Bedrock BioBlitz: Monitoring Riparian Restoration for Adaptive Management

(Final Report 08 October 2012)

Martin Moses - Private Lands Wildlife Biologist (RMBO, NRCS, CPW), Durango, CO

Recently, I started working with a landowner that controls 160+ ac and 3,300 ft of riparian area along the Dolores River near Bedrock, CO in the heart of the Paradox Valley (Figure 1 and Figure 2). The landowner has managed this property for nearly 20 years and has always considered it a wildlife refuge. However, unmanaged free-range livestock access, tamarisk and Russian knapweed invasion, along with regulated flows resulting from McPhee Dam on the Dolores River have conspired to degrade the property and reduce its apparent wildlife habitat value. On the bright side, the tamarisk leaf beetle has established a successful population in the Paradox Valley and has effectively defoliated most of the tamarisk (albeit with some small shoots greening up at the base of tamarisk snags). Yet, it appears that there is much that can be done to restore the property.

Figure 1. Landscape view of the Bedrock BioBlitz project location.

Wildlife habitat restoration projects are often initiated with the objective of increasing habitat suitability for a single species or suite of species. Often, it is assumed that habitat restoration for a focal species will concomitantly benefit the habitat for other wildlife species as well. Biological assessments that have a broad scope of inquiry are required in order to determine the full effect a restoration project has on wildlife. However, this critical phase of restoration is often omitted; mainly due to the time and expense required to implement a comprehensive baseline inventory and monitoring program. As I worked with the landowner, it became evident that she was very interested and passionate about environmental education and scientific research. It was this revelation that inspired me to begin a conversation with her about monitoring her property before we consider management options.

As a novel approach to address this restoration requisite, I suggested we emulate the BioBlitz strategy to establish a baseline inventory of the property. By using the BioBlitz approach, I hoped to gather multiple experts from a variety of ecological disciplines to inventory as many members of the natural community as possible. Ultimately, this baseline inventory will help us to select management objectives and provide a yardstick to compare future changes by. We plan to continue using the BioBlitz approach to collaboratively monitor the environment through time and to guide subsequent management choices. In this way, we hope it will serve as an example of adaptive management for restoration projects.

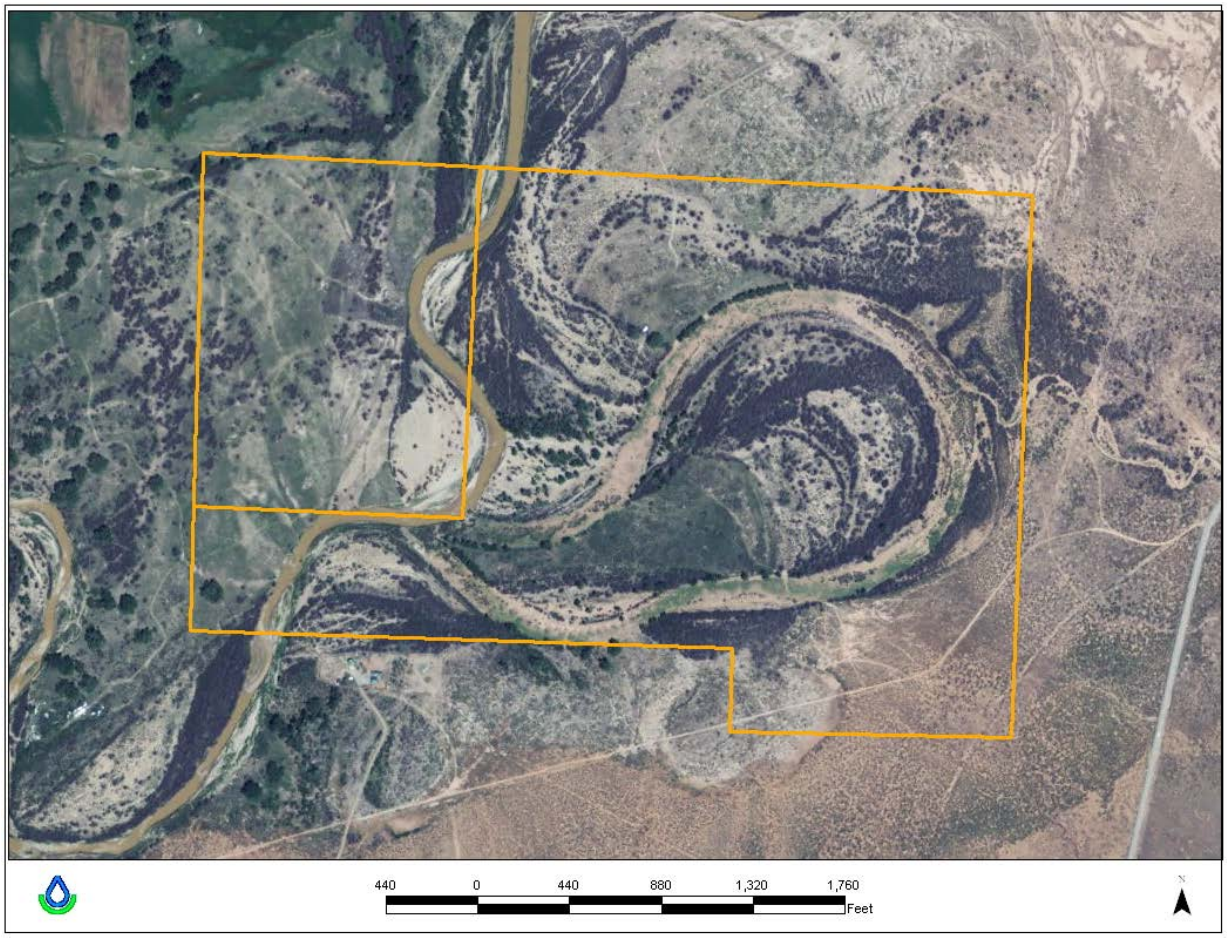


Figure 2. Aerial view of the Bedrock BioBlitz project location.

In addition, the BioBlitz concept lends itself well to local environmental and natural history education for schools and communities. The project facilitates experiential learning and compliments standards-based curriculum in science, math, geography and language arts. Elementary through university level students and community members will have the opportunity to experience how scientists practice in the field and assist them as a service learning project. These place-based learning activities will enhance participants' understanding of the local environment and perhaps instill a sense of responsibility and stewardship. By being better stewards, they are able to make decisions that are socially, economically, and ecologically sound.

Two BioBlitz's have been conducted at the Bedrock property this year. The first was on 5-8 May 2012 and was timed to capture spring migration and early wildlife activity and to document the early growing season condition of vegetation. The results of this first BioBlitz were included in the Interim report submitted 23 July 2012. The second BioBlitz was conducted on 27-30 September 2012 and was timed to capture fall wildlife activity and to document how vegetation responded to summer growing conditions.

This BioBlitz was coordinated to include participation from Naturita Middle School, Nucla High School, and Fort Lewis College students and teachers.

Partners that were involved in the September Bedrock BioBlitz included:

- Private Landowner – Vicki Phelps (Teacher)
    - Assisted in setting traps and collecting field data
    - 10 Naturita Middle School and 2 Nucla High School students
    - 2 Naturita Middle School teachers
- Private Citizen – Coen Dexter (Field Ornithologists)
    - Assisted with area bird surveys
- Colorado Parks and Wildlife – Chris Kloster and Evan Phillips (Conservation Biologists)
    - Assisted in setting traps, track plates, and camera traps
    - Loaned two acoustic recorders and analyzed bat echolocation calls
    - Mist netted for bats
- Fort Lewis College – Erin Lehmer (Biology Assistant Professor)
    - Loaned 140 small mammal traps
    - 19 Wildlife Management students
- Mountain Studies Institute – Chris Peltz (Research Coordinator)
    - Loaned four digital, motion activated, camera traps

Prior to the Bedrock BioBlitz, the landowner initiated wildlife habitat restoration project planning with:

- Natural Resources Conservation Service – Martin Moses, Jim Boyd, Steve Woodis
    - Ongoing restoration planning
- Dolores River Restoration Partnership – Peter Mueller (Representative from The Nature Conservancy)
    - Ongoing restoration planning
- Goebel & Associates (Jeff Goebel)
    - Facilitating Holistic Management planning – ongoing
- Soil Carbon Coalition (Peter Donovan)
    - Collected and analyzed soil samples for carbon sequestration - 18 Mar 2012

Habitat Stratification

The habitat on the Bedrock BioBlitz property was stratified by vegetation canopy type and wildlife inventory methods were placed at random or logistically feasible locations (depending on inventory method) in representative habitat across the project location (Figure 3). Due to access limitation, the property on the west side of the Dolores River was excluded from the inventory (botanical and bird surveys were conducted across the entire property east of the Dolores River). The stratification resulted in seven habitat types including the Dolores River (Table 1 and Figure 4). The most dominant habitat type was Tamarisk (66.1 ac, 41%), which was mostly standing dead as a result of recent Tamarisk Leaf Beetle (*Diorhabda carinulata*) infestation. There is some weak re-growth occurring. The least dominant habitat type was Willow (1.2 ac, 1%).

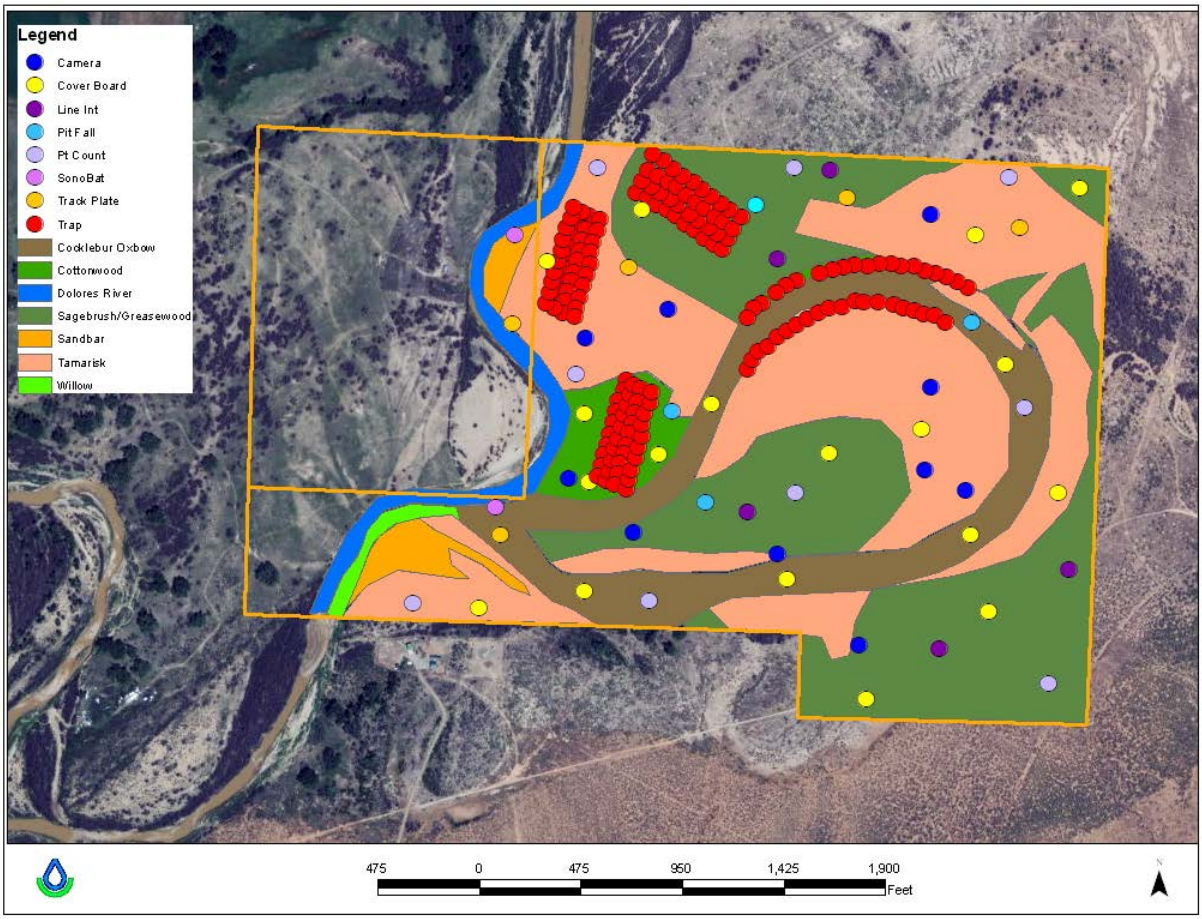


Figure 3. Stratified habitat based on vegetation types and locations of wildlife inventory methods east of the Dolores River at the Bedrock BioBlitz (inventory methods expanded, see below for details).

Table 1. Stratified habitat types based on vegetation and their corresponding area east of the Dolores River at the Bedrock BioBlitz.

Habitat Type	Area (ac)
Tamarisk	66.1
Sagebrush/Greasewood	55.9
Cocklebur Oxbow	23.1
Cottonwood	7.1
Dolores River	5.7
Sandbar	3.7
Willow	1.2
Total	162.8

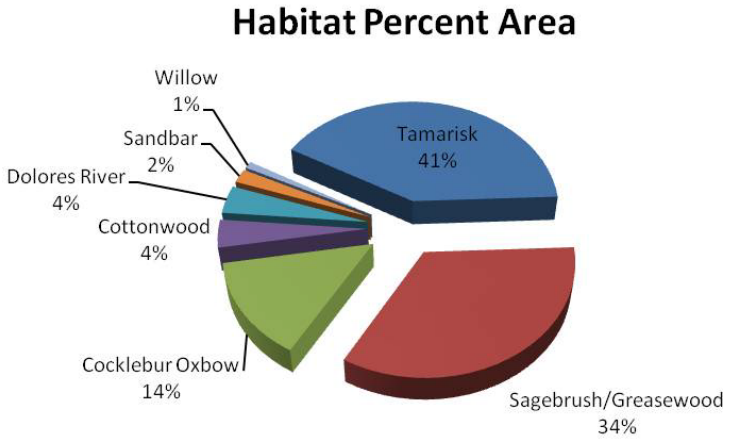


Figure 4. Percent area that each habitat type covered at the Bedrock BioBlitz.

Vegetation Cover

A quantitative measurement of vegetation within each habitat was planned; unfortunately, during the course of the wildlife inventory I was not able to collect this information. I still plan to collect vegetation cover in the future (prior to restoration treatment) and will use the following method. Twenty cover board plots, five plots randomly placed in Tamarisk, Sagebrush/Greasewood, Cocklebur Oxbow, and Cottonwood habitat types, will be established to estimate vertical cover. Cover boards will be 6.5ft tall and 1ft wide with alternating white and black bands 1.6ft wide, colored bands will be considered layers. Cover estimates, in each of the cardinal directions, will be made 15ft away from a central point 3ft high by estimating the percent cover of each layer by vegetative species. Total percent cover and species percent cover by layer will then calculated for each plot. Cover values will be compared between habitat types and pre- and post-restoration treatment using Randomization Test of Independence.

Wildlife Inventory

Small Mammal Trapping

Small mammal trapping was expanded to include an additional grid (40 more traps). On 27 September 2012, small mammal trapping grids were set-up in Tamarisk, Sagebrush/ Greasewood and Cocklebur Oxbow-Cottonwood, and Cottonwood habitat (Figure 5). Trapping grids were arranged into four transects spaced 50ft apart with 10 traps per transect spaced 50ft apart; in Cocklebur Oxbow the grid was two parallel trap lines on either side of the oxbow bank (Figure 3). Traps were opened at dusk and baited with peanut butter/oatmeal mixture then checked and closed at dawn. Captured individuals were collected at a central processing station and were ear tagged, weighed, sex and reproductive condition were determined, and body, tail, and foot lengths were recorded; individuals were then released at initial point of capture.

Figure 5. From left: Fort Lewis College Wildlife Management students set-up small mammal traps, Dr. Erin Lehmer and Fort Lewis College Wildlife Management students tag, weigh, and measure small mammals, Ord's Kangaroo Rat (*Dipodomys ordii*) at the Bedrock BioBlitz.

Abundance estimates were able to be calculated using the Schanbel Estimator:

$$N = \Sigma (M_t C_t) / ((\Sigma R_t)+1),$$

where N = approximate maximum likelihood estimate of closed population abundance estimator, M_t = number of marked animals in the population just before the (t) sample is taken, C_t = total number of individuals caught in sample (t), R_t = number of individuals already marked when caught in sample (t).

Overall, only two species were captured Deer Mouse (*Peromyscus maniculatus*) and Ord's Kangaroo Rat (*Dipodomys ordii*). Nine individual Deer Mice were captured, two were recaptured once and one was recaptured twice. One Ord's Kangaroo Rat was captured (Table 2).

Table 2. Small mammals captured within Tamarisk, Sagebrush/ Greasewood, Cocklebur Oxbow – Cottonwood, and Cottonwood habitat types during 27-30 September 2012 at the Bedrock BioBlitz. PEMA = *Peromyscus maniculatus*; DIOR = *Dipodomys ordii*; i= initial capture; r= recapture

Habitat Type	28 Sept 12		29 Sept 12		30 Sept 12		Total	
	PEMA	DIOR	PEMA	DIOR	PEMA	DIOR	PEMA	DIOR
Tamarisk	2i	0	1i 1r	0	1r	0	3i 2r	0
Sagebrush/ Greasewood	1i	0	1r	0	1i	1i	2i 1r	1i
Cocklebur Oxbow – Cottonwood	2i	0	0	0	1i 1r	0	3i 1r	0
Cottonwood	0	0	1i	0	0	0	1i	0
Total	5i	0	2i2r	0	2i2r	1	9i 4r	1i

Abundance estimates were only calculated for Deer Mouse and all estimates were less than the minimum number known alive, which is the tally of initially captured individuals (Table 3). This is probably the result of low numbers captured. Because of the low numbers, no further analyses were calculated.

Table 3. Abundance estimates for small mammals captured within Tamarisk, Sagebrush/ Greasewood, Cocklebur Oxbow – Cottonwood, and Cottonwood habitat types during 27-30 September 2012 at the Bedrock BioBlitz. PEMA = *Peromyscus maniculatus*; DIOR = *Dipodomys ordii*

Habitat Type	Schnabel Abundance Estimate	Minimum Number Known Alive
	PEMA	PEMA
Tamarisk	2.3	3
Sagebrush/ Greasewood	1	2
Cocklebur Oxbow – Cottonwood	2	3
Cottonwood	0	1

Bird Point Counts and Area Bird Survey

On 30 September 2012, a walking area bird survey was conducted across all habitat types east of the Dolores River (Figure 6 and 7). Walking surveys were conducted at dawn. Random direction transects were walked short distances and identified species were tallied. Visual and audible observations were used to identify species. On 28 and 29 September 2012, nine point count plots (three plots randomly located within Tamarisk, Sagebrush/ Greasewood, and Cocklebur Oxbow habitat types) were visited at sunrise to survey for bird species (Figure 3). During point count surveys, observers quietly approached a plot then observed (visual and auditory) and tallied birds within 164ft, further than 164ft, or flying over (Figure 6 and 8). Twenty-one species were observed on the area bird survey and 23 species were observed during point count survey; 10 species were common between both surveys (Figure 7 and 8). When compared to the May Bedrock BioBlitz, there were 34 less species observed in September. Fifteen species were observed during both May and September BioBlitz's (i.e. 40 unique species observed in May and 6 unique species observed in September). This difference likely arises from the different migration seasons and the level of effort/ expertise available for the surveys. However, it is interesting that most of the unique species observed in May were neo-tropical migrants and the unique species observed in September were elevational migrants.

Figure 6. From left: Coen Dexter leading walking survey for birds, point count survey with Fort Lewis College Wildlife Management students, and Coen Dexter using spotting scope to observe birds with Naturita Middle School students at the Bedrock BioBlitz.

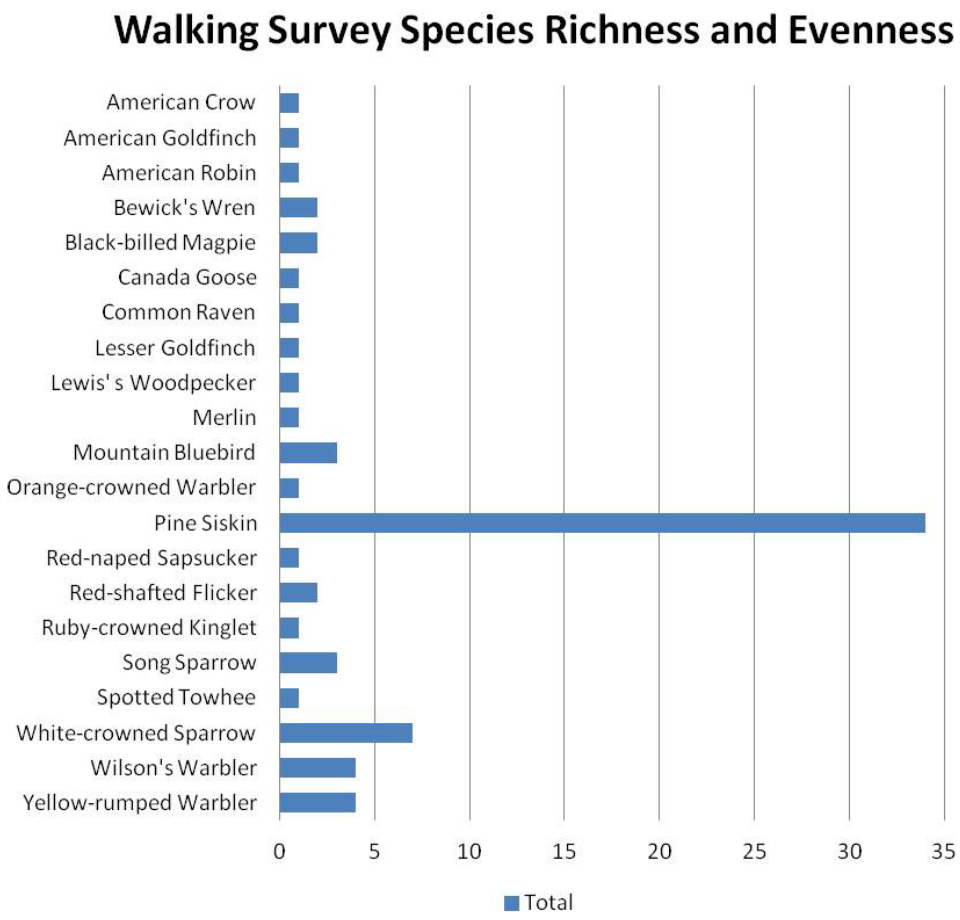


Figure 7. Bird species richness and evenness from walking survey across the entire property at the Bedrock BioBlitz.

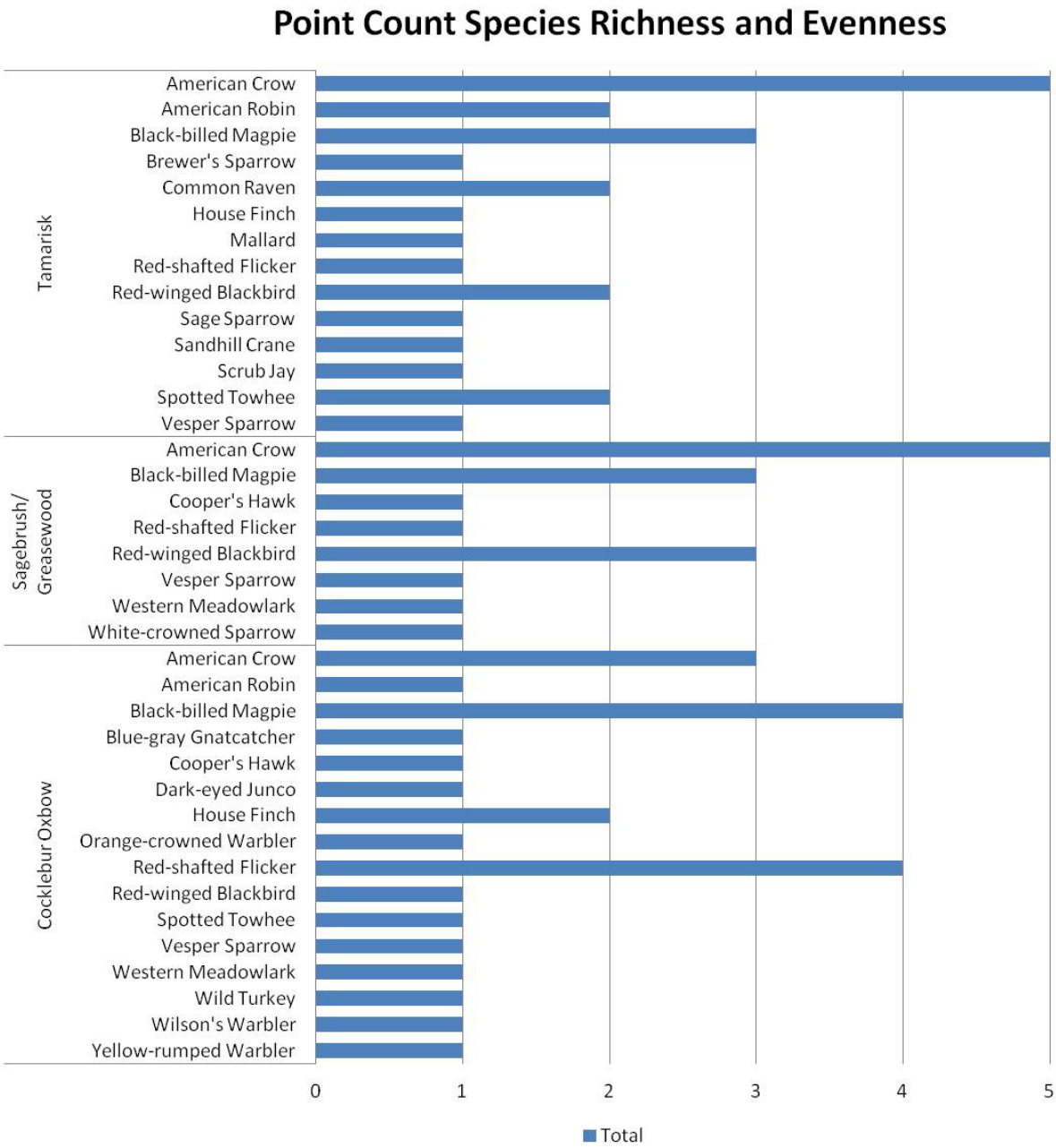


Figure 8. Bird species richness and evenness from point count surveys across the three most dominant habitat types at the Bedrock BioBlitz.

Acoustic Recording and Mist Netting for Bats

On 27 September 2012, two (North and South) bat echolocation acoustic recorders were mounted on 5ft posts placed along the Dolores River (Figure 3). Recorders were active for two nights and the data was analyzed using SonoBat software. SonoBat software analyzes the frequency and pattern of bat echolocation signals and identifies species by matching the signals to specific calls. Sonobat software was able to distinguish 483 calls from six species across both acoustic recorders. The North recorder collected 345 calls from four species and the South recorder collected 138 calls from 6 species (Table 4). In addition, a 30ft mist-net was setup across the Dolores River and operated for two nights to capture bats during forage and watering bouts. Only one bat, Canyon Bat (*Parastrellus hesperus*), was captured, which occurred on the second night of netting (Figure 9). When compared to the May Bedrock BioBlitz,

there were more calls (483 in Sept vs 185 in May) but two less species (6 in Sept vs 8 in May) in September. Five species were common between the two samples (Canyon Bat, Yuma Myotis, Little Brown Bat, Western Small-footed Myotis, and Hoary Bat), one species was only in September (Fringed Myotis) and three were only in May (Brazilian Free-tailed Bat, Big Brown Bat, and Silver-haired Bat).

Table 4. Bat calls recorded along Dolores River during 27-28 September 2012 at the Bedrock BioBlitz.

Location	Common Name	Scientific Name	Number of Calls
North	Canyon Bat	*Parastrellus hesperus*	190
North	Yuma Myotis	*Myotis yumanensis*	131
North	Little Brown Bat	*Myotis lucifugus*	21
North	Fringed Myotis	*Myotis thysanodes*	3
South	Canyon Bat	*Parastrellus hesperus*	89
South	Yuma Myotis	*Myotis yumanensis*	32
South	Fringed Myotis	*Myotis thysanodes*	10
South	Western Small-footed Myotis	*Myotis ciliolabrum*	4
South	Hoary Bat	*Lasiurus cinereus*	2
South	Little Brown Bat	*Myotis lucifugus*	1
Richness	**6 Species**		**483**

Figure 9. Fort Lewis College Wildlife Management students examine a Canyon Bat that was caught in a mist over the Dolores River at the Bedrock BioBlitz.

Track Plates

On 27 September 2012, five track plates were prepared and placed in the three most dominant habitat types (Figure 3). Track plates were made of 3ft by 4ft sheet metal with 1in by 1in wood runners attached to underside to add stability along the long edge and were prepared by misting with water and dusting with carpenters chalk (Figure 10). Track plates were placed on level ground and a can of wet cat food was dumped into the center to serve as a scent attractant; track plates were cleaned and re-set after a visitation occurred. Track plates were active for three nights and resulted in nine detections of three species: Coyote (*Canis latrans*), Bobcat (*Lynx rufus*), Desert Cottontail (*Sylilvagus audubonii*), and a Black-billed Magpie (*Pica hudsonia*) (Figure 11). On another track plate in Tamarisk unknown bird tracks and possibly tracks along with a scat pellet were visible in the chalk dust. No further analysis was conducted.

Figure 10. Martin Moses, Fort Lewis College Wildlife Management students (left) and Naturita Middle School students (right) set up track plates at the Bedrock BioBlitz.

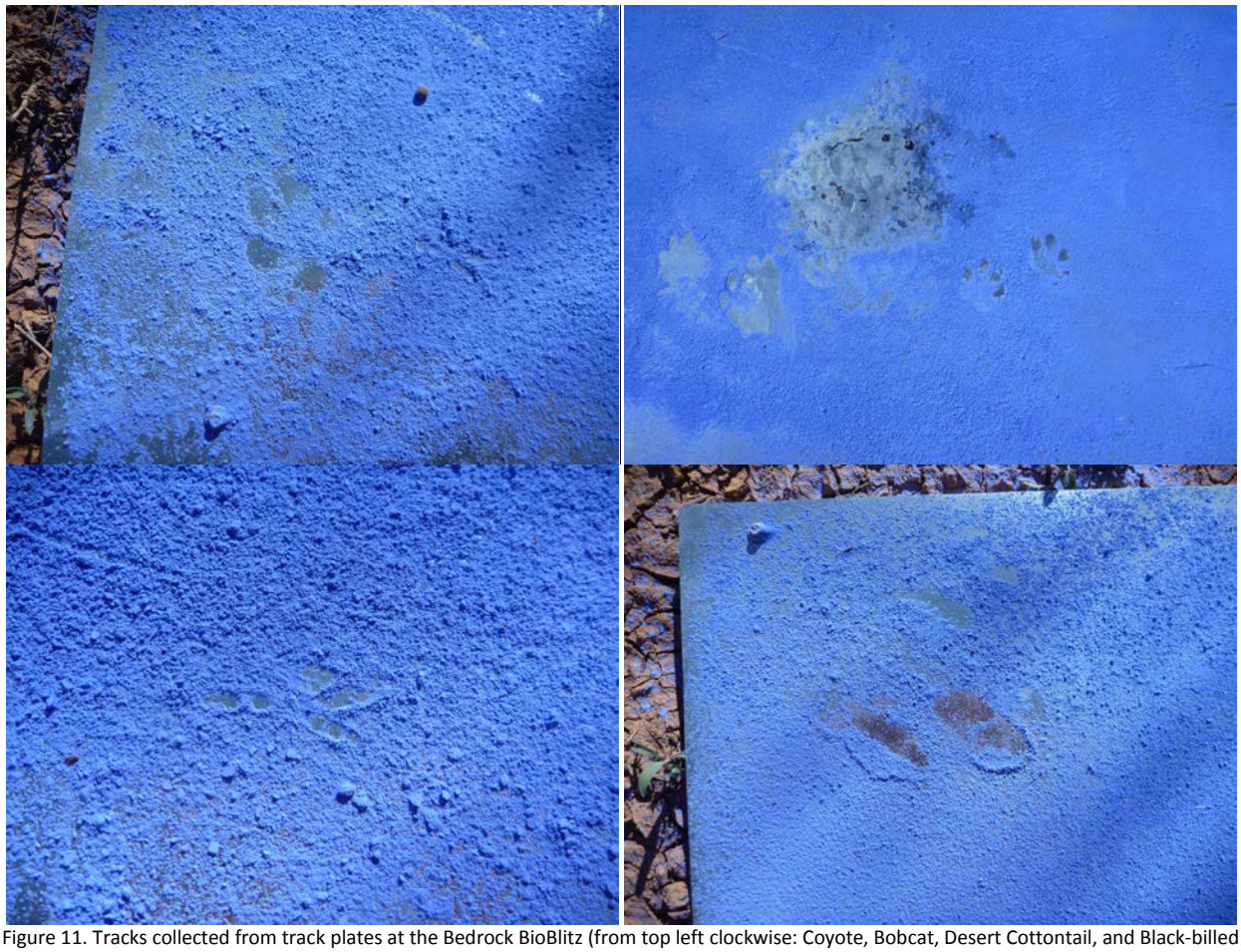


Figure 11. Tracks collected from track plates at the Bedrock BioBlitz (from top left clockwise: Coyote, Bobcat, Desert Cottontail, and Black-billed Magpie).

Drift Fence Pit Fall Trapping

On 27 September 2012, four drift fence pit fall trap arrays were established in the three most dominant habitat types (Figure 3). Drift fence pit fall trap arrays had three wings that were made of 10ft by 15in

aluminum flashing with wooden stakes at each end. Four buckets, 12in deep, were buried at the center and at the end of each wing of the array (Figure 12). Twenty one different insect species were collected from the pit fall traps. Three species occurred in all habitat types, seven species occurred in two habitat types, and 11 species were found in only one habitat type (Figure 13).

Figure 12. Martin Moses, Fort Lewis College Wildlife Management, and Naturita Middle School students check drift fence pit fall traps (left and middle) and examine a Jerusalem Cricket (*Stenopelmatus fuscus*) at the Bedrock BioBlitz.

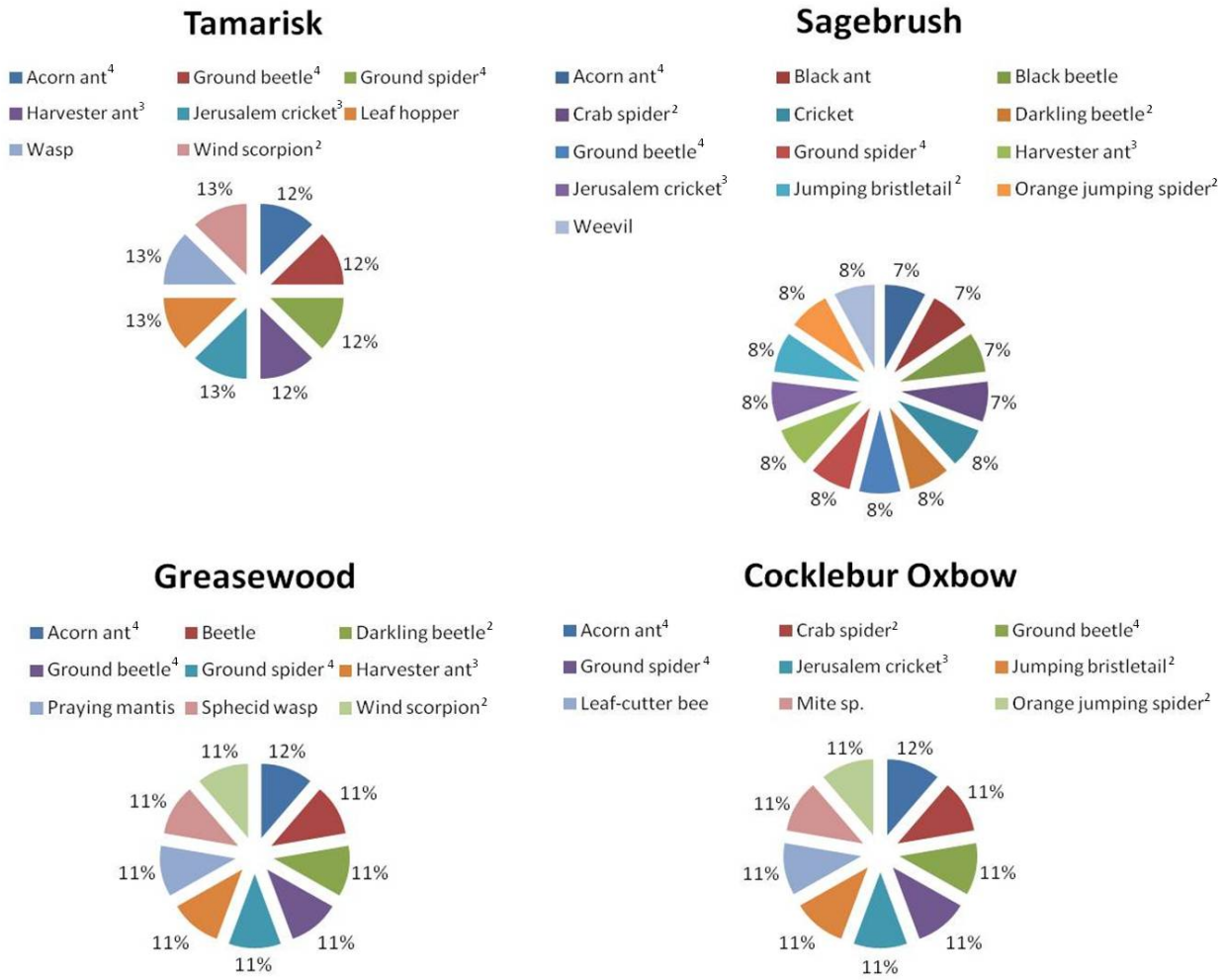


Figure 13. Arthropod species richness and relative composition for the three dominant habitat types (Sagebrush/Greasewood habitat was divided into two based on primary local canopy cover) at the Bedrock BioBlitz.

Camera Trapping

On 27 September 2012, 10 digital, motion activated, camera traps were placed across the three dominant habitat types (figure 3). The cameras were mounted on a stake approximately 1.5ft off the ground and a can of punctured cat food that served as a scent attractant was staked to the ground approximately 10ft in front of the camera trap (Figure 14). Camera traps were set-up to take three consecutive pictures when activated, this constituted an event and any observation during an event is considered one occurrence. The 10 camera traps recorded 273 pictures over 91 events. However, all events were empty except one, which was an occurrence of Striped Skunk (*Mephitis mephitis*), and was taken in Sagebrush/ Greasewood habitat (Figure 14). No further analysis was conducted.

Figure 14. Typical camera trap (left) and Striped Skunk (*Mephitis mephitis*) (right) photo taken in Sagebrush/Greasewood habitat at the Bedrock BioBlitz.

Anecdotal

In addition to the above report field data, several anecdotal observations were made. A Northern Leopard Frog (*Rana pipens*) was observed along the Dolores River, Raccoon (*Procyon lotor*) tracks were found along Dolores River, a cow Elk (*Cervus canadesis*) was flushed out of Tamarisk cover, a bull bugled from Tamarisk, and scat/tracks/rubs was found at several locations, Mule Deer (*Odocoileus hemionus*) tracks and scat were found at several locations, a Northern Harrier (*Circus cyaneus*) was flushed from Tamarisk, two Monarch (*Danaus plexippus*) observations in Sagebrush/Greasewood, Kangaroo Rat mounds were found at several locations in Sagebrush/Greasewood, Black-tailed Jackrabbit (*Lepus californicus*) was observed in Sagebrush/ Greasewood, Black and Yellow Garden Spider (*Argiope aurantia*) was observed in Sagebrush/ Greasewood, and a Solder Beetle (*Chauliognathus basalis*) was observed on Rubber Rabbitbrush.

Next Steps

The landowner is currently planning the restoration stategy, timing, and funding. In preliminary discussions, the restoration project was going to consider entire or partial livestock exclusion, partial dead tamarisk removal, native tree plantings, native herbaceous vegetation plantings, streambank stabilization, and oxbow wetland enhancement. The Natural Resources Conservation Service will plan the restoration treatments and work is anticipated to begin in 2013. This restoration project is only one of many that will occur along the Dolores River. The Dolores River Restoration Partnership (http://ocs.fortlewis.edu/drrp/), a collaborative effort among Federal, State, and County governments along with non-profit organizations, is currently working across jurisdictional boundaries to eradicate non-native and restore native riparian vegetation in the Dolores River watershed. Response in the

biological community resulting from the restoration treatment will be documented through the Bedrock BioBlitz. These results will be shared with the Dolores River Restoration Partnership through internal documentation and with the broad restoration community through the Wildlife and Habitat Restoration Working Group of The Wildlife Society (http://joomla.wildlife.org/habitatrestoration/index.php), and the Colorado Plateau Conservation Registry (http://cpcesu.conservationregistry.org/). This information should prove useful in an adaptive management framework as future riparian restoration projects will better anticipate the effect of treatment on the wildlife community and modify restoration actions to benefit biodiversity.

Lois Webster Fund

The $1500 grant request that was funded by the Lois Webster Fund permitted the acquisition of material necessary to conduct the Bedrock BioBlitz (Table 5).

Table 5. Supplied acquired using funds from Lois Webster Fund to conduct the Bedrock BioBlitiz.

Item	Quantity	Purpose
Sweet Feed Grain	25lbs	Bait for small mammal traps
Plastic Baggies	25	Handling small mammals
Hair Dye	2	Temporarily mark small mammals (did not use)
3ftx4ft Sheet Metal	5	Track plates
1inx1inx8ft Furring Strip	6	Stabilize track plates
Blue Carpenters Chalk	10lbs	Dusting track plates
Spray Bottle	1	Mist track plates
Packaging Tape	1	Transfer prints From tack plates (did not use)
Trail Cameras	6	Camera traps
4gb Memory Cards	6	Camera traps
AA Batteries	36	Camera traps
D Batteries	24	Camera traps
12in Spikes	18	Setting scent attractant for camera traps
Cat Food	24	Scent attractant for camera traps and track plates
2ft Wooden Stake	60	Constructing camera trap mounts, supporting drift fence
Mini Bungee Cords	16	Mounting camera traps
14inx10ft Flashing	12	Drift fences
2Gal Buckets	16	Pit fall traps
Bolts, Nuts, Screws	25	Construction material
Plywood	1	Construct cover boards
Spray Paint	4	Black and white for cover boards
Rebar stakes	25	Permanently mark vegetation surveys
Soil Carbon Test	1	Baseline plot-3 depths, data processing

Appendix 1. Soil Carbon Test
Appendix 2. Interim Report

VP report: 10/11/2012

This baseline data report has been generated by a query to the table in which the Soil Carbon Challenge data is stored.

The baseline data is **self-referential.** It does not mean that your management is good, bad, or indifferent. It is a starting point of repeatable monitoring. By repeating this monitoring in several years, change in soil carbon can be detected and measured.

Because soils may vary considerably over short distances, the baseline data may not be applicable to an entire pasture, field, or farm.

The tops and bottoms of soil probe samples (depths) are reported in centimeters (0 cm = soil surface).

Percent total carbon is reported. Remember, soils may contain significant percentages of inorganic carbon (carbonates, CaCO3, caliche), particularly soils that have formed on limestone. It is common for the percentage of carbonates to increase with depth. Where carbonates are present, the total carbon test **does not** translate to organic matter. However, the change in total carbon over time can usually be attributed to changes in organic matter, and that is what the Soil Carbon Challenge is designed to detect and measure.

For soils that **do not** contain carbonates, multiply by 1.7 to approximate the percentage of organic matter.

The date of each sample or observation, and the person reporting it or analyzing it, are noted for each data point. In general, the label for the data (such as %C=) precedes the data itself. Care has been taken to ensure that these observations can be *repeated with consistency* in the future. For methods used, see soilcarboncoalition.org/files/MeasuringSoilCarbonChange.pdf. For comments or corrections, please contact:

Peter Donovan
541-263-1888 (usually on Pacific time)
info@soilcarboncoalition.org

When plots are resampled, the reports will include the degree and direction of change. In the meantime, plot data can also be viewed by means of the MAP:
soilcarboncoalition.org/changemap.htm

Plot report for:
VP generate

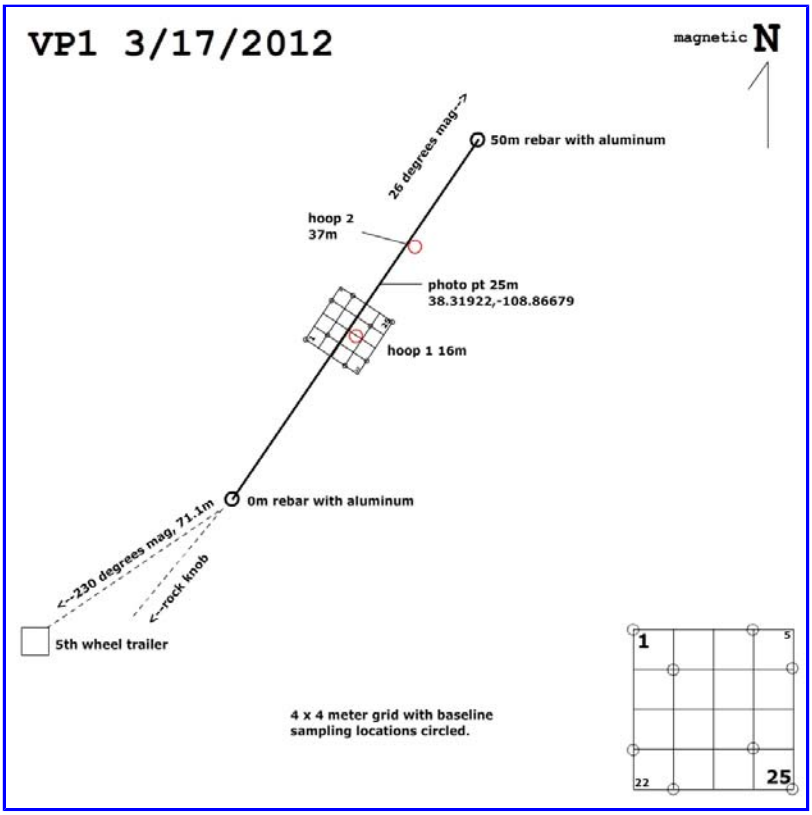
VP1	plot description	% carbon, 0-10 cm:	2.01	% carbon, 10-25 cm:	2.11	% carbon, 25-40 cm:	1.79	tons C/ha:	100

3/17/2012 Peter Donovan

Flat site in vicinity of Dolores River oxbow. Sandy loam, containing carbonates, no worms observed, darker color < 10 cm. Uncontrolled grazing at baseline.

VP1 map

3/17/2012 Peter Donovan



VP1 photo

3/17/2012 Peter Donovan

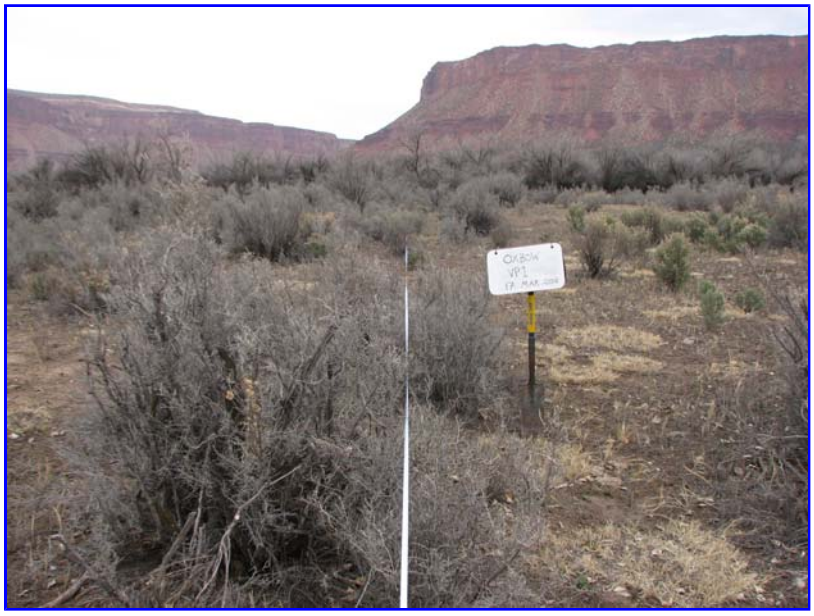
SSW along transect

VP1 photo

3/17/2012 Peter Donovan 

SSW along transect

VP1 photo

3/17/2012 Peter Donovan 
NNE along transect

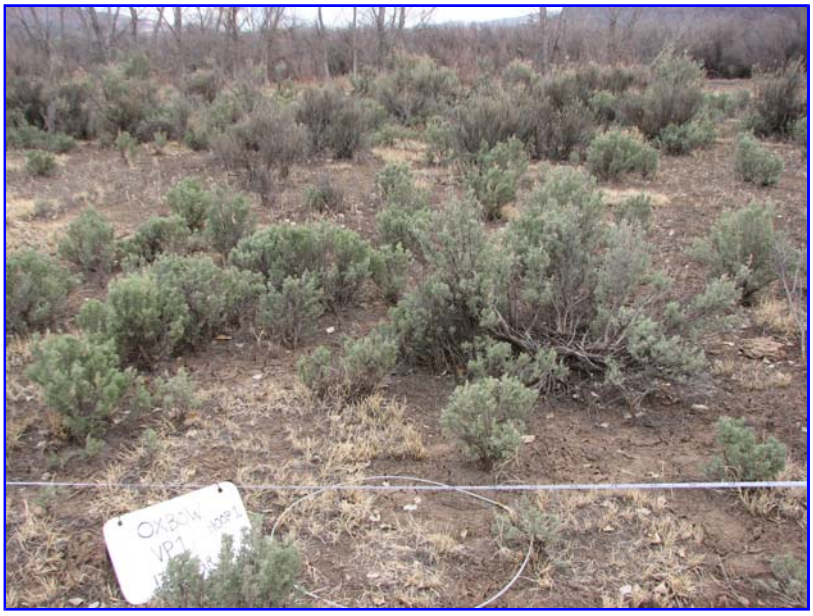
VP1 photo %bare= 32 %basal= 18.5 %canopy/litter= 49.5

3/17/2012 Peter Donovan

hoop 1, 16m

VP1 photo

3/17/2012 Peter Donovan



hoop 1, 16m, step back looking SSE

VP1 photo %bare= 90 %basal= 1 %canopy/litter= 9

3/17/2012 Peter Donovan

hoop 2, 37m

VP1 photo

3/17/2012 Peter Donovan

hoop 2, 37m, step back looking SSE

VP1A1BD bulk density top= 4 bottom= 8 dry wt, g= 201 cm3= 183.5 bulk density= 1.1
3/17/2012 Peter Donovan

VP1B1BD bulk density top= 14 bottom= 18 dry wt, g= 277.5 cm3= 211.1 bulk density= 1.31
3/17/2012 Peter Donovan

VP1C1BD bulk density top= 28 bottom= 32 dry wt, g= 322.2 cm3= 237.6 bulk density= 1.36
3/17/2012 Peter Donovan

VP1A bulked probe sample top= 0 bottom= 10 %C= 2.01 %N= 0.19 C/N= 10.83

3/17/2012	Utah State University Analytical Lab										
VP1B	bulked probe sample	top=	10	bottom=	25	%C=	2.11	%N=	0.08	C/N=	26.12
3/17/2012	Utah State University Analytical Lab										
VP1C	bulked probe sample	top=	25	bottom=	40	%C=	1.79	%N=	0.11	C/N=	16.41
3/17/2012	Utah State University Analytical Lab										
VP1	minidisk infiltration	tension (cm)=	1	1st minute (ml)=	9	near surface					
3/17/2012	Peter Donovan										
VP1	minidisk infiltration	tension (cm)=	1	1st minute (ml)=	8	near surface					
3/17/2012	Peter Donovan										
VP1	minidisk infiltration	tension (cm)=	1	1st minute (ml)=	5	35 cm in pit					
3/17/2012	Peter Donovan										
VP1	ring infiltration	minutes=	2	mm=	10	mm/min=	5				
3/17/2012	Peter Donovan										
VP1	plants										
3/17/2012	Peter Donovan, Vicki Phelps	sagebrush, rabbitbrush, greasewood, alkali sacaton, muhly, aster, mustard, wild carrot, a cool season grass, cheatgrass, buckwheat									

Bedrock BioBlitz: Monitoring Riparian Restoration for Adaptive Management

(Interim Report 23 July 2012)

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In March 2012, I initiated a Doodle Poll among interested partners in order to determine a date on which to initiate the Bedrock BioBlitz. A consensus was reach by the majority of partners to meet at the Bedrock property (Figures 1 and 2) on 5 May 2012 and conduct inventories through 8 May 2012. This time frame also facilitated detection of migrating birds and provided a "snap-shot" of what spring vegetation conditions were. Unfortunately, coordination with local schools did not work out because the school year was concluding; however I am currently planning with local school contacts to include students for the upcoming early fall 2012 BioBlitz.

Figure 1. Landscape view of the Bedrock BioBlitz project location.

Partners that were involved in the May Bedrock BioBlitz included:

- Private Landowner – Vicki Phelps (Teacher)
  - Assisted in setting traps and collecting field data
- Rocky Mountain Bird Observatory – Jason Beason and Josh Kreitzer (Ornithologists)
  - Coordinated area bird surveys
- Private field ornithologists – Coen Dexter and Brenda Wright
  - Assisted with area bird surveys
- Colorado Parks and Wildlife – Evan Phillips (Conservation Biologist)
  - Assisted in setting traps, track plates, and camera traps
  - Loaned two acoustic recorders and analyzed bat echolocation calls
- Colorado Natural Heritage Program – Peggy Lyon (Botanist)
  - Coordinated area botanical survey
- Fort Lewis College – Erin Lehmer (Biology Assistant Professor)
  - Loaned 120 small mammal traps
- Mountain Studies Institute – Chris Peltz (Research Coordinator)
  - Loaned four digital, motion activated, camera traps
- Citizen – Glenn Sommer (Science teacher)
  - Assisted in collecting field data

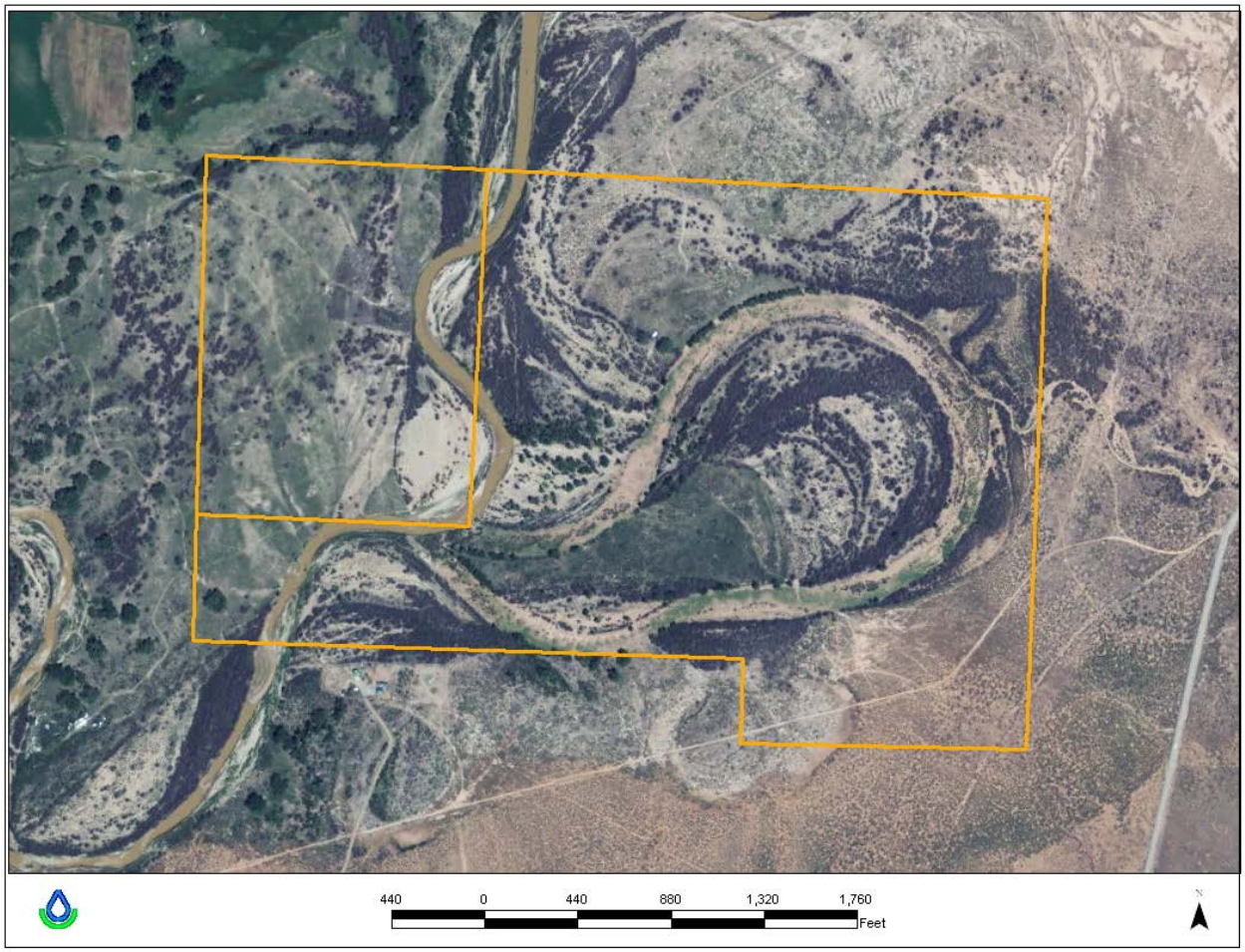

Figure 2. Aerial view of the Bedrock BioBlitz project location

The landowner initiated project planning and monitoring prior to the Bedrock BioBlitz:

- Natural Resources Conservation Service – Martin Moses, Jim Boyd, Steve Woodis
    - Ongoing restoration planning
- Dolores River Restoration Partnership – Peter Mueller (Representative from The Nature Conservancy)
    - Ongoing restoration planning
- Goebel & Associates (Jeff Goebel)
    - Facilitating Holistic Management planning – ongoing
- Soil Carbon Coalition (Peter Donovan)
    - Collected and analyzed soil samples for carbon sequestration - 18 Mar 2012

Habitat Stratification

The habitat on the Bedrock BioBlitz property was stratified by vegetation type and wildlife inventory methods were placed at logistically feasible locations in representative habitat across the project location (Figure 3). Due to access limitation, the property on the west side of the Dolores River was excluded from the inventory (botanical and bird surveys were conducted across the entire property east of the Dolores River). The stratification resulted in seven habitat types including the Dolores River (Table 1). The most dominant habitat type was Tamarisk (66.1 ac), which was mostly standing dead as a result

of recent Tamarisk Leaf Beetle (*Diorhabda carinulata*) infestation. There is some weak re-growth occurring. The least dominant habitat type was Willow (1.2 ac).

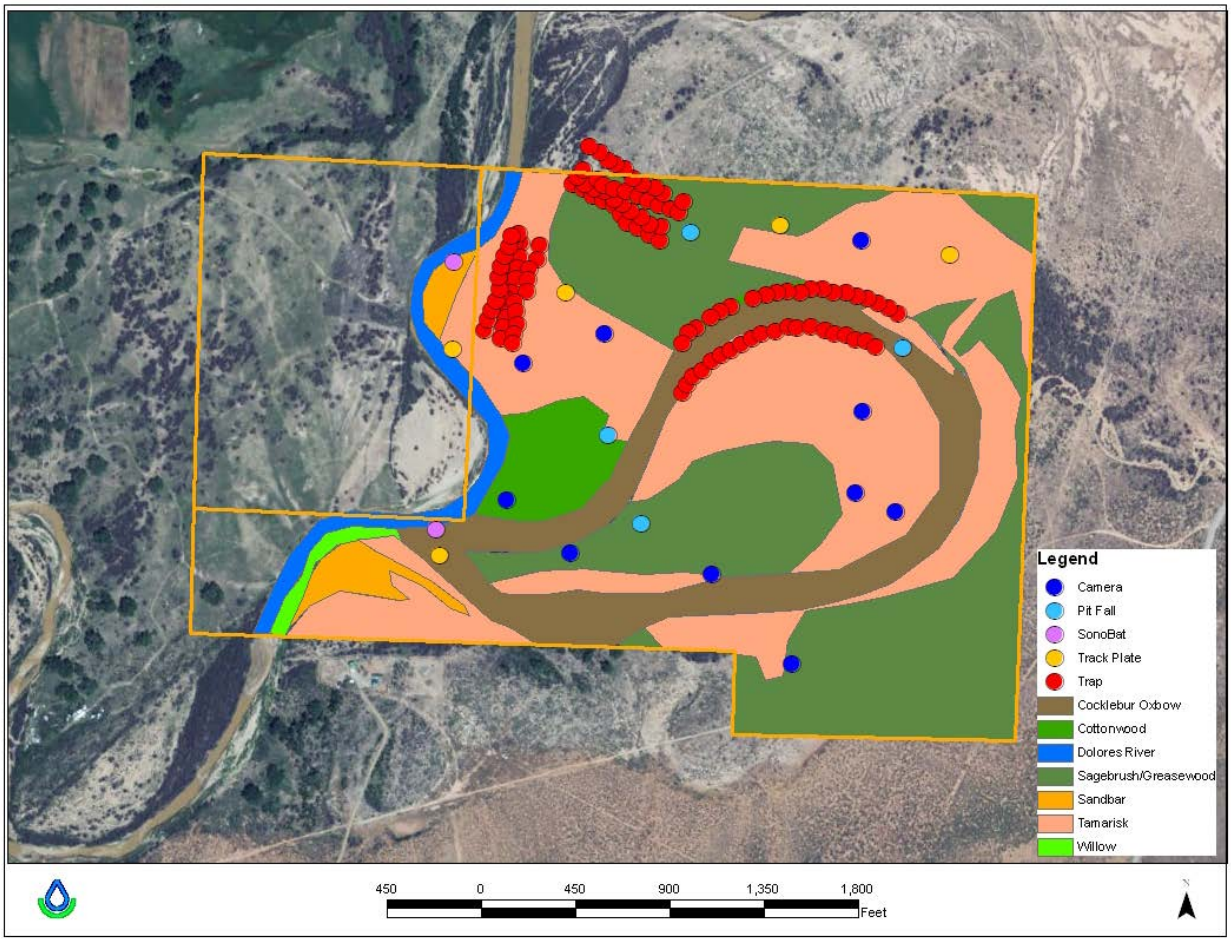

Figure 3. Stratified habitat based on vegetation types and locations of wildlife inventory methods east of the Dolores River at the Bedrock BioBlitz.

Table 1. Stratified habitat types based on vegetation and their corresponding area east of the Dolores River at the Bedrock BioBlitz.

Vegetation Type	Area (ac)
Tamarisk	66.1
Sagebrush/Greasewood	55.9
Cocklebur Oxbow	23.1
Cottonwood	7.1
Dolores River	5.7
Sandbar	3.7
Willow	1.2
Total	162.8

Vegetation Inventory

On 6 May 2012, the botanical survey provided a list of 46 readily identifiable species (Table 2). It should be taken into consideration that the botanical survey was conducted early in the year and after a dry spring; therefore plant identification was made without flowers or fruit. Further, it is likely that there are additional species present that were not sufficiently developed to permit identification. The dominant species were Tamarisk, Sagebrush, Greasewood, Sand Dropseed, and Russian Knapweed. The dominant grass, Sand Dropseed, should respond favorably to increased moisture and elimination of grazing. Desirable native species include Cottonwood, Coyote Willow, and New Mexico Privet.

Table 2. Plant list from botanical survey conducted on 6 May 2012 at Bedrock BioBlitz (non-native species are indicated in blue).

Scientific Name	Common Name
Trees	**Trees**
Populus deltoids	Rio Grande Cottonwood
Tamarix ramosissima	Tamarisk (Saltcedar)
Shrubs	**Shrubs**
Artemisia tridentata ssp. tridentata	Basin Big Sagebrush
Atriplex canescens	Fourwing Saltbush
Chrysothamnus linifolius	Spearleaf Rabbitbrush
Chrysothamnus nauseosus	Rubber Rabbitbrush
Chrysothamnus viscidiflorus	Yellow Rabbitbrush
Forestiera pubescens	New Mexico Privet
Opuntia polyacantha	Pricklypear Cactus
Rosa woodsii	Wood's Rose
Sarcobatus vermiculatus	Greasewood
Salix exigua	Coyote Willow
Suaeda torreyana	Mojave Seablite
Graminoids	**Graminoids**
Bromus tectorum	Downy Brome (Cheatgrass)
Distichlis spicata	Inland Saltgrass
Elymus elymoides	Bottlebrush Squirreltail
Eremopyrum triticeum	Annual Wheatgrass
Graminoids *cont.*	**Graminoids *cont.***
Pascopyrum smithii	Western Wheatgrass
Sporobolus cryptandrus	Sand Dropseed
Forbs	**Forbs**
Alyssum desertorum	Desert Madwort (Yellow Alyssum)
Asparagus officinalis	Wild Asparagus
Astragalus sp.	Milkvetch species
Centaureum repens	Russian Knapweed
Chaetopappa ericoides	Rose Heath
Chenopodium fremontii	Fremont's Goosefoot
Chorispora tenella	Crossflower
Corydalis aurea	Scrambled Eggs
Cryptantha minima	Little Cryptantha
Descurainia sophia	Herb Sophia
Erodium cicutarium	Redstem Stock's Bill
Gutierrezia sarothrae	Broom Snakeweed

Table 1 cont. Plant list from botanical survey conducted on 6 May 2012 at Bedrock BioBlitz (non-native species are indicated in blue).	
Halogeton glomeratus	Saltlover
Heterotheca villosa	Hairy False Goldenaster
Hymenopappus filifolius	Fineleaf Hymenopappus
Iva axillaris	Povertyweed
Bassia americana	Green Molly
Lappula redowskii	Flatspine Stickweed
Lepidium densiflorum	Common Pepperweed
Lepidium perfoliatum	Clasping Pepperweed
Melilotus officinalis	Sweetclover
Ranunculus testiculatus	Curveseed Butterwort
Rumex crispus	Curly Dock
Salsola australis	Prickly Russian Thistle
Sphaeralcea coccinea	Scarlet Globemallow
Taraxacum officinale	Common Dandelion
Xanthium strumarium	Rough Cocklebur

Wildlife Inventory

Small Mammal Trapping

On 5 May 2012, small mammal trapping grids were set-up in Sagebrush/ Greasewood and Cocklebur Oxbow-Cottonwood habitat and on 6 May 2012 a trapping grid was set-up in Tamarisk habitat (Figure 3 and 4). Trapping grids were arranged into four transects spaced 50ft apart with 10 traps per transect spaced 50ft apart (Figure 3). Trapping grids in sagebrush/ greasewood and cocklebur oxbow-cottonwood habitat were operated for three nights and the trapping grid in tamarisk habitat was operated for two nights. Traps were opened at dusk and baited with sweet feed grain mixture then checked and closed at dawn. I was not able to acquire any tagging devices in order to mark captured individuals, consequently I was unable to determine recapture status in order to estimate relative abundance. Overall, only two species were captured Deer Mouse (*Peromyscus maniculatus*) and Western Harvest Mouse (*Reithrodontomys megalotis*). Deer Mice were captured 26 times and Western Harvest Mice were captured nine times (Table 3). Seven traps had consecutive recaptures of Deer Mice.

Figure 4. Typical habitat structure where small mammal trapping grids were located at the Bedrock BioBlitz (from left: Sagebrush/ Greasewood, Cocklebur Oxbow – Cottonwood, and Tamarisk habitat).

Table 3. Small mammals captured within Sagebrush/ Greasewood, Cocklebur Oxbow – Cottonwood, and Tamarisk habitat types during 6 – 8 May 2012 at the Bedrock BioBlitz. PEMA = *Peromyscus maniculatus*; REME = *Reithrodontomys megalotis*

Habitat Type	6 May 12		7 May 12		8 May 12		Total	
	PEMA	REME	PEMA	REME	PEMA	REME	PEMA	REME
Sagebrush/ Greasewood	1	0	4	1	5	0	10	1
Cocklebur Oxbow – Cottonwood	0	0	6	1	8	3	14	4
Tamarisk	X	X	1	0	1	4	2	4
Total	1	0	11	2	14	7	26	9

Area Bird Survey

On 6 and 7 May 2012, a walking area bird survey was conducted across all habitat types east of the Dolores River. Walking surveys were conducted at dawn, at afternoon, and at dusk. Random direction transects were walked short distances and indentified species were tallied. Visual and audible observations were used to identify species. Fifty five species were observed (Table 4, Figure 5).

Table 4. Birds observed across all habitat types during 6-7 May 2012 at the Bedrock BioBlitz.

Species	Count	Species	Count
Violet-green Swallow	35	Bald Eagle	2
White-throated Swift	12	Western Screech-Owl	2
Spotted Towhee	10	Ash-throated Flycatcher	2
Yellow Warbler	10	Western Kingbird	2
Chipping Sparrow	10	Barn Swallow	2
Lazuli Bunting	9	Cliff Swallow	2
Pinyon Jay	8	Bewick's Wren	2
Violet-green Swallow	8	American Robin	2
Chipping Sparrow	8	European Starling	2
Lark Sparrow	8	Bullock's Oriole	2
Red-winged Blackbird	8	Green-winged Teal	1
Cliff Swallow	8	Ring-necked Pheasant	1
Brown-headed Cowbird	7	Great Blue Heron	1
American Crow	6	Sharp-shinned Hawk	1
Common Raven	5	Cooper's Hawk	1
Yellow Warbler	5	Greater Sandhill Crane	1
Canada Goose	4	Barn Owl	1
Turkey Vulture	4	Common Poorwill	1
Mourning Dove	4	Brewer's Sparrow	1
Black-billed Magpie	4	Song Sparrow	1
Yellow-rumped Warbler	4	Pine Siskin	1
Western Meadowlark	4	Eurasian Collared-Dove	1
Blue-gray Gnatcatcher	3	Long-eared Owl	1
Yellow-breasted Chat	3	Black-chinned Hummingbird	1
Common Grackle	3	Northern Rough-winged Swallow	1
House Finch	3	Purple Martin	1
Barn Swallow	3	Northern Mockingbird	1
Mallard	2		


Figure 5. One nesting Long-eared Owl and owlet in Cottonwood habitat at the Bedrock BioBlitz.

Acoustic Recording

On 6 May 2012, two high frequency bat echolocation acoustic recorders were mounted on 5ft posts placed along the Dolores River (Figure 3 and 6). One recorder was active for one night and one recorder was active for two nights. The single night recorder data has been downloaded and analyzed using SonoBat software. SonoBat software analyzes the frequency and pattern of bat echolocation signals and identifies species by matching the signals to specific calls. Eighty eight calls were recorded over a single night and represented seven bat species (Table 5).


Figure 6. Bat echolocation acoustic recorder placed along the Dolores River at the Bedrock BioBlitz.

Table 5. Bat calls recorded along Dolores River during 6-7 May 2012 at the Bedrock BioBlitz.

Common Name	Scientific Name	Number of Calls
Canyon Bat	*Parastrellus hesperus*	62
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	9
Silver-haired Bat	*Lasionycteris noctivagans*	7
Big Brown Bat	*Eptesicus fuscus*	6
Yuma Myotis	*Myotis yumanensis*	2
Western Small-footed Myotis	*Myotis ciliolabrum*	1
Myotis sp.	*Myotis* sp.	1
Total		88

Track Plates

On 6 May 2012, five track plates were prepared and placed in the three most dominant habitat types (Figure 3). Track plates were made of 3ft by 4ft sheet metal with 1in by 1in wood runners attached to underside to add stability along the long edge and were prepared by misting with water and dusting with carpenters chalk (Figure 7). Track plates were placed on level ground and a can of wet cat food was dumped into the center to serve as a scent attractant; track plates were cleaned and re-set after a visitation occurred. Track plates were active for two nights and resulted in two detections: one Coyote (*Canis latrans*) in Tamarisk and one skunk (*Mephitis* sp.) in Sagebrush/ Greasewood (Figure 8). On another track plate in Tamarisk bird wing tips were visible in the chalk dust and on the track plate in the Cocklebur Oxbow livestock (*Bos* sp.) lip/ lick smudges were evident.

Figure 7. Setting up track plate for Bedrock BioBlitz.

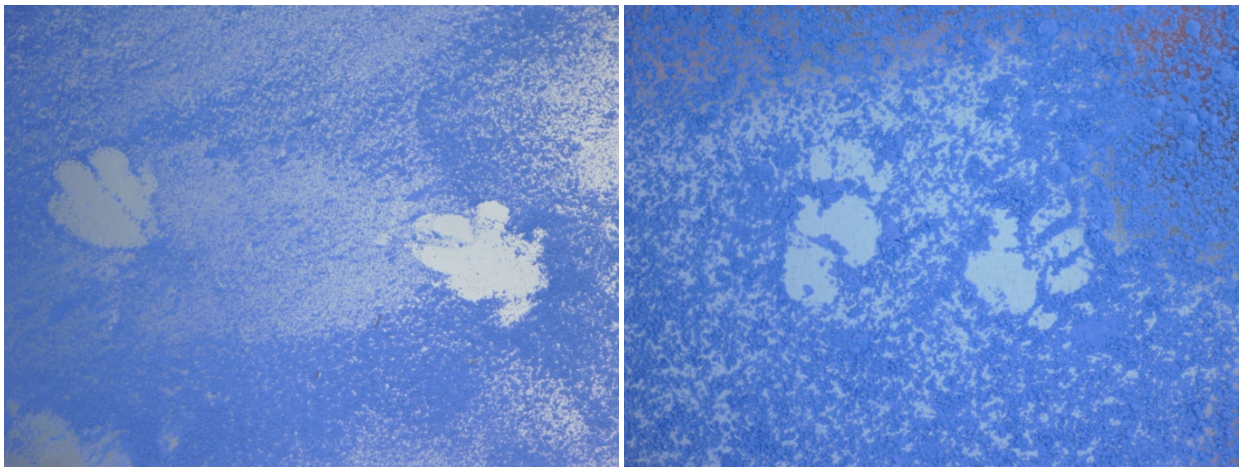

Figure 8. Tracks collected from track plates at the Bedrock BioBlitz (from left: Coyote and Skunk).

Drift Fence Pit Fall Trapping

On 6 May 2012, four drift fence pit fall trap arrays were established in the three most dominant habitat types (Figure 3). Drift fence pit fall trap arrays had three wings that were made of 10ft by 15in aluminum flashing with wooden stakes at each end. Four buckets, 12in deep, were buried at the center and at the end of each wing of the array (Figure 10). All pit fall traps captured ants, grasshoppers, and a variety of spiders. A Sagebrush/ Greasewood pit fall captured two Wind Scorpions (*Solifugae* sp.) and three Velvet Ants (*Pseudomethoca* sp.), a Tamarisk pit fall captured one Plateau Striped Whiptail lizard

(*Cnemidophorus velox*), and a Sagebrush/ Greasewood pit fall captured one Deer Mouse (*P. maniculatus*).

Figure 9. Checking drift fence pit fall traps for Bedrock BioBlitz.

Figure 10. Three of the most unique species captured in drift fence pit fall traps at the Bedrock BioBlitz (from left: Wind Scorpion, Velvet Ant, and Plateau Striped Whiptail).

Camera Trapping

On 5 May 2012, six digital, motion activated, camera traps were placed across the three dominant habitat types: four in Tamarisk, one in Sagebrush/ Greasewood, and one in Cottonwood, then on 6 May 2012 four additional camera traps were placed: two in Tamarisk and two in Sagebrush/ Greasewood. A can of punctured cat food that served as a scent attractant was staked to the ground approximately 10ft in front of the camera trap. Camera traps were set-up to take three consecutive pictures when activated, this constituted an event and any observation during an event is considered one occurrence (one camera trap was mistakenly set to record video and has been removed from analysis). The nine camera traps recorded 786 pictures over 262 events. However, 142 events did not contain an occurrence; the other 120 events did contain occurrences, all of which were of livestock. The most occurrences (35) of livestock were from a camera trap in Sagebrush/ Greasewood habitat and the second most occurrences (26) of livestock were from a camera trap in Cottonwood (Table 6).

Table 6. Occurrences recorded on digital, motion activated, camera traps during 5-8 May 2012 at the Bedrock BioBlitz.

Camera	Habitat	Total Pix	Total Events	Occurrences				Total
				5 May 12	6 May 12	7 May 12	8 May 12	
C3	Sagebrush/ Greasewood	342	114	x	11	18	6	35
83	Cottonwood	96	32	0	13	6	7	26
85	Tamarisk	63	21	6	13	0	0	19
84	Sagebrush/ Greasewood	66	22	0	13	2	3	18
C4	Sagebrush/ Greasewood	78	26	x	2	0	7	9
C1	Tamarisk	48	16	x	3	1	1	5
86	Tamarisk	30	10	0	3	2	0	5
C2	Tamarisk	45	15	x	1		1	2
81	Tamarisk	18	6	1	0	0	0	1
	Total	786	262	7	59	29	25	120

Anecdotal

In addition to the above report field data, several anecdotal observations were made. Along the banks of the Dolores River a Northern Leopard Frog (*Rana pipens*) was encountered, Raccoon (*Procyon lotor*) and Bobcat (*Lynx rufus*) tracks were found on mud flats, Elk (*Cervus canadesis*) scat was found at several locations, audible bat calls were heard at night and are thought to be Spotted Bat (*Euderma maculatum*) because they have been documented nearby the area in the past, four River Otter (*Lonra canadensis*) were observed just up river of the Bedrock property a week prior to the BioBlitz, a flock of Burrowing Owls (*Athene cuniculalria*) were occupying a Prairie Dog (*Cynomys* sp.) town east of the Bedrock property, a Bald Eagle (*Haliaeetus leucocephalus*) was nesting west of the Dolores River, a Long-eared Owl (*Asio otus*) was nesting in Cottonwood habitat at the Bedrock BioBlitz, Showy Milkweed (*Asclepias speciosa*) and *Poa* sp. was found in small quantities, Primrose (*Oenothera* sp.) was common among the Sagebrush/ Greasewood and White Top (*Cardaria draba*) was quite common under Tamarisk.

Among all the wildlife species recorded, five species are listed as Colorado State Species of Special Concern: Northern Leopard Frog – Special Concern, Bald Eagle – Special Concern, Burrowing Owl – State Threatened, Greater Sandhill Crane – Special Concern, and River Otter – State Threatened.

Next Steps

Planning is currently underway for a second BioBlitz effort this fall. The next BioBlitz will emphasize including local school and area college students. This will include hands on experience and environmental education regarding the local riparian community. Some changes that will hopefully occur include: quantitatively inventory vegetation, mark small mammals to facilitate relative abundance estimation, mist-net and band birds to estimate relative abundance and persistence, mist-net bats to confirm identification from SonoBat analyses, and collect insect for identification.

Lois Webster Fund

The $1500 grant request the was funded by the Lois Webster Fund permitted the acquisition of material necessary to conduct the Bedrock BioBlitz (Table 7). There remains just over $300 in the budget after purchasing the below material, this will facilitate future BioBlitz sessions.

Table 7. Supplied acquired using funds from Lois Webster Fund to conduct the Bedrock BioBlitiz.

Item	Quantity	Purpose
Sweet Feed Grain	25lbs	Bait for small mammal traps
Plastic Baggies	25	Handling small mammals
Hair Dye	2	Temporarily mark small mammals (did not use)
3ftx4ft Galvanized Sheet Metal	5	Track plates
1inx1inx8ft Furring Strip	6	Stabilize track plates
Blue Carpenters Chalk	5lbs	Dusting track plates
Spray Bottle	1	Mist track plates
Packaging Tape	1	Transfer prints From tack plates (did not use)
Trail Cameras	6	Camera traps
4gb Memory Cards	6	Camera traps
AA Batteries	36	Camera traps
D Batteries	24	Camera traps
12in Spikes	18	Setting scent attractant for camera traps
Cat Food	24	Scent attractant for camera traps and track plates
2ft Wooden Stake	60	Constructing camera trap mounts, supporting drift fence
Mini Bungee Cords	16	Mounting camera traps
14inx10ft Aluminum Flashing	12	Drift fences
2Gal Buckets	16	Pit fall traps
Bolts, Nuts, Screws	25	Constructing camera trap mounts, stabilizing track plates, supporting drift fence