2018 WILDLANDS RESTORATION VOLUNTEERS MONITORING REPORT

The Monitoring Group of Wildlands Restoration Volunteers presents the 2018 Monitoring Report competed by our monitoring volunteers who visited past project sites to evaluate success. We include a summary of important lessons learned from monitoring completed in 2018, detailed project site monitoring forms, and project site photographs. See page 2 for a complete list of projects assessed in this report. By providing project feedback, our findings support the hard work of volunteers, staff, agencies, and donors.

Thanks to all of our monitoring volunteers who helped in the field and behind the scenes: Alan Carpenter, Laura Backus, Tracy Halward, Katherine Thompson, Tim Seastedt, Brian Sechler, Niki Eschler, Andy Grinstead, Sara Kramer, Ryan Schroeder, Khum Thapa-Magar, Stephen Hauptli, Jean-Pierre Georges, Allison Hamm, and Karen Cozzetto.

Thanks also to Laura Backus and Tim Seastedt for compiling and editing this report.

2018 Lessons Learned

Our 2018 monitoring of old Wildlands Restoration Volunteers projects shows successful projects as well as projects with mixed success. Long-term monitoring, rarely conducted, brings out the deep lessons in restoration projects, i.e., the effects of nature, human nature, and climate change. Keep on monitoring our very large backlog of 10 to 20 year old projects.

1. Work with nature. Projects with low plant survival were those with competition from aggressive non-native grasses and weedy forbs, post-project flooding, post-project drought, insufficient information on site hydrology, and/or fall planting of willow and cottonwood poles without follow-up watering,

- Evaluate the soils, especially in post-flood projects. Some floodplain species like silt, others cobble deposits.
- Plant at least 5-gallon container plants, especially in areas of sediment deposit,
- Scatter woody debris to create micro-habitats for promoting volunteer revegetation.
- Protect existing native volunteers; they are hardier and more diverse than plantings.
- Expect invasive species, especially if they are already known in the area. The presence of surviving invasive species and the dispersal of their seeds via multiple potential vectors is out of our control.

2. Work with human nature so that our projects also benefit the human community:

- Make it possible for people to access views, interesting features, and water.
- Find out about routine maintenance activities, especially mowing areas and post-project supplemental watering.
- Follow up with agencies on their post-project activities, especially watering and closures.
- “Area Closed for Revegetation” signs do protect restoration areas.
- Partnerships with graduate students benefit both them and WRV.
- Remember that building community is part of our mission. Include local people and fire departments.

3. Our planting techniques and species selections, for the most part, are effective and appropriate including:

- Deep planting
- Planting leadplant in cobble areas
- Planting river bank willows in shallow areas of high spring flows.
- Use of 4-person augers to facilitate very deep riparian area plantings
- Fall planting of **container** willows and cottonwoods
- Copious project day watering and several years of very intermittent follow-up watering

We recommend:

- More research on use of bio char and willow treatments; we have not seen an effect in our projects, but we have been working with small samples.
- Inclusion of typical native volunteer species in the seeding and/or planting such as wild raspberry, golden aster, silver sage, geranium.

4. Plan for climate change resilience:

- Consider using our lower elevation seed mixes and plantings at higher elevations.
- Plan for follow-up plantings or other remedial work.
- Record pre-project vegetation so that we can follow changes over time.

5. Plan during project implementation to facilitate future monitoring:

- Take many project day photographs of completed areas and include identifiable background. GPS location of photographs and important project work.
- Mark plantings if follow-up is intended. Use t-posts for tagging trees in areas of seasonally high water. Use bamboo poles in upland areas, especially in high grass or forbs.
- When possible, have an appropriate crew member make a sketch of plantings with plant ID # and photo #.

Sites monitored in 2018:
FOUR MILE CANYON FIRE RESTORATION 2011
LONG LAKE RESTORATION PROJECT 2001
BOSLOUGH RIPARIAN RESTORATION 2016
BIG ELK MEADOWS (1000TH PROJECT) 2017
COAL CREEK 2014
CAMPBELL VALLEY BEAVER ANALOGUE 2017
PESCHEL RIPARIAN 2016
ELDORADO FUEL REDUCTION 2004
TOMMY THOMPSON STREAMSIDE 2009

WRV Quick Monitor Form 10-1-2018

FOUR MILE CANYON FIRE RESTORATION

Project Date: March 19, 2011 **Monitoring Date**: September 8, 2018
Location: Emerson Gulch, side road to north from upper Four Mile Canyon
Agency / Partners: Boulder County Parks and Open Space
Monitor(s): Alan Carpenter and Laura Backus

Project goal(s): Plant native grass seed to reduce the potential for weed colonization and erosion in the area burned by the September 2010 Four Mile Canyon fire.

Did the project meet the goals? Yes. No erosion is evident, and state-listed noxious weeds Canada thistle, musk thistle, and mullein are a minor component of the vegetation. Much of the area of former ponderosa pine and Douglas fir forest now is dominated by invasive smooth brome, a deeply rooted, non-native pasture grass.

Techniques used and their effectiveness: Crews seeded slender wheatgrass, bottlebrush squirreltail, and Sandberg bluegrass and raked the seeds into the soil and existing vegetation debris. We observed widely scattered slender wheatgrass and bottlebrush squirreltail. Our project did not establish native grasses, but few noxious weeds were present.

General observations of plant survival, weediness, erosion: Although smooth brome was the dominant post-fire species, we also observed occasional asters, silver sage, buckwheat, ragweed, and gay feather. Woody species included native buckbrush, wild rose, mountain maple, chokecherry, and aspen. Likely some of these resprouted from surviving roots. We noted one sapling Engelmann spruce next to the drainage.

Did the project cause any unintended consequences? Yes. Smooth brome covers much of the burned area. Could smooth brome roots or rhizomes have survived the fire? Been in the seed bank? Invaded from nearby unburned areas? Been seeded by property owners? Been brought on site by the project or other post-fire restoration activities?

Corrective or Maintenance activities needed: Because smooth brome is so well-established, seeding or planting of ponderosa pine, Douglas fir, and spruce likely will be necessary to re-establish a forest.

Other pertinent information (flood, fire, construction, wildlife observations): Some houses have been rebuilt.

What were the community benefits? WRV showed up and worked with a community recovering from forest fire. Building community is part of our mission.

Important lessons for future WRV projects:

- Presence of surviving invasive species and dispersal of their seeds from multiple potential vectors is out of our control.
- The current dominance by invasive smooth brome coupled with a warming climate will likely prevent a return to the pre-fire ponderosa pine and Douglas fir forest without further work.

Comparison Photos:

2001, view to west down to Four Mile Canyon

2018, view to west down to Four Mile Canyon

Views of upper gulch

September 8, 2018, view to southwest from side road to 724 Emerson Gulch. Note dominance by smooth brome, lack of conifer regeneration.

September 8, 2018, view to northeast from side road to 724 Emerson Gulch. Note grasses and some forb and deciduous shrub regeneration.

LONG LAKE RESTORATION PROJECT
WRV Quick Monitor Form 10-1-2018

Project Date: June 23, 2001 **Monitoring Date(s):** September 6 and 7, 2019
Location: Long Lake outlet in Brainard Lake Recreation Area, west of Boulder, CO
Agency / Partners: US Forest Service
Monitor(s): Laura Backus

Project goal(s): Revegetate the unvegetated top of an old constructed berm at the Long Lake outlet with willows and bog birch harvested on-site. We also included minor willow planting to close a social trail through wet forest at the south end of the berm.

Did the project meet the goals? Although project although survivor rates for all species and project areas had been very high in the first few years post-project, I observed mixed success 17 years after the project. Approximately 1/3 of the plane-leaf willow plantings survived; these were nearly all in locations furthest from the intended trail and from social trails. None of the planted upland willows or bog birch survived to 2018.
To view Long Lake and peer inside an old metal bucket, hikers walked through the plantings on the west side of the intended trail resulting in high willow mortality. See Figure 1: Long Lake Berm Plantings. Probably, as plantings failed to survive or died, more people walked through the planting area.
In contrast, on the unplanted northeast portion of the berm which had an "Area Closed for Revegetation" sign and scattered woody debris, volunteer plant growth had proceeded well, and there is no evidence of visitor trampling.
Three of the four willows planted on the wet social trail to the south were surviving, but showed only minor growth. Despite a closed sign, the trail appears to get some use.

Techniques used and their effectiveness:
1. On-site, project-day harvest of dormant willows. Nearly all willows were plane-leaf willow (*Salix planifolia*). We included a few upland willows, (*Salix* spp.), and bog birch (*Betula glandulosa*).
2. Hand-digging of planting holes to a depth of 1 to 2 feet and placement of at least 4 stems in each hole.
3. Each planting received either 1 or all of four treatments or was in a control group. The treatments were water-holding Polymer, Mycorrhizal inoculation, Hormone, or All three treatments. There was an untreated Control group.
4. Most stems were trimmed to approximately 12".
5. All plantings were well-watered on project day and intermittently watered by volunteers over the next few years.

Our planting techniques were appropriate as evidenced by 100% willow survival at the end of the 2001 growing season as well as high survivorship in 2003 and 2009. There was at least 1/3 survivorship in 2018.

General observations of plant survival, weediness, erosion:
Volunteer plants, especially those located in the shelter of willows and rocks and at areas with closure signs, included Engelmann spruce, blueberry, bog birch, forbs, grasses, sedge, and rush.
Except for possible smooth brome, no weediness was observed.
No erosion was apparent.

Did the project cause any unintended consequences? Yes. Once the intended trail boundaries became unclear, hikers chose a route through the more scenic planting area.

Corrective or Maintenance activities needed:
Formally construct the trail through the west side lake view area with old metal bucket. Add a bench and plaque with history of the site. In the area of the 2001 intended trail, plant plane-leaf willows. Add an "Area Closed for Revegetation" sign and woody debris.

Other pertinent information (flood, fire, construction, wildlife observations):
The Brainard Lake Recreation Areas is a very popular hiking destination.

What were the community benefits?
Berm area became somewhat more scenic due to increased vegetation.

Important lessons for future WRV projects:

- Pay attention to **Human Nature**. At Long Lake hikers were attracted to the better views of the lake and Indian Peaks available from the west side planting area. Everyone wanted to look inside the old metal bucket. The project would likely have had higher survivorship of the dominant plane-leaf willow if we had planted on the east side of the berm and defined a trail along the more scenic west.
- Omit planting upland willows and bog birch. By the beginning of the second growing season, nearly all had died.
- Although the highly compacted berm was an exceptionally difficult place to plant willows, our deep planting techniques were successful. Additionally, copious project day watering and several years of very intermittent follow-up watering were likely components of success. There is no clear difference among the treatments.
- On selected projects, have an appropriate crew member make a sketch of plantings with ID # and photo # or accurately GPS and record plantings.
- Project day photos are invaluable in analyzing long-term success. It is possible, after 17 years, to confirm, for nearly all plantings, the ID# by shape of stems and position of rocks, etc. Include more background in the photos and attach metal ID tags.
- Note that people move and/or take out rock and log barriers. Rocks start to get covered by sediment and nearby vegetation. Some group, no doubt very muscular, moved the extremely heavy metal bucket!
- Places posted "Area Closed for Restoration" had higher survivorship of plantings and much greater cover by volunteer vegetation.
- Scattering of woody debris promoted volunteer revegetation as did the large boulders lining the intended trail.
- Long-term monitoring, rarely conducted, brings out the deep lessons in restoration projects. Keep on monitoring our store of 10+ year old projects.

Comparison Photos:
View to south of west side of berm planting area

September 14, 2001. Note: newly planted willows and bog birch to right of boulders and intended trail to left. The planting area was devoid of woody vegetation prior to the project. Note the old metal bucket in center of photograph.

September 7, 2018. Note: Both the planting area and the intended trail are used by hikers. The antique metal bucket has been moved slightly down the slope of the berm. Some surviving willows are present along the margins of the bare areas. Spruce have grown.

View to north of east side of berm planting area

June 23, 2001. Note: very sparsely vegetated area, back of "Closed for Restoration" sign at the far end, and boulder/log barrier marking the right side of the trail. This area was closed, but not planted.

September 6, 2018. Note: Vigorous growth of volunteer spruce and willow, likely due to a clearly closed area.

Feature Photos

Volunteer plants edging out from shelter of willow plantings and boulders:

Volunteer grasses spreading out from willow planting #31

Small Engelmann spruce in shelter of plane-leaf willow planting #20

Value of "Area Closed for Restoration" signs:

Closure sign at entrance to wet social trail with one of the #33 willow plantings in middle ground

Posted "Area Closed for Restoration" sign (barely visible near left end of slanted log) at the north end of the east side; the volunteer plant growth here was much more successful than the west side. Scattered woody debris also contributed to maintaining the closure.

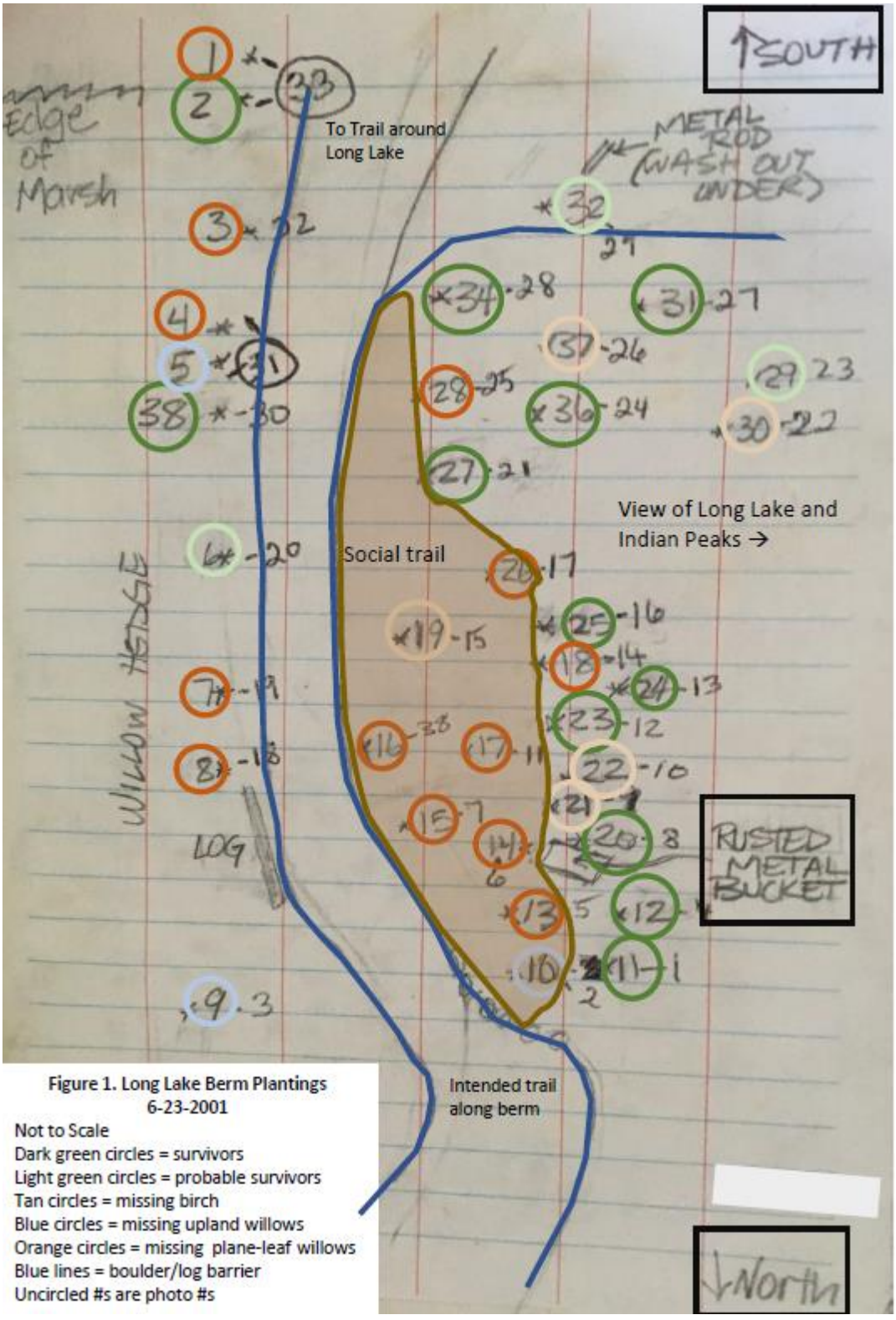


Figure 1. Long Lake Berm Plantings
6-23-2001

Not to Scale
Dark green circles = survivors
Light green circles = probable survivors
Tan circles = missing birch
Blue circles = missing upland willows
Orange circles = missing plane-leaf willows
Blue lines = boulder/log barrier
Uncircled #s are photo #s

Graphic showing survivors as of 2018

BOSLOUGH PROPERTY, SOUTH ST. VRAIN CREEK
WRV Quick Monitor Form 10-1-2018

Project Date(s): May 15, 2016 **Monitoring Date:** September 15, 2018
Location: 9.1 miles above Lyons on Colorado Highway 7
Agency / Partners: Mark Boslough with grant from Colorado Water Conservation Board, St. Vrain Watershed Coalition, Colorado Department of Transportation
Monitor(s): Laura Backus and Tracy Halward

Project goal(s): (1) Speed up post-flood revegetation of approximately one acre of cobble deposition plus scoured-out areas of the upper bank; (2) Supplement property owner Mark Boslough's tree plantings on old jeep road on the slope above river right to prevent vehicle access.
See the Boslough monitoring report of August 2016 for more project details.

Did the project meet the goals? Yes, most areas of the banks and slopes are revegetating well with both planted and volunteer species. Erosion and bare ground are minor within the project area. On the old jeep road, planted and volunteer trees have grown well; there is no indication of vehicle use.

Techniques used and their effectiveness:

- Planting of locally-sourced willow poles: Both on the stream banks and in the trench, willow plantings show vigorous growth, including willows planted into areas of spring shallow water.
- Planting of native shrubs and trees, plus ponderosa pine and cottonwoods donated by Mark Boslough: many planted woody species are surviving.
- Seeding of native grasses and forbs: Slopes are revegetation, but we did not collect data on species.
- Light application of Biosol: Unable to determine effect, but revegetation was proceeding well.
- Spreading WoodStraw mulch throughout the entire site: Probably contributed to post-project vegetation growth. We observed several piles of WoodStraw around plantings.
- Protection of of native volunteer species: Many volunteer trees, shrubs, forbs, grasses, and grass-likes are growing well.
- Tree planting on old jeep trail: many transplants were growing well. There is no evidence of vehicle use.
- Buddy's track hoe access on downstream river left is revegetating well.

General observations plant survival, weediness, erosion on streambanks and slopes:

Willow plantings in all locations had good survivorship. Dominant species in bold.

Best planted survivors on bank of shady river right: **narrowleaf cottonwood**, dogwood, Woods' rose, Douglas fir. Some lanceleaf cottonwood, chokecherry, currant, alder, aspen, pine. Many volunteer raspberries. Includes survivorship on eroded steep slopes.

Best planted survivors on bank of sunny river left: **narrowleaf cottonwood**, aspen, alder, chokecherry. Some ponderosa pine, Douglas fir, Woods' rose, currant. Variety of volunteer forbs.

Weeds: Minor mullein, bull thistle, Canada thistle, sweetclover, soapweed, smooth brome, redtop.

Bare ground is filling in, no major erosion observed.

Did the project cause any unintended consequences? None observed

Corrective or Maintenance activities needed: None observed

Other pertinent information (flood, fire, construction, wildlife observations): No further impacts observed.

What were the community benefits?
Giving and receiving of community support for a river reach damaged in the 2013 floods, improved bank and highway embankment stability

Important lessons for future WRV projects:

- Our riparian woody species selection was appropriate for the site; at least one of each planted species survived.
- It was well worth the effort to plant in shallow areas of high spring flows. The willows survived well and are out of the water during low flows.
- Include typical native volunteer species in the seeding and/or planting: raspberry (*Rubus idaeus*), golden aster, silver sage, geranium.
- Mark container plantings with bamboo poles on project day for better post-project identification.

Photographs:
Road Closure on river right slope

April, 2016 View up jeep road closure from near start of planting project

September 15, 2018. Note good growth of most ponderosa tree plantings, volunteer Douglas fir, and development of grass and forb cover. No evidence of vehicle traffic.

River Left, view down stream from bridge of banks and road embankment

April 30, 2016. Note very little vegetation in low bank cobbles.

September 15, 2018. Note vigorous willow growth on low bank plus some pockets of volunteer wetland vegetation, fewer areas of bare ground on the road embankment.

River Right willow trench

April 30, 2016, view down stream of willow trench post-construction. Note groundwater in trench bottom.

September 15, 2018, view down river of vigorous growth of planted willows and volunteer cottonwoods in trench.

BIG ELK MEADOWS (1000TH PROJECT)

WRV Quick Monitor Form 10-1-2018

Location: US 36 and Big Elk Road (Larimer Co. Road 47), downstream of bridge
Project date(s): Sept 29, 2017 **Monitoring Date**: Aug. 21, 2018
Monitor(s): Tim Seastedt, Brian Sechler

Project goal(s): Riparian planting + revegetate a staging area used for equipment that rebuilt HWY 36 after the 2013 flood

Techniques used and their effectiveness: The site had apparently been reseeded immediately following the removal of heavy equipment, but the site had very low vegetation cover. Forest Service supplied a top soil that was applied to part of the reseeded area (insufficient quantities for entire area), riparian plantings included cottonwood, peachleaf willow, and western birch. A small amount of erosion matting was placed on the most severe slope adjacent to Big Elk Road.

General observations of plant survival:
Riparian woody plantings appeared to be nearly 100% established and surviving well. Seed mix suggested that selected C3 grasses (Elymus spp.) dominated the first year cover. We estimate that 5-10% of herbaceous cover is from either volunteer seeds blown onto the site, contaminants of the seed mix, or a surviving seed crop from the long-abused and scraped soil. The diversity of the non-seeded plants appeared very large, a mix of weedy native and introduced species, with no single weed dominating this small fraction of the canopy

Did the project meet the goals?
A very positive response on treated areas. High planting and seeding survivorship, low weed competition. A follow-up seeding by the USFS on an untreated upper, adjacent region not treated has apparently not been accomplished to date.

Did the project cause any untended consequences?
None identified

Corrective or Maintenance activities needed: The USFS or County weed manager should inspect the site and decide if any proactive weeding is necessary (e.g., ox-eye daisy may be present). The USFS should complete the restoration as some modest erosion onto the treated areas from untreated uplands is occurring.

Other pertinent information (flood, fire, construction, wildlife observations):
None observed.

Important lessons for future WRV projects:
See photos. The top soil dressing clearly stimulated vegetation early on, and did result in greater production. It was unclear how this dressing affected weed abundance.

Restoration area on 9/30/2017: riparian zone up to highway, Big Elk Road in background. Note topsoil dressing on parts of the restoration. Erosion matting used on steep slope below road. Following spreading of topsoil, seeding, raking, and woodstraw applied.

Spring of 2018, view to north with Big Elk road in background. More abundant vegetation on topsoil areas clearly visible.

8/21/2018, view to north, US 36 in background

8/21/2018, view to south with US 36 in background. Foreground area NOT restored above site is eroding and weedy.

8/21/2018, view to north, Big Elk Road in background. Erosion matting on left, wood straw on right. Weeds in this picture include diffuse knapweed (which contain biocontrol -seed weevils but do not contain root weevils, which could be added), and tumble mustard, a common early successional disturbance species. The volunteer native forb, gumweed, (*Grindelia squarrosa)* also is in the background.

Ponderosa pine is among the volunteer species found on the site. Note presence of wood straw added the year before.

COAL CREEK FLOOD RESTORATION, OCTOBER 11, 2014
WRV Quick Monitor 9-8-2018

Project Date: October 11, 2014 **Monitoring Date**: September 16, 2018
Location: Coal Creek Regional Trail, west side of Alder- Fingru Property, Lafayette, CO
Agency: City of Lafayette, Boulder County Parks and Open Space, contact: Rob Burdine
Monitor(s): Laura Backus, Tracy Halward, Katherine Thompson

Project goal(s): Improve creek-side habitat and flood resiliency of the Coal Creek riparian area where a trail was realigned to a location further from the streambanks following extensive flooding in 2013.

Techniques used and their effectiveness:

- Construction of 250' of post and dowel fencing to close the restoration area
  Effective - no evidence of a new social trail through the restored riparian area
- Willow pole plantings: mixed results
  Stinger holes along streambank: some survivorship; the area is probably too shady for a high level of willow development or the plantings may have been out-competed by reed canarygrass.
  Effective – north side ditch willows are thriving in this sunnier location
- Seeding native riparian species:
  Somewhat effective – of the four native grass species, only slender wheatgrass was prevalent in the forest understory.
- Planting shrubs:
  Yes for leadplant (1 gal.) – found 21 of 30 plantings done in cobble deposition area
  Yes for snowberry (5 gal.) – found 19 of 30 plantings, better in sunnier areas
  Yes for golden current (5 gal.) – found 10 of 30 plantings
  No for American plum (1 gal.) – found 3 of 45 plantings
  No for chokecherry (l gal.) – no survivors found
  Low or no survival of American plum and chokecherry may be due to very strong competition from non-native reed canarygrass, smooth brome, teasel, Canada thistle, and others in areas of sediment deposited by the flood as well as the use of 1 gallon instead of 5 gallon containers.
  Shrubs planted in areas of social trails near the south end bridge had low survival due to trampling.
- Planting tall pot plains cottonwood in pre-augered holes along the new trail alignment:
  Somewhat effective – 4 of 10 plantings survived; several of these were cut near ground level and are developing new growth. Low survivor ship was most likely due to placement of planting holes within the mower swath.
- Wetland transplants from a ditch scheduled for reconstruction to suitable sites in the riparian area:
  We noted a few threesquare bulrush, but it was not clear if these were transplants. The new sites may have been too shady or dry or have had excessive competition from weedy species making survivors difficult to see.

General observations of plant survival, weediness, erosion:
Non-native grasses and thistles are dominant. Non-native lambsquarters are greatly reduced. We noted a patch of milkweed near the stream.

Did the project meet the goals?
Yes – the creek-side habitat is in good condition, and the former trail through the riparian area has completely revegetated.

Did the project cause any unintended consequences?
None observed

Corrective or Maintenance activities needed:
Replant cottonwoods outside of mower path along new trail alignment. Confirm that follow-up watering will take place. Protect resprouted and cottonwood plantings and volunteer cottonwoods.
Remove non-native trees such as Siberian elm, phased removal of crack willow.

Other pertinent information (flood, fire, construction, wildlife observations):
None observed

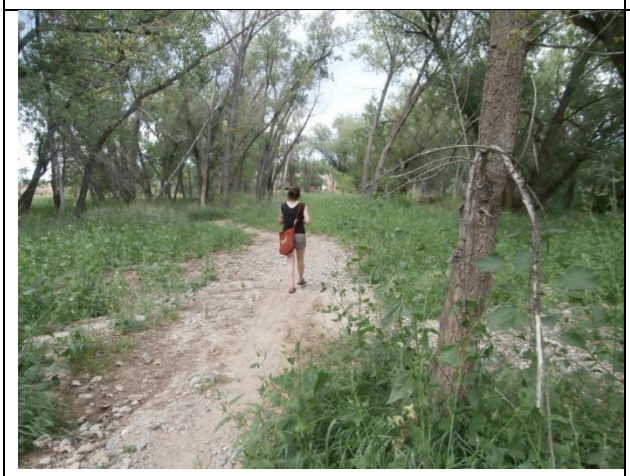
What were the community benefits?
People are enjoying the new plant growth and new trail.

Important lessons for future WRV projects:
- Plant outside of maintenance mower width and/or clearly mark plantings, inform maintenance staff about protecting new trees.
- Planting leadplant as deep as possible into a cobble bar worked very well.
- Avoid planting where an obvious social trail could develop, although planting along the edge worked well.
- On project day, mark plantings with bamboo poles so that they are easier to find.

Coal Creek Flood Restoration, Before and After Photographs – August 6, 2014 and October 11, 2018

2014, view to south of leadplant planting area.

2018, view to south of leadplant planting area.



2014, view to north of trail through riparian area. Note dominance of lambsquarters.

2014, Revegetated trail through riparian area, mostly volunteer species, few shrub and tree planting survivors. Note that trail is not longer visible.

2014, view downstream of typical stream bank. Note sediment deposit and very little bank vegetation	2018, Streambank with willow plantings on upper bank. Note abundant growth of volunteer species, mostly non-native.
	
2081, view to south of vigorous sandbar willow plantings in north side ditch.	2018, view to north of weedy upper riparian area with thistles, lambsquarters, teasel.

CAMPBELL VALLEY RANCH BEAVER DAM ANALOGUE MONITORING – FALL 2018
WRV Quick Monitor Form 10-1-2018

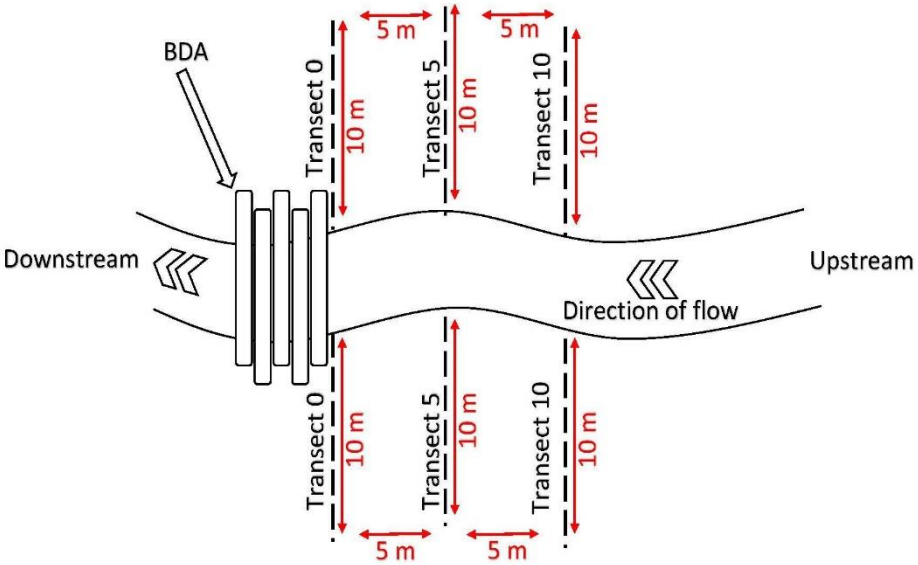
Project Date: Fall 2018 (September through December)
Location: Campbell Valley Ranch, Livermore, CO
Agency / Partners: Colorado State University Rangeland Science 532: Rangeland Ecosystem Sampling graduate students and Dr. Jayne Jonas-Bratten (class professor)
Monitor(s): Niki Eschler, Andy Grinstead, Sara Kramer, Ryan Schroeder, Khum Thapa-Magar

Project goal(s): The primary objectives of this project include (a) determine the treatment effectiveness of livestock exclosures on the recovery of riparian vegetation near 7 Beaver Dam Analogues (BDAs) - one year post installation; (b) determine an ideal sample size for future monitoring efforts of unfenced BDA's; (c) conduct an initial vegetation assessment, both in the area where BDA's have already been installed and where future BDA's may be installed; and (d) develop a long-term monitoring protocol that WRV can use to track the effectiveness of BDA treatments.

Did the project meet the goals?
Yes, all goals set out for this project were achieved.

Figure 1. A visualization of a sample unit along Campbell Creek in Campbell Valley. Three 10m transects were laid on either side of Campbell creek at the 0 m, 5 m and 10 m.

November 2018. A total of 7 BDA's and 2 non-BDA, non-exclosure control sites along Campbell Creek were used as sample units. Three 10-m transects were laid on either side of Campbell Creek at the 0m (perpendicular to the BDA), 5m upstream of the BDA and 10m upstream of the BDA (Figure 1). The control unit sites were selected due to similarities of BDA sample unit topography and stream sinuosity.



The line point intercept (LPI) method for vegetation sampling was utilized for this assessment (Elzinga et al., 1998). Measurements were taken every 1m along each of the six 10m transects. The top hit, intermediate hit, and ground covered were recorded for each point. Because of the constricted nature of the valley walls at some sites, especially the BDA's further downstream, we were not always able to sample the full 10 points for the 10-m transects.

Due to sampling being conducted outside of the growing season and time constraints, not all plants could be identified to the species level. Due to our focus on riparian vegetation and their phenology, many upland plants were identified to the lifeform - including "annual grass", upland "bunchgrass", "forb", "shrub", and "subshrub." Desired, indicator riparian species were either identified to the species or genus levels when possible. Six indicator species were found in the vegetation communities and include *Calamagrostis canadensis* (bluejoint grass), *Poa secunda* (Sandberg's bluegrass), *Sisyrinchium montanum* (mountain blue-eyed grass), *Carex* spp. (sedge), *Juncus* spp. (rush), and *Equisetum* spp. (horsetail). *Salix* spp. (willow) and *Populus* spp. (cottonwood) are also considered desired riparian vegetation, but no individuals of these genera were found along LPI transects (USDA PLANTS Database, 2018).

This sampling method was developed by the RS 532 graduate student team and a monitoring protocol document was developed for further long-term ecological monitoring by WRV volunteers, staff, and/or future rangeland ecosystem sampling class students.

General observations of plant survival, weediness, erosion:
N/A

Did the project cause any unintended consequences?
Not to our knowledge or observation.

Corrective or Maintenance activities needed:
N/A

Other pertinent information (flood, fire, construction, wildlife observations):
Some of the BDAs installed along Campbell Creek are experiencing down-cutting on the downstream side of the BDA that may compromise the BDA over time.

What were the community benefits?
This project helped to foster a closer relationship between WRV and Dr. Jayne Jonas-Bratten (a researcher scholar with the Restoration Ecology Lab at CSU) and the five graduate students who were involved with the RS532 class project. The team of graduate students met with Nate Boschmann to develop project goals, coordinated with him to go out to the site for an overview of the property, and subsequently went out repeatedly to conduct vegetation monitoring in a safe manner. The graduate student team then conducted statistical analyses of the monitoring data and developed a presentation to display the findings of the project. The presentation was attended by Nate Boschmann, Dr. Jonas-Bratten, Dr. Sonya LeFebre, and undergraduate students from the undergrad. range sampling class.

Important lessons for future WRV projects:
Indicator species cover ranged from 13% to 42%, with an overall mean near 25% for all treatment types - Fenced, Unfenced, and Control sites. At an alpha of 0.05, Analysis of Variance (ANOVA) found no significant difference in indicator species cover between Unfenced and Fenced treatments ($p = 0.57$) and no significant difference in indicator species cover between all three treatment types ($p = 0.81$). However, it is important to note that Fenced sites had lower variability in indicator species cover as compared to Unfenced sites. Additionally, an ideal sample size calculation was conducted based upon this preliminary data and found that, to be able to detect a 50% difference in percent cover of indicator species, 18 unfenced BDA's would have to be sampled in the future.

This project also resulted in the development of a protocol document for future long-term monitoring of the BDAs at Campbell Valley. This protocol can be utilized for other monitoring efforts associated with Beaver Dam Analogues, requiring only small modifications depending on the ecosystem being worked in.

Site Photos, 2018:

October 24, 2018. Beaver Dam Analogue #1

November 1, 2018. Monitoring team running vegetation count transects

PESCHEL RIPARIAN RESTORATION
WRV Quick Monitor Form 10-1-2018

2018 update

Location: St. Vrain Creek east of County Line Road, southeast of Longmont, CO.
Project date(s): Sept 17-18, 2016 **Monitoring Dates**: Aug. 4, 2018, Oct. 7, 2017
Monitor(s): Laura Backus, Tim Seastedt, Brian Sechler (2017), Seastedt & Sechler 2018.

Project goal(s): Create a post 2013 flood riparian area by installing herbaceous, willow, and cottonwood plantings along sandbar and upland bench of St Vrain Cr.

Techniques used and their effectiveness:
Gas-powered soil augers used to facilitate deep plantings. (so-called 'two man augers' were best employed using four people). Willow and cottonwood non-dormant poles were used (not recommended: see comments below), as well as willow and cottonwood container plantings. Plugs of wetland herbaceous species were installed. We also used biochar as a soil amendment for approximately half of the cottonwood and willow plantings and a small portion of the herbaceous plantings. No biochar effects were noted in either year

General observations of plant survival:
High water in spring, 2017 opened up what was believed to be a non-active channel and removed a large majority of the herbaceous plugs. Survivors at the furthest most eastern planting were observed. Non-dormant willow and cottonwood poles did not survive whereas all of the cottonwood and willow plantings appeared to have survived.

Did the project meet the goals?
A definite mixed bag. The sandbar cottonwood and willow restoration that used container plants is thriving; other components were largely unsuccessful. 2018: sandbar plantings now threatened with plant competition (both salt cedar and *Melilotus albus* (sweetclover) were common.

Did the project cause any untended consequences?
Plantings with cages that slowed flood waters and allowed deposition of drifting wood and sand are now becoming areas of herbaceous vegetation, although mostly weedy thistles and grasses.
Lines of cottonwood seedlings sprouted downstream from cages.

Corrective or Maintenance activities needed: We suggested in 2017 that Longmont personnel should be consulted about possible removal of cages. 2018 update: NO…100% survivorship to date suggests that protective fences are OK and do not harm trees during high flows. Salt cedar control is needed in this area.

Other pertinent information (flood, fire, construction, wildlife observations):
No 2018 updates save need for tamarisk action.

Important lessons for future WRV projects:
2018 update: Use t-posts for tagging trees in areas of seasonally high water. Tags placed on trees or shrubs, themselves, are not sustainable. Can permanently mark posts in ways to identify individuals or plots. Additional information on this project is available from:

Sechler, B. 2018. Factors affecting the success of riparian restoration in the Colorado Front Range. U. of Colo. MS Thesis, Boulder CO

Comparisons 2016, 2017, 2018

Sandbar in summer, 2016, view to north toward former channel. Herbaceous planting were installed on left side, cottonwood and willows planted in center.

Sandbar in early Oct., 2017, view to north. Note active channel on left, with cottonwood and willow plantings visible in center

August 2018, view to north. Island plantings are doing well; we observed 100% survivorship of island cottonwoods and no mortality in willows from 2017 counts. Threats, however, are noted from invasive salt cedar (tamarisk). A subsequent tamarisk weeding event in 2018 removed these.

ELDORADO PONDEROSA FOREST RESTORATION
WRV Quick Monitor Form 10-1-2018

Location: City of Boulder Open Space & Mountain Parks, Goshawk Ridge Trail, access is south of Eldorado Springs at the terminus of County Road 67
Project date(s): 2004 **Monitoring Date**: November 8, 2018
Monitor(s): Laura Backus, Alan Carpenter

Project goal(s): Improve forest health and resiliency to forest fire by cutting small-diameter ponderosa pines to promote a forest more similar to those pre-dating effective fire suppression beginning in the late 1800s.

Techniques used and their effectiveness: Cutting ponderosa measuring fewer than about 4 inches at the base effectively reduced doghair pines.

General observations of plant survival, weediness, erosion: We observed neither a regrowth of cut pines nor increased weediness.

Did the project meet the goals? Yes, the area is much more open and has a variety of tree ages.

Did the project cause any unintended consequences? None observed.

Corrective or Maintenance activities needed: Ponderosa pines that grew post project are now comparable in size to those cut in 2004. We recommend a follow-up thinning project within or prescribed burn in the next few years

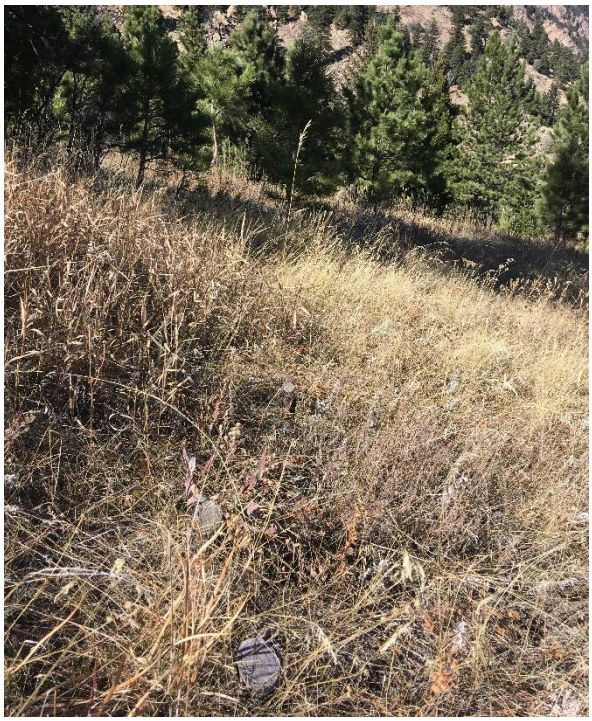
Other pertinent information (flood, fire, construction, wildlife observations): We observed wild turkeys in the project area. Turkeys like mature ponderosa pines for roosting and a mixture of open ponderosa pine forest and grassland for foraging. The project area is located within a Habitat Conservation Area.

What were the community benefits? The Goshawk Trail runs adjacent to the project area. The project created more visually attractive forest and reduced the risk of a catastrophic wild fire.

Important lessons for future WRV projects: Forest management projects nearly always require maintenance follow-up to maintain benefits.

Monitoring Photos:
All photos, except for the comparison set, were taken during the November 8, 2018 monitoring. The photos show small ponderosa pines that sprouted following the 2004 tree thinning project. The relatively open savannahs would have become dense forests without the project.

View to south across a portion of the project area.


Close-up of dead cut stumps from the 2004 project.

2004 Pre-Project. Note many dog-hair ponderosa pine.

2018 Monitoring. Note larger open areas and several small pine.

Comparison set showing view to west across an upper portion of the project area

TOMMY THOMPSON
WRV Quick Monitor Form 10-1-2018

Location: Immediately north of Northwest Parkway, ½ mile east of 120th Street
Project date(s): April 22, 2009 **Monitoring Date**: August 28, 2018
Monitor(s): Alan Carpenter, Stephen Hauptli
Agency / Partners: Boulder Co. Parks & Open Space

Project goal(s): Jump-start creation of riparian plant communities (especially the shrubs and trees) along an intermittent drainage which receives water primarily from the subdivision to the south; create wildlife habitat; stabilize the drainage channel.

Techniques used: Plant native riparian species including container-grown shrubs (coyote willow, golden currant, chokecherry, wild plum, snowberry) and trees (plains cottonwood, peach-leaf willow); install stakes of coyote willow; plant container-grown alkali sacaton; install one log check dam. Planting was easy due to of relatively soft soil and absence of rocks in the gulley bottom.

General observations of plant survival, weediness, erosion: Overall survival of the container stock and the stakes was be low. Only four of the 68 planted cottonwoods and 3 or the 58 planted peach-leaf willows were living. Although we did not count surviving shrubs, we noted that survival of coyote willows was far greater than the other shrubs. We noted several Russian-olives and a few Canada thistles. We did not see the check dam; it was probably buried under wetland vegetation. The zone of saturated soil now extends across the entire drainage bottom. The bottom of the gulley appears to be increasing in elevation.

Did the project meet the goals? Yes. A riparian forest is developing in an area formerly lacking riparian vegetation and is providing riparian wildlife habitat.

Did the project cause any unintended consequences? None observed.

Corrective or Maintenance activities needed: Remove the five Russian olive trees using the cut-stump method. Plant additional container-grown plains cottonwoods and peach-leaf willows 1 to 2 feet the gulley invert and cattail area Remove vole depredation cages.

Other pertinent information (flood, fire, construction, wildlife observations): To our surprise, the bottom of the intermittent drainage was choked with narrowleaf cattail supported by minor flows. The dense cattails likely outcompeted many of the planted shrubs and trees or may be an indicator that the drainage soils are too saturated to support woody vegetation. Survival of planted shrubs and trees was highest along the upper margins of the channel at the base of the adjacent upland. Based on saturated soils, domination by wetland obligate cattail and the presence of flowing water, the cattail area now qualifies as wetland.

What were the community benefits? It's doubtful that the project created any direct community benefits because Boulder County Parks & Open Space has closed the property to public use. The project area is not readily visible by members of the public.

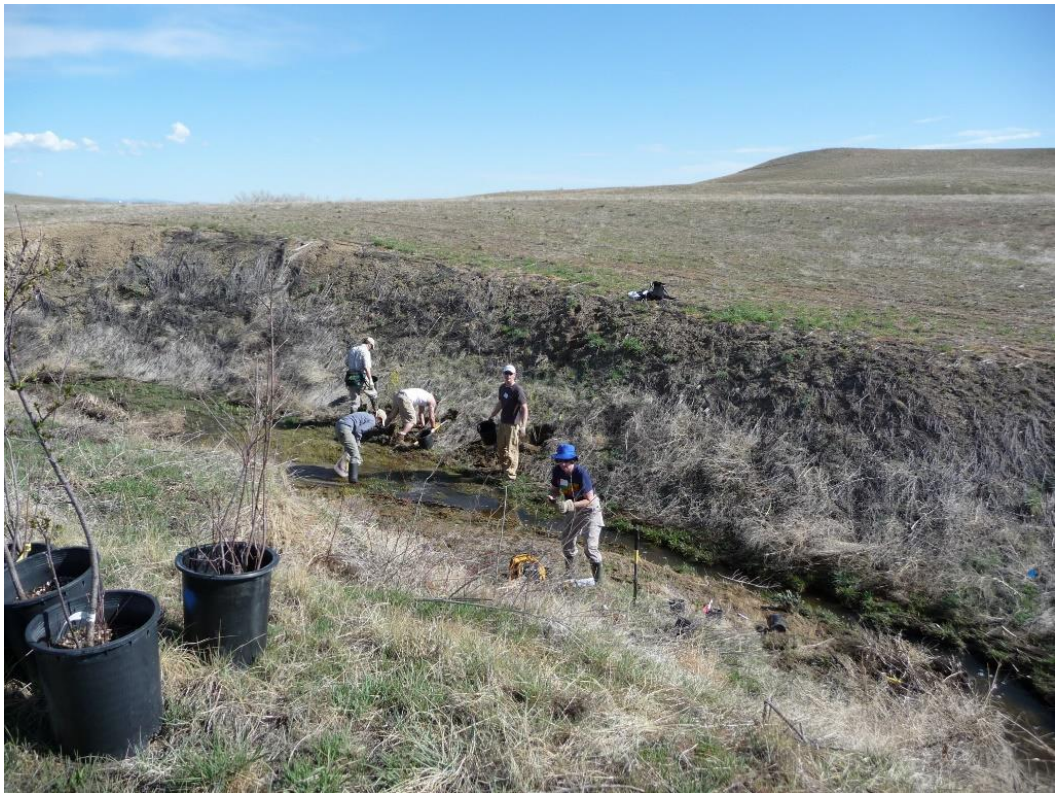
Important lessons for future WRV projects: The unanticipated substantial increase in soil moisture in the drainage bottom likely created soil conditions too wet for golden currant, wild

plum, chokecherry, and snowberry. Dense cattails likely outcompeted planted coyote willows except for those on the margins of the drainage bottom. The proliferation of cattails was surprising given the dry drainage bottom (except along the narrow flow channel) prior to the project. Water from the development to the south very likely caused saturation of the drainage bottom which now qualifies as a wetland. Cattail proliferation commonly occurs in wetland restoration projects on the plains.

Before and After Comparison Photos: GPS coordinates are noted on the monitoring photos.

April 22, 2009, view to northwest of drainage

August 28, 2018, view to northwest of drainage



April 22, 2009, View to north across drainage bottom.

August 28, 2018, View to north across drainage bottom.