The Nature Conservancy
Protecting nature. Preserving life.™

Gunnison Basin Climate Change Adaptation Project

The Nature Conservancy with the Gunnison Climate Working Group

Climate change is already impacting nature and people in the southwestern United States and is projected to have an even greater impact in coming decades. Rapidly warming temperatures pose serious threats to ecosystems and species, e.g., changes in water flows, larger and more severe fires, widespread insect outbreaks and forest dieback. In the Gunnison Basin of Colorado, the average annual temperature is projected to increase by approximately 5.4°F by 2050. Average summer temperatures are projected to increase by about 7°F. Actions are needed to help ecosystems and species in this landscape cope with a changing climate. The measures we take today to build ecosystem resilience to climate change will not only benefit natural resources, but will also protect the foundation upon which the Basin's agricultural and recreational economies depend.

A Climate Change Partnership in the Gunnison Basin

The Gunnison Climate Working Group is a partnership of federal, state and private partners working to:

- Understand the threats posed by climate change
- Identify strategies to reduce adverse impacts
- Promote coordinated implementation of these strategies

This group is collaborating with the Southwest Climate Change Initiative to share climate science information and practical tools with natural resource managers and conservation practitioners in vulnerable landscapes of Arizona, Colorado, New Mexico and Utah. Colorado's Gunnison Basin is one of four landscapes developing and testing ways to sustain natural resources in a changing climate.

The Gunnison Basin: What's at Risk

The sagebrush ecosystem is one of the most imperiled ecosystems in North America. Wet meadows and riparian areas make up a small percentage of the sagebrush landscape of the Gunnison Basin, but are critically important as they provide important habitat for a variety of wildlife and plant species, e.g., the imperiled Gunnison Sage-grouse, migratory birds, small mammals, and insects. Sage-grouse use these habitats to feed and raise their young. Local ranchers also depend on these riparian areas/wet meadows for their livelihoods for grazing of livestock. Yet these habitats have been altered and degraded due to past land uses. Rising temperatures and more frequent and severe droughts will likely cause further drying and degradation, reducing suitable habitat for the grouse. If we lose these habitats, we could lose one of the rarest bird species in North America, along with other wildlife species. And, ranchers may lose key grazing habitats, impacting their current and future livelihoods.

Gunnison Basin sagebrush shrublands ©Betsy Neely

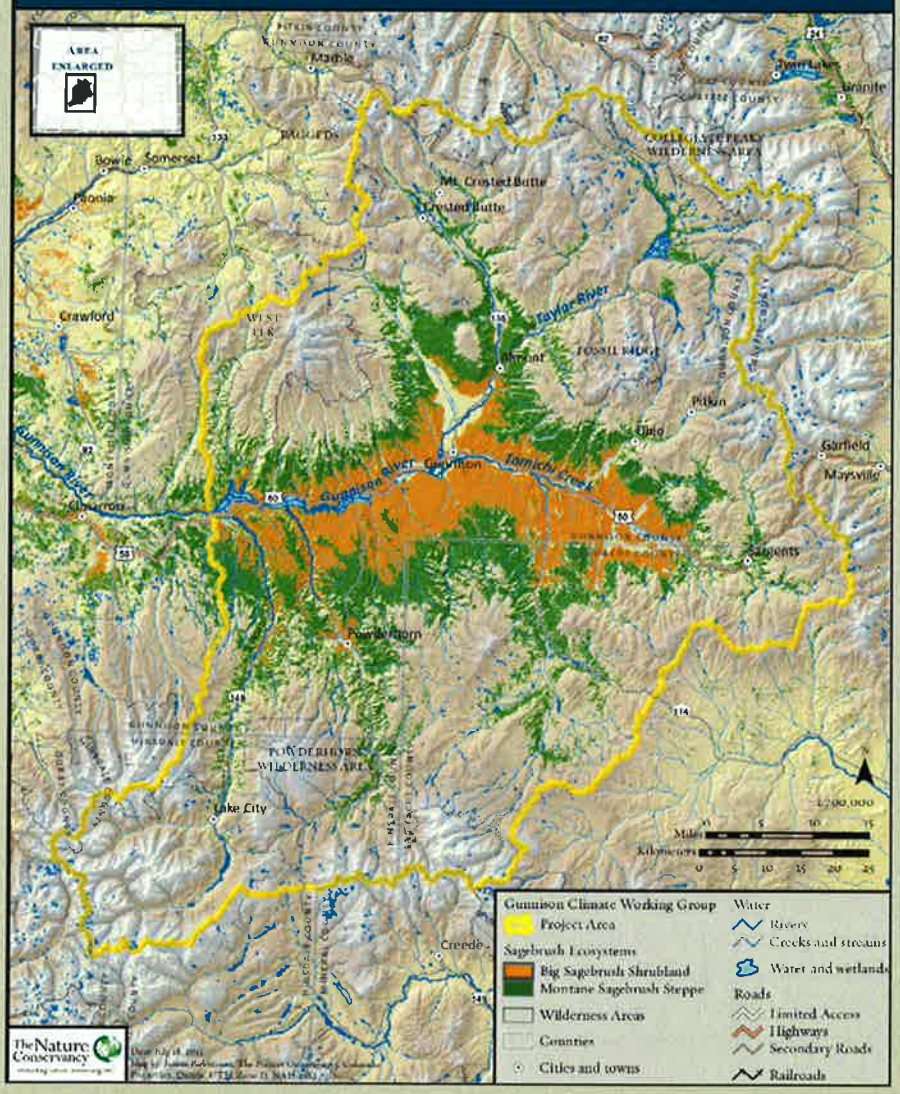
Assessing restoration needs of incised gully © Betsy Neely

Gunnison Sage-grouse © Noppadol Paothong

A Solution for the Gunnison Basin

The Nature Conservancy, in partnership with the Gunnison Climate Working Group, is working to design and implement an on-the-ground climate adaptation project to help the riparian areas/wet meadows retain water over the long-term, thereby enhancing the resilience of this critical habitat and long-term viability of the Gunnison Sage-grouse in the face of a changing climate. After prioritizing locations for treatments, we will design and build simple, low-cost structures in drainages to "let the water do the work" to raise the water table to support grasses and insects needed by the grouse and other species. We will then set up a monitoring program to help us determine if the structures are working. We will share these techniques so they can be applied in similar sagebrush ecosystems across the West. The Wildlife Conservation Society and Upper Gunnison River Water Conservancy District are providing major funding for this project.

Sagebrush Ecosystems in the Gunnison Basin



Project Goals

1. Complete design of an on-the-ground adaptation project by developing a conceptual model and predictive model of habitats, prioritize areas for restoration and reconnection.

2. Establish a repeatable and economical monitoring program to measure vegetation and species response.

3. Restore and enhance resilience of at least 500-800 acres of riparian/wet meadows within sagebrush shrublands in at least three locations to enhance the adaptive capacity of the Gunnison Sage-grouse and other wildlife species.

4. Share tools, methods and findings with groups working to conserve vulnerable habitats within sagebrush shrublands in similar ecosystems across the West to help bolster their climate adaptation efforts.

Gunnison Climate Working Group:

Bureau of Land Management
Colorado Natural Heritage Program
Colorado Parks and Wildlife
Gunnison County
Gunnison County Stockgrowers Assn
National Park Service

National Center for Atmospheric Research
Natural Resources Conservation Service
Rocky Mountain Biological Laboratory
The Nature Conservancy
US Fish and Wildlife Service

US Forest Service
Upper Gunnison River Water Conservancy District
Western State College
Western Water Assesment,
University of Colorado, Boulder

For more information visit:
http://conserveonline.org/workspaces/gunnisonclimatechange
or contact

Betsy Neely: bneely@tnc.org | Jim Cochran: JCochran@gunnisoncounty.org

	Site Name	Land Owners, Public and Private	Elevation Mean (feet)	Elevation Minimum (feet)	Elevation Maximum (feet)	Tool Score (BR Hab Only)	Tool Score (Overall)	SB System Performance Mean (2000-2009)	SB System Performance Minimum (2000-2009)	SB System Performance Maximum (2000-2009)	SB System Performance Mean Avg. Change (2010-2050)	SB System Performance Minimum Avg. Change (2010-2050)	SB System Performance Maximum Avg. Change (2010-2050)	Distance to Road (miles)	Distance to Lek (miles)	Seep/Spring Presence	Seep/Spring Needing Restoration
Id	Site_Name	LAND_OWNER	ELEV_AVG	ELEV_MIN	ELEV_MAX	BRHAB_SCR	ALLHAB_SCR	PERF_AVG	PERF_MIN	PERF_MAX	PERF_AVGCH	PERF_MINCH	PERF_MAXCH	MI_TO_ROAD	MI_TO_LEK	SPG_PRES	SPG_RESTOR
1	Hot Springs Creek (NW spur)	BLM; Taramarcaz	8,566	8,376	8,720	13	28	-9	-159	272	-0.3	-7.3	4.1	0.039	0.962	1	1
2	Monson Gulch	BLM; Pesnell	8,451	8,110	9,183	12	34	-43	-255	183	-4.9	-7.7	-2.3	0.279	0.402	1	1
3	Needle Creek (below reservoi	USFS; Unknown private	8,378	8,192	8,835	12	22	17	-173	290	0.4	-2.4	4.3	0.000	0.248	1	0
4	Quartz Creek (below gaging st	BLM; Shaver; McClain	8,551	8,278	9,203	13	30	19	-165	305	0.0	-1.8	2.9	0.190	0.785	0	0
5	Chanch Gulch (above confluer	BLM; Ballantyne; Lypps Frame	8,653	8,081	9,383	12	25	-12	-100	125	-0.7	-7.7	4.3	0.002	0.200	1	1
6	Sage Hen Gulch (above conflu	BLM; Ballantyne; Lypps Frame	8,591	8,215	8,953	11	27	-16	-102	55	-1.1	-5	1.5	0.230	0.587	1	0
7	South Beaver (upper)	BLM; Unknown private	9,068	8,481	9,741	13	25	7	-179	142	0.8	-2.2	4.1	0.000	1.659	0	0
8	Wolf Creek (upper)	BLM; Kaichen	8,730	8,586	8,891	11	24	23	-56	85	-1.1	-1.7	4.2	0.062	0.587	1	1
9	Kesar Basin (upper reaches in	BLM; Moncrief	8,080	7,825	8,350	12	29	-3	-101	132	-2.3	-8.6	0	0.043	0.000	1	1
10	West Flat Top (near Ohio Cree	USFS; Redden Ranches	8,913	8,123	9,629	13	41	-16	-114	152	-2.5	-3	-1.7	0.331	0.188	0	0
11	West Flat Top (near Ohio Cree	USFS; Ranch Properties LLC	8,908	8,310	9,446	13	42	-10	-70	46	-1.8	-1.9	-1.7	0.085	0.000	0	0
12	Unnamed drainage b/n Stever	CPW; BLM	8,195	7,697	9,127	12	35	-38	-131	70	-3.2	-8.8	4.4	0.744	0.000	1	0

Draft Work Plan (Revised August 16, 2012)
Redden Ranch Restoration Project, West Flat Top: September 17-21, 2012
Climate Adaptation Demonstration Project
Gunnison Climate Working Group

Objectives

1. Learn the purpose of the rock structures and how to build at least 3-4 rock structures to help restore the ephemeral stream channel.
2. Apply learning and complete building of 52 rock structures at the Redden Ranch (move to Wolf Creek later in week as time allows).
3. Understand the broader context of the restoration project – a climate adaptation demonstration project – to help build resilience of riparian areas/wet meadows, important brood rearing habitat for the Gunnison Sage-grouse and other wildlife species, in the face of a changing climate.

Monday, September 17th Meeting Time Location and Directions

1. Meet 12:30 PM: Southern Rockies Fire Module and interested partners/workers will meet at Eagle Ridge Road turnoff on County Road 730 (Ohio Creek road) to carpool up to the Redden Ranch (To be confirmed; alternative parking is at Miller Ranch further up Ohio Creek Road)
2. Start Hands-on Training at 1 PM: Start hands-on training on building 2-3 types of rock structures with Bill Zeedyk; break up into small teams to build rock structures; Bill will advise.
3. Directions to Site: From Gunnison, go north on Hwy 135 towards Crested Butte about 3.4 miles. Turn left or west onto County Rd 730 (Ohio Creek Road) and travel about 3.2 miles to Eagle Ridge Road.

Logistics for Sept. 17th Work Day and Week

1. Assuming Nate gets clearance, CPW will haul rocks to gate and then stage near every 3-5 structures by Sept. 13-14 or before.
2. TNC Southern Rockies Fire Module (7 technicians) is set to work during week of Sept. 17th
3. Project team members are invited to training and to help build structures (pls RSVP with Betsy)
4. Pat Magee, WSC, offered a group of about 16 WSC students from 11-5 pm on Sept. 18th
5. Assuming we complete the Redden Ranch, the field crew will move over to Wolf Creek the latter part of the week.
6. Assuming we complete Redden structures on Wedn., move crew over to Wolf Creek to start work on the dry middle fork. Directions will be provided.

Rock

1. Amount: 35 cubic yards of rock, add 10% for maintenance and repairs = 39 cubic yards or approximately 60 tons. Approximately 1.5 tons per yard, 60 tons total. 4 truckloads?
2. Type: The *rocks should be between 6-18 inches, long dimension, with 70-80% between 8-12 inches. Maybe 10% can be 12-18 for use as footers or in taller structures.* Need to be able to lift by hand. We can use some gravel and rock fragments for chinking, usually part of the tidy-up phase at each structure. Angular rock is preferable, but river rock is acceptable.
3. Source of rock: Warren Wilcox at Gunnison Gravel and Excavation.
4. Hauling rock: We need to haul in and stage rocks. Nate will work with CPW, Brett and Wilcox to determine how best to haul it and where to stage. Likely pull inside gate and dump and then haul up to site, smaller dump truck or front loader and stage nearby every approximately 5 structures.

Tools/Supplies (Bill will finalize types and amounts of each needed)

1. Wheel barrows-Nate checking, other?
2. Shovels?
3. Gloves-please bring; Betsy will have some on hand
4. UTV and trailer provided by TNC field crew
5. Litter bags to carry rocks-Bill
6. Pick axes-Bill will bring (how many?)
7. Other?

What to Bring

1. Sunscreen, water, sturdy shoes, hats, lunch, gloves
2. Betsy will provide cooler of drinks and snacks
3. TNC field crew will bring 2 UTVs with trailers
4. Betsy can provide one high clearance SUV
5. If camping, bring camping equipment, food

Project Scope

1. 1580 ft of channel length surveyed/mapped, 1201 square feet of surface area of structures
2. 52 rock structures, marked with surveyor stakes (18 in), #, diminsions, Length is stream length, Height-depth of rock. Marked length and width of each structure with blue paint (attached is the detailed estimate of rocks for each structure).

Types of Structures:

1. One Rock Dam: A one rock dam is suited for streams and gullies fewer than 15 feet in width. They are only one rock deep, but several rows long. Size varies depending on the depth of the channel, usually about one third the depth of the bank-full channel. Once the dam has been installed, the first flow event will deposit fine particles, organize debris, plant propagules and seeds in the spaces between the rocks.
2. Rock Rundown: A rock rundown is simply one to two layers of rock spread across the channel bed at the base of a shallow head-cut, usually 5-8 feet long and as wide as the developing cut. Looks very much like a one rock dam, but has a different function and purpose. Used where the headcut is shallow, maybe 6-12 inches tall and a drop structure, such as Zuni Bowl, is not needed.
3. Media Luna: A media luna is a simple but effective rockwork structure that can be used to subtly manipulate sheet flow in a number of ways to prevent erosion. Generally it spreads runoff and initiates sheet flow.
4. Zuni Bowl: Zuni bowls are built to stop head-cuts using the principle of the natural cascade or step pool. The Zuni bowl has three key features: a hardened pour over, a rock-lined catchment, and a rock-lined backsplash to protect the headwall and sides of the channel. The backsplash replicates immovable boulders in a natural step pool stream.

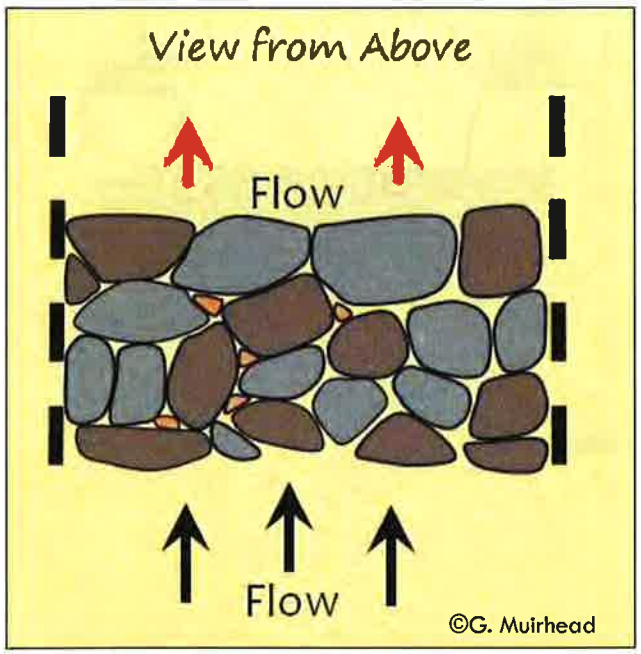
Monitoring

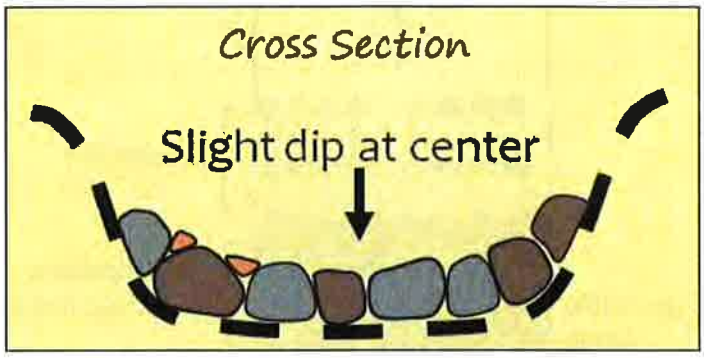
1. Renee Rondeau is developing the monitoring plan to be reviewed by the project team and landowner
2. Renee will conduct baseline monitoring prior to the work

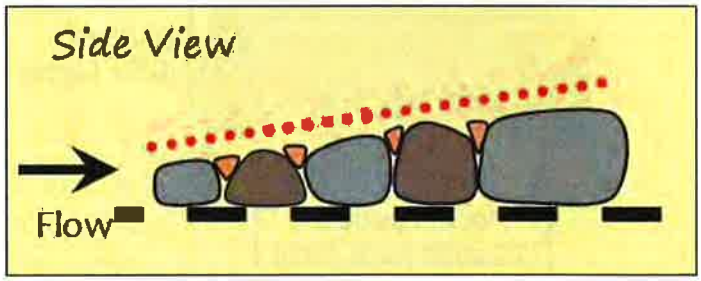
Redden Planning Team: Andrew Breibart, Jim Cochran, Betsy Neely, Brett Redden, Renee Rondeau, Nathan Seward, Christina Santana, Liz With, Bill Zeedyk. Contact Betsy Neely at bneely@tnc.org.

One Rock Dam

= 1 rock high + uniform surface

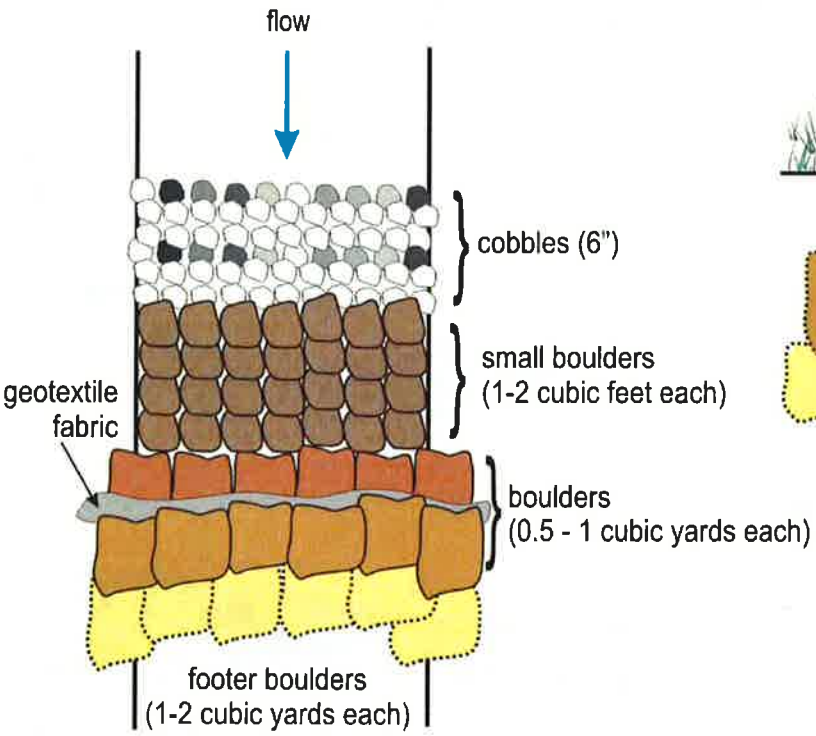




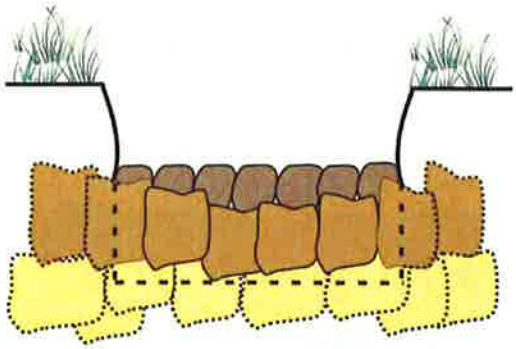


Filter Weir

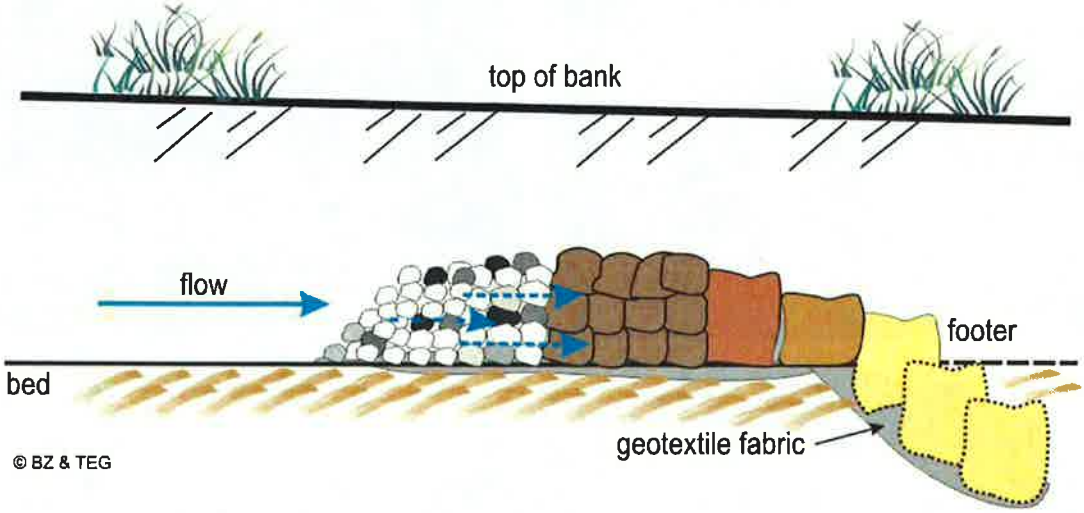
Plan View



Cross Section



Longitudinal Profile

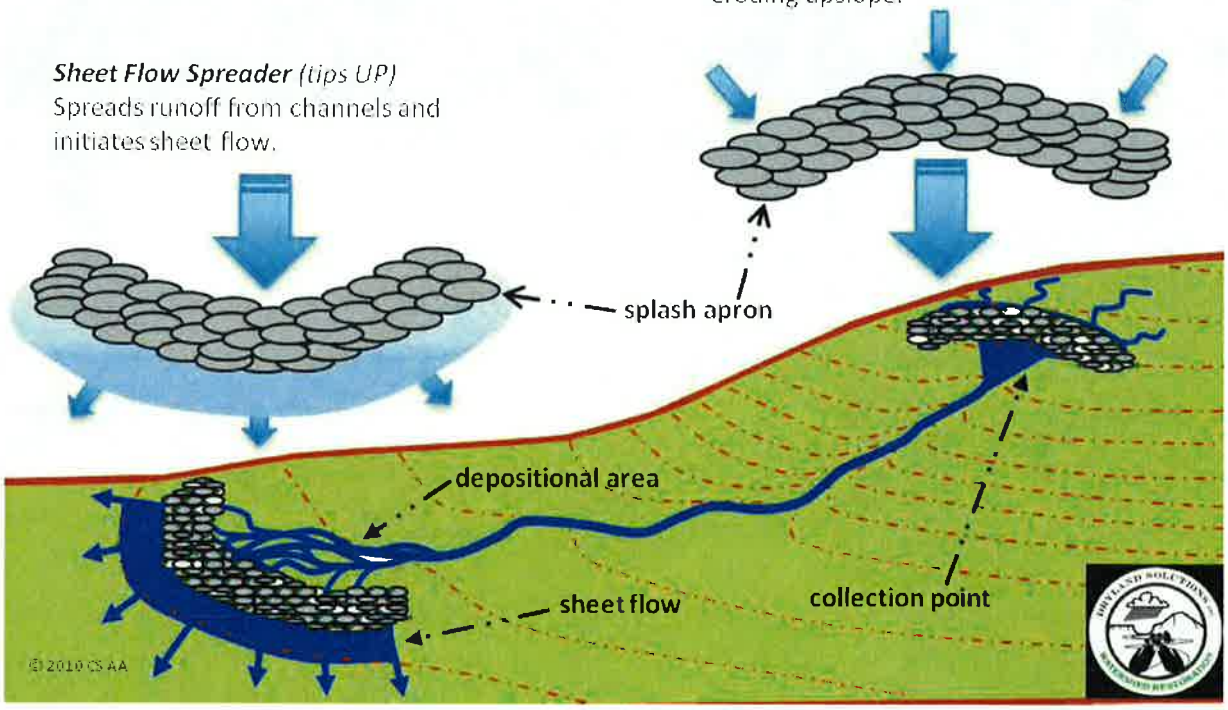


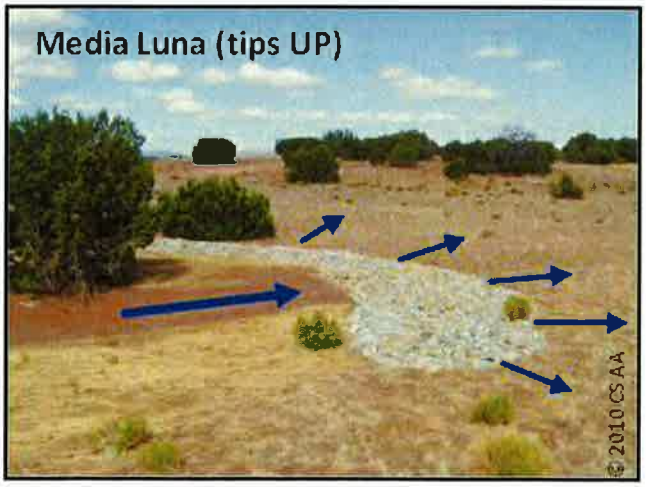
© BZ & TEG

MEDIA LUNA

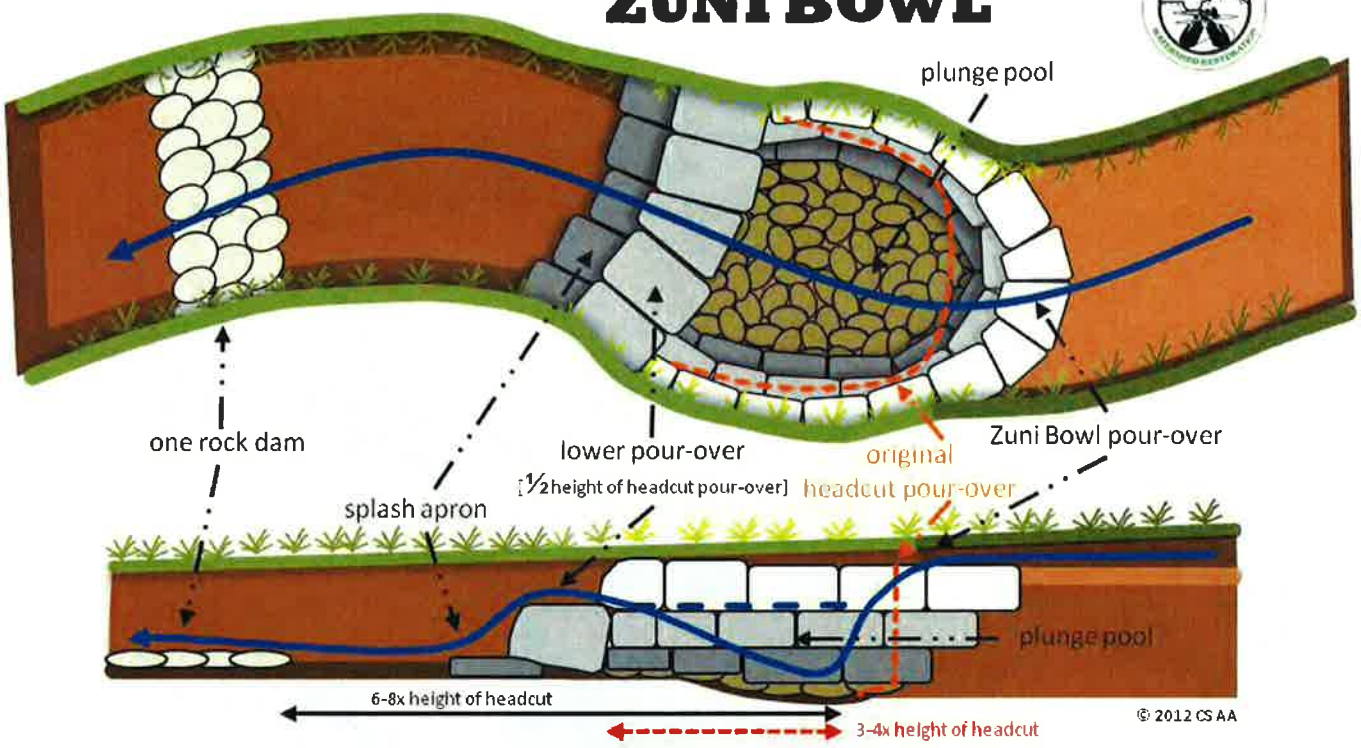
Sheet Flow Collector *(tips DOWN)*
Prevents developing rills and gullies from eroding upslope.

Sheet Flow Spreader *(tips UP)*
Spreads runoff from channels and initiates sheet flow.

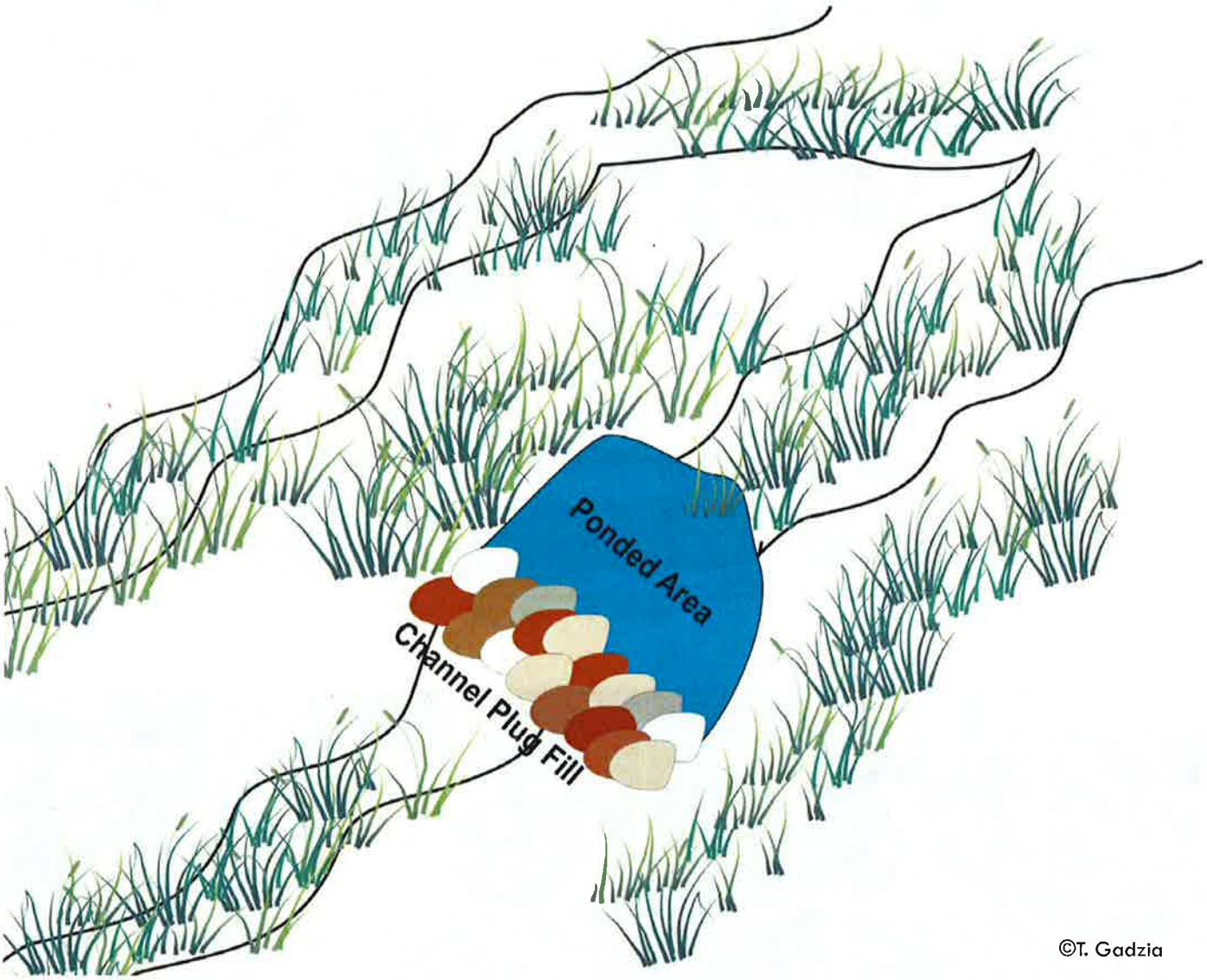




ZUNI BOWL


plunge pool
one rock dam
lower pour-over
[½ height of headcut pour-over]
original
headcut pour-over
Zuni Bowl pour-over
splash apron
plunge pool
6-8x height of headcut
3-4x height of headcut
© 2012 CS AA

Plug and Pond



Redden Ranch

Site	Type	Length	Width	Height	Area	Volume	Remarks
1	ORD	4	3	0.5	12 sq ft	6 cft	
2	ORD	4	7	0.5	28	14	Blue marks upper surface
3	RR	4	2	0.5	8	4	Stop head cut
4	ORD	3	3	0.5	9	4.5	
5	RR	6	2	1	12	12	
6	ORD	4	2	0.5	8	4	Shrubs on both sides
7	RR	3	2	1	6	6	Below meander
8	ORD	4	5	1	20	20	
9	RR	5	2	1	10	10	
10	ZB	6	4	1.5	24	36	
11	ORD	5	3	1	15	15	Use large rocks
12	ORD	5	4	1	20	20	
13	ORD	7	4	1	28	28	
14	RR	5	3	1	15	15	Could use existing rock on site
15	ORD	6	6	1	36	36	
16	ORD	6	6	0.5	36	18	
17	ORD	5	4	1	20	20	
18	ORD	5	2	1	10	10	
19	ORD	5	4	1	20	20	
20	ORD	5	4	1	20	20	
21	ORD	6	5	1	30	30	
22	ORD	4	4	1	16	16	
23	ORD	4	4	0.5	16	8	
24	ORD	6	6	1	36	36	
25	ORD	5	8	0.5	40	20	
26	ORD	6	6	0.5	36	18	Salvage sod
27	ORD	5	5	0.5	25	13	Salvage sod

28	ORD	3	4	1	12	12	Prevent trailing
29	ORD	4	4	1	16	16	
30	ORD	5	5	1	25	25	
31	ORD	4	5	1	20	20	
32	ORD	5	6	1	30	30	
33	ORD	4	4	0.5	16	8	
34	ORD	4	4	0.5	16	8	
35	RR	8	2	1	16	16	
36	RR	7	3	1	21	21	Stop headcut
37	ORD	5	3	1	15	15	Start of bed scour due to trailing
38	ORD	6	4	1	24	24	
39	ORD	3	4	1	12	12	
40	ZB	6	3	1.5	18	27	
41	ORD	3	3	1	9	9	
42	ORD	5	3	1	15	15	
43	ORD	8	3	1	24	24	
44	RR	7	2	0.5	14	7	Reconn. ck w/ floodplain
45	ORD	7	4	1	28	28	Crossover
46	ORD	6	5	1	30	30	Cattle crossing
47	ORD	5	5	0.5	25	13	
48	ORD	5	5	1	25	25	Willows
49	ZB	6	4	1.5	24	36	Willows
50	ORD	4	7	0.5	28	14	Willows
51	ORD	4	6	0.5	24	12	Willows
52	ORD	5	4	1	20	20	
53	---	---	---	---	---	---	Fill with sod cut from site 54
54	---	---	---	---	---	---	Remove sod; open new channel
55	ORD	5	6	0.5	30	15	
END							
				Total	1201	965	

Wolf Creek

Site	Type	Length	Width	Height	Area (sq ft)	Volume (cu ft)	Remarks
	Upper	Reach					
1	ORD	7	5	1.5	35	55	Big and small rocks available on site
2	ORD	7	5	1.5	35	55	Big and small rocks available on site
3	ORD	7	5	1	35	35	Big rock available
4	Steel dam	8	8	0.5	64	32	Fill to rim on upstream side; add large rock to apron
5	Steel dam	8	12	1.5	98	144	Same
6	ORD	7	4	1	28	28	
7	ORD	7	4	1	28	28	
8	RR	7	3	1	21	21	
9	RR	6	5	1	30	30	No rock handy
10	RR	8	3	1	24	24	No rock handy
11	ORD	8	4	0.5	32	16	No rock handy
12	ORD	6	4	0.5	24	12	No rock handy
13	RR	6	4	0.5	24	12	Prevent further headcut
14	ORD	8	4	1	32	32	
15	ORD	6	4	1	24	24	Outlet to valley right
16	ZB	14	4	1.5	56	84	Advancing headcut
17	ORD	6	4	0.5	24	12	Local rock on slope
18	RR	6	2	1	12	12	
19	ORD	5	4	1	20	20	Add dirt and sod on upstream side
		Total			**644**	**676**	
	Lower	Reach					

20	ORD	6	18	0.5	108	54	
21	ORD	4	14	0.5	56	28	
22	ORD	4	14	0.5	56	28	Have rock nearby
23	ORD	4	12	0.5	48	24	
24	ORD	5	12	1	60	60	Have rock nearby
25	ORD	4	7	1	28	28	Have rock nearby
26	ORD	7	6	1	42	42	Have rock nearby
27	ORD	6	16	1	96	96	Rock on site
28	Steel dam	7	11	0.5	77	39	Fill to rim, upstream side, add apron below
29	ORD	6	8	1	48	48	Add to natural rock
30	ORD	5	10	1	50	50	Some rock on site
31	ORD	6	8	1	48	48	
32	RR	6	5	1	30	30	
33	ORD	4	6	0.5	24	12	
34	ML	4	36	0.5	144	72	Spread water from spring, rock on site
35	ML/ORD	6	18	0.5-1	108	54	ML&ORD hybrid, turn H2O to left. back w/sod, key structure
36	ORD	6	10	1	60	60	Key structure/include willow. Send H20 to south
37	ORD	6	6	1	36	36	
38	RR	8	4	0.5	32	16	Trailing caused headcut`
39	ORD	6	10	1	60	60	Key structure
40	ORD	4	12	1	48	48	
41	RR	4	8	1	32	32	
42	ORD	4	12	1-0.5 mix	48	48	
43	ML	6	22	0.5	132	66	Plug w/sod, spread H20 to fill pond

44	Flow splitter	-	-	-			Make surface same depth, old stock pond
45	ML	6	25	0.5	150	75	In meadow, to spread H2O
46	Sod dam	6	4	0.5	24	12	No rocks, just sod
47	End/culvert	8	6	1	48	48	Raise invert (bottom of culvert) Open up culvert. Restore wetland upstream
			Sub-Total		1693	982	Lower Reach

6 sod dams at 30 ft intervals between 46 & 47

Grand Total, Upper and Lower Reaches: 2337 sq ft, 1922 cu ft

Gunnison Climate Working Group

Wants to THANK YOU for participating in our Redden Ranch Restoration/Resilience Building Training and Work Day/Week

Kick-Off: Monday, September 17, 2012 (12:30 PM)

Please RSVP:

Please RSVP with Betsy Neely at bneely@tnc.org or 720-974-7015. We need to limit the number of volunteers to 30 people/day for safety and logistical reasons. Please let Betsy know what days you are participating so we can plan accordingly.

Climate Adaptation Pilot Project:

The Gunnison Climate Working Group, a partnership of federal, state and private partners, is working to understand the threats posed by climate change, identify strategies to reduce impacts, and promote coordinated implementation of these strategies. The Group is working together to implement a climate adaptation pilot project to help riparian/wet meadows retain water over the long-term, thereby enhancing the resilience of this critical habitat and the long-term viability of the Gunnison Sage-grouse in the face of a changing climate. We are building simple low-cost structures (designed by Bill Zeedyk) in several drainages to "let the water do the work" to raise the water table to support grasses and insects needed by the grouse and other species. TNC's Southern Rockies Fire Module will be on hand to build the rock structures, but there is much work to be done and and we could use some assistance.

Directions and Meeting Times:

The Redden Ranch is *approximately 6.5 miles north of Gunnison*, located east of Ohio Creek Road (CR 730) on the western flank of Flat Top Mountain. Please bring a high clearance vehicle and carpool from Gunnison to reduce the number of vehicles in the project area.

Directions: From Hwy 50, drive north on Hwy 135 for 3.3 miles. Turn left on Ohio Creek Road (CR 730) and drive approximately 3 miles. Look for Redden Ranch Project sign and flagging on the right side. Park in the hay meadow (if you get to Eagle Ridge Ranch Road, you have gone too far).

Meeting time: We will meet 12:30 pm at the parking area on September 17, 2012. Please look for Betsy Neely to sign a waiver and arrange carpooling before going up to the project site. It is very important that you have signed-in and handed us a Release of Liability Form before getting to work. See below for other

The Nature Conservancy, 2424 Spruce Street, Boulder, Colorado 80302

meeting times.

What to Bring:

The weather can be unpredictable this time of year so bring appropriate clothing for hot, cool or stormy weather that includes:

- Sunglasses
- Sunscreen
- Rain gear
- A hat
- Good walking boots (preferably steel toe)
- We will have some work gloves, goggles, and hard hats available

The Nature Conservancy will provide all workshop materials, snacks, and water (for refilling your water bottle) for the field. ***Please bring a sack LUNCH, drinking WATER, and your own labeled WATER BOTTLE.***

Tentative Schedule:

Monday, September 17th

12:30 pm – Everyone meets at Redden Ranch Parking area for safety and logistics talk. Arrange carpools to drive to the worksite.

1:00-5:30 pm – Bill Zeedyk will lead a safety talk and hands-on-training about building rock structures at the worksite. Volunteers/participants will be organized into work teams to begin building rock structures.

Tuesday-Wednesday, September 18th-19th

7:30 am- Meet at the Gunnison County Courthouse to carpool to the Ranch.

8:00 am – Meet at the Redden Ranch Parking area to carpool and drive up to the worksite.

8:30 am – Bill Zeedyk will give the plan of action for the day and assign work teams and leaders. Work teams will build rock structures and Bill will roam providing input and recommendations.

12:00-12:30 pm-Break for lunch (please bring your own lunch, snacks/drinks will be provided)

5:00-5:30 pm – Bill Zeedyk will review our progress and announce plans for Thursday-Friday.

Thursday-Friday, September 20th-21st (assuming we have completed work at the Redden Ranch)

7:30 am - Meet at the Gunnison County Courthouse to carpool/caravan to the 2nd worksite. Betsy will provide directions to the 2nd site, assuming we are ready to move to the second site. If not we will return to the Redden Ranch.

8:00 – 5 pm – Meet at the worksite for orientation and begin work.

5:00 pm – Finish up work and head home.

Being Green:

Please help us reduce our carbon footprint by:

1) Carpooling: Please arrange to carpool.
2) Please bring your own water bottle – LABELED WITH YOUR NAME.
3) We will have recycling containers at both the worksite and we ask that you please use them.

Thank You:

Your participation in this training work day and work week is very important to us. This restoration work is graciously supported by grants from Wildlife Conservation Society, Upper Gunnison River Water Conservancy District, Colorado Parks and Wildlife, and The Nature Conservancy. Special thanks to Mr. Brett Redden of Redden Ranches Inc. for making this project possible on his land. For more information, contact me at (720) 974-7015 or e-mail at bneely@tnc.org.

The Nature Conservancy, 2424 Spruce Street, Boulder, Colorado 80302

Looking forward to seeing you soon! Thanks for your participation and help on this important restoration and resilience-building project!

Cheers,
Betsy

Betsy Neely
The Nature Conservancy
On behalf of the Gunnison Climate Working Group
720-974-7015 (work)
303-881-4144 (mobile)
bneely@tnc.org

Safety Rules

Think Safety. An accident is an unplanned event caused by an unsafe act, an unsafe condition, or both. Accident prevention is everyone's responsibility.

If you are injured, please notify Betsy Neely **immediately** so that we can provide the appropriate aid. Please do not wait until you have gone home before informing us that you were hurt.

We will make available for participant use eye and ear protection, gloves, and a first-aid kit. Drinking water and field snacks will also be provided. Participants who have their own safety equipment are welcome to bring and use them.

Work and Camping Areas: Work and camping areas shall be kept neat and organized. Trash, tools, and materials shall be picked up and kept in an organized manner so as to create safe working and camping zones (i.e., not leaving tools on the ground so that others my trip over them).

First Aid: During the introduction of the workshop, people who have First Aid training will be identified and a First Aid Kit will remain onsite during workshop hours.

Defective Tools: If a tool or piece of equipment has broken or is no longer working properly, **do not** continue to use it. Defective tools and equipment (i.e., loose or cracked handles on shovels, etc.) need to be reported to the organizers immediately.

Power Tools: Tools need to be kept in good condition and safe working order. No staff or volunteer will be asked to operate a power tool that he/she has not been properly trained to use. All participants must receive approval from the workshop coordinator before using power tools such as chainsaws. Those who do have approval, and their helper, **must wear** appropriate eye and ear protection.

Hydration & Nutrition: Outside physical labor during the heat of the day can drain your body's fluids and utilized more than normal calories. Please remember to stay well hydrated. ***Water will be provided on-site for drinking.*** Eating a nutritious breakfast and snacks in the field is recommended. Pace yourself and take frequent breaks. Overheating can lead to heat stroke.

Appropriate Clothing and Foot Wear: Please wear appropriate clothing for the type of work and weather conditions. **Tennis shoes or sandals are not appropriate shoes for these outdoor workshops.** Hiking or work boots (rubber waterproof boots when appropriate) with good ankle and or toe protection are best. **Know when you need to wear gloves, eye protection or ear plugs.** Good leather gloves will prevent blisters and splinters! Keep these items on hand and use when necessary: hat, long sleeve shirt, rain-gear, sunscreen and long pants.

Lifting: Proper body positioning during lifting reduces back injuries. Lifting should always be done with the legs, bending at the knees and keeping the back straight. If you are moving an object that is heavy and/or awkward, stop and get help so as not to strain your back. Staff and volunteers should use common sense when shoveling, lifting or carrying, to position their body so as not to strain their back. Participants may be required to lift rocks and move wheelbarrows. If you have previous injuries that maybe re-injured due to these activities, please do not volunteer for these tasks!

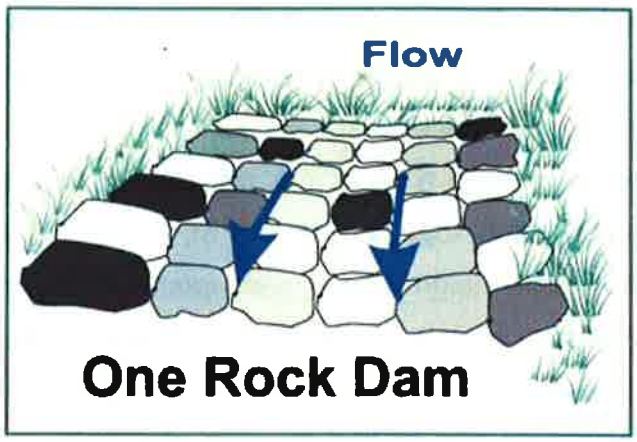
Hand Tools: Inspect any hand tool for defects before you use it. If any are found do not use the tool. Bring the defect to the attention of workshop or staff. Outdoor workshops may require the use of various hand tools

such as sledge hammers, axes, hammers, loppers, pliers, digging bars, shovels, post drivers, and others. If you are unfamiliar with the proper and safe use of these tools, please see the workshop coordinator.

Behavior: Awareness of other workers around you is critical. Know where others are at all times and do not approach a person during physical activity from an unobservable direction. Do not place your hands on any surface, such as on top of a vane post, that may be subject to impact from hand tools (ex: sledge hammers) during the structure installation or maintenance activities. Carry all tools/equipment/supplies by your side, perpendicular to the ground when possible. Do not carry tools over your shoulders! How you behave can directly affect the safety of others and yourself. Please be considerate to all participants.

Do not stand in front or behind of anyone using tools such as sledge hammers and axes in an "over-the-shoulder" action. The heads of these tools can come loose during the swing action and become deadly projectiles.

One-Rock Dam



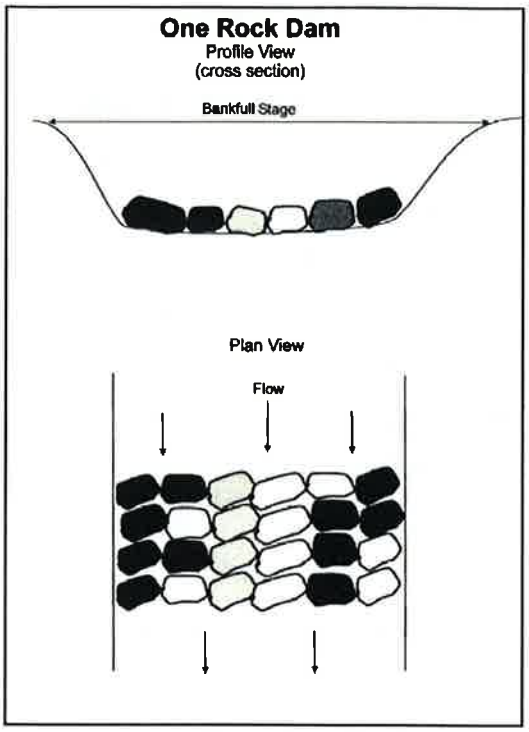
A **one-rock dam** is so named because it is only one rock tall. The dam should be several rows of rock across from the upstream to the downstream edge. The dam should not be taller than 1/3 bankfull depth of the planned channel.

Stones should be selected, sized, and placed so that the completed structure ends up relatively level from bank to bank and flat from the upstream edge to the downstream edge. This can be accomplished by placing larger rocks in the deepest part of the channel, smaller ones to either side.

A **one-rock dam** is also a grade control structure. The primary purpose of a grade control structure is to keep a gully from eroding deeper. Properly used, grade control structures are the first step in reversing the erosion process and initiating sediment deposition, water harvesting, nutrient retention, revegetation, and bank stabilization. Grade control structures are especially important in harvesting water from storm flows in order to irrigate and nurture new plant growth and colonization in gully bottoms. Vigorous plant growth is critical to increasing channel roughness, trapping sediments, detaining and retaining organic debris, and capturing soil nutrients.

When using **one-rock dams** the emphasis is on keeping these structures low in profile and compact in form. This is in contrast to check dams which tend to be tall in profile and are designed to trap larger volumes of sediment and water, and are typically installed in steep mountain streams (>4% grade). Check dams tend to be vulnerable to undercutting and end-cutting when too much water is stored behind the dam.

A **one-rock dam** consists of more than one rock! The key to its success is that rocks are placed only one rock tall or one rock deep! They are not stacked. Rocks are placed in several, parallel rows across the gully floor and packed tightly together. A row of rocks should be of equal height and appear relatively flat or level from bank to bank. The elevation of the upstream row can be slightly higher than the downstream row so that the dam slopes gently from the top edge to the bottom edge.



Dams consisting of 3 to 5 parallel rows of rocks have considerable mass but minimal surface exposure to the force of moving water. Therefore, advancing flood waters slide across the surface of the dam rather than pushing against it. Because the dam is low in height, the water drops only a few inches and has little power to erode a scour pool that might undercut the structure. Successive floods pack sand, gravel, and organic material between the rocks forming an excellent seed bed for new plants to colonize and grow. Moisture accumulates under the rocks to nurture the young plants. Soon the roots of the maturing plants bind the rocks of the dam together for greater resistance to successive flood forces.