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Emigrant Creek Cattle Allotment: Lessons From 30 Years of Photomonitoring

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Abstract

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Emigrant Creek cattle allotment is located 48 km northwest of Burns, Oregon. It was photo sampled at nine original sites, starting in 1975. Photos were taken three times per year: June 15 prior to cattle grazing, August 1 at pasture rotation, and October 1 at the end of grazing. An additional four photopoints were established following disturbance from flooding and beavers. Results reported here cover 30 years, 1975 to 2005. Cattle did not significantly impact the riparian area. Beavers (*Castor canadensis*) arrived in 1984 and departed in 1994. They seriously reduced aboveground willow biomass by harvesting stems for food and dam construction. Dams raised the water table causing a dry meadow to become moist, and increased water in a wet meadow that inhibited willow growth. Beaver departure in 1994 left dams unmaintained. A 50-year flood event in February 1996 eroded dams and created a new channel. The water table was reduced below that of the 1984 levels, causing a dry meadow to revert to pre-1984 conditions and permitting willows to vigorously expand in a wet meadow. Dynamic riverine riparian environmental conditions seriously challenge the typical range management concepts of “condition and trend.” There is no “climax good condition.” Instead a “state-and-transition” concept seems a more apt range management concept to describe range conditions resulting from beaver dams and flooding over a 30-year period on Emigrant Creek cattle allotment.

Keywords: Riverine, riparian, beavers, floods, condition and trend, cattle, grazing.

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Introduction

Emigrant Creek allotment is on the Emigrant Creek Ranger District, Malheur National Forest. It has been grazed by domestic livestock since about 1885. In 1952, a sheep permit was terminated and the area was assigned to cattle use on a 4- to 5-month season-long basis. Grazing management was changed in 1974 to a three-pasture rest-rotation system. This change prompted the author to initiate a study to appraise effects of altered grazing management on riparian areas.

Starting in 1975, riparian areas in each of three pastures were sampled by photomonitoring: June 15 prior to start of grazing, August 1 when pastures were rotated, and October 1 at the end of grazing. In all, nine permanent photopoints were initially established, each composed of a general view with a meter board placed at 10 m and closeup views of the vegetation on each side of the meter board (Hall 2002: 32–33). All species were recorded by their percentage of canopy cover on 1-m² plots on each side of the meter board.

Additional photomonitoring was initiated on specific sites whenever conditions suggested the need, such as a spring flood in 1984 (p. 6), deposition of an alluvial fan in 1984 (p. 7), dam building by beavers (*Castor canadensis*) (p. 8), or creation of a new stream channel (p. 9). In all, about 2,000 photographs were taken in a 30-year span. This publication uses 83 images to illustrate change in the riparian areas.

The Setting

The study site, Emigrant Creek allotment, is in the southern Blue Mountains province adjacent to the High Lava Plains Province (Franklin and Dyrness 1988). Elevation ranges from 1515 m at lower Emigrant Creek, to 1640 m at Pole Camp, to 1780 m at Button Meadow. The climate is continental characterized by winter snowfall and dry summers with little effective precipitation.

Emigrant Creek allotment is approximately 48 km north and west of Burns, Oregon, on the east edge of the former Snow Mountain Ranger District, now combined with the Burns Ranger District. On U.S. Highway 20, drive about 1.6 km west of Hines, Oregon, and turn north on Oregon Road 127 to its junction, about 40 km, with Forest Service (FS) Road 43 bordering Emigrant Creek. Follow the 43 Road to its juncture with the 4870 Road and cattle guard identifying the lower end of Emigrant Creek allotment (see fig. 1). The middle pasture, Pole Camp is identified, as is Button Meadow, which has a division fence between the east and west pastures.

Plant communities in the Emigrant Creek allotment are similar to others on the east side of the Cascade Range. Three general kinds were investigated: willow shrublands, aquatic sedge communities, and Kentucky bluegrass dry meadows. All have been reported in riparian ecological studies (Crowe and Clausnitzer 1997, Kovalchik 1987, Kovalchik and Clausnitzer 2004).

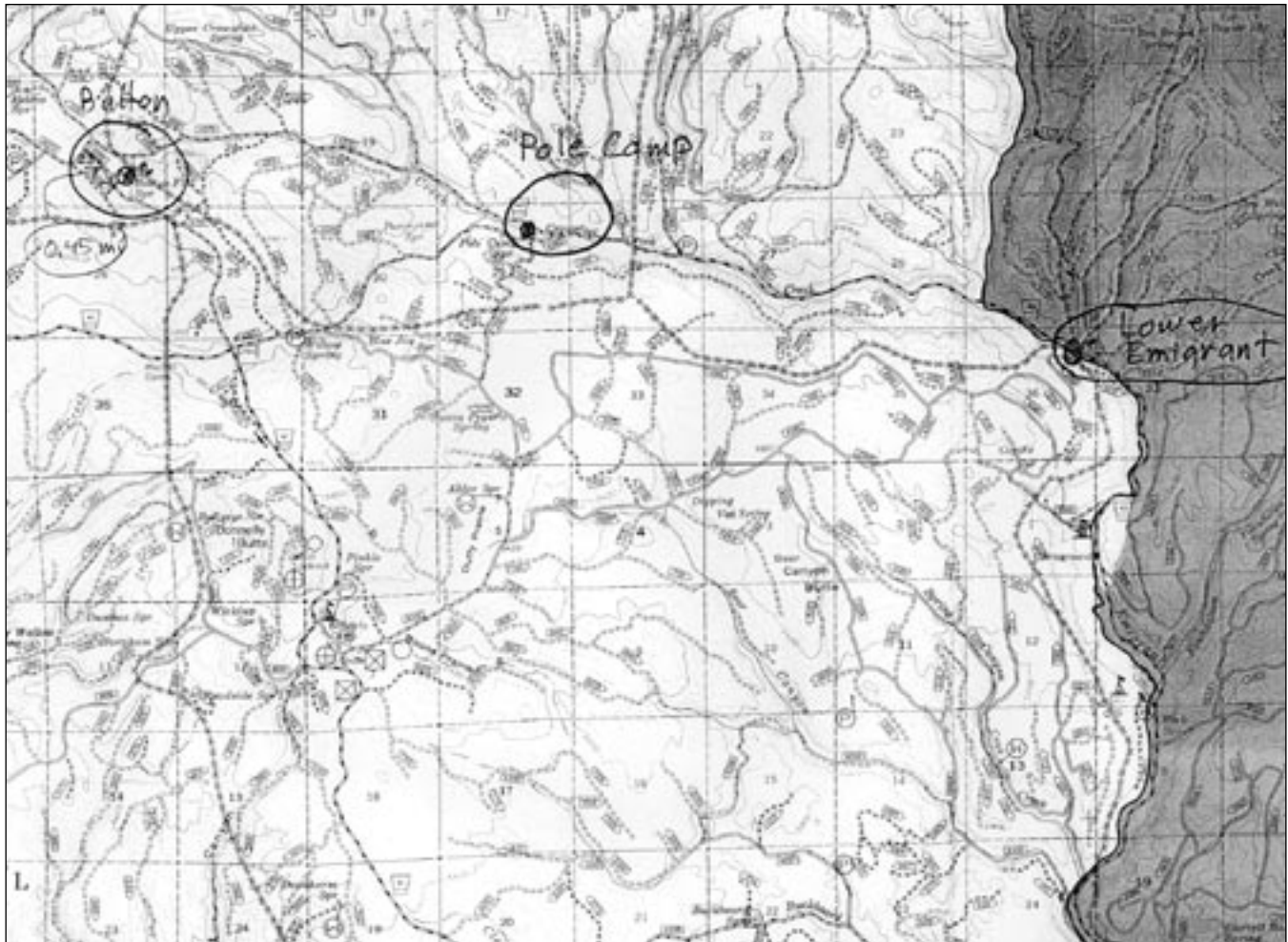


Figure 1—Sampling locations in the Emigrant Creek allotment. Photo sampling Pole Camp, the center location, is illustrated on the facing page. Geographic positioning system (GPS) coordinates for camera locations are lower Emigrant: North latitude 43°54'15.14", West longitude 119°33'43.99"; Pole Camp: North latitude 43°53'56.65", West longitude 119°30'06.36"; Button Meadow: North latitude 43°54'15.14", West longitude 119°33'43.99".

A map detailing the photomonitoring layout was made for each location. An example is a detailed map of Pole Camp, an intensively sampled area, shown in figure 2.

Organization

The purpose of this study is to compare conditions over time, in most cases 30 years. Therefore, six images, taken at 6-year intervals, are placed on opposite pages to facilitate comparison (see pages 12 and 13). The dates 1975, 1981, and 1987 are on the left and 1993, 1998, and 2004 are on the right. All images of the topic are displayed side by side. Explanations are in the outer margins.

Some special topics are illustrated with only three images. They are observations and the concept of range condition and trend.

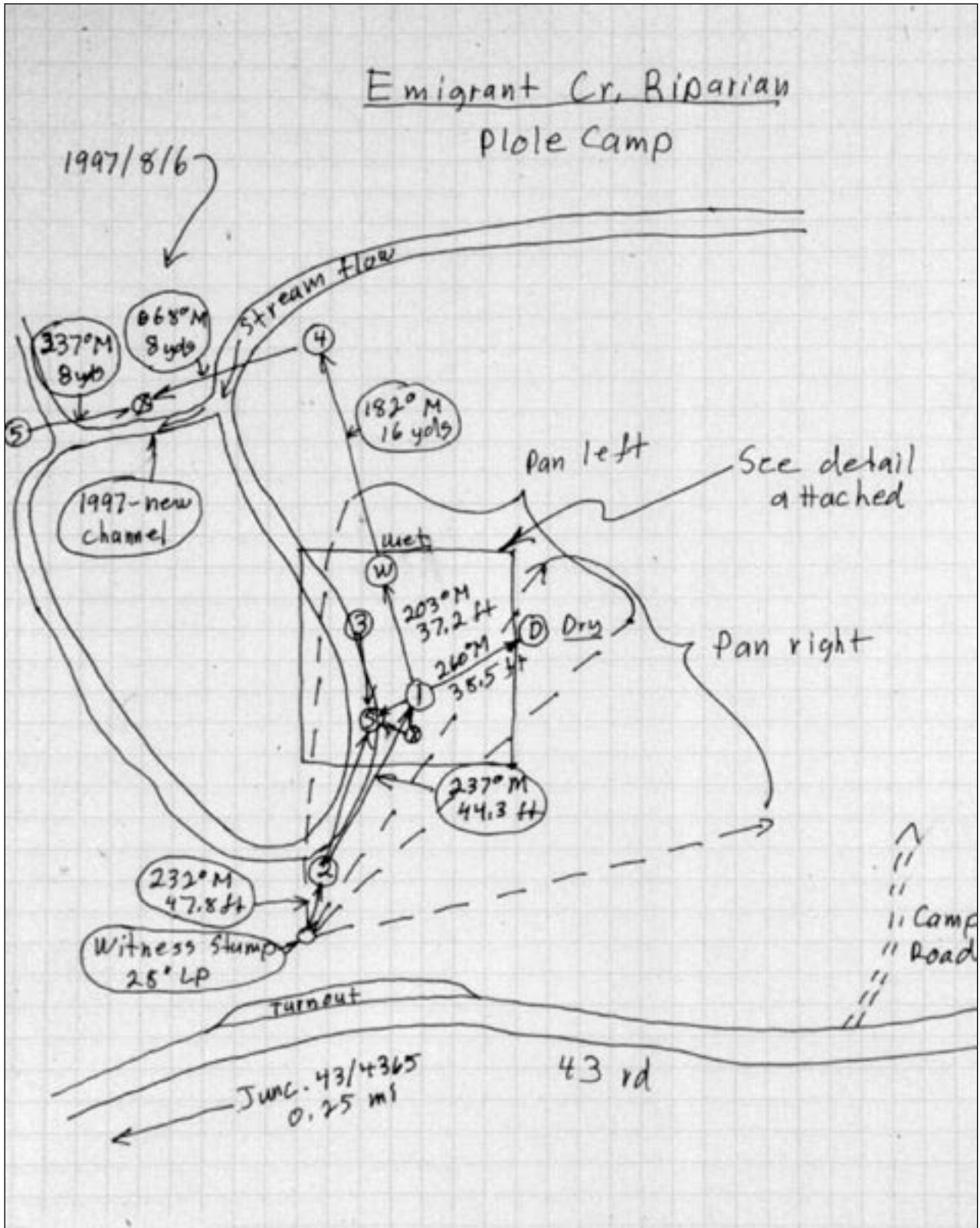


Figure 2—Pole Camp photomonitoring system. Four locations are illustrated in this report: (D) dry meadow (pp. 14–17), (W) wet meadow (pp. 18–21), (S) stream (pp. 22–25), and (X) new channel (p. 9) resulting from the flood of February 1996.

Observations

Some things to consider when evaluating riparian areas in the Emigrant Creek allotment are animal use; the flood of May 21, 1984; an alluvial fan deposited following a thunderstorm on July 15, 1984; beavers and their dams; the flood of February 1996, which caused a new stream channel; and measurement of change in the profile of willows. The following pages illustrate these observations.

Concept of Range Condition and Trend

The concept of range condition and trend supposes that natural climax vegetation is the basis for best condition, here called “good.” Any departure from this condition is presumably caused by livestock overgrazing, resulting in a downward successional trend. In condition classes less than good, proper livestock management is supposedly designed to foster an upward trend in the plant community toward good condition.

Two problems with this concept must be dealt with in riverine riparian settings: (1) what is “good” condition in an environment characterized by disturbance (Winward 2000), and (2) livestock grazing is only one of several factors influencing vegetative development (Prichard 1995). This study will show that beavers, owing to their dams raising the water table, have a major influence on “range condition.” It will also show that floods, like that of February 1996, make new channels and thus new sites within the riparian zone.

And finally, one must deal with the concept of “best condition” described in Forest Service range condition guides. Three lists of species were proposed: decreasers, palatable species that decrease with livestock overuse; increasers, less palatable species that increase; and invaders that are unpalatable species.

Traditionally, the concept of “good range condition” has presumed that it is dominated by palatable species. We must ask why. This might be true in the Great Plains. But is it always true? A series of articles in *Rangelands* (2003: vol. 25) clearly discussed this concept (Box 2003, Pyke 2003, Ragsdale 2003) and strongly concluded that “dominance by decreasers” was a concept that must be reconsidered. I propose that in some cases, such as a dry meadow in Pole Camp, the plant community type may be dominated by low-palatability species.

A condition and trend section, pages 32 and 33, deals with a concept of range condition. See also the discussion of bluegrass,¹ in footnote 2 under “Common and Scientific Names.”

¹See “Common and Scientific Names” for plant species mentioned in this publication, pp. 35–36.



Livestock Use

Cow and calf overlooked in fall roundup have spent 3 weeks grazing in Pole Camp resulting in stubble heights of only 4 to 5 cm and significant use on the green line along the stream. Cattle must be moved when the area has been grazed enough (Hall and Bryant 1995).



Beaver Cutting

Beavers cut willows for dam construction and food. Page 10 illustrates a method for measuring the effects of beavers on willows.



Gopher Activity

Gophers are active during the winter under snow cover and can disrupt roots of herbs, grasses, and shrubs. Their tunnels tend to funnel spring snowmelt, which can lead to riverbank erosion. See page 24, May 22, 1999.

Flood of May 21, 1984

May 21, 1984—Water is above bankfull, flooding the first terrace. Fencing marks the lower allotment unit. Tree with board is dead as shown below. The lower Emigrant study site is immediately above the fence, shown on pages 12 and 13.



June, 1988—Four years later, this photo reveals that the flood water had been about 31 cm deep.



Meter board marks the wet meadow sampling site. Compare the pattern of water to vegetation on pages 18 to 21 and on the cover of this report.





Alluvial Fan, Lower Emigrant Creek

June 15, 1984—An alluvial fan was deposited in Emigrant Creek, at the lower sampling site, following a thunderstorm on June 15, 1984. The material was washed off FS Road 5870. Images below show how fast recovery can be.



August 1, 1985—One and a half growing seasons after the photo above, Geyer's willow is colonizing the rubble and is moving into moist areas.



August 1, 1990—Now five growing seasons after the photo above and six-and-a-half since deposition, Geyer's willow is becoming dominant, thinleaf alder (left) has colonized the fan, and Kentucky bluegrass is dominant on the dryer sites.

Beaver Dams

Beaver Dam A in Pole Camp—Beaver dam A upstream from the wet meadow sampling site in 1985. This and other dams (see below) raised the water table causing changes in the dry meadow (pp. 14 to 17) and made the wet meadow a little too moist for willows (pp. 18 and 19).



Beaver Dam B, June 15, 1985—Beaver dam B just downstream from the wet meadow site with water flowing around the edge. The dam gave way during the February 1996 flood because departed beavers had not maintained it. As a result, a new channel was formed draining the dry and wet meadow (pp. 14 through 19). The tall tree on the horizon can be used to orient this photo.



Beaver Dam B, October 1, 1997—Same dam as shown above. A new channel is developing as shown on the next page. The lone tree on the horizon helps orient the photo, as a camera location was not established for the June 15, 1985, photo. Compare willow stature following 10 years of use by beavers with image above.





New Stream Channel, Pole Camp

August 1, 1997—A new stream channel was formed by the February 1996 flood, which collapsed beaver dam B shown on the previous page. The lower two images on page 8 were taken facing the camera within the willows in the background.



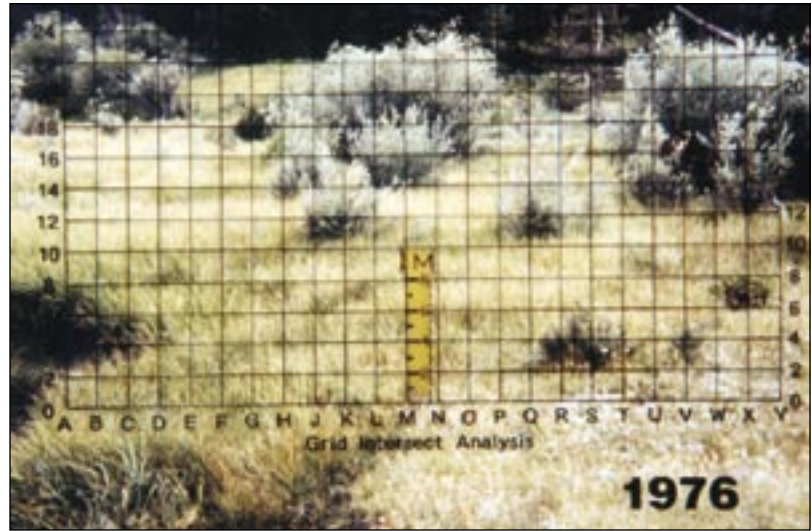
August 1, 1999—New stream channel 2 years after the image above. The meter board is placed lower than in the 1997 photo by about 4 dm, down on bedrock. Note that it is now 2 m tall with “1M” just visible.



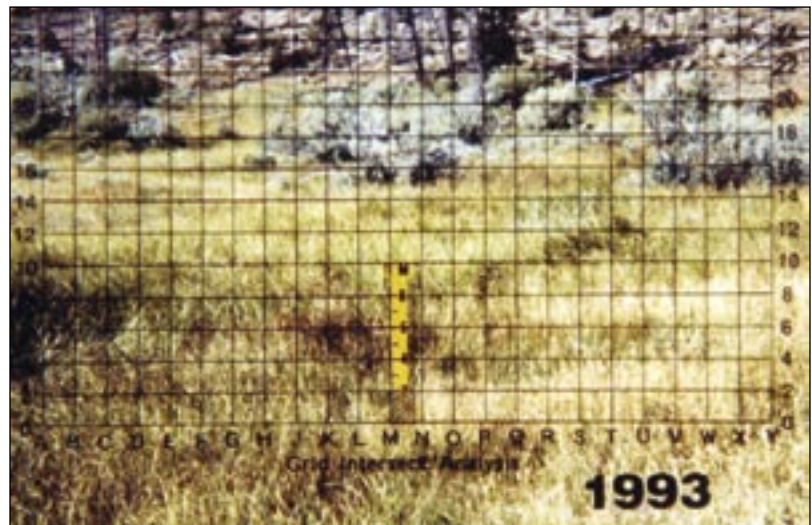
August 1, 2004—Five years after the middle picture above and 7 years after channel formation (top picture). By now the stream bottom has stabilized with aquatic sedge, tufted hairgrass, and Kentucky bluegrass. The dead willow at left in 1999 photo has been washed into the stream channel.

Measurement of Change by Grids

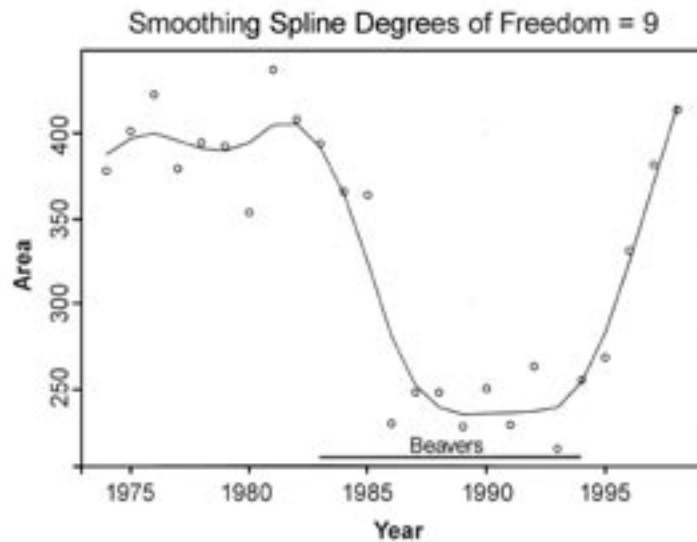
Grid analysis (Hall 2002) may be used to document change of identifiable features in photographs. This is Pole Camp wet meadow in **August 1976**. A grid has been precisely adjusted to the meter board based on 2 dm marks. Grid adjustment is one function of the meter board. The willows in the background were outlined and grid intersects on each shrub counted. These data were then compared to the image below.



August 1993—Beavers were still active and had reduced willow profile area significantly. The willow profile area was again measured. This outlining and measurement was done every August 1st from 1975 to 2004 with results shown below.



Smoothing spline regression—This regression of willow profile area by year is significant at the 1 percent probability level. Presence of beavers in Pole Camp is shown at the bottom of the graph. Willows have responded rapidly with reduction in beaver use and a lower water table permitting adequate root aeration.



Lower Emigrant Pasture

Lower Emigrant pasture became a study in frustration and learning. The original camera location had to be moved in 1985 and again in 1998 because willows obstructed the view. The total movement was 2.7 m to the right. But even by 2004, the view was again obstructed. The lesson was to select a camera location that will not become obstructed by vegetation because blocking the view renders the location useless.

In all cases, the meter board “1 M” is dead center of the image, even though one may not see it. Orientation of the photos from 1975 to 1993 may be estimated by noting the stump and living ponderosa pine in the upper right corner.

Thirty Years Change: Lower Emigrant

August 1, 1975—Geyer's willow is dominant at about 40 percent canopy cover. Herbaceous species are aquatic sedge, tufted hairgrass, Baltic rush, Kentucky bluegrass, bluejoint reedgrass, and shrubby cinquefoil. Standing water is 8 cm deep.



August 1, 1981—Geyer's willow has increased to about 50 percent cover. Herbaceous species are the same. There is no standing water.



August 1, 1987—Camera location had to be moved a little less than 1 m to the right to avoid willows. Meter board is small, yellow spot just below midcenter. Willows are now 60 percent cover. Density of herbaceous species has declined. Kentucky bluegrass only occurs on drier sites to the right of the fencepost. Shrubby cinquefoil is absent. Cows have not impacted the vegetation. There is wet soil but no standing water.





August 1, 1993—Geyer's willow continues to increase. Herbaceous species now are aquatic sedge, bluejoint reedgrass, and scant Baltic rush. Cover of herbs is half that of 1975. Soil is wet but with no standing water. Meter board is in center of image.



August 1, 1998—Camera location was moved 1.8 m right, now 2.7 m right of 1975. Double meter board is now standard. Geyer's willow is 60 percent cover. Herbs are dominated by aquatic sedge, bluejoint reedgrass, beaked sedge and scant Baltic rush. Soil is wet with no standing water.



August 1, 2004—Double meter board is nearly invisible owing to increasing willow cover, which is now about 75 percent. The board is located dead center of the image. Herbs are still aquatic sedge, bluejoint reedgrass, beaked sedge, and scant Baltic rush. Soil is wet with no standing water.

Thirty Years Change: Pole Camp Dry Meadow

August 1, 1976—Dominant species are high mountain cinquefoil (or gray cinquefoil), narrowleaf pussytoes (also grey colored), Kentucky bluegrass (or Agassi's bluegrass), slender cinquefoil, some analogue sedge, and dandelion. At far background edge of meadow, note small stature and spotty distribution of willows. Moist meadow well behind the meter board is dominated by analogue sedge.



August 1, 1981—Dominant species are the same: high mountain cinquefoil (or gray cinquefoil), narrowleaf pussytoes (also grey colored), Kentucky bluegrass (or Agassi's bluegrass), slender cinquefoil, some analogue sedge, and dandelion. After 6 years, willows at the far edge of the meadow have increased in stature and density.

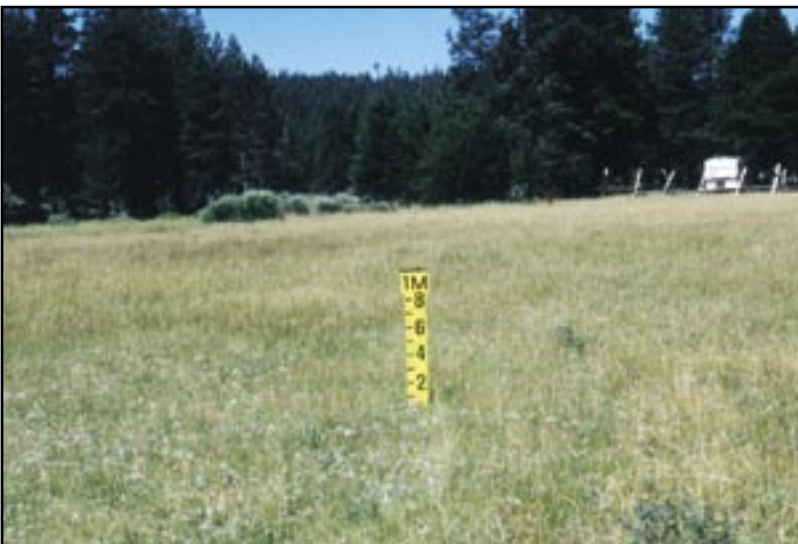


August 1, 1987—Beaver moved into Pole Camp in 1984 building dams and raising the water table in this meadow. Willows at the far edge of the meadow are no longer visible. The dry meadow is now becoming a moist meadow where analogue sedge is assuming dominance. Other species are bluegrass, some tufted hairgrass, and much reduced high mountain and slender cinquefoil and pussytoes.





August 1, 1993—The dry meadow has become moist owing to a raised water table caused by beaver dams. It is now dominated by analogue sedge. Beavers have been here for 9 years and have clearly changed the site potential of this area. The former moist analogue sedge meadow behind the meter board is now approaching a wet meadow. A small lodgepole pine right of the meter board has been killed by the raised water table.



August 1, 1998—Four years have passed since beavers and their dams left Pole Camp. The moist meadow of 1993 is reverting to a dry meadow. Dominant species are now bluegrass (Kentucky or Agassi's), poor-vigor tufted hairgrass, decreasing analogue sedge with increasing pussytoes and both high mountain and slender cinquefoils.



August 1, 2004—Ten years have passed since beavers left and the water table was lowered to about the 1981 level. Vegetation is now similar to that in 1976 and 1981: pussytoes is codominant with both cinquefoils, bluegrass is common, with scant junegrass and occasional analogue sedge. Willows at the far edge of the meadow have increased in stature.

**Seasonal Change:
Pole Camp Dry Meadow.**

June 15, 1981—Plant community condition is shown prior to beaver influences and prior to livestock turnout. Vegetative conditions at start of the grazing season are dry meadow at the meter board and analogue sedge moist meadow rear of board. At the board, grey cast is high mountain cinquefoil and narrowleaf pussytoes; green is slender cinquefoil, bluegrass, and scant analogue sedge.



August 1, 1981—The date when livestock are moved from one pasture to another. This area had not been grazed by August 1 as shown by stubble height. Both the dry meadow at the meter board and the moist meadow rear of the board are dry. Low palatability of dry forage often causes a change in animal preference to green forage such as willow leaves. Compare greenness with the opposite page for August 1.



October 1, 1981—This is the date when livestock are supposed to leave the allotment. The pasture was fall grazed leaving an uneven stubble height of 4 to 5 cm. This light use should foster an upward trend if site potential is better than existing vegetation suggests.





June 15, 1983—Vegetative conditions at the start of grazing look very similar to those of 1981. A slightly greener cast seems apparent. Gray cast is high mountain cinquefoil and narrowleaf pussytoes; green is slender cinquefoil, bluegrass, and scant analogue sedge.



August 1, 1983—When 1983 is compared to 1981, one sees much more green in 1983. Phenological development appears quite different for 1983. The greenish color suggests extended palatability of herbaceous vegetation.



October 1, 1983—Compare 1983 to 1981. Ungrazed stubble height is 5 to 10 cm in both years. For this kind of meadow with its low-stature vegetation, the stubble height in 1981 was probably not detrimental to an upward trend. The 30-year record on pages 14 and 15 suggests this might be in good range condition for the site potential. See “Concept of Range Condition and Trend,” page 4, and “Condition and Trend” on pages 32 and 33.

Thirty Years Change: Pole Camp Wet Meadow

August 1, 1975—Meter board is at the transition from dry to wet meadow. Dry meadow, at right in front of meter board, is analogue sedge, Kentucky or Agassi’s bluegrass, strawberry, slender and high mountain cinquefoil. Wet meadow left and rear of board is aquatic sedge, slender cinquefoil, tufted hairgrass, and strawberry.



August 1, 1981—Little change in species dominance: dry meadow, at right in front of meter board, is analogue sedge, Kentucky or Agassi’s bluegrass, strawberry, slender and high mountain cinquefoil. Wet meadow left and rear of board is aquatic sedge, slender cinquefoil, tufted hairgrass, and strawberry. Willows in background show little change as does the shrubby cinquefoil to right of the meter board. However, beavers arrived in 1984 causing significant changes.



August 1, 1987—Four years after beavers cut willows for dam construction, the rising water table caused aquatic sedge to overwhelm the dry meadow right and front of the meter board. Willows rear of the board are significantly reduced. Mountain-pine-beetle (*Dendroctonus ponderosa*) killed lodgepole pine on the distant slope, which was salvaged in 1985.





August 1, 1993—Nine years since beavers raised the water table with dams, resulting in major expansion of aquatic sedge into former dry meadow (right and front of meter board). Willows have disappeared from the aquatic sedge site owing to both beaver use and raised water table, which inhibit willow growth owing to poor root aeration. There was standing water here in August 1993.



August 1, 1997—Beavers have been gone for 3 years and their dams deteriorated causing the water table to recede to its 1975 and 1981 level. The new channel (p. 9) has diverted water, leaving the stream dry. Willows are starting to emerge behind the meter board. Wet meadow is aquatic sedge, tufted hairgrass, slender cinquefoil, and fleabane. Former dry meadow is tufted hairgrass, slender cinquefoil, and bluegrass. Lodgepole pine has regenerated on the slope in background.



August 1, 2004—Willows have become dominant in the former wet meadow, presumably owing to better root aeration. The new channel cut by the flood of February 1996 has further drained the wet area, resulting in poor vigor of aquatic sedge. Tufted hairgrass is common with slender cinquefoil, analogue sedge, and strawberry. The dry meadow is again in pussytoes, bluegrass, slender cinquefoil, strawberry, and analogue sedge.

Seasonal Change: Pole Camp Wet Meadow

June 15, 1981—Wet meadow behind meter board is good-vigor aquatic sedge. Dry meadow right and front of board is analogue sedge, slender cinquefoil, strawberry, Kentucky or Agassi's bluegrass, pussytoes and some tufted hairgrass. These are conditions prior to beaver activity.



August 1, 1981—The wet meadow is turning brown, whereas the dry meadow is already cured. Compare to seasonal conditions for the dry meadow shown on page 16. Change in herbaceous maturity often causes livestock to change preference for greener forage such as willow leaves.



October 1, 1981—Pasture was fall grazed showing a 4- to 5-cm stubble height on the dry meadow with little use on the wet meadow. Evaluating stubble heights on the **most palatable** species, such as bluegrass, may be used as an indication of livestock preference for forage species (Hall and Bryant 1995). In this case, livestock were removed prior to undesirable browsing of willows.





June 15, 1983—Plant development is a little later than in 1981. Herbaceous plants have grown enough to support moderate spring grazing.



August 1, 1983—Herbaceous plant maturity is much later than in 1981. Aquatic sedge is ready for use but the soil is still very wet. The dry meadow is also greener, owing in large part to slender cinquefoil and bluegrass (Kentucky or Agassi's). Compare to the dry meadow on page 17. Cattle can easily fill their rumen under these conditions.



October 1, 1983—The pasture was not grazed this season. Everything is mature, offering little nutritious forage for livestock.

Thirty Years Change: Pole Camp Stream

August 1, 1975—This is Crowfoot Creek, viewed upstream, where it flows through Pole Camp. The photopoint was established to document fate of the fallen sod block. A fencepost was pounded down to the top of the meter board to evaluate soil change. Edge of bank is 2.8 m from camera location No. 1. The dry meadow on pages 14 through 17 is 13.6 m right of the meter board (see map on p. 3). The wet meadow, pages 18 to 21, is in the background. Soil is silt loam over clay loam, providing poor aeration for willow roots.

August 1, 1981—The block of sod is still present but has been colonized by aquatic sedge and has been enlarged by silt deposition. Edge of bank is still 2.8 m from camera location No. 1.

August 1, 1987—Beavers arrived in 1984, built dams, and backed water up about 4.6 dm above previous August 1 levels. Aquatic sedge has greatly expanded. Edge of bank is still 2.8 m from camera location No. 1. Willows in the background, the wet meadow site, have been significantly reduced.





August 1, 1993—After 9 years of beaver presence, aquatic sedge now dominates the old stream channel and the block of sod remains. Beaver dams raised the water table changing the dry meadow above the stream to analogue sedge. Bluegrass and slender cinquefoil right of the meter board have almost disappeared.



August 1, 1998—Beavers departed 4 years previously and the flood of February 1996, cut a new channel (p. 9) draining water from this elbow and re-creating the dry meadow. Aquatic sedge is still dominant on the lower stream channel. Willows are increasing and lodgepole pine is reproducing near the meter board.



August 1, 2004—Willows have increased dramatically in the background, and lodgepole pine regeneration is growing well. Aquatic sedge shares dominance with tufted hairgrass in the old stream channel. The meter board was placed behind the original fencepost to measure amount of soil deposition. Top of the fencepost is at 5 dm, meaning 5 dm of soil has been deposited on the old sod block.

Seasonal Change: Pole Camp Stream

April 21, 1999—These photos document riparian areas during seasons other than livestock use. Pole camp stream, Crow-foot Creek, was visited April 21 to October 1, 1999. On page 23, August 1, 1998, a year earlier, no water was flowing. Here, in late winter, the stream is flowing. Note in particular standing water on the dry meadow at camera location No. 1 fencepost. The fencepost in the snow in the distance is photopoint “Wet Meadow.”



May 2, 1999—Eleven days later, new snow had fallen and water still stood on the dry meadow site.



May 22, 1999—Snow is gone and greenup has just begun, particularly on parts of the dry meadow. Cold snowmelt water apparently retards aquatic sedge’s early development. Holes made by gophers in the bank to the right of the meter board and in the foreground tend to funnel snowmelt water and can cause bank erosion.





June 15, 1999—Spring runoff is over and the streambed has only pools of water. Aquatic sedge dominates with tufted hairgrass above the winter water line.



August 1, 1999—Only a few pools of water remain in the streambed and aquatic sedge is fully grown.



October 1, 1999—Occasional pools of water remain. These are apparently the result of subsurface flow. The gopher hole near the lower right corner can contribute to bank erosion during spring runoff.

**Thirty Years Change:
Button Meadow, East Pasture**

August 1, 1975—Green cast suggests palatable, nutritious forage. Dominants are ragwort, aquatic sedge, American bistort, slender cinquefoil, longstalk clover, checkerbloom, and delphinium. The composition is 70 percent forbs. See “Condition and Trend” on pages 32 and 33. Pasture was not used in the spring.



August 1, 1981—Much drier conditions compared to 1975. Dominants this year are aquatic sedge, tufted hairgrass, ragwort, American bistort, slender cinquefoil, and fleabane. Light spring use this year.



August 1, 1987—Vegetation is moderately green, composed of aquatic sedge, aster, tufted hairgrass, slender cinquefoil, ragwort, and Baltic rush. Light spring use.





August 1, 1993—Forbs dominate the plant community: ragwort in yellow flower, slender cinquefoil, aquatic sedge, flowering heads of tufted hairgrass, dried American bistort, some geranium, foxtail barley, and foothill arnica. No spring grazing.



August 1, 1998—Tufted hairgrass seedheads overemphasize its dominance. Common species are aquatic sedge, slender cinquefoil, analogue sedge, aster, American bistort, Baltic rush, and foothill arnica. No spring grazing.



August 1, 2004—Tufted hairgrass seed heads belie its low cover percentage. Common species are aquatic sedge, slender cinquefoil, ragwort, and American bistort. Composition is still about 70 percent forbs. These images clearly show light cattle use over 30 years. Apparently this site should be considered a “forb-sedge type.”

**Seasonal Change:
Button Meadow, East Pasture**

June 15, 1981—Dominant species are ragwort, American bistort (white flowers), aquatic sedge, slender cinquefoil (yellow flowers), analogue sedge, long-stalk clover, small camas, and buttercup. Dark green areas are Baltic rush with standing water. Plant height is about 2 dm.



August 1, 1981—Nearly all species have cured out for this year. But compare to August 1, 1983. Species are ragwort, foothill arnica, aquatic sedge, tufted hairgrass (the flowering stalks), fleabane, small camas, and California oatgrass.



October 1, 1981—Fall use at the end of the grazing season. The “scruffy” appearance of the vegetation indicates (1) cattle could fill their rumen with preferred species leaving less palatable ones, and (2) they were not forced to eat less desired forage, which could cause overuse of preferred species and a switch to willow leaves.





June 15, 1983—Some change in flowering heads from 1981. Still ragwort, American bistort, aquatic sedge, slender cinquefoil, small camas, dandelion, and Baltic rush in dark green areas.



August 1, 1983—Vegetation is much greener than in 1981, emphasizing phenological differences between years. These differences tend to cause shifts in livestock preference, which should be considered when evaluating animal impacts on riparian vegetation. Common species remain ragwort, foothill arnica, aquatic sedge, tufted hairgrass (the flowering stalks), small camas, and California oatgrass.



October 1, 1983—No livestock use this year. Seed heads are tufted hairgrass. For some reason, the dominant sedge has produced so few seed heads that its identification as aquatic sedge might be questionable.

**Button Meadow:
Mule-Ears Flowering**

June 15, 1975—This photopoint was established to document flowering of mule-ears (the white flower). It also records apparent erosion or former erosion. There have been no changes in the soil pattern for 30 years. Other species present are fleabane, ragwort, Baltic rush, and scant bluegrass (Kentucky or Agassi's).



June 15, 1976—No flowering on mule-ears even though the leaves are visible. Other species are the same.



June 15, 1977—Again, no flowers on mule-ears. (There have been **no flowers** for the 29 years since 1975.) Yet mule-ears leaves are clearly evident. Growing conditions this spring were good for the dominant species: fleabane, ragwort, Baltic rush, and scant bluegrass.





Button Meadow: Fence Line

August 1, 1975—Fence-line conditions are shown at the start of rest-rotation grazing. Cattle are beginning fall use on the right pasture. Dominant species are ragwort, aquatic sedge, American bistort, slender cinquefoil, checkerbloom, tufted hairgrass, delphinium, and longstalk clover. Species compositions on both sides of the fence are similar.



August 1, 1989—This is halfway through the 30-year study. Species composition is similar on both sides of the fence. Seed heads belie the low coverage of tufted hairgrass.



August 1, 2004—After 30 years, little change is apparent across the fence. Right pasture is being fall grazed. Plant community composition is still 70 percent forbs and 30 percent grasses and sedges. Much of the green is slender cinquefoil and ragwort, even at midseason.

**Condition and Trend:
Button Meadow, East Pasture**

June 15, 1975—Spring vegetation is compared over 30 years to appraise trend and to evaluate concepts of range condition. Cattle grazing, using a rest-rotation system, has been moderate to light—supposedly fostering an upward trend if previous range condition was less than good. Here, species composition was ragwort, American bistort, small camas, aquatic sedge, slender cinquefoil, long-stalk clover, and dandelion.



June 15, 1990—Fifteen years later, composition is very similar: ragwort (yellow flowers), American bistort (white flowers), aquatic sedge, slender cinquefoil, small camas (blue flowers), analogue sedge, and longstalk clover. There is no evidence of trend toward presumably aquatic sedge. Composition is about 70 percent forbs and 30 percent sedges and grasses.



June 15, 2004—There is no apparent change in “range condition” over 30 years of moderate to light grazing. Dominants here are again ragwort (yellow flowers), American bistort (white flowers), aquatic sedge, slender cinquefoil, small camas (blue flowers), analogue sedge, rush, and longstalk clover. I call this a **forb-sedge** meadow in good condition. It is a functioning riparian system (Prichard 1995).





**Condition and Trend:
Pole Camp Dry Meadow**

June 15, 1975—In this example, range “condition” will change because of a raised water table caused by beaver dams. Prior to beavers, species composition looked like it was “poor condition”: high mountain cinquefoil (grey color), narrowleaf pussytoes (also grey color), slender cinquefoil, bluegrass (Kentucky or Agassi’s), and scant analogue sedge. Composition was about 80 percent forbs. See discussion of bluegrass in footnote 2 (p. 36).



June 15, 1990—After 6 years of a raised water table, composition has changed to analogue sedge dominant, with narrowleaf pussytoes, high mountain cinquefoil, bluegrass, and slender cinquefoil. Herbage production is double that in 1975. Now look at 2004 below.



June 15, 2004—Now 9 years since beaver dams disintegrated and the water table dropped. Composition is back to slender cinquefoil, pussytoes (grey color on the ground), high mountain cinquefoil, bluegrass, and scant analogue sedge. Herbage production is less than half that in 1990. Water table depth was the primary “range trend” factor here. The plant community returned to its low water table “best condition.” In all three examples, it is a functioning riparian system (Prichard 1995). I call this a **dry forb-grass meadow** in good condition.

Conclusions

In 1975, a change in cattle management from season-long to three-pasture rotation was implemented on Emigrant Creek allotment, Emigrant Creek Ranger District, Malheur National Forest. A photomonitoring study was implemented to track changes in vegetation and soils in riparian areas. An area was selected in each of three pastures: lower Emigrant, Pole Camp, and Button Meadow. Eleven photo-points were established and were visited 3 times per year: June 15 at start of grazing, August 1 at change in pastures, and October 1 at the end of grazing.

The current grazing system is having no adverse impact on either soils or vegetation. Other impacts have had far greater influence:

- A flash flood created an alluvial fan into Emigrant Creek, which has been colonized and stabilized by herbs and shrubs under current livestock grazing.
- Beavers moved into Pole Camp in 1984 and left in 1994. They severely reduced willow dominance by harvesting shrubs for dam construction and forage. Beaver dams also raised water tables reducing soil aeration and apparently adversely affecting willow growth in wet meadows. Raised water tables also changed a dry meadow to a moist meadow causing major shifts in species composition and an increase in production. When beavers left Pole Camp and their dams disintegrated, water tables were lowered and the moist meadow reverted to its dry status and species composition. Livestock did not influence this change in vegetation. After beavers departed, willows increased significantly in profile area on a wet meadow under current livestock grazing.
- Abandoned beaver dams and the flood of February 1996, a 50-year event, combined to create a new stream channel in Crowfoot Creek as it flows through Pole Camp. Livestock had no influence on this event. The new channel has further reduced water tables in adjacent wet meadows, causing a shift in species dominance and an increase in diversity as less water-sensitive species colonize the area.

A concern that became evident during this study was what constitutes “good range condition”? Traditionally it is characterized by a dominance of decreasers, species palatable to livestock. Of the five moist and wet meadows sampled, only one was initially dominated by a typical “decreaser,” aquatic sedge at Pole Camp. The other meadows were dominated by forbs typically of low palatability to livestock. Yet none of these showed an upward range trend after 30 years of light to moderate livestock use. The conclusion is that, ecologically, dominant species need not be palatable to domestic livestock.

Another concern was range trend. Lower Emigrant soils have a gravel layer providing root aeration for willows. Even though aquatic sedge and bluejoint reedgrass dominated the herbaceous layer, willows expanded under livestock grazing to the extent that herbage production was cut by two-thirds.

The Pole Camp wet meadow, dominated by aquatic sedge, was another example. Loss of beaver dams and a lowering of the water table has caused a major increase in willows. This is a “downward range trend” **not** caused by livestock. The increase in willows is reducing herbage production at Pole Camp. Adjustment in grazing will not alter this trend.

Riparian areas are a unique environment quite different from uplands. Traditional concepts of range condition and trend have been based on upland conditions (Winward 2000). They should be seriously challenged in the riverine riparian setting in favor of a “state and condition” concept (Box 2003, Pyke and Herrick 2003, Ragsdale 2003).

Names of Plants

Common name	Scientific name
Agassi’s bluegrass ²	<i>Poa agassizensis</i> Bolvin & D. Löve
American bistort	<i>Polygonum bistortoides</i> Pursh
Analogue sedge	<i>Carex simulata</i> Mackenzie
Aquatic sedge	<i>Carex aquatilis</i> (Holm) Kükenth.
Aster	<i>Aster</i> spp.
Baltic rush	<i>Juncus balticus</i> Willd.
Beaked sedge	<i>Carex rostrata</i> Stokes
Bluejoint reedgrass	<i>Calamagrostis canadensis</i> (Michx.) Beauv.
Buttercup	<i>Ranunculus</i> spp.
California oatgrass	<i>Danthonia californica</i> Boland
Checkerbloom	<i>Sidalcea</i> spp.
Dandelion	<i>Taraxacum officinale</i> G.H. Weber ex Wiggers
Delphinium	<i>Delphinium</i> spp.
Fleabane	<i>Erigeron</i> spp.
Foothill arnica	<i>Arnica fulgens</i> Pursh
Foxtail barley	<i>Hordeum jubatum</i> L.
Geranium	<i>Geranium viscosissimum</i> Fisch. & C.A. Mey. ex C.A. Mey.
Geyer’s willow	<i>Salix geyeriana</i> Anderss.
High mountain cinquefoil	<i>Potentilla flabellifolia</i> Hook. ex Torr. & Gray
Junegrass	<i>Koeleria macrantha</i> (Laedeb.) J.A. Shultes = <i>K. cristata</i> auct. p.p. non Pers.
Kentucky bluegrass ²	<i>Poa pratensis</i> L.
Lodgepole pine	<i>Pinus contorta</i> Dougl. ex Loud.
Longstalk clover	<i>Trifolium longipes</i> Nutt.
Mule-ears	<i>Wyethia amplexicaulis</i> (Nutt.) Nutt.
Narrowleaf pussytoes	<i>Antennaria stenophylla</i> (Gray) Gray
Ponderosa pine	<i>Pinus ponderosa</i> Dougl. ex Laws
Ragwort	<i>Senecio</i> spp.

Common name	Scientific name
Shrubby cinquefoil	<i>Dasiphora floribunda</i> (Pursh) Kartesz, comb. nov. ined = <i>Potentilla fruticosa</i> auct. non L.
Slender cinquefoil	<i>Potentilla gracilis</i> Dougl. ex Hook.
Small camas	<i>Camassia quamash</i> (Pursh.) Greene
Strawberry	<i>Fragaria</i> spp.
Thinleaf alder	<i>Alnus incana</i> (L.) Moench ssp. <i>tenuifolia</i> (Nutt.) Breitung
Tufted hairgrass	<i>Descampsia caespitosa</i> (L.) Beauv.
Willows	<i>Salix</i> spp. (<i>S. geyeriana</i> is most common)

²*Poa pratensis* and *P. agassizensis* look very similar as both can be prostrate and both have a web of hairs on the lemma. *Poa agassizensis* is considered a native, whereas *P. pratensis* is considered an alien (Cronquist and others 1977). *Poa pratensis* leaves are broader, and it is mostly three-flowered rather than two-flowered. Bluegrasses found in the Emigrant Creek allotment more closely resemble *P. agassizensis* and tend to support the concept of a “forb-bluegrass dry meadow” type.

English Equivalents

When you have:	Multiply by:	To get:
Decimeters (dm)	3.94	Inches
Centimeters (cm)	0.394	Inches
Meters (m)	3.28	Feet
Kilometers (km)	0.6215	Miles
Square meters (m ²)	10.76	Square feet

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