Wet Meadow and Riparian Restoration Resiliency Building Project
2025 Field Season Report

Prepared for the Upper Gunnison River Water Conservancy District
by
Amanda Aulenbach, Jules Iovino, and Ari Yamaguchi
-
December 2025

Wet Meadow and Riparian Restoration Resiliency Building Project

The Wet Meadow and Riparian Restoration Resiliency Building Project (hereafter, Wet Meadows Program (Program)) was initiated in 2012 by the Gunnison Climate Working Group, a public–private partnership formed to help the Upper Gunnison River Basin (Basin) adapt to climate change. Climate change is projected to increase the duration, frequency, and severity of droughts, intensify floods and runoff, and reduce soil moisture (Dai 2011). From 2012–2020, average annual temperatures in the Basin were 0.3ºC warmer than the 1971–2000 average, and six of those nine years were classified as drought years (Abatzoglou et al. 2017; Rondeau et al. 2023). In response, the Program implements collaborative, watershed-scale restoration of wet meadows and riparian areas (hereafter, mesic areas) to improve watershed resilience and support wildlife and ranching livelihoods in the Basin.

The Basin contains more than 2.5 million acres of semi-arid sagebrush steppe, and mesic areas occupy less than 2% of the landscape; a rare resource that provides critical habitat. Over 80% of wildlife species, as well as livestock, rely on mesic areas during summer and fall when uplands dry out (Naiman et al. 1986). These areas function as hydrologic "sponges," absorbing spring runoff, reducing flood impacts, and slowly releasing water to maintain higher water tables through the late growing season (July 15–September 30) (Hunt 2018; Maestas et al. 2018). As a result, mesic areas support high-quality forage and habitat for diverse taxa and are especially important during the brood-rearing season of the federally threatened Gunnison Sage-grouse (*Centrocercus minimus*; GUSG).

Approximately 95% of mesic habitats have been modified or degraded by historical land uses, such as grazing, recreation, water diversions, and fire suppression (Krueper 1995). These impacts cause headcuts, channel incision, wetland vegetation loss, and lowered water tables, and as a result, reduce soil moisture, increase erosion, and facilitate upland shrub encroachment into mesic areas (Hunt 2018). Climate change further exacerbates these stressors. The Basin receives around 90% of its water from spring snowmelt (Gunnison Basin Roundtable 2013), but warming temperatures are shifting precipitation from snow to rain, reducing snowpack, altering runoff timing, and decreasing annual streamflow (Nash et al. 2018). Continued degradation threatens agriculture and wildlife, especially the GUSG, of which over 88% of the global population resides in the Basin. With fewer than 5,000 individuals remaining worldwide, conserving mesic habitats is paramount for GUSG survival.

To address these challenges, the Program uses Zeedyk-style rock structures and other Low-Tech Process-Based Restoration (LTPBR) techniques to restore hydrologic and ecological function of mesic areas (Zeedyk and Clothier 2014). These techniques use natural materials ("sticks and stones") to stabilize erosion, capture sediment, slow runoff, reconnect floodplains, and raise water tables, thereby increasing infiltration and supporting wetland vegetation. Restoration approaches

[1] Cover Photo: Program partners and Back Country Hunters and Anglers (BHA) pose after a long day of building LTPBR structures with the District, CPW, and Pact on July 19, 2025, at Centennial State Wildlife Area (CPW).

are adapted to site-specific hydrologic, geomorphic, and ecological conditions across the Basin. This flexible approach promotes long-term resilience to changing temperature and precipitation regimes while providing broad ecological and social benefits.

Monitoring indicates that LTPBR structures installed over the past twelve years are effectively improving mesic habitat condition (Rondeau et al. 2023). One Program objective is to increase soil moisture and wetland plant cover (Table 1). Data from more than 500 monitoring transects show wetland plant cover increased by 39% in mesic habitats following treatment (Rondeau et al. 2023). These improvements enhance GUSG brood-rearing habitat, extend late-season water availability, and increase palatable forage, especially during periods of drought. Through adaptive management, the Program continues to support groundwater recharge, water quality, soil health, wildlife conservation, wildfire mitigation, and agriculture production. The success of mesic restoration in the Basin reflects both ecological outcomes and strong collaboration among stakeholders, contributing to basin-wide climate resilience.

Table 1. Wet Meadow Program Goals and Strategies to achieve those goals (v. 04-2022)

Goal	Strategies
Goal 1: Increase ecosystem resistance and resilience to climate change and disturbance by restoring hydrologic function of priority wet meadow and riparian habitat across the Basin	**A.** Evaluate and prioritize sites needing treatment across the Basin most likely to benefit GUSG, other wildlife species, and ranchers **B.** Design and implement restoration at priority sites **C.** Apply restoration treatments as wildfire buffers and to reduce post-wildfire impacts
Goal 2: Build a sustainable and enduring program to increase restoration across the Basin	**A.** Increase local and stakeholder capacity for restoration efforts through training, outreach events, and educational programs to the agricultural community, private landowners, students, and natural resource managers within and outside the Basin **B.** Procure sustainable funding for the project
Goal 3: Ensure scientific rigor of project	**A.** Support a long-term monitoring program to help determine and document restoration treatment efficacy, as well as allow for the Partnership to continually adapt methods and strategies as appropriate
Goal 4. Maximize efficiency and efficacy of the Program over time	**A.** Develop and evaluate cost-effective tools, methods, and planning
Goal 5. Expand the use of techniques and collaborative approaches to address similar resource issues across the region	**A.** Share best practices and lessons learned to encourage application of restoration methods within and outside the Basin

2025 Season Summary

In 2025, the Program built 65 structures restoring 2.82 stream miles, 9.72 acres of wetland habitat, and 92.8 acres of GUSG habitat; crews also assessed 2.86 stream miles for new site potential. The 2025 season brings the total amount of work done to 2,738 structures built, 79.5 stream miles assessed, and 51.3 stream miles, 331.3 wetland acres, and over 2,264 acres of GUSG brood-rearing habitat restored. Additionally, maintenance was done on 27 structures maintaining restoration on 1.07 stream miles, 3.89 acres of wetland habitat, and 34.5 acres of GUSG habitat. Work was completed at 22 different sites across land management boundaries with help from the District, BLM, USFS, CPW, NPS, and Tribal staff to ensure successful project implementation throughout the Basin (Figure 2). Volunteers from High Country Conservation Advocates (HCCA), Backcountry Hunters and Anglers (BHA), and Western Colorado University (WCU) contributed greatly to projects as well (Figure 1). The District crew along with CPW, BLM, and USFS staff helped to survey and spot treat 30 acres of cheatgrass at Centennial SWA (CPW) and treat 19 acres at Woods Gulch (USFS/BLM).

The Program completed the 14th year of long-term vegetation monitoring with guidance and assistance from Renee Rondeau, Marcella Tarantino (Bird Conservancy), Ben Prior (NRCS/GCD), USFS staff, and District staff. Sites monitored include South Cottonwood (USFS), Chance Gulch (BLM) and Gold Basin (new site, BLM).

Figure 1. Backcountry Hunters and Anglers (BHA) volunteers posing for a group photo with two wicker weir structures they built.

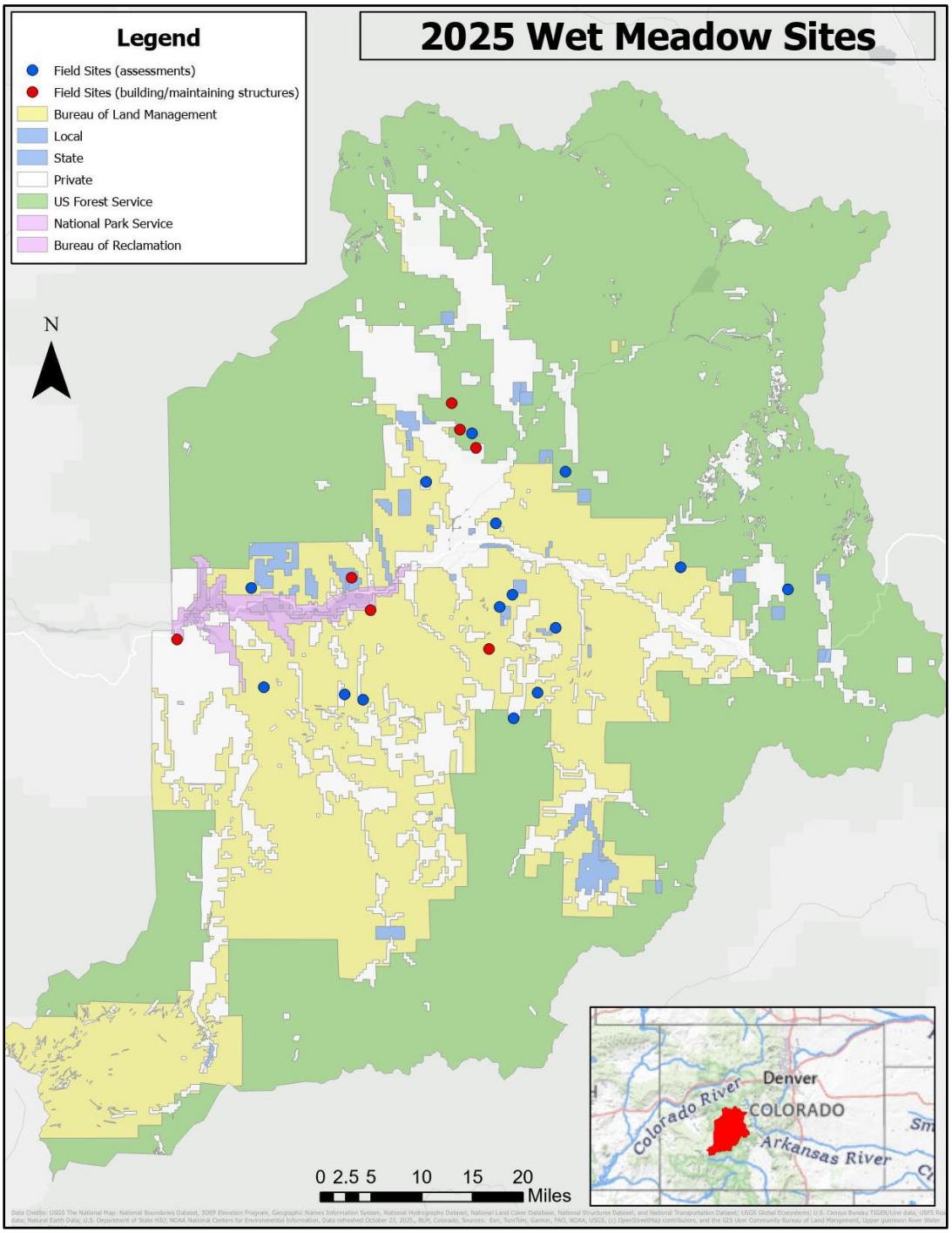

Figure 2. 2025 work locations by type of work completed. Blue circles indicate where maintenance or new site assessments occurred and red circles indicate where new structures were built or maintenance on structures was completed. 2025 sites were located on private, Tribal, USFS, BLM, and CPW managed land.

Wet Meadow Prioritization Tool

In September 2025, University of Denver (DU) graduate researcher Joslyn Hays developed and launched a prioritization model to help inform future Program restoration work (Figure 3). This model is based on the initial model created by The Nature Conservancy (TNC) in 2012 (and updated in 2017) but incorporates additional parameters to further refine drainages classified as "high priority," including slope, channel type, road locations, power line locations, and wildfire hazard zones. Like the TNC model, this model uses the most up-to date GUSG lek locations and NDVI data. This updated and refined model lowered the number of "high priority" acres from 40,768 in the TNC model to 9,891; a quarter of the total acres originally identified. This provides a more realistic outlook on future restoration efforts. This is a dynamic model with a custom interface, allowing the output of "high priority" drainages to be refined according to the specific needs of the agency or grant. This model was created for ephemeral and intermittent drainages (mesic areas) and excludes most perennial drainages.

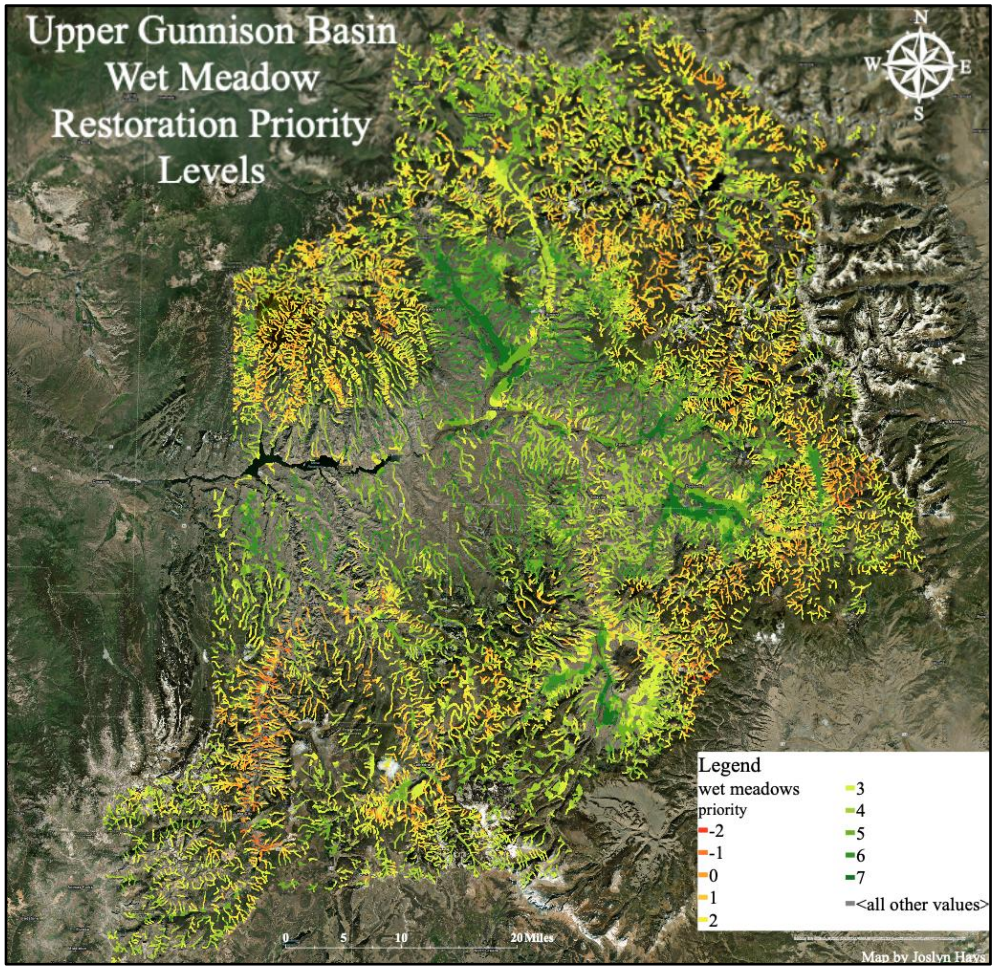

Figure 3. Wet meadow priority rankings in the Upper Gunnison Basin without additional weighting applied (Map by Joslyn Hays). Additional weights to conditions (riparian greenness, riparian sensitivity, roads, conifer cover, mesic resources, lek proximity, and GUSG habitat) can be added to calculate priority levels based on land management objectives. -2 is the lowest priority level and 7 is the highest priority level.

2025 Summary Tables of Restoration Structures and Restored Habitat

Table 2. Restoration structures built at each restoration site by land manager. A total of 65 structures were installed in 2025.

	Land Manager	BLM	BLM Total	USFS	USFS Total	CPW	CPW Total	Tribal	Tribal Total	Private	Private total	Grand Total
	Site Name	Gold Basin		Hinkel		Centennial SWA		Pinecrest Ranch		Woodcock		
Structure Type	ORD	9	9			8	8	10	10	1	1	**28**
	Rock Armoring											
	Rock Layback							1	1			**1**
	Rock Mulch					1	1	5	5			**6**
	Rock Rundown	5	5			13	13	3	3			**21**
	Wicker Wier							3	3	1	1	**4**
	Media Luna											
	Zuni Bowl	1	1			1	1					**2**
	Debris Dam					1	1	1	1			**2**
	Fence			1	1							**1**
	Grand Total	15	**15**	1	**1**	24	**24**	23	**23**	2	**2**	**65**

Table 3. Restoration structures maintained at each site by land manager. A total of 26 structures had maintenance completed in 2025.

	Land Manager	BLM		BLM Total	USFS			USFS Total	CPW	CPW Total	Tribal	Tribal Total	Private	Private Total	Grand Total
	Site Name	Gold Basin	Sage Hen Gulch		Mules 1	Bebbs Willow	Flat Top		Centennial SWA		Pinecrest Ranch		South Cottonwood		
Structure Type	ORD	3		3	1	1		2	2	2	1	1			**8**
	Rock Armor										1	1	1	1	**2**
	Rock Layback	2		2	1			1							**3**
	Rock Mulch										1	1			**1**
	Rock Rundown		1	1											**1**
	Wicker Wier	3		3							2	2			**5**
	Plug & Spread												2	2	**2**
	Bank Buster														
	Zuni Bowl						1	1	1	1					**2**
	Hybrid ORD/RR														
	Rock Pile								1	1					**1**
	Fence						1	1							**1**
	Grand Total	8	1	**9**	2	1	2	**5**	4	**4**	5	**5**	3	**3**	**26**

Table 4. Stream miles, wetland habitat acres, and GUSG habitat acres restored at each site by land manager. A total of 2.82 stream miles, 9.72 wetland acres, and 92.8 GUSG habitat acres were restored in 2025.

Land Manager	BLM Total	USFS Total	CPW Total	Tribal Total	Private Total	Grand Total
Site Name	**Gold Basin**	**Hinkel**	**Centennial SWA**	**Pinecrest Ranch**	**Woodcock**	
Stream Miles Restored	0.54	0.06	0.79	1.27	0.16	**2.82**
Wetland Habitat Acres Restored	2.89	0.46	1.61	4.39	0.38	**9.72**
GUSG Habitat Acres Restored	21.0	1.94	28.0	37.5	4.36	**92.8**

Table 5. Restored stream miles, wetland habitat acres, and GUSG habitat acres maintained at each site by land manager. A total of 1.07 restored stream miles, 3.89 restored wetland acres, and 34.5 restored GUSG habitat acres were maintained in 2025.

Land Manager	BLM		BLM Total	USFS			USFS Total	CPW Total	Tribal Total	Private Total	Grand Total
Site Name	**Gold Basin**	**Sage Hen Gulch**		**Mules 1**	**Bebbs Willow**	**Flat Top**		**Centennial SWA**	**Pinecrest Ranch**	**South Cottonwood**	
Stream Miles Maintained	0.31	0.03	**0.34**	0.05	0.06	0.06	**0.16**	0.1	0.32	0.14	**1.07**
Wetland Acres Maintained	1.4	1.3	**1.53**	0.35	0.17	0.18	**0.70**	0.21	1.02	0.40	**3.89**
GUSG Habitat Maintained	10.3	1.94	**12.2**	2.03	1.94	1.94	**5.91**	3.3	8.16	4.89	**34.5**

2025 Methods for Estimating Stream and Habitat Metrics

A major objective of the Program is to improve brood-rearing habitat for GUSG. Therefore, the project measures the number of acres of GUSG brood-rearing habitat restored by restoration treatments. This metric is based on a broad definition of brood-rearing habitat for GUSG, including various habitat types within and adjacent to restoration reaches. Thus, the estimate of restored habitat includes wet meadows, riparian areas, and some upland habitat that are likely to benefit from restoration. The acres of restored wetland and brood-rearing habitat are calculated separately to distinguish the direct and indirect influence of restoration on wetland species and nearby sagebrush habitat. These analyses were performed in ArcGIS Pro v3.5.4 unless otherwise stated.

Total New and Maintained Structures: GPS points were recorded in the field using Esri Field Maps upon the completion of construction or maintenance of structures. The attribute tables were downloaded to an Excel file, which was then used to generate the pivot tables presented above.

Total GUSG Acres Restored: On a site-by-site basis, the Points to Line tool was used to connect each newly built structure along the length of the reach. The lines exclude segments where there is a gap between structures greater than 0.25 miles. A 50-meter buffer was then generated on each line (CSGWG 1997; Connelly et al. 2000; GSRSC 2005; GBSSC 2012. This is a slight deviation from past years' methods, wherein buffers were created only on each structure and dissolved by site; this new method increases the estimated acreage by counting more of the distance between structures and is more representative of restoration benefits.

Total GUSG Acres Maintained: For all restoration structures on which maintenance work was completed in 2025, a 50-m buffer was generated (CSGWG 1997; Connelly et al. 2000; GSRSC 2005; GBSSC 2012) where dissolve field was set to "Site name" so that each site would have a single polygon associated without double-counting overlapping buffers.

Stream Miles Restored: NHD Plus flow paths (Esri 2025; Moore 2019) were clipped by restored site polygons, and the resulting length was reported: i.e., the length reported was the channel distance starting at the up-valley margin of the uppermost structure's 50-m buffer and ending at the down-valley margin of the lowermost structure's 50-m buffer.

Stream Miles Maintained: NHD Plus flow paths (Esri 2025; Moore 2019) were clipped by the maintenance polygons and the resulting length was reported.

Wetland Acres Restored: The polygons generated in *Total GUSG Acres Restored* (above) were clipped from the USFWS Wetlands layer (USFWS 2024), creating a resulting polygon of those areas where the restored reach polygon and USFWS Wetlands overlapped. Resulting acreages are reported.

Wetland Acres Maintained: The polygons generated in *Total GUSG Acres Maintained* (above) were clipped from the USFWS Wetlands layer (USFWS 2024), creating a polygon of those areas where the structure buffers and USFWS Wetlands overlapped. Resulting acreages are reported.

For all the above analyses, overlap analysis was also performed with a Land Management Boundaries layer to output the metrics by agency in addition to solely by site. For more details on the metrics, please contact Ari Yamaguchi at ayamaguchi@ugrwcd.org.

2025 Education, Outreach, and Volunteer Summary

In addition to restoration efforts, the Program successfully connected with over 300 community members and promoted involvement and education of restoration activities. Multiple groups of volunteers from WCU, HCCA, and BHA assisted with building and maintaining restoration structures at three different site locations (Table 6). The Program aimed to educate all volunteers and crew members by beginning each project with a discussion of the causes and types of mesic habitat impairment and how LTPBR techniques address these impairments.

The Program hosted or participated in various site tours, workshops, and other outreach events:

- Thinking Like Water Film Screening and Panel Discussion (80 people), April 18th
- LEAD Homeschool Group wet meadow demonstration (35 students), May 15th
- Colorado River Water Conservation District site tour (two staff), July 22nd
- Northern Water Conservancy District site tour (two staff), August 5-6th
- Taylor Challenge wet meadow demonstration (80 students), August 28th
- Wet Meadow Restoration Landowner Workshop (10 landowners), October 3rd
- WCU Field Trip to Gold Basin (12 students), October 16th
- America the Beautiful grant site tour (two staff), October 25th
- Night of Lights (>100 people), December 5th

Additionally, District staff visited Gunnison High School's environmental science class on five occasions with the water wonder trailer to discuss wet meadow restoration and other water issues. District technicians created a Wet Meadow Program brochure that will be used and handed out at future education and outreach events.

Table 6. Summary of total volunteer hours for three volunteer events in 2025. An estimated total of 668 volunteer hours accrued during the 2025 field season.

Site	Date	Volunteer Group	Number of Volunteers	Volunteer Hours	Total Hours
Woodcock (private)	May 17th	BHA	13	6	78
Centennial SWA (CPW)	July 19th	BHA	32	5	160
Gold Basin (BLM)	Sept 4th	HCCA	24	10	240
	Sept 5th	HCCA	19	10	190
		Totals	**88**		**668**

Scientific Endeavors: Program partners met multiple times to review and/or provide feedback for Sophia Reggiani's (WCU) research project assessing insect variation at treated vs untreated wet meadow sites, and for Joslyn Hays' (DU) research project developing the Wet Meadow Restoration Prioritization Tool. Both projects are completed as of December 29, 2025.

2025 Funding and Partner Contributions

Table 7. District wet meadow grants and funding agreements expended through 2025 (as of September 30, 2025).

		BUDGET		EXPENDED		BALANCE
America the Beautiful	$	80,000.00	$	47,121.94	$	32,878.94
Travel	*$*	*3,000.00*	*$*	*1,567.24*	*$*	*1,432.76*
Supplies & Materials	*$*	*9,000.00*	*$*	*6,834.09*	*$*	*2,165.91*
Contractors	*$*	*61,000.00*	*$*	*35,841.98*	*$*	*25,158.02*
Staff Time	*$*	*9,000.00*	*$*	*8,590.91*	*$*	*409.09*
Administrative	*$*	*8,000.00*	*$*	*4,286.84*	*$*	*3,713.16*
FWS Sagebrush Ecosystem	$	272,219.00	$	195,572.57	$	76,646.43
FY22-GIS Modeling	*$*	*19,500.00*	*$*	*19,500.00*	*$*	-
FY22-Planning	*$*	*75,000.00*	*$*	*75,000.00*	*$*	-
FY22-Administration	*$*	*9,450.00*	*$*	*9,450.00*	*$*	-
FY23-Planning	*$*	*30,000.00*	*$*	*23,903.27*	*$*	*6,096.73*
FY23-Implmentation & Mob.	*$*	*29,743.00*	*$*	*19,372.50*	*$*	*10,370.50*
FY23-Outreach & Training	*$*	*77,500.00*	*$*	*30,673.18*	*$*	*46,826.82*
FY23-Travel	*$*	*3,229.32*	*$*	*1,862.70*	*$*	*1,366.62*
FY23-Equipment	*$*	*2,500.00*	*$*	*2,500.00*	*$*	-
FY23-Supplies & Materials	*$*	*9,999.50*	*$*	*4,981.60*	*$*	*5,017.90*
FY23-Administration	*$*	*15,297.18*	*$*	*8,329.32*	*$*	*6,967.86*
TNC 2025	$	150,000.00	$	34,225.08	$	115,774.92
Task 1: Antelope Creek	*$*	*99,141.60*	*$*	-	*$*	*99,141.60*
Task 2: UTV/Trailer	*$*	*25,000.00*	*$*	*25,000.00*	*$*	-
Task 3: Pinecrest Ranch	*$*	*25,858.40*	*$*	*9,225.08*	*$*	*16,633.32*
USFS PA22	$	89,000.00	$	72,539.74	$	16,460.26
Salaries/Labor Coordinator	*$*	*30,000*	*$*	*22,695.06*	*$*	*7,304.94*
Supplies/Materials	*$*	*4,563.64*	*$*	*4,563.64*	*$*	-
Other (Initial Agreement)	*$*	*8,800.00*	*$*	*8,800.00*	*$*	-
Contractors	*$*	*39,363.64*	*$*	*30,795.61*	*$*	*8,568.03*
Administrative	*$*	*6,272.72*	*$*	*5,685.43*	*$*	*587.29*
CPW RPI Grant	$	20,000.00	$	-	$	20,000.00
Personnel Costs	*$*	*6,000.00*	*$*	-	*$*	*6,000.00*
Fringe Benefits	*$*	*2,005.00*	*$*	-	*$*	*2,005.00*
Equipment Costs	*$*	*780.00*	*$*	-	*$*	*780.00*
Contractual Costs	*$*	*9,396.82*	*$*	-	*$*	*9,396.82*
Indirect Costs/Admin	*$*	*1,818.18*	*$*	-	*$*	*1,818.18*
BLM L24AC00687	$	629,403.30	$	96,508.47	$	532,894.83
Personnel Costs	*$*	*370,610.00*	*$*	*45,704.98*	*$*	*324,905.02*
Fringe Benefits	*$*	*97,046.00*	*$*	*20,335.00*	*$*	*76,711.00*
Travel Costs	*$*	*28,475.00*	*$*	*5,695.00*	*$*	*22,780.00*
Supply Costs	*$*	*2,000.00*	*$*	*1,000.00*	*$*	*1,000.00*
Contractual Costs	*$*	*81,209.00*	*$*	*15,000.00*	*$*	*66,209.00*
Indirect Costs/Admin	*$*	*50,063.00*	*$*	*8,773.49*	*$*	*41,289.51*
	$	**1,240,622.00**	**$**	**445,967.80**	**$**	**794,654.20**

2025 Partners and Crews

Table 8. 2025 Program organizations and partners that provided expertise and assistance with funding, planning, coordinating, implementing, and monitoring wet meadow restoration projects.

Organization	Partner
BIO-Logic, Inc.	Shawn Conner
Bureau of Land Management	Andy Stokes
	Brian Brown
	Ryan Romero
	Amy Hammermeister
	2025 Fuels & Watershed Techs: Grace Lindell, Savannah Adkins, Melissa Cox, and Kylie Moorehouse
Bird Conservancy of the Rockies	Marcella Tarantino
Colorado Parks and Wildlife	Nathan Seward
	Jerimiah Rummel
	Brooke Vasquez
	Miranda Middleton
	Clayton BonDurant
Contractors	Renee Rondeau
	Rocky Moutain Aggregate – McCabe Quarry
Gunnison County Cheatgrass Coordinator	Sarah Elzay
National Park Service	Jessica Frey
	Morgan Conley
	Dangoule Bockus
	2025 Biological Techs: Sage Bartow, Lili Zertuche, Alexandria Knoell, and Anna Trushenski
Natural Resource Conservation Service	Ben Prior
Partners for Fish and Wildlife (USFWS)	Brandon Miller
Trout Unlimited	Jesse Kruthaupt
U.S. Fish and Wildlife Service	Angela Trnka
	Nathan Darnall
U.S. Forest Service	Matt Vasquez
	Sarah Lowe
	Shannon Muenchow
	Liam Duggan
University of Denver	Joslyn Hays
Upper Gunnison River Water Conservancy District	Sonja Chavez
	Amanda Aulenbach
	Ari Yamaguchi
	Alana Nichols
	Bailey Friedman
	2025 Wet Meadow Techs: Julia Iovino and Ryan Outler
Volunteers	High Country Conservation Advocates
	Backcountry Hunters and Anglers
	Pact
	Western Colorado University students
Western Colorado University	Briget Eastep
	Sophia Reggiani
	Susan Washko
	Brooke Zanatelle

Report

This report was written by Amanda Aulenbach, Wet Meadows Program Director for the Upper Gunnison River Water Conservancy District with assistance from Ari Yamaguchi, Water Resources Specialist and Jules Iovino, Water Resources Fellow. For information or questions, please contact Amanda Aulenbach at aaulenbach@ugrwcd.org.

References

Abatzoglou, J.T., McEvoy, D.J., and Redmond, K.T. 2017. The west wide drought tracker: drought monitoring at fine spatial scales. *Bulletin of the American Meteorological Society,* 98:1815–1820.

Colorado Sage Grouse Working Group (CSGWG). 1997. Gunnison Sage-grouse conservation plan. *Colorado Parks and Wildlife. Gunnison, Colorado.*

Connelly, J., Schroeder, M., Sands, A., and Braun C. 2000. Guidelines to manage sage grouse and their habitats. *Wildlife Society Bulletin*, 28(4): 967–985.

Dai, A. 2011. Drought under global warming: A review. *Wiley Interdisciplinary Reviews: Climate Change* 2: 45–65.

Gunnison Sage-grouse Range-wide Steering Committee (GSRSC). 2005. Gunnison Sage-grouse range-wide conservation plan. *Colorado Division of Wildlife, Denver, Colorado.*

Gunnison Basin Roundtable. 2013. Basin: A handbook for inhabitants. *Gunnison Basin Roundtable 2013-14*.

Gunnison Basin Sage-grouse Strategic Committee (GBSSC). 2012. Gunnison Basin Gunnison Sage-grouse habitat prioritization tool. *Gunnison County, Colorado.*

Hunt, L.J.H., Fair, J., and Odland, M. 2018. Meadow restoration increases baseflow and groundwater storage in the Sierra Nevada Mountains of California. *Journal of the American Water Resources Association,* 54 (5): 1127–1136.

Krueper, D.J. 1995. Effects of livestock management on southwestern riparian ecosystems. *General Technical Report RM-GTR-272. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.*

Rondeau, R., Austin, G., Miller, R., Parker, S., Breibart, A., Conner, S., Neely, E., Seward, N., Vasquez, M., and Zeedyk, W. 2023. Restoration of wet meadows to enhance Gunnison Sage-grouse habitat and drought resilience in arid rangelands. *Restoration Ecology, 32(2), e14039.*

Maestas, J. D., Conner, S., Zeedyk, W., Neely, E., Rondeau, R., Seward, N., Chapman, T., With, L., and Murph, R. 2018. Hand-built structures for restoring degraded meadows in sagebrush rangelands: Examples and lessons learned from the Upper Gunnison River Basin, Colorado. *Range Technical Note No. 40. USDA-NRCS, Denver, CO.*

Moore, R.B., McKay, L.D., Rea, A.H., Bondelid, T.R., Price, C.V., Dewald, T.G., and Johnston, C.M., 2019, User's guide for the national hydrography dataset plus (NHDPlus) high resolution: U.S. Geological Survey Open-File Report 2019–1096, 66 p., https://doi.org/10.3133/ofr20191096. Accessed December 10, 2025

Naiman, R.J., Melillo, J.M., and Hobbie, J.E. 1986. Ecosystem alteration of boreal forest streams by beaver (*Castor canadensis*). *Ecology, 67(5),* 1254-1269.

Nash, C.S., Selker, J.S., Grant, G.E., Lewis, S.L., and Noël, P. 2018. A physical framework for evaluating net effects of wet meadow restoration on late-summer streamflow. *Ecohydrology, 11(5*), e1953.

U.S. Fish and Wildlife Service (USFWS). 2024. https://www.fws.gov/program/national-wetlands-inventory. *U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.*

Zeedyk, B. and Clothier, V. 2014. Let the water do the work: Induced meandering, an evolving method for restoring incised channels, 2nd edition. *Quivira Coalition.*