershed is located in the Southern Rockies Ecoregion 21 (Chapman et al. 2006). Vegetation encompasses three distinct zones—alpine (above tree line or about 11,500 feet), subalpine (9,000 feet to tree line), and montane (7,000 to 9,000 feet). Major plant communities are depicted in Figure 7-1. Note, however, that the boundaries between these communities are seldom distinct as they are influenced by slope, aspect, moisture, soils, and severity of wind exposure and high temperatures.

The tributaries to the South Arkansas River above the project corridor are situated in the alpine and subalpine zones. Most of the project corridor is located in the montane zone. Alpine plant communities are dominated by meadows of grasses and forbs, plus willows along drainages. Subalpine forests include spruce-fir, Douglas-fir, aspen, and lodgepole pine. Most areas in the alpine and subalpine zones in the watershed are managed by the Pike-San Isabel National Forest. Upland plant communities in the montane zone include ponderosa pine, pinyon pine-juniper, and mountain mahogany. Much of the montane area is managed by the Bureau of Land Management. Lower down and in riparian areas the most common communities have aspen, cottonwoods, and alder/willow. Most of the land in these areas is privately owned. These communities are described in more detail below. Plant identification used Wingate (1994), Weber and Wittman (2001), and Carter (2004). Scientific names are from NRCS (2013a).

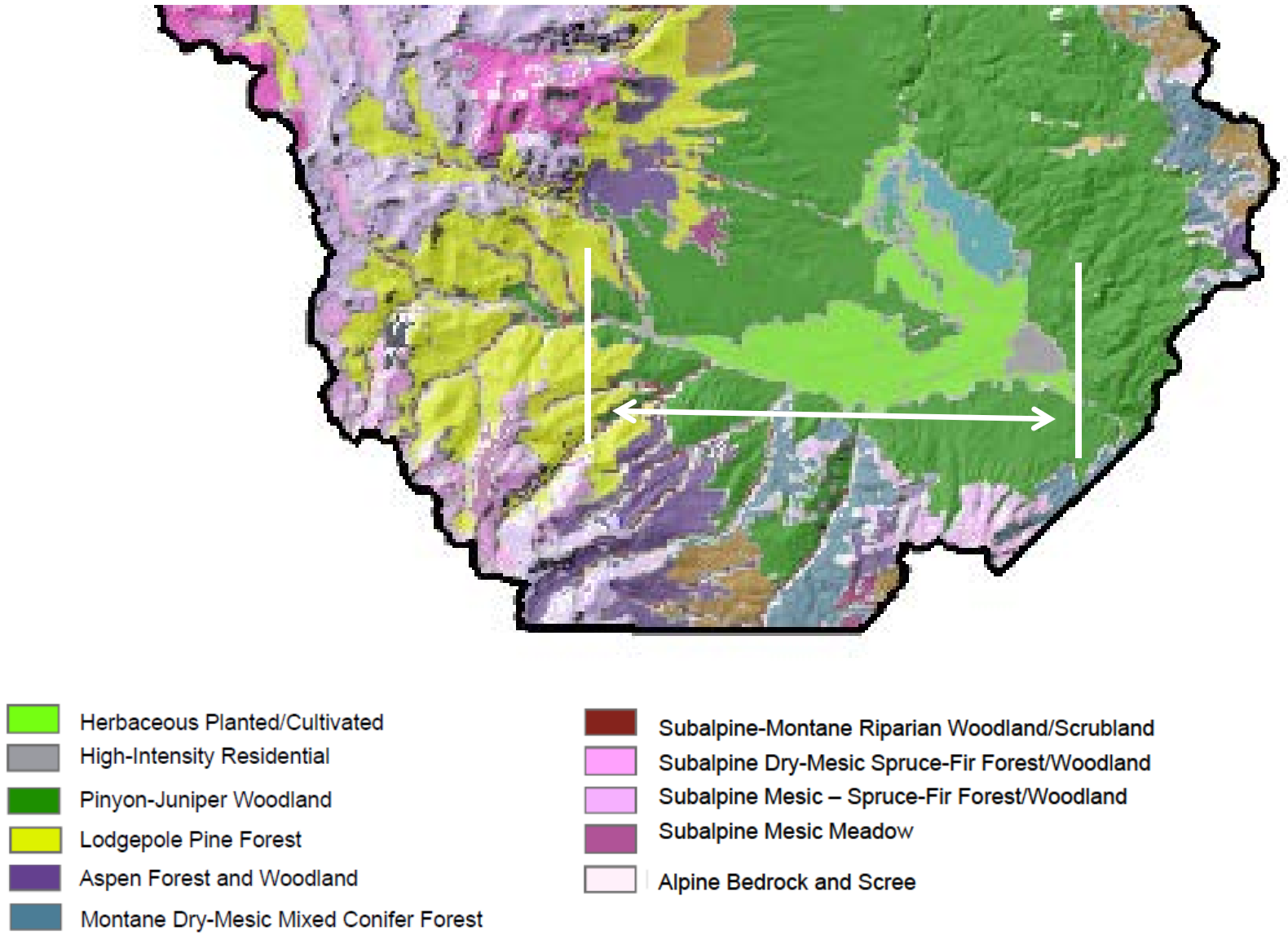

Figure 7-1. Native plant communities in the South Arkansas River watershed
(CNHP 2009) White lines correspond to South Arkansas River project corridor.

In alpine and subalpine areas, **spruce-fir forests** are dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). These forests can be found on all slopes, are often dense, cool, and humid, and often hold their snow well into the summer. Remote, rugged terrain limited the impact of logging in these areas. Insect outbreaks, avalanches, and wind all shape spruce-fir forests. At lower elevations, spruce-fir forests transition to lodgepole pine or aspen-dominated forests, often along abrupt fire-induced boundaries (CNHP 2009).

From CCR 225 to the Xcel power plant, most of the land is managed by the U.S. Forest Service. This represents the upper (west) end of the South Arkansas River project corridor. On the southwest-facing slopes of Missouri Hill and Lost Mountain, a mixture of **ponderosa pine** (*Pinus ponderosa*) and **pinyon pine** (*Pinus edulis*) dominate the overstory. Ponderosa pine tolerates a wider range of growing conditions, but is often found in the warmest and driest areas. These conditions force individual trees to be widely spaced and the understory to be sparse. Pinyon seeds provide important forage for Pinyon Jay (*Gymnorhinus cyanocephalus*) and Clark's Nutcracker (*Nucifraga columbiana*). The shrub layer includes mountain mahogany (*Cercocarpus montanus*) and wax currant (*Ribes cereum*). The understory includes barberry (*Mahonia repens*), junegrass (*Koeleria macrantha*), fescue (*Festuca* sp.), and muhly (*Muhlenbergia* sp.).

In this area, U.S. 50 separates the ponderosa-pinyon community from habitat adjacent to the river dominated by **aspens** (*Populus tremuloides*). Aspens are the only upland deciduous forest species in the region. This species occurs on most slopes between 8,000 and 10,000 feet, but prefers sunny exposures with higher soil moisture. Aspens spread rapidly into areas disturbed by fire, avalanche, or logging by expanding its root system and sprouting new saplings ("suckering"). Thus, a single stand of aspen often represents an individual tree that has expanded. Aspens represent valuable nesting and forage habitat for a wide variety of wildlife. The center of the aspen tree ("heartwood") is susceptible to rot and tends to hollow-out over time. This provides important habitat for cavity-nesting birds such as sapsuckers (*Sphyrapicus* spp.) and woodpeckers (*Picoides* spp.). Aspens are also important forage and construction materials for beavers (*Castor canadensis*).

Soils in aspen forests are usually less rocky, deeper, and richer due to the rapid decomposition of aspen leaves. These conditions create a diverse understory that is quite different from adjacent conifer stands. The shrub layer at drier sites includes dogwood (*Cornus* sp.), twinberry (*Lonicera* sp.), and gooseberry (*Ribes* sp.). Streamside, common shrubs include alder (*Alnus incana* ssp. *tenuifolia*) and willows such as Drummond's (*Salix drummondiana*), Rocky Mountain (*S.moniticola*), and plane-leaf (*S. planifolia*). These shrubs are usually rooted in gravel substrate at or within the active channel, helping to anchor stream banks and streamside soils. Herbaceous plants include cow parsnip (*Heracleum sphondylium*), coneflower (*Rudbeckia lacianata*), and false Solomon's seal (*Maianthemum stellata*).

Across the valley on the north-facing flanks of Pahlone Peak, **lodgepole pine** (*Pinus contorta*) dominates the overstory. Higher up, lodgepole pine is common in areas that are too cold or too wet for other conifers; lower down it is common is areas that are relatively too sterile and dry. Lodgepole pine is quick to spread into areas disturbed by logging, disease, and fire. Thus, disturbance, especially fire, is a critical aspect of lodgepole forest ecology. Lodgepole cones open to release their seeds when fire breaks the resin gluing them shut ("serotony"). The winged seeds then germinate on ground cleared of competition from other plants. The understory in lodgepole forests is usually sparse because of a layer of pine needles that resist decomposition due to tannins and resins and which creates fairly sterile, acidic soils. At the top of the project corridor, the understory consists of buffaloberry (*Shepherdia canadensis*), blueberry (*Vaccinium* sp.), barberry, and wintergreen (*Pyrola minor*). Several ephemeral drainages exist, but the major drainage in this area is Fooses Creek.

As slope aspect changes to north-south, ponderosa pine gives way to pinyon pine with juniper (*Juniperus scopulorum/J. monosperma*) on south-facing slopes, again on sites with intense sunshine, low precipitation, and strong winds. Both pinyon pine and juniper have long taproots as well as chemical means ("allelopathy") to limit browsing by animals and germination by other plants. Understory includes yucca (*Yucca glauca*), golden aster (*Heterotheca villosa*), Indian ricegrass (*Achnatherum hymenoides*), tall oatgrass (*Arrhenatherum elatius*), fringed sage (*Artemisia frigida*), blue grama (*Bouteloua gracilis*), prickly pear (*Opuntia* sp.), and needle-and-thread (*Hesperostipa comata*). This area is drained by Cree and Lost creeks.

Across the valley on the north-facing side, **Douglas-fir** (*Pseudotsuga menziesii*) and scattered ponderosa pine comprise the overstory. Douglas-fir is most common where conditions are cooler and moister. Because of past logging, mixed conifer forests often prevail where Douglas-fir once dominated. The shrub layer is minimal and the understory includes elk sedge (*Carex greyeri*) and heart-leaf arnica (*Arnica cordifolia*). This area is drained by several ephemeral streams. Next to the river, cottonwoods (*Populus angustifolia*) replace aspens in the tree layer. Like aspen, **cottonwoods** provide important habitat for cavity-nesting birds and, to a lesser degree, forage and construction material for beavers. Shrubs and understory plants are similar to aspen forests.

Between the Xcel power plant and Maysville, the highway begins to move away from the river, and level areas between the road and the river are occupied by residential buildings, lawns, and landscaping. Pinyon-juniper dominates the slopes to the north, the shrub layer is largely absent, and ground cover is minimal. Higher elevations in this area are drained by the North Fork of the South Arkansas River. Between Maysville and Poncha Springs/US 285, level terraces expand between the highway and the river. Remnant sagebrush (*Artemisia* sp.) communities appear, but most areas have been converted to grazing and irrigated hay fields. To the south, pinyon pine mixes with Douglas-fir and lodgepole pine above; mountain mahogany is prominent in the shrub

layer. In this area, Green, Willow, and Cochetopa creeks drain Chipeta Mountain and Mount Ouray. The cottonwood-willow-alder association continues adjacent to the river.

At Poncha Springs, Poncha Creek joins the South Arkansas River, draining the higher elevations of Mount Ouray and Antora Peak. From Poncha Springs to the confluence with the Arkansas River, land between U.S. 50 and the river alternates between residential and commercial development and agricultural areas of haying and grazing. Wetlands composed of willows, sedges (*Carex* spp.), and rushes (*Juncus* spp.) are fairly extensive. To the south, the base slopes of Poncha Mountain and Methodist Mountain are dominated by pinyon pine below and Douglas-fir and lodgepole pine above. Several ephemeral streams drain the flanks of the north end of the Sangre de Christo Mountains.

Forest Disturbance and Watershed Health

The role of disturbance in the watershed's conifer forests—insect infestations, pathogens, and fire—can significantly affect watershed health. Except in areas dominated by aspens and cottonwoods, forest soils are usually coarse, not well developed, and easily eroded. When forest health declines, so too does the quality of water flowing from the forest, particularly as a result of reduced soil stability and resulting debris flows (CSFS 2013). Insect infestations can be worsened by climate change (Bentz et al. 2010) and drought (University of Colorado-Boulder 2013).

Insect infestations. Insects impacting the South Arkansas River watershed include spruce bark beetle, western balsam bark beetle, Douglas-fir beetle, the mountain pine beetle, and the pinyon ips beetle.

Spruce beetles (*Dendroctonus rufipennis*) can cause significant mortality in mature Engelmann spruce. Outbreaks typically start a few years after the shallow-rooted spruce are downed by strong winds ("windthrow"), which occurred on Monarch Pass in 2012. The spruce beetle typically requires two years to complete its life cycle. After the initial infestation, subsequent generations attack and kill live trees. In addition to spruce beetle, trees downed by windthrow are vulnerable to Douglas-fir and engraver beetles (CSFS 2013). Significant mortality of spruce in the South Arkansas River watershed is expected in the next few years (Rudney 2013).

Western balsam bark beetles (*Dryocoetes confusus*) commonly infests subalpine fir. Its biology is not fully understood but, like the spruce beetle, it is thought to have a two-year life cycle. The larvae spend the first winter beneath the bark, then develop into adults during the second year. Beetles frequent trees weakened by drought, wind breakage, and root disease (e.g., *Armillaria* spp.). Tree mortality is not usually uniform across the landscape, although cumulative mortality can result in extensive impact areas (NRCS 2007a, USFS 2011).

Douglas-fir beetles (*Dendroctonus pseudotsugae*) infestations continue in drainages north of Florence and Cañon City and in areas from Manitou Springs south (CSFS 2013). In the South Arkansas River watershed, infestations were larger several years ago than they are today (Rudney 2013).

Mountain pine beetles (*Dendroctonus ponderosae*) attacks several pine species, most notably lodgepole pine in Colorado. During the initial stages, the beetle attacks trees stressed by injury, poor site conditions, fire damage, overcrowding, root disease, or old age. As the population expands, beetles may attack most large pine trees in the area (CSU 2007). The age and density of lodgepole forests in the South Arkansas watershed provide potential habitat for the beetle, but the outbreak and damage prevalent in areas farther north seems to have stopped at Fremont and Tennessee passes (Rudney 2013).

Pinyon ips bark beetle (*Ips confusus*) infestations exist in the Arkansas River west of Cañon City, particularly downstream of Parkdale. Damage to pinyon pine shoots by twig beetles (*Pityophthorus* sp.) also exists. Like other tree species in the watershed, existing pinyon pines are older which makes them more vulnerable to the *Ips* beetle (CSFS 2013, Rudney 2013)

Wetlands in the South Arkansas River Project Corridor

Wetlands in the South Arkansas River project corridor are comprised of large irrigated areas next to the river (Figure 7-2) and as discontinuous, narrow strips (≤ 3 feet) immediately adjacent to moving water.[1] Large wetlands are dominated by sedges (*Carex* spp.), rushes (*Juncus* spp.), and other grass-like plants. These wetlands are classified as “palustrine emergent-persistent”, according to Cowardin et al. (1979). Wetlands immediately adjacent to the river are dominated by willows (*Salix* spp.) and alder (*Alnus incana* ssp. *tenuifolia*) and are classified as “palustrine scrub-shrub” according to Cowardin et al. (1979). Understory vegetation in these areas was often limited, but fairly diverse. Both of the Cowardin wetland classes would be considered “riverine” under the hydrogeomorphic (HGM) classification system (Brinson et al. 1995).

Riparian Vegetation in the South Arkansas River Project Corridor

Seven vegetation transects were established to characterize riparian plant communities in the South Arkansas River project corridor (Figure 7-3). Two main differences are apparent in those communities—the extent of trees in the overstory and the prevalence of non-native and weedy species in the understory. The dividing line for these differences is U.S. 285, not coincidentally where development dominates in Poncha Springs and Salida. To the west, most streamside areas are well-vegetated with native trees (aspens, cottonwoods) and shrubs (willows, alders) characteristic of healthy riparian zones. In terms of cover, the tree layer ranges from 50 to 90% closed, and the

[1] Wetlands were identified using the three parameter method specified by the U.S. Army Corps of Engineers (USACE 1987).

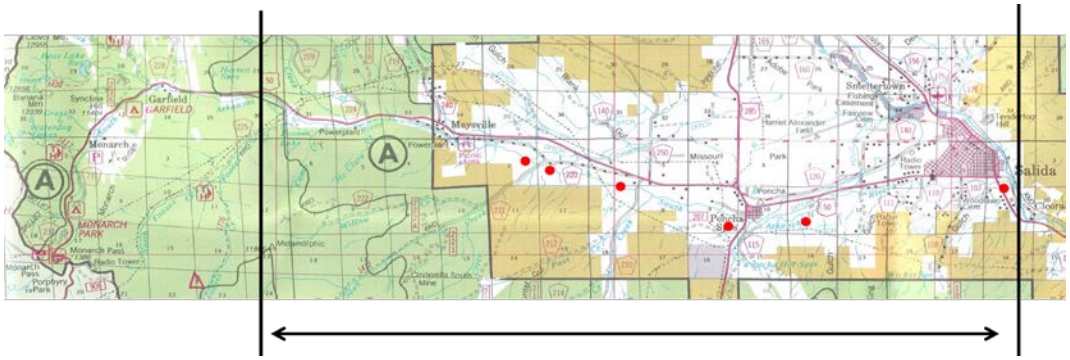

Figure 7-2. Locations of major wetland areas in the South Arkansas River project corridor

shrub cover ranges between 50 and 75%. In developed areas, similar figures are 0-60% for trees and 0-50% for shrubs. Other differences are described below.

- Areas upstream of U.S. 285 have a greater diversity of age classes among the trees and shrubs present, meaning that these key components of the system are actively recruiting and replacing themselves.
- Upstream of U.S. 285, the diversity of native shrubs is also higher, including natives like dogwood, twinberry, and gooseberry. Part of this difference is due to elevation.
- In terms of the understory – grasses and forbs – species diversity is similar up and downstream of U.S. 285, but the species upstream are almost solely native, while those downstream tend toward upland and weedy, such as intermediate wheatgrass (*Thinopyrum intermedium*), Canada thistle (*Cirsium arvense*), and milkweed (*Asclepias* sp.).
- The reasons for areas without vegetation are notable – needles and leaves upstream of U.S. 285, and construction materials and disturbed ground below.

For the most part, riparian vegetation on agricultural and undeveloped land between the two towns has more in common with areas west of U.S. 285.

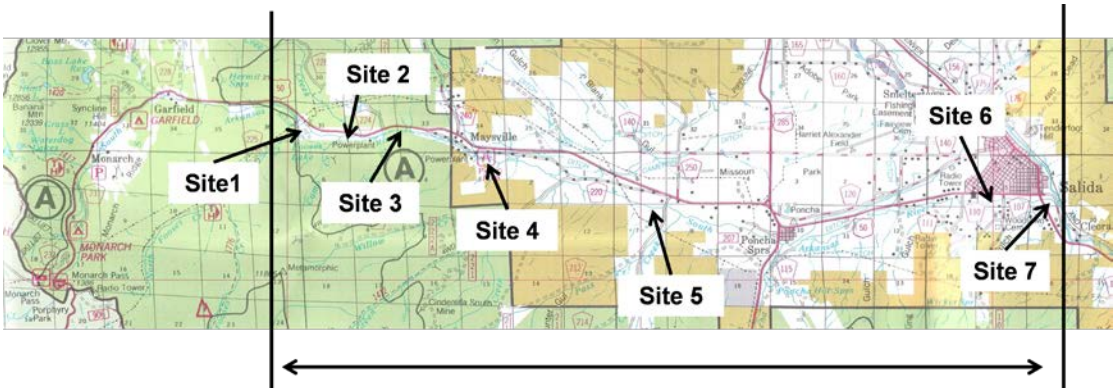

Figure 7-3. Locations of riparian vegetation transects in the South Arkansas River project corridor

These differences in the riparian zone above and below U.S.285 affect its ability to perform its normal functions, such as bank stabilization, wildlife habitat, shade, and organic matter at the base of the stream food chain. Intact riparian communities are also more resilient to disturbance induced by flooding, while other habitats are more likely to continue to degrade. Procedures and data sheets are provided in Appendix C.

Rare Plant Communities

Figure 7-4 depicts the locations of unique plant communities ("potential conservation areas") in the South Arkansas River watershed as identified by the Colorado Natural Heritage Program (CNHP 2009). Table 7-1 provides more details. Potential conservation areas include a single occurrence of a rare element or a suite of rare elements or significant features. Specific activities or land use changes within or adjacent to such areas should be evaluated for potential adverse impacts.

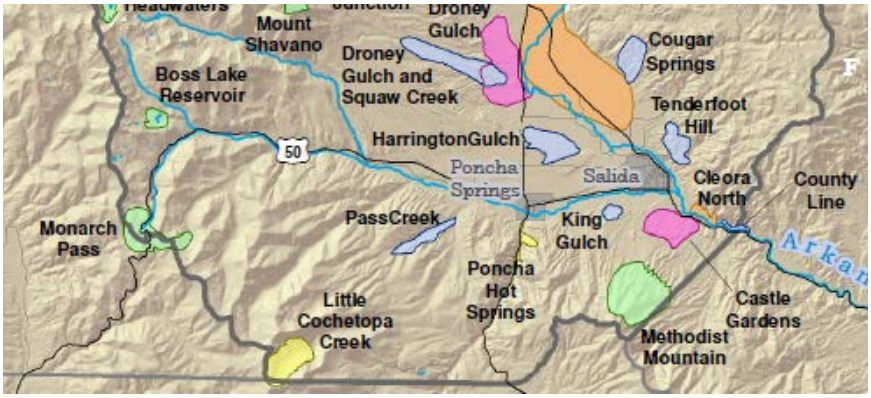

Figure 7-4. Potential conservation areas in the South Arkansas River watershed
(CNHP 2009; see Table 7-1 below)

Native and Non-Native Weeds

At some time, all ecosystems experience natural disturbances, such as fire, avalanche, or trees uprooted by windthrow. Therefore, all ecosystems have "weedy" plant species whose role it is to move into disturbed areas under conditions other plants cannot tolerate—disturbed areas are usually hotter and drier than adjacent areas, and soil nutrient levels are often low. In the Southern Rocky Mountains, fireweed (*Chamerion* sp.) is such a plant. As opportunists that take advantage of the vacancy, native weeds serve to anchor and shade the soil surface and begin rebuilding soil water and nutrient levels. In this way, they prepare the site for other species in a process of healing ("succession") that moves toward a subsequent plant community. That community may be the one prior to disturbance or some other combination of natives (Colinvaux 1973).

Weeds become a problem when they change the course of the normal healing process. They do so by altering local conditions so that the species that would normally follow cannot do so. These weeds are known by many names—non-natives, invasives, noxious, exotics, non-indigenous, and introduced species. At the federal level,

Table 7-1
Potential Conservation Areas in the South Arkansas River Watershed

Potential Conservation Area	Biodiversity Rating	Elements
King Gulch	Very high	Fendler's townsend-daisy (*Townsendia fendleri*, G2/S2); rock-loving neoparrya (*Aletes lithophilus*, G3/S3)
Pass Creek	Very high	Montane riparian forest (*Populus angustifolia–Juniperus scopulorum*, G2G3/S2S3)
Monarch Pass	High	Reflected moonwort (*Botrychium echo*, G3/S3); Colorado Divide whitlow-grass (*Draba streptobrachia*, G3/S3); least moonwort (*Botrychium simplex*, G5/S1)
Boss Lake Reservoir	High	Reflected moonwort (*Botrychium echo*, G3/S3); least moonwort (*Botrychium simplex*, G5/S1)
Poncha Hot Springs	Moderate	Narrowleaf cottonwood-river birch riparian forest (*Populus angustifolia-Betula occidentalis*, G3/S3); Narrowleaf cottonwood–Douglas-fir riparian forest (*Populus angustifolia - Pseudotsuga menziesii,* G3/S2); beaked spikerush (*Eleocharis rostellata*) wetland (G3/S2);helleborine stream orchid (*Epipactis gigantean*, G4/S2)
Little Cochetopa Creek	Moderate	Subalpine riparian willow carr (*Salix planifolia–Carex aquatilis*, G5/S4)

G = global; **S** = state

G1, S1: Critically Imperiled—Critically imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation or extinction. Typically 5 or fewer occurrences or less than 1000 remaining individuals.

G2, S2: Imperiled—Imperiled because of rarity or because of some factor(s) making it very vulnerable to extirpation or extinction. Typically 6 to 20 occurrences or between 1,000 and 3,000 remaining individuals.

G3, S3: Vulnerable—Vulnerable either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation or extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 remaining individuals.

G4, S4: Apparently Secure—Uncommon but not rare, and usually widespread. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.

G5: Secure—Common, widespread, and abundant. Perpetually secure under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

Executive Order 13112 (1999) defines weeds as an “alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.” Weeds cause adverse impacts by degrading grazing lands (Leistritz et al. 1993) and recreational values (Eiswerth et al. 2006), outcompeting native species, degrading ecosystem functions, and changing natural fire regimes (Blossey 1999).

Local conditions and the characteristics of non-native weedy species combine to promote the establishment and spread of those non-natives. Local conditions include: (1) soil disturbance; (2) loss of native plant cover, such as from foot and vehicle traffic, and (3) unhealthy native plant communities, such as that caused by drought stress (Hobbs and Huenneke 1992). Soil disturbance and compaction also prolong the time required to re-establish native vegetation (Allmaras et al. 1988). Travel corridors such as roads and hiking and packing trails, represent pathways (“vectors”) for the spread of non-native plant species. Characteristics of non-native weedy species that allow them to enter into and spread within habitats include: (1) tolerance of a wide range of growing conditions; (2) small, short-lived seeds that germinate easily; (3) short maturation period; (4) short intervals between seed production; (5) reproduction by seeds and vegetative means; and (5) long flowering period (Goodwin et al. 1999).

Colorado noxious weed list. The Colorado Department of Agriculture maintains a state noxious weed list consisting of three categories: “A”, “B”, and “C” List species. “A List” species are given the highest priority and are designated for eradication. Weed management plans—required for all counties—should be designed to stop the continued spread of all “B” List species. For “C List” species, county weed management plans should support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands (CDA 2013).

Non-Native Plant Species in the South Arkansas River Watershed

Five weed species identified in areas immediately adjacent to the South Arkansas River within the project corridor are on the state weed list: Canada thistle, Russian olive, teasel, mullein, and downy brome. Of these, only Canada thistle is a priority weed species in Chaffee County (Chaffee County 2013c). Two other species—kochia and Russian thistle—are not state-listed species in Colorado, but are having visible impacts in the watershed. They are of concern because they displace native species, degrade existing habitats, decrease their value to wildlife and grazing, and often increase the potential for erosion. More details regarding these species are provided below.

Canada thistle (*Cirsium arvense*, “B” List) can infest many different land types, from roadsides, ditch banks, riparian zones, pastures, and irrigated cropland, to the most productive dry cropland. Infestations reduce biodiversity in natural areas, reduce crop production in agricultural areas, and reduce forage in rangelands because cattle will not graze near infestations of mature plants (Figure 7-5) (CDA 2008a, CSU 2013).

Russian olive (*Elaeagnus angustifolia*, "B" List) is more tolerant of drought, salinity, and shade; is less palatable to cattle and wildlife and so is not browsed as much; and its seeds are larger and remain viable for longer (Figure 7-6). Once established, this deep-rooted species can out-compete natives (e.g., cottonwoods, willows) for water, inhibit germination and growth through shading, and alter the understory community. Russian olive seeds are also attractive to wildlife, particularly birds, and survive the digestive process. This serves as a primary vector for its spread.

Changes in the natural flow regime of western rivers have reduced the frequency and intensity of flooding and thereby diminished or eliminated the forces that would normally scour and remove exotics like Russian olive. Conversely, those same forces would normally create and maintain the open areas of sand and gravel on which new willows and cottonwoods germinate. Russian olive, on the other hand, is not dependent on such processes. A wide variety of animals depend in whole or in part on western riparian ecosystems. As Russian olive begins to dominate native vegetation, the overall diversity in structure and composition of the habitat decreases. Overall bird numbers and species diversity declines (e.g., cavity-nesting birds), and native insect populations also decline, which has implications for those species that depend on those insects. In terms of societal impacts, dense stands can develop along river banks, making access to the river difficult or impossible for boaters or fishermen. The plant can also spread to low-lying pastures, reducing forage production and livestock use, and it can spread along irrigation channels, increasing the maintenance requirements for these structures (Stoleson and Finch 2001, Katz and Shafroth 2003, CDA 2008b).

Teasel (*Dipsacus fullonum*, "B" List) is usually found in relatively moist, disturbed areas, but is moving into drier areas (Figure 7-7). Its spines and bristles discourage grazing and thereby decreases range quality. High seed production and germination allow it to invade and begin to out-compete other plants. It can establish single-species stands ("monocultures") that adversely impact riparian area integrity as well as habitats important to sensitive or threatened plant species (CDA 2008c, Gucker 2009).

Common mullein (*Verbascum thapsus*, "C" List) colonizes newly disturbed sites and it can displace native forbs and grasses in sparsely vegetated meadows (Figure 7-8). However, it is usually not a significant weed in natural areas, as it is easily crowded out by other vegetation (Gross and Werner 1978, CDA 2008d, AKNHP 2011).

Downy brome (*Bromus tectorum*, "C" List) is not a significant component in areas immediately adjacent to the South Arkansas River, but it is common in pinyon-juniper communities that border the corridor (Figure 7-9). Pinyon-juniper communities are easily invaded by downy brome (aka "cheatgrass"); disturbance accelerates the process, but is not necessary. Downy brome begins growth and depletes soil moisture before most native plants. It gains a competitive advantage in cold, semi-arid environments and can maintain its dominance for many years. This change in understory vegetation often leads to more frequent and hotter fires and, therefore, subsequent further degradation

Figure 7-5. Canada thistle

Figure 7-6. Russian olive

Figure 7-7. Teasel

Figure 7-8. Common mullein

of the entire community, and increased erosion (Zouhar 2003, CSU 2012, Murphy et al. 2013).

Russian thistle (*Salsola kali*) invades many different disturbed plant communities (Figure 7-10). It competes with row crops for space, water, and nutrients but, when young, provides browse for cattle, sheep, mule deer and elk; its seeds are also consumed by birds and small mammals. It is usually not as persistent as other weed species, and recovery from disturbance may actually be accelerated by its presence. Perhaps its greatest nuisance stems from its habit of breaking off at its base and rolling across the landscape ("tumbleweed"), the means by which it spreads its seeds. This behavior causes it to accumulate along fence lines and in depressions along roads and in culverts, ditches, and streams. These accumulations can present fire hazards (Howard 1992).

Figure 7-9. Cheatgrass
(NRCS 2013a)

Kochia (*Bassia scoparia*), along with Russian thistle, is one of the most common weeds in arid and semi-arid western U.S. (Figure 7-11). Although it is readily browsed by cattle and wildlife, it can be toxic. Its seeds are eaten by birds and it can be useful for restoration – it grows in harsh soils, germinates and grows any time during the growing season, and provides quick groundcover. However, like Russian thistle, kochia is a tumble weed and competes with row crops. It also has allelopathic properties (Esser 1995, Casey 2009).

Figure 7-10. Russian thistle
(USDA 1971)

Vegetation— Impacts and Issues in the South Arkansas River and Watershed

The following issues related to vegetation are apparent in the South Arkansas River watershed:

- non-native plants;
- degradation and removal of riparian vegetation; and
- fire and insect infestations.

Non-Native Weeds

A particularly large infestation of Russian thistle/kochia is located west of Chaffee County Road (CCR) 210. Formerly Friends Ranch, the area is currently a defunct golf course (Figure 7-12). Infestations in some areas were complete, rendering past and

present uses problematic. Because of the tumbleweed habit of Russian thistle and kochia, impacts extend beyond these infestations (Figure 7-13). Although the structure in Figure 7-13 is located immediately east of CCR 210, similar accumulations were observed in other areas farther downstream. During 2013, the health of Russian thistle/kochia seemed to decline and Canada thistle was spreading through the same area.

Figure 7-11. Kochia (USDA 1971)

Russian olive is widely distributed throughout Chaffee County. At present, however, only individual trees were observed in streamside areas in the project corridor downstream of U.S. 285. However, if not controlled, spread of this species can severely degrade riparian and adjacent agricultural lands, and crowd out important tree species, such as cottonwoods.

On private land, weed control is largely a county government responsibility, with county weed management staff working with private landowners to address infestations.

Figure 7-12. Thistle/kochia infestation west of CCR 210 (2012)

Degradation and Loss of Riparian Vegetation

Degradation and loss of riparian vegetation takes two forms in the South Arkansas River project corridor—grazing impacts and development.

Grazing impacts to riparian vegetation. Several areas adjacent to the river in the project corridor are heavily grazed. Streamside vegetation in these areas is limited in its ability to hold stream banks and to withstand flooding. Bank collapse and erosion are evident.

Figure 7-13. Thistle/kochia at water diversion structure (2012)

Prior to major settlement, riparian areas were used by most wildlife species, including herbivores like deer and elk. It is, therefore, reasonable to assume that grazing livestock in the same areas does not, in and of itself, adversely impact streamside habitat. Instead, it is prior site conditions and use, and the timing, intensity, frequency, and duration of subsequent grazing that matter. A wide variety of grazing systems and strategies are available

depending on site conditions and production requirements (Wyman et al. 2006).[2]

Programs are available to address livestock impacts to riparian areas, such as those with the Natural Resources Conservation Service (NRCS 2013b), Partners for Fish and Wildlife (USFWS 2013b), and the Private Land Program at Colorado Parks and Wildlife (CPW 2013b). Projects include river restoration design and in-stream work, fencing to control livestock grazing, stream water access, off-channel watering, and revegetation.

Development impacts on riparian vegetation. The encroachment of residential and commercial development on the South Arkansas River in Poncha Springs and Salida has limited or eliminated riparian vegetation along several river segments (Figure 7-14). For the most part, these areas now contain man-made bank stabilization and non-native plant species. Encroachment—and the subsequent responses to protect property—has limited or eliminated the functions and benefits of riparian areas.

Figure 7-14. Development encroachment into streamside areas
South Arkansas River, 2012

However, re-creation of functioning riparian areas in developed areas is difficult. Space constraints and the need to protect existing property and structures make solutions complicated and costly. However, in such confined areas, a stepped design can re-create a series of floodplain "shelves" or terraces that can provide some buffer benefits and still accommodate higher flows. In Figure 7-15, the red line represents the existing steep-sided stream channel that is wide and shallow with no floodplain and little vegetation. The black dotted line represents the reconfigured bed and bank where two new floodplain "steps" are created on both sides. These new steps provide room for riparian vegetation where none existed before and also allow for overbank flooding at medium flows (1st step) and higher flows (2nd step).

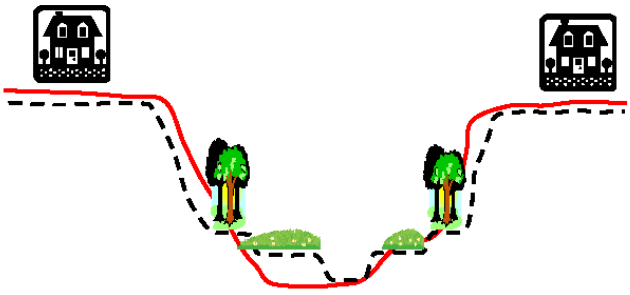

Figure 7-15. Diagram of stepped floodplain redesign
(Red line represents current bank configuration)

[2] More detail on grazing impacts in riparian areas is provided in Section 3.0, History, Land Use, and Development.

Degraded riparian habitat. Streamside vegetation in various areas within Salida is degraded by the presence upland and weedy plants. These areas are not grazed nor are they directly encroached upon, but appear to still reflect impacts from past practices and reduced stream flows. These areas will likely continue to decline, further destabilizing stream banks. Programs are available to help landowners address degraded riparian areas, but if the land is *not* in agricultural production, the money and assistance available is limited.

Drought, Insects, and Fire

In a healthy forest, the tree canopy and litter layer protect the soil from erosion caused by intense rainfall. Soil structure and organic matter slow runoff and increase infiltration. Wildfires can change all of these aspects by removing the overstory, consuming the litter and soil organic matter, and exposing the soils beneath. Extremely hot fires can create a surface layer that repels water. The extent, location, and burn patterns are important determinants of how watershed processes are impacted (Ice et al. 2004).

Forest age and structure, drought, and insect infestations combine to increase the chances of wildfire in the South Arkansas River watershed. Given the soils in the South Arkansas watershed, the resulting erosion and debris flows may adversely impact streams. Figure 7-16 indicates areas of wildfire risk in Chaffee County (Chaffee County 2009). Most of these areas are managed by federal agencies, but given the potential impacts, awareness and coordination among local, state, and federal agencies is advised.

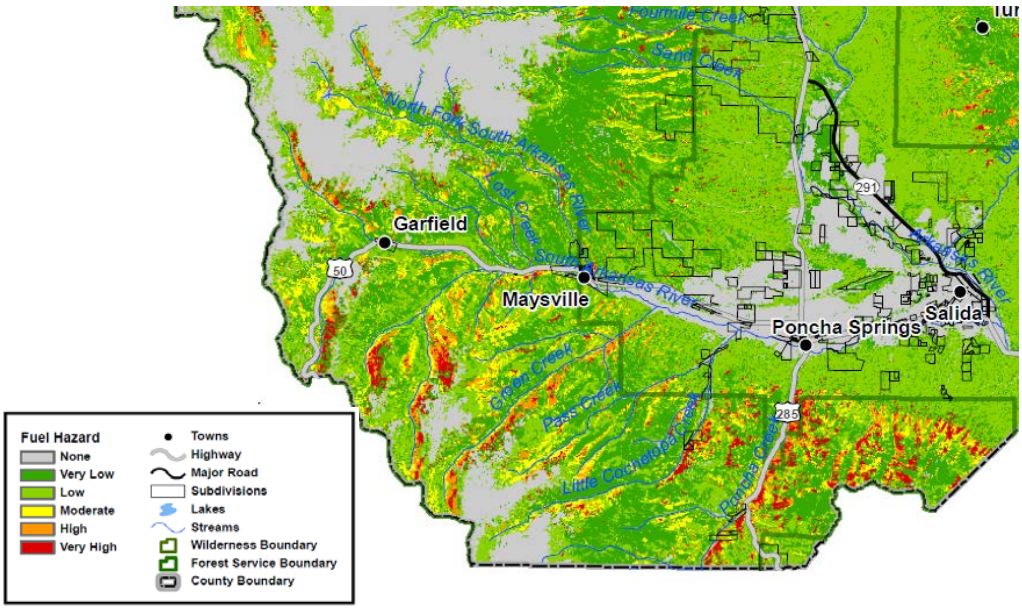

Figure 7-16. Forest fuel hazard areas in the South Arkansas River watershed
(Chaffee County 2009)

Fire and stream ecosystems. Streams are disturbance-driven systems (Ward 1998), and fire is a natural disturbance in western ecosystems (Beschta et al. 2004), so the impact of wildland fires in the South Arkansas River watershed (e.g., increased erosion, debris flows) would normally not be a long-term concern. However, alterations in the river's natural functions, especially reduced in-stream flows, have compromised its ability to accommodate such disturbance, especially its ability to move sediments.

Other aspects of vegetation in watershed and river functions are discussed in the sections listed below.

- Section 2.0, Watershed Assessment and Stream Ecology
- Section 6.0, Hydrology and Flow Regime
- Section 8.0, Wildlife, Fish, and Aquatic Invertebrates
- Section 9.0, Water Quality
- Section10.0, Channel and Floodplain Processes

Restoration goals and recommendations for the South Arkansas River and watershed are discussed in Section 11.0, Establishing Watershed and Riparian Restoration Goals.

A weed is a plant that has mastered every survival skill except for learning how to grow in rows.

Doug Larson

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