Wildlands Restoration Volunteers 2017 Site Monitoring Report: A Glimpse of Successes, failures and potential futures.

February 24, 2018.

See individual projects for monitoring participants. Report assembled by Laura Backus.

Pre-Project 2007

Monitoring 2017

Left Hand Canyon Restoration 2007, Alan Carpenter photos

Executive Summary: A volunteer committee led by Laura Backus and facilitated by staff liaison, David Fulton-Beale attempted to monitor 10, mostly post-project assessments to evaluate the efficacy of the effort. The monitoring group is still undergoing a learning curve regarding what comprises 'best practices' for monitoring. The key to quantitative assessment is adequate pre-assessment information collected before and during projects. Assessments currently range from simple time-series photos that may or may not reveal vegetation composition to statistical analyses of treatment effects that are capable of comparing individual species responses. Our mission is to provide in as precise a way as possible a time-series assessment of project goals as well as identify specific treatments, procedures and materials that facilitate those goals. To that end we 1) need to develop protocols for pre-project baseline monitoring and 2) help volunteers understand the use of the quick monitor field procedure and use it effectively.

Major Lessons Learned in 2017 (see reports for details):

<u>Seed Mix Additions, especially low elevations forests</u>
- hairy goldenaster (*Heterotheca villosa*)
- buckbrush shrubs (*Ceaonothus fendleri*)
- wild buckwheat forbs (*Eriogonum jamesii*)
- mountain muhly (*Muhlenbergia montana*)

Flood effects

- Had the pre-existing roads and trails of Carnage Canyon not been closed and restored, there's very good reason to believe that landslides and erosion from the 2013 flood would have been much more extensive. We simply cannot know this with any certainty.
- Protecting areas from human abuse is straightforward; protecting areas from catastrophic flooding is a crap-shoot.
- Successful riparian restoration projects can be substantially damaged by 100-yr flood.
- Planted balled and burlapped plains cottonwoods at Rock Creek 2006 survived the flood, probably because they were located above the elevation of peak flow and rock scour.

Post-flood planting, Peschel Riparian 2016

- Do more deep planting in dry cobble deposits.
- The advantage of fall planting is the information on the extreme low of the groundwater table. - Tagging of plants was problematic. Either tags were lost during high water or interfered with plant growth.
- Biochar, at least in the form used at Peschel riparian, appears unlikely to facilitate plant survival; no biochar effects were noted.
- Non-dormant willow and cottonwood poles did not survive whereas all of the cottonwood and willow container plants appeared to have survived.
- Two person augers used by teams of four were an effective way to dig holes for pole plantings.

Project Planning

White Rocks 2016 appears to be an excellent example where "prior proper planning prevented piss-poor performance", i.e., relative to many riparian plantings, survivorship appeared very high. Container plants were vigorous to start, planting holes were adequate and proper back-filling techniques also seemed to have been employed. Removing undesirable competing vegetation also may have contributed to the success of this effort. This project did not attempt to do 'too much' and only restored a portion of impacted riparian areas out at White Rocks.

Support for monitors

- Stating the project goal(s) in specific rather than general language would help volunteer monitors decide if the project was successful.
- Marking original photopoints with GPS coordinates would be helpful on future projects.

Agency relations

- Before the project, question agency in depth about their long-term plans for the area.
- Keep in contact with agency as their plans change post-project.
- Check container species for accurate labeling.

Cooperation with University graduate students and professors:

- Volunteers help with project implementation and data collection, then graduate students provide WRV with much more extensive analysis of specific ecosystems and new techniques.
- Brian Sechler and Jarret Roberts, students of Tim Seastedt at the University of Colorado, did detailed analysis of the 2016 Peschel post-flood project and White Rocks 2016 (Sechler) and 2012 Georgia Pass alpine mulch comparisons (Roberts) for their Master's theses.

Riparian

- Soil lifts at Rock Creek created stable surfaces for revegetation.

Upland

- Seeding and matting and rocking at Georgia Pass 2012 are believed to have significantly enhanced revegetation.
- The erosion mat at Carnage Canyon 2008 was very effective at fostering native plant establishment and erosion control on steep, south-facing slopes.
- Among volunteer plant species to establish in modest numbers on treated areas at Georgia Pass were *Festuca brachyphylla*, *Luzula spicata*, *Poa glauca* and *Minuartia biflora*.

Weeds

- Post-project weed control at Rock Creek may have reduced the invasion of multiple species of non-native plants

Project Monitoring Form

See information in Project Plan, Crew Leader Notes, Site Map, and Project Debrief

Project Name: Rock Creek Restoration Project Date: June 15, 2005

Project Location: Carolyn Holmberg Preserve Open Space, ¼ miles west of US Highway 287 about one mile north of Broomfield

Project Leader: Ed Self

Technical Advisors: Alan Carpenter, Justin Martin

Agency Name: Boulder County Parks & Open Space

Agency Contact: David Hirt

Monitoring Evaluator: Alan Carpenter

Monitoring Date: July 11, 2017

Pre- project Site Conditions

Down-cutting of Rock Creek, erosion of the creek banks, and minimal riparian vegetation.

Project Activities

Prior to WRV project day: Heavy equipment created soil lifts formed from soil wrapped in erosion blankets then compacted by heavy equipment. Coyote willows were installed by the contactor.

WRV project day: Planting of herbaceous wetland species, mostly Emory sedge, in the soil lifts west of raptor rehabilitation cages and in a riparian area east of 104th St. about 1 mile west of the main area.

After WRV project day: Balled-and-burlapped plains cottonwoods were installed by the contractor.

Project Goals

Goal	Current Status
Revegetate the riparian area of Rock Creek in the project area with native plant species.	The riparian area now is a dense tangle of coyote willow with lesser amounts of hawthorn, leadplant (*Amorpha fruiticosa*), peach-leaf willow, and plains cottonwood. Sedges (presumably planted during the project) are growing under the coyote willows. Noxious weeds are abundant and include tall whitetop, low whitetop, Canada thistle, poison hemlock, and common teasel. The thick riparian vegetation would seem to provide suitable habitat for songbirds, such as yellow warblers, but I did not see or hear any.

Problems to Correct

- The Rock Creek site is very weedy, but controlling the noxious weeds would be a major challenge given the intermingled presence of the weeds and desirable plant species.
- During the massive flood of 2013, the channel of Rock Creek downcut by about two vertical feet. Increasing the elevation of the creek bed would be a major project.

Lessons Learned

- Soil lifts created stable surfaces for revegetation.
- Successful riparian restoration projects can be substantially damaged by massive floods.

Planted balled-and-burlapped plains cottonwoods survived the flood, probably because they were located above the elevation of the peak flow. As the cottonwoods mature, they will contribute substantially to the wildlife habitat value of the Rock Creek riparian corridor.

Post-project weed control may have reduced the invasion of multiple species of noxious weeds.

Project successes, especially for new techniques

Planting riparian and wetland plant species in the soil lifts worked well. Lots of sedges are still present on the banks that lay above the zone of downcutting. I did not visit the portion of the project located about one mile west of the Carolyn Holmberg buildings. Thus, I do not know if work in that area was successful or not.

GPS coordinates are in photo file metadata.

Monitoring Photos:

Photo 1, Pre-project 2005: View east-northeast (67 degrees) up Rock Creek. Note zero riparian vegetation on the soil lifts. Photo taken during crew leader orientation.

Monitoring 2017: No site comparison photo due to dense coyote willows obscuring the riparian area.

Photo 2a, Pre-project 2005: View to southeast (117 degrees) up Rock Creek just downstream from bend in channel. Note soil lifts with no riparian vegetation, channel wide and shallow.

Photo 2b: Monitoring 2017: Same view with small white structure in background. Note that creek is not visible due to dense thicket of coyote willow and planted plains cottonwoods. Channel narrow and shallow.

Photo 3a, Pre-project 2005: View to southeast (144 degrees) across Rock Creek of concrete apron at upper end of the project area with raptor rehab cages in the background. Note lack of riparian vegetation.

Photo 3b, Monitoring 2017: Same view. Note thick coyote willows along creek.

Photo 4a, Pre-project 2005: View to southwest (207 degrees) up Rock Creek from bottom end of project area. Note the soil lifts and the lack of riparian vegetation except for a lone mature plains cottonwood.

Photo 4b, Monitoring 2017: Same view. Note the planted plains cottonwood to the left of the mature plains cottonwood. Coyote willows dominate the thick riparian vegetation.

Project Monitoring Form

See information in Project Plan, Crew Leader Notes, Site Map, and Project Debrief

Project Name: Left Hand Canyon Restoration

Project Date: September 22, 2007

Project Location: Left Hand Canyon in Boulder County; on hillside about ¼ south of Left Hand Canyon Drive

Project Leader: John Baggenstos Technical Advisors: Ed Self, Alan Carpenter

Agency Name: Boulder Ranger District, Arapahoe-Roosevelt NF Agency Contact: Brian Rasmussen

Monitoring Evaluator: Alan Carpenter Monitoring Date: July 7, 2017

Pre-project Site Conditions

Vehicle ways were unstable and eroding contributing contributed substantial amounts of sediment to Left Hand Creek about ¼ mile downhill. Sediment in Left Hand Creek impaired water quality for the Left Hand Water District.

Project Activities

Pre-project day heavy equipment obliterated vehicle ways by regrading and ripping. On project day, volunteers reseed regraded / ripped vehicle ways, installed erosion mats on steep slopes, and installed post and cable barriers to protect areas to be restored. Biosol and Regreen were used in some areas.

Project Goals

Goal	Current Status
Obliterate vehicle ways	Vehicle ways obliterated
Restore native vegetation on obliterated vehicle ways	The obliterated vehicle ways are largely covered with native plant species. The former Forest Road 286C has a high component of cheatgrass for no apparent reason.
Minimize soil erosion on the obliterated vehicle ways	Soil erosion on the restored vehicle ways is minimal. On former Forest Road 286C, some soil erosion may have occurred during the massive flood in September 2013.

Problems to Correct

Treat a small patch of Canada thistle in Area A0 with herbicide.

Lessons Learned:

The erosion mat was very effective at fostering native plant establishment on steep, south-facing slopes. Hairy goldenaster (*Heterotheca villosa*) is common in the restored areas and would be a good addition to seed mixes in lower- to middle-elevation ponderosa pine forest sites.

Project successes, especially for new techniques

The heavy equipment work was essential to site preparation. Nearly all of the identified restored areas are well-vegetated with native plant species. I could not conclusively identify most of the restoration sites – indicating that they now look more or less like the adjacent undisturbed areas that weren't restored. Currently, Forest Road 286 is open to motorcycles but not to other motor vehicles. It appears that motorcycles are complying with regulations to stay on designated motorcycle trails.

GPS coordinates for post-project photos are in metadata.

1a, Pre-project 2007: View to (265 degrees) up steep slope at Area A0. Note deep, eroding gulley.

1b, Monitoring 2017: Same view. The regraded gulley is covered with native plant species (sedge, hairy goldenaster, scurfpea). A patch of Canada thistle lies in the drainage in the right side of the photo. Despite the 2013 flood, the slope is now stabilized with no signs of erosion or vehicle use.

Photo 2, Pre-project 2017: View to northwest (294 degrees) up old Forest Road 286C and Area A2. Abundant cheatgrass, plus the land surface is rough. The crests of small mounds have minimal native vegetation. Native plant species are sparse, mostly slender wheatgrass and hairy goldenaster. However, there was no significant soil erosion. It's unclear why the land surface is so lumpy. Based on other restored area nearby, a smoother surface would have been easier to revegetate with native species

Photo 3, Monitoring, 2017: View to northwest (292 degrees) up a steep slope possible along Area A9. The restored slope is well vegetated with native plant species including hairy goldenaster and scurfpea. Minimal signs of soil erosion at bottom left of photos; no signs of vehicle use. The erosion mat helped vegetation establishment on this steep, southeast-facing slope.

Photo 4, Monitoring, 2018: View to north (359 degrees) up a steep slope along Area A12. The restored slope is well vegetated with native hairy goldenaster, western wheatgrass, sand dropseed, needle-and-thread. No signs of soil erosion or vehicle use. The erosion mat helped vegetation to establish on this steep, south-facing slope.

Photo 5a, Pre-project: View to south (173 degrees) down a steep slope at Area A13 toward a camping area. The vehicle way is eroding.

Photo 5b, Monitoring 2017: Same view, now well-vegetated with native hairy goldenaster, scattered slender wheatgrass and other native grasses. The erosion matting was effective. No signs of soil erosion or vehicle use. Common mullein is abundant in the flat camping area below. A fire swept through this site about five years ago.

WRV QUICK MONITOR

Project Name: Carnage Canyon/ Big Mother Hill Restoration
Location: Left Hand Canyon, Boulder County, Colorado
Project date(s) 2008 **Monitoring Date**: June 14, 2017
Monitor(s): Jean-Pierre George, Tim Seastedt

Project goal(s): Obliteration of social trails converted into ATV roads, revegetation of hillslopes and riparian areas.

Techniques used and their effectiveness:
The restoration area was protected by post and cable fencing, and heavy equipment used to prepare site. Volunteers seeded multiple areas.

General observations: This site was near 'ground zero' of the Sept. 2013 flood. Eighteen inches of rain fell on the area. While mud slides were visible on canyon sides, these had revegetated with 'early successional plants' (read: weeds but nothing on the A list). All areas contained appropriate native plant species.

Did the project meet the goals? At the time, yes, undoubtedly a major success. Post-flood? High uncertainty, but it's very possible the proactive restoration greatly reduced flood damage in 2013. Certainly adjacent areas (e.g., Spruce Gulch), showed much greater damage.

Did the project cause any untended consequences?
Possible flood protection: closed watersheds did not rip out vegetation as seen elsewhere.

Corrective or Maintenance activities needed:
None observed: The inability of the USFS to reopen approved trails has enhanced revegetation.

Other pertinent information (flood, fire, construction, wildlife observations):
Relocation of exact photo points was difficult which increases uncertainty of outcomes post flood.

Important lessons for future WRV projects:
Protecting areas from human abuse is straightforward. Protecting areas from catastrophic flooding is a crap-shoot. Had the pre-existing roads and trails not been closed and restored, there's very good reason to believe that landslides and erosion from the 2013 flood would have been much more extensive**.** We simply cannot know this with any certainty.

2008, Pre-project: Numerous areas contributed to water run-off and severe erosion.

Monitoring 2017

Steep canyon areas are plugged with flood debris, but have completely revegetated.

A south-facing hillslope shows no signs of a previous road, and is a mix of native vegetation with some cheatgrass.

Metal post and cable structures for vehicle exclusion remain in place.

Project Monitoring Form

See information in Project Plan, Crew Leader Notes, Site Map, and Project Debrief

Project Name: Bald Mountain Skid Trail Restoration Project Date: May 2, 2009

Project Location: Bald Mountain Scenic Area immediately south of Sunshine Canyon Drive about three miles west of Boulder;

Project Leader: Technical Advisor: Alan Carpenter

Agency Name: Boulder County Parks & Open Space Agency Contact:

Monitoring Evaluator: Alan Carpenter Monitoring Date: July 5, 2107

Pre- project Site Conditions
Bare, eroding skid trails from heavy equipment used to haul logs to a staging area (Area J in the project map, not attached).

Project Activities
-Spread native seed mix

- install several water bars and check dams
- install three rolls of erosion mat on steeper slopes
- transplant small ponderosa pine seedlings.

Project Goals and Current Conditions

Goal	Current Conditions
Revegetate skid trails with native plant species	The skid trails are revegetated and are similar in appearance to the adjacent non-skid trail areas. Native plants species are common in the restored areas.
Prevent significant soil erosion on the skid trails.	Soil erosion from the skid trail has been insignificant. The check dams and water bars appear to have been effective.

Problems to Correct:
Spot-treat patches of Canada thistle with herbicide.

Lessons Learned:
- Buckbrush shrubs (*Ceaonothus fendleri*) and wild buckwheat forbs (*Eriogonum jamesii?*) are common in restored areas. Supposedly *Eriogonum umbellatum* from Mud Lake was part of the seed mix. These species could be included in future seed mixes for middle-elevation, relatively open ponderosa pine forest areas.
- Mountain muhly (*Muhlenbergia montana*), a long-lived desirable perennial grass, is common along the restored skid trails; it supposedly was not part of the seed mix, but its high abundance suggests that it was part of the seed mix.

Project successes, especially for new techniques:
The restored skid trails are largely indistinguishable from the adjacent areas that weren't used as skid trails. The re-seeding was successful. Soil erosion was minimal.

1a, Pre-project, March 2009: View to southwest (240 degrees) along first part of de-vegetated skid trail just west of Area J.

1b, Monitoring, 2017: Same view. Note excellent establishment of native plant species, including mountain muhly, hairy goldenaster, wild buckwheat, and daisy fleabane. Non-native cheatgrass common. Skid trail largely invisible. No signs of erosion. Soil surface ~ 35% bare ground.

2a, Pre-project, March 2009: View to northeast (30 degrees) up Area A of de-vegetated skid trail at fallen tree.

2b, Monitoring 2017: Same view Note skid trail largely invisible. No signs of erosion. Soil surface ~ 10% bare ground. Non-native cheatgrass common. Common native plant species include mountain muhly, ragwort, wild buckwheat, and buckbrush.

3a, Pre-project, March 2009: View to north-northwest (344 degrees) of de-vegetated skid trail down Area F toward junction of Areas B and H.

3b, Monitoring 2017: Same view. Note: skid trail largely invisible. No signs of erosion. Soil surface ~ 10% bare ground. Canada thistle prevalent. Common native plant species include sun sedge and hairy goldenaster.

BOULDER CREEK ADOPTION SITE
WRV Quick Monitor

Project Name: Boulder Creek Adoption Site
Location: East side of Boulder Creek south of Valmont Rd and east of 55th Street
Project date(s): Oct 9, 2010 and July 20, 2011 **Monitoring Dates**: July 14, 2017
September 22, 2017
Monitor(s): Alan Carpenter / Tracy Halward and Brian Sechler

Project goal(s): Long term: Re-establish a riparian gallery cottonwood forest dominated by plains cottonwood, peach-leaf willow, and native riparian shrub species. Short-term: Eliminate the existing tree canopy of non-native tree species. Plant native riparian trees and shrubs to jump-start the process of riparian forest establishment. Boulder Open Space and Mountain Parks staff began cutting non-native trees in prior to the volunteer project.

Techniques used and their effectiveness:
1. Cut non-native trees to ground level (large trees cut by City Staff) and apply herbicide to the freshly cut stumps – canopy now much more open
2. Leave a few large, killed non-native trees for cavity-nesting birds – need a bird survey
3. Plant riparian shrubs and trees – It was difficult to determine the success of the riparian tree and shrub planning. In some areas we observed many riparian shrubs of the same species that were planted. We'd guess that they were planted during the projects but could not be sure. Several patches of dense cottonwood saplings have appeared in low-lying spots. The tree canopy is far more open and more natural looking.
4. Follow-up control of noxious, biennial weeds by OSMP personnel – no information

General observations of plant survival, weediness, erosion:
A number of the plains cottonwood trees that predated the projects have died over the past seven years for no apparent reason. Many mature cottonwoods still remain.
The herbaceous understory of the project site is dominated by non-native species.

Did the project meet the goals?
Yes. However, the herbaceous understory is dominated by non-native species.

Did the project cause any unintended consequences?
Not that we could tell.

Corrective or Maintenance activities needed:
1. Periodic cutting and stump-poisoning of green ash, Russian olive, and other non-native tree saplings
2. Periodic control of biennial noxious weeds, namely Scotch thistle, musk thistle, and common teasel

Other pertinent information (flood, fire, construction, wildlife observations):
The 2013 flood scoured the channel and banks of Boulder creek in the project area and likely inundated portions of the project site.

Important lessons for future WRV projects:
The 'wild plums' furnished by the Colorado State Forest Service do not appear to actually be wild plums.
Stating the project goal(s) in specific rather than general language would help volunteer monitors decide if the project was successful.
Marking original photopoints with GPS coordinates would be helpful on future projects. With all of the changes that have taken place in the 6-7 years since the initial photos were taken at this site (follow-up maintenance over the years by OSMP personnel and the 2013 flood), it was difficult to identify the precise location of the original photopoints for follow-up photos. Note: GPS coordinates were noted on the follow-up monitoring photos.

Comparison photos from 2010 and 2011 are from City of Boulder files.

Comparison Photos, PS 1 North, N 40º 01.561; W 105º 13.406

Pre-project, June 2010: Note dense understory Canada thistle.

Post-project, first phase, June 2011: Note open understory.

Monitoring, September 2017: Note developing understory, Canada thistle at fence line.

Comparison Photos, PS 4, 20 degrees N40º 01.615; Wº 105 13.382

Pre-project, June 2010

Post-project, first phase, October 2011

Monitoring, September 2017, approximate location

Comparison Photos PS 5 S, N40º 01.587; W 105º 13.391

Pre-project, June 2010

Post-project, first phase, June 2011

Monitoring, September 2017, approximate location. Note increase of understory shrubs.

GEORGIA PASS
WRV Quick Monitor

Project Name: Georgia Pass
Location: White River National Forest Continental Divide
Project date(s): 2012-2016 **Monitoring Date**: July 2016
Monitor(s): Jarret Roberts + 10 others

Project goal(s): Measure seedling and treatment success on a social road obliteration project in the high alpine of the Colorado Front Range.

Techniques used and their effectiveness:
We evaluated seeding with three alpine grass species, addition of erosion matting, and addition of enhanced rock cover. Erosion matting resulted in 35% plant cover versus 26% plant cover on rocked areas. Native area reference areas averaged 73% cover. Of seeded species, *Trisetum spicatum* and *Poa alpina* dominated the restored plots, whereas *Deschampsia caespitosa* failed to establish in significant numbers.
Erosion was greatly reduced on treated areas.

General observations of plant survival, weediness, erosion: Among volunteer plant species to establish in modest numbers on treated areas were *Festuca brachyphylla*, *Luzula spicata*, *Poa glauca* and *Minuartia biflora*.

Did the project meet the goals? Facilitated seeding and both matting and rocking are believed to have significantly enhanced revegetation (when compared to non-proactive restoration measurements from other alpine areas.)

Did the project cause any unintended consequences? None noted

Corrective or Maintenance activities needed: none noted.

Other pertinent information (flood, fire, construction, wildlife observations):
This project is detailed in Roberts, Jarret. 2018. MS Thesis, U of Colo, Boulder.

Important lessons for future WRV projects:
1. small, unseeded areas and small areas that were neither matted or rocked would provide a more statistically robust assessment of success.
2. Facilitated seeding and both matting and rocking are believed to have significantly enhanced revegetation
3. Among volunteer plant species to establish in modest numbers on treated areas were *Festuca brachyphylla, Luzula spicata, Poa glauca* and *Minuartia biflora*.

Comparison Photos: (latitude and longitude 39.463506, -105.904778 to 39.468906, -105.901624)

Pre-project 2011. Note bare ground on road.

Post-project 2014. Note advanced revegetation on road.

Immediately post-project 2012: Erosion matting treatment

Immediately post-project 2012: Rock cover treatment

WRV QUICK MONITOR

Project Name: St Vrain Creek, Peshel Property Flood Restoration
Location: Southeast of Longmont, CO.
Project date(s): Sept 17-18, 2016 **Monitoring Date**: Oct. 7, 2017
Monitor(s): Laura Backus, Tim Seastedt, Brian Sechler

Project goal(s): Improve the wildlife habitat of the Peschel riparian area and increase resiliency to future floods by planting wetland plugs, willows, and cottonwoods along river left sandbar and upland bench of St Vrain Cr., just east of East County Line Rd.

Techniques used and their effectiveness:

1. Gas-powered soil augers facilitated deep plantings of non-dormant cottonwood poles on a slightly elevated upland bench and some of the willow plantings on the sandbar. The so-called 'two man augers' were best employed using four people.
2. Non-dormant willow and cottonwood poles had low??? survival
3. Container plantings of willow and cottonwood on the sand and cobble bar were very successful.
4. Wetland herbaceous plug planting in a side channel was successful until washed out by high flows directed into the channel by post-project riprap placement.
5. Biochar was 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.

General observations of plant survival:

High water in spring, 2017 opened up what was believed to be a non-active side channel and removed nearly all herbaceous plugs except at the most downstream end. Non-dormant willow and cottonwood poles did not survive whereas all of the cottonwood and willow container plants 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.

Did the project cause any untended consequences?

Plantings with cages slowed flood waters and allowed deposition of drifting wood, sand, 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:

Consult Longmont personnel should be about eventual removal of cages.

Other pertinent information (flood, fire, construction, wildlife observations):

Loss of most of the herbaceous plantings was likely facilitated by the placing of riprap on the south side of the main stream channel. The riprap forced water to the north and potentially allowed for the re-opening of what was believed to be an inactive channel.

Important lessons for future WRV projects:

1. Before the project, question agency in depth about their long-term plans for the area and keep in contact with agency as their plans change post-project.
2. Do more deep planting in dry cobble deposits.
3. The advantage of fall planting is information on the extreme low of the groundwater table.
4. Tagging of plants was problematic. Either tags were lost or interfered with plant growth.

5. Biochar, at least in the form used here, appears unlikely to facilitate plant survivorship. We note that a paired planting that used dormant willows and cottonwoods with and without biochar also failed to show an effect of the amendment.

Additional information will be available from: Sechler, B. 2018. Factors affecting the success of riparian restoration in the Colorado Front Range. U. of Colo. MS Thesis, Boulder CO

Comparison Photos

2016, Pre-project: View to north of sand and cobble bar. Note very sparse, mostly weedy vegetation.

2017 – Monitoring: Same view. Note vigorous cottonwood and willow plantings, development of additional vegetation.

Boulder Creek White Rocks riparian restoration
WRV QUICK MONITOR

Project Name: Boulder Creek White Rocks riparian restoration.
Location: Boulder Cr., just east of 75th St.
Project date(s): Oct 8, 2016 **Monitoring Date**: Oct. 6, 2017
Monitor(s): Brian Sechler, Tracy Halward, Tim Seastedt, Eric Farley

Project goal(s): Restore riparian area previously overgrown with crack will by planting and mulching native trees and shrubs.

Techniques used and their effectiveness:
Only cottonwood and shrubs were quantitatively assessed in the monitoring effort.
1. All container plantings. Boulder Open Space and Mountain Parks pre-staged containers and augered holes for plantings. Mulch from downed crack willows was available in substantial quantity. The quality of the plantings and site prep appeared to contribute to the success of this effort.
2. Pre-project removal of crack willow was conducted by OSMP.

General observations of weediness, plant survival: Mulch held down weeds and undesirable grasses in many areas. OSMP weed-whipped some the competing vegetation during summer, 2017.

Did the project meet the goals? Based upon tagged plant recovery, approximately 50% or more survivorship has occurred for cottonwood, peach willow, rose, current, and plum. Survivorship may be higher due to failure to identify/recover tagged plants. Mortality rates were low based upon ratios of tagged dead plants/total tagged plants recovered.

Did the project cause any untended consequences?
None observed

Corrective or Maintenance activities needed:
None observed, although weed whipping, if possible, seems beneficial.

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

Important lessons for future WRV projects:
1. This project appears to be an excellent example where "prior proper planning prevented piss-poor performance", i.e., relative to many riparian plantings, survivorship appeared quite high. Container plants were vigorous to start, planting holes were adequate and proper back-filling techniques also seemed to have been employed. Removing undesirable competing vegetation also may have contributed to the success of this effort.
2. This project did not attempt to do 'too much' and only restored a portion of impacted riparian areas out at White Rocks. However, it was a prototype project that was repeated in 2017 (another section was restored), and deserves further attention.

Data obtained in the monitoring will be included in Sechler, B. 2018. Factors affecting riparian restoration in the Colorado Front Range. Univ. Colo. Masters Thesis, Boulder Co.

Comparison Photos:

2016 Immediate post-project: Cottonwood container planting interspersed with shrub and herbaceous plantings.

2017 Monitoring: Note good condition of plantings, few weeds due to wood chip mulch.

Daniels Park, Spring 2017
Pre-Project Baseline
Alan Simpson

Two goals of the initial pre-project baseline photographs are:

- Location, location, location …. We need to be able to go back to the same precise location in later years to capture the "after" photographs
- Capture a clear picture of what the site was like before commencement of the project.

Below is a pre-project baseline photograph from the 2017 Daniels Park project.
This photograph was taken on a smart phone using the "NavCam" app. There are other apps that capture (and embed) similar information. Embedding this information is important so that it does not get lost or separated from the baseline photograph in the future.
Note that the app records:

- The date and time,
- The position (in our preferred UTM format but we can work with long/lat),
- The azimuth bearing (i.e. the direction the camera was pointing …

GPS location on phones is not perfect but should be adequate to navigate back to a point close to the baseline photograph.

After the date/location/directional data has been captured, additional photographs using a conventional camera may be taken ….

For fine tuning the location so that follow up monitors can identify the precise location and take a monitoring photograph in later years it is helpful to include in the baseline photograph distinctive physical features. Look at the rocks and fence in this photograph …

And the fence and building in this one ….

BOULDER CREEK RESTORATION- WHITE ROCKS 2017
WRV Pre-Project Conditions

Project Name: White Rocks 2017
Location: White Rocks Open Space, Boulder Open Space and Mountain Parks
Project date(s): Oct 21, 2018 **Monitoring Date**: Initial
Monitor(s): Stephen Hauptli

Project goal(s): Restore riparian area previously overgrown with crack will by planting and mulching native trees and shrubs.

Techniques used and their effectiveness: Most holes for planting were augered before WRV volunteers worked. WRV volunteers then hand planted with the help of a planters mix fill. Planting using deep planting methods described in TA notes. Plants were watered and then mulched with chips from ground up willows.
Mulch was not as heavy as that used in 2016, and the expectations for 2018 would be higher weeds in the 2017 restoration area.

General observations of plant survival, weediness, erosion: Area mostly covered with canary reed grass (*Phalaris arundinacea*) and some smooth brome (*Bromus inerme*) with an over story of crack willow. Willows where mostly treated with hack and squirt method, not done by WRV. Grasses were removed by scrapping off tops and not sprayed with herbicides, also not done by WRV. Roots were still present in soil.

Did the project meet the goals? Mostly, some areas of mulch were not spread because of lack of material.

Did the project cause any unintended consequences?
Unknown

Corrective or Maintenance activities needed:
Unknown

Other pertinent information (flood, fire, construction, wildlife observations):
Many weeds in the planting containers.
Mulch from the 2017 restoration was not as heavy as that used in 2016 project area, and the expectations for 2018 would be higher weeds in the 2017 restoration area.

Important lessons for future WRV projects: N.A.