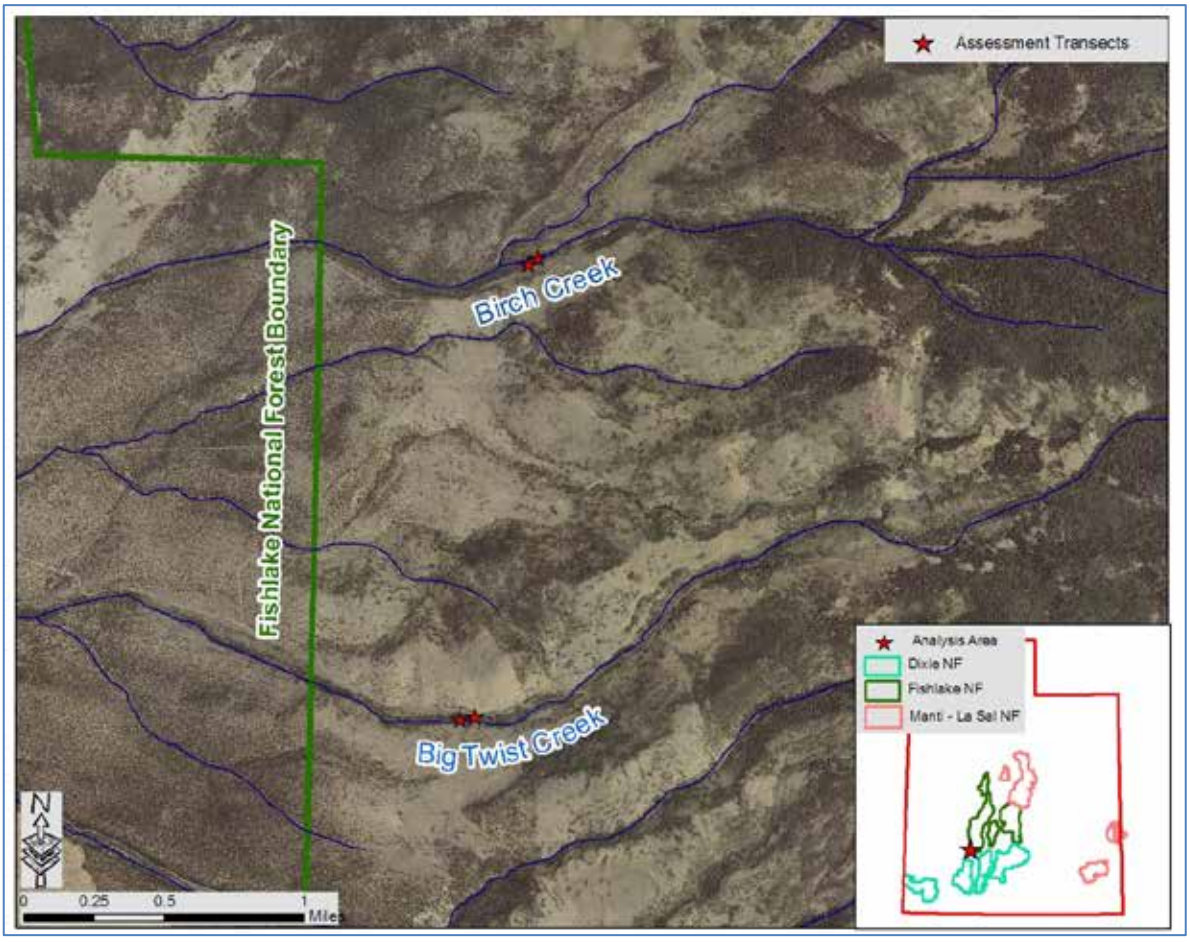
Comparison of riparian areas:
Birch Creek East Exclosure (June 19, 2011)
and along Big Twist Creek
(June 20 measurements; July 17, 2011 photos)

Grand Canyon Trust

January 6, 2012



INTRODUCTION

The exclosure around Birch Creek East serves as a good comparison to similar riparian areas in the region that are actively being grazed. Although no records show the date of construction for this exclosure, it appears it has been effective for quite some time as the stream has several channels through the exclosure and in the wet spring months there is sheet flow over much of the area. In June 2011, Grand Canyon Trust completed some quantitative monitoring within the exclosure along Birch Creek as well as a similar reach approximately 1.3 miles south along Big Twist Creek to note differences and similarities between areas that are regularly grazed and those that are not. A table showing a summary of the two sites is below.

Comparison Chart

Birch Creek East (Exclosure)	Big Twist
FLNF/ Beaver RD - South Beaver Allotment / ON border between Kane and Twist pastures	FLNF/ Beaver RD - South Beaver Allotment /Twist pasture
GPS Coords (NAD 83) 367478E 4230826 (start) 367427E 4230792N (end)	GPS Coords (NAD 83)367033E 4228180N (start) 367122E 4228197N (end)
Elevation: 7580'	Elevation: 7480'
Aspect: WSW	Aspect: West
Avg Width of Riparian area - ~ 60m	Avg Width of Riparian area - ~40m
Slope: ~1%	Slope: ~1%
Dominant Vegetation: Baltic rush (*Juncus balitcus*), Kentucky bluegrass (*Poa pratensis*), horsetail (*Equisetum arvense*), juniper (*Juniperus scopulorum*), aspen (*Populus tremuloides*), Bebb's willow (*Salix bebbiana*)	Dominant Vegetation: Narrowleaf cottonwood (*Populus angustifolia*), sagebrush (*Artemisia tridentata* var *vaseyana*), Gambel oak (*Quercus gambelii*), Kentucky bluegrass (*Poa pratensis*), juniper (*Juniperus scopulorum*), sedges (*Carex* spp), xlover (*Trifolium repens*)
Notes: Date of exclosure construction unknown by Forest Service	2011 AOI: June 14 – July 15, 2011

METHODS

Four attributes of riparian areas were assessed as characteristics of riparian areas that would indicate the overall health of the site. These attributes include:

1) **Degree of connection with the stream's floodplain**. The ability of a stream to easily flow over its banks and use the surrounding areas for flood attenuation, groundwater recharge, and sediment capture contributes to suitable riparian habitat for wildlife species dependent upon riparian vegetation. The more easily the stream can flow into its floodplain, the more favorable the rating.

2) **Amount of bare soil.** Bare soil in riparian areas is often the source of sediment in streams, which can degrade water quality and aquatic habitat. As well, bare soil is an indication that vegetation in a riparian area (where moisture is not as limiting as in many upland areas) has been reduced below its potential. The more bare soil, the less favorable the indicator rating. At each site, ground cover was examined both *aerial cover* (the vegetation covering the ground above the ground surface) and *ground cover* beneath vegetation. Aerial cover can vary considerably from year to year due to differences in precipitation, plant vigor and the time of year sampled. The analysis of ground cover beneath plants can provide a more stable estimate of the degree to which the ground surface is truly protected from erosive forces.

3) **Vegetation composition.** The composition of riparian area vegetation can be affected by physical properties of the site (e.g., landscape position, elevation, soils) as well as past and present land uses. The exotic Kentucky bluegrass (*Poa pratensis*) and redtop (*Agrostis stolonifera*) grasses that often occupy these riparian sites have shallower root systems than native sedges. Furthermore, consistent grazing can eventually select for plant species that are best able to carry out their life history within 1 to 2 inches of the ground surface each year. These species are generally referred to as "increasers", as their relative cover tends to increase with consistent grazing. Many increaser plants avoid grazing damage because they may be poisonous, grow close

to the ground or are less palatable than other plants. These plants should be watched carefully because they are a sign of high grazing pressure and can increase in number and abundance beyond what is desired while native "decreaser" plants decline in abundance and/or diversity. The more shallow rooted non-native species and/or the more increaser species present in the assessment area, the less favorable the rating.

4) **Woody palatable native vegetation demography**. Adequate representation of all aspen and willow height classes is needed to insure ongoing recruitment of tall, mature, reproductive aspen and willow, as well as structural complexity for wildlife habitat. The fewer size classes present, the less favorable the indicator rating.

The methods by which these data were collected are below

Vegetation composition

One main 300 ft transect along the creek bank was established, then four perpendicular transects equidistant from one another were established, using a random number generator to obtain the location of the first transect. Two of the perpendicular transects were on one side of the creek, and two on the other. These transects were 100' long or to the furthest willow or cottonwood, if less than 100'. At the starting point of each perpendicular transect, four readings from a spherical densitometer were used to record canopy cover. On each of these four transects, a pointer was lowered at a given interval depending upon the length of the transect (between 25 to 50 points per transect).

The plant species and ground cover were recorded. If more than one plant was touched by the pointer, the height and species of the 1st (tallest), 2nd and, 3rd plant encountered were recorded. If hummocks were present, the plant was noted as being on or between the hummocks. Cottonwood, willow and aspen height and browse data were recorded along a 6'- wide belt transect centered on each perpendicular transect, as well as the number and height of any hummocks encountered.

Greenline data collection

Along the stream, a pointer was lowered 1' outside the bank full edge (the water level at which a stream is at the top of its banks and any further rise would result in water moving into the immediate floodplain) and vegetation species and type of ground cover were recorded. At least 50 points on each side of the stream, spaced according to transect length, were gathered. These data are intended to be able to compare stream and riparian health using only greenline data with data using the additional riparian indicators collected with this assessment protocol.

Floodplain connectivity

At the start of each perpendicular transect, the distance from the bottom of the channel to bankfull, and the distance from the bottom of the channel to any historic floodplain terrace were measured and recorded. The ratio of the two measurements was calculated to generate one indicator number to rank (as in Rapid Stream Riparian Assessment (RSRA 2008). A ratio of 1 to 1.3 is 'very good' a ratio 1.4 – 1.5 is good, 1.5- 1.6 is fair and anything above 1.6 (i.e., indicating incision of the creek and isolation from the floodplain) is poor.

Woody palatable native vegetation demography

Along each of the four perpendicular riparian transects, any willow, cottonwood or aspen was recording within a 6' wide belt transect (3 feet on each side of the tape). The height of the plant was recorded to the nearest foot; the tallest leader was assessed as to whether it was browsed, dead, otherwise unhealthy (e.g. frost damage, diseased),

or not browsed; and all subleaders within 6" of the top leader were counted and noted in the same categories as for the tallest leader. In the case of willow, subleaders six inches vertically and horizontally were counted. The assessment gives a percentage of browsed leaders and sub-leaders.

RESULTS

Birch Creek exclosure was visited on June 19, 2012 for quantitative measurements. Big Twist was visited on June 20, 2012 (on a very wet field day), at the start of the 2012 grazing season of Big Twist Pasture (June 14-July 15) for quantitative measurements, and again on July 17 immediately after livestock scheduled exit (July 17) for photos.

The riparian sites differed in size (mostly width), and thus differed in the number of sampling points taken. Cover numbers in the lower part of the charts include second and third hits, thus the measure of vegetation cover can exceed 100%. In addition, to give an estimate of aerial cover (a number that cannot exceed 100%), the total vegetation cover at the head of each data table in this report includes only first hits.

The estimates for litter, rock, gravel, water and bare ground at the head of the data sheets are also based on first hits only. The ground cover tables for each site in the data tables are based on the cover type under the plants to give a true representation of how completely the ground is protected from erosive forces.

Amount of Bare Soil

The most noticeable difference between the two sites is the amount of bare ground. The Birch Creek exclosure total vegetation cover was 78% in the riparian transects and 96% in the greenline transect, whereas along Big Twist Creek, total vegetation cover was 45% along the riparian transects and 64% in the greenline area. (Bank alteration was not measured, but see Figs. 9-10, 13-14 in Big Twist.)

Correspondingly, the Birch Creek exclosure had 1% bare ground (28% when the ground under the plants was considered) in the greenline, and the Big Twist site showed 27% bare ground (78% when including the ground under the plants).

The Birch Creek exclosure also showed a much higher degree of layered vegetation as 82% of the greenline points had second or third hits, whereas the Big Twist site had only 12% of second hits along the greenline. Photos 3, 5, 6, 7, 9, 13 and 14 clearly show these differences.

Additionally, the greenline of the Big Twist Creek assessment area was grazed beyond Fishlake National Forest standards with sedges averaging only 2.4" in height (the standard is 4").

Vegetation Composition

The Birch Creek exclosure riparian area had 20% cover of Kentucky bluegrass, whereas the Big Twist riparian area had 2%. However, the exclosure riparian area also had 36% cover of grasslike plants (sedges, rushes, horsetail), while Big Twist Creek had only 2% grasslike riparian plants.

Along the greenline, the cover of Kentucky bluegrass is similar (10% in the exclosure and 12% in Big Twist Creek). Greenline cover by grasslike plants differed: 50% in the exclosure, but 17% along Big Twist Creek.

Overall, the Birch Creek exclosure had 10% vegetation cover from shallow rooted, increaser exotic species (e.g., common dandelion (*Taraxacum officinale*) and clover (*Trifolium repens*) along the greenline, whereas the Big Twist Creek had 19% cover by these species.

Floodplain Connectivity

Birch Creek showed much higher connectivity with its floodplain with a ratio (distance from the bottom of the channel to bankfull to the distance from the bottom of the channel to any historic floodplain terrace) of 1.2 (very good). On the other hand, Big Twist Creek showed signs of incision and, bank shearing and had a floodplain connectivity ratio of 2.6 (poor). Photos 2, 3, 7, 4, 10, 13 and 14 show these differences.

Native Palatable Woody Plant Demography

In the Birch Creek exclosure, only a few aspen were encountered along the transects, although there were a number of Bebb's willows in the area (See Figs 1 and 2). One of the few aspen encountered was 5.1-6' tall. No signs of browse were detected on the aspen.

Big Twist Creek showed a dearth of narrowleaf cottonwoods in the 3'- 6' range as it appears most are being highly browsed before they can reach that height. The browse assessment shows 47% of the tall leaders being browsed and 35% of the subleaders being browsed. The browse assessment was done on June 20, 2011 prior to livestock entry.

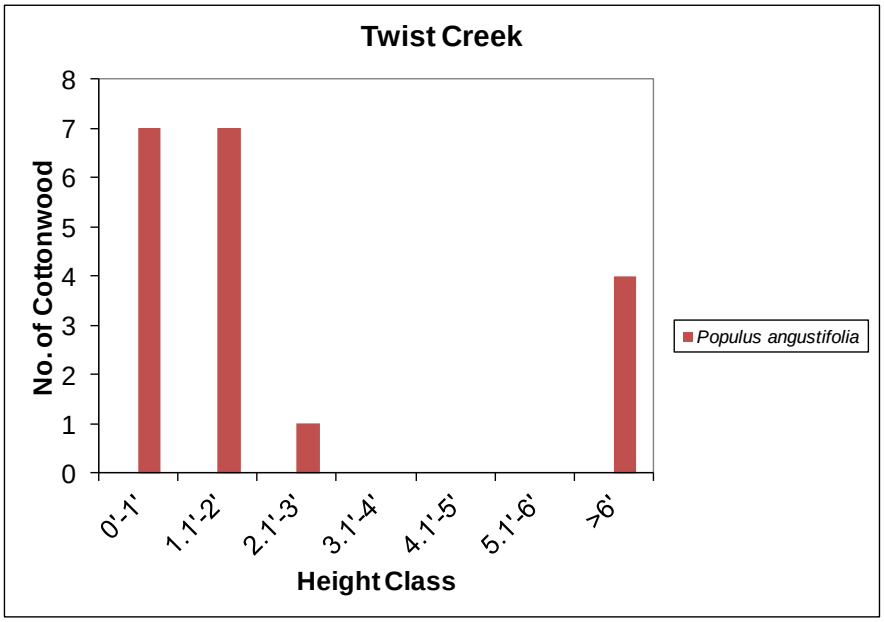
Native Palatable Woody Plant Demography
Birch Creek Exclosure
June 19, 2012

No browse of leaders/subleaders

Percent browse Twist Creek
June 20, 2011
(livestock entry scheduled June 14, 2011)

Twist Creek 15 *Populus angustifolia* <6' 4 *Populus angustifolia* > 6’	
	Populus angustifolia
% tall leaders browsed	46.7
% tall leaders browsed or dead	46.7
% subleaders browsed	34.8
% subleaders browsed or dead	34.8

Native Palatable Woody Plant Demography



Conclusion

Although the date of the construction of the Birch Creek exclosure is unknown, Birch Creek and its riparian area are in much better condition than the Big Twist Creek assessment area. Annual heavy grazing in the Big Twist area allows few cottonwoods to grow above browse height, leaves excessive riparian bare ground available for erosion into the creek,; bank incision isolating the creek from its floodplain; and ongoing narrowing and species depletion of the riparian area.

It is recommended that this pasture be rested two years, and utilization be reduced to 30%. A one-quarter acre riparian exclosure should be established on a particularly vulnerable area and annually monitored, along with points outside the exclosure, to document whether and how quickly the area recovers during the rest and after grazing is reduced to 30% utilization.

Fig 1 (6/19/2011) Main transect in the Birch Creek exclosure with Bebb's willow in the far end of the photo

Fig 2 (6/19/2011) Young, unbrowsed willow along main transect in Birch Creek Exclosure

Fig 3 (6/19/2011) Main (baseline) transect Birch Creek exclosure looking toward starting point

Fig 4(6/19/2011) Main (baseline) transect in Birch Creek exclosure looking toward end

Fig 5 (6/19/2011) One of the many side channels in Birch Creek Exclosure

Fig 6 (6/19/2011) Another side channel within Birch Creek Exclosure. Note tall sedges.

Fig 7 (6/19/2011) Well-vegetated side channel in the Birch Creek Exclosure

Photos Big Twist Creek

Fig 8 (7/17/2011) Big Twist riparian site – note grazing beyond USFS standards

Fig 9 (7/17/2011) Incised Big Twist Creek, and sheared, sloughed and bare banks

Fig 10 (7/17/2011) Incised, Big Twist Creek, and sheared and sloughed banks

Fig 11 (7/17/2011) Narrowleaf cottonwood unable to grow above browse height

Fig 12 (7/17/2011) Overbrowsed narrowleaf cottonwood – Big Twist Creek

Fig 13 (7/17/2011) Bare, sloughed banks – Big Twist Creek

Fig 14 (7/17/2011) Range pole showing 3’ of incision of creek bed, isolating Big Twist Creek from its riparian area and floodplain.

Appendix A. Data in Table format

Birch Creek East Exclosure
Greenline June 19, 2011

Birch Creek East Riparian Area Exclosure June 19, 2011	n=92	Livestock on/off dates: N/A			
	Scientific Name	Common Name	Cover	Relative Cover	Ave ht (in)
Total Vegetation Cover			66.3		
Water			1.8		
Mosses			1.1		
Litter			14.1		
Bare Soil			6.5		
Total Ground Cover			93.5		
Cool season perennial grasses					
	Other cool season perennial grasses		3.8	5.3	
		Sub-total		5.3	
Grasslike plants					
	Carex nebrascensis	Nebraska sedge	6.6	9.3	5.2"
	Carex spp	Sedges	2.8	4.0	
	Equisetum arvense	Field horsetail	0.9	1.3	
	Juncus balticus	Baltic rush	25.4	36.0	9.6"
		Sub-total	35.7	50.6	
Introduced perennial grasses					
	Poa pratensis	Kentucky bluegrass	19.8	28.0	5.8"
		Sub-total	19.8	28.0	
Perennial forbs					
	Epilobium halleanum	Hall's willowherb	0.9	1.3	
	Sidalcea neomexicana	Checkermallow	0.9	1.3	
	Veronica serpyllifolia	Thyme-leaved speedwell	1.1	1.3	
		Sub-total	2.9	3.9	
Shrubs					
	Rosa woodsii	Woods rose	5.7	8.0	
	Symphoricarpos oreophilus	Snowberry	1.9	2.7	
		Sub-total		10.7	
Trees					
	Juniperus scopulorum	Rocky Mountain Juniper	0.9	1.3	

14 second hits (15%)

Ground Cover(%)	
Litter	52
Bare soil	30
Rock	1
Moss	15
Water	6

Birch Creek Exclosure
Greenline June 19, 2011

Birch Crk Exclosure Greenline June 2011	n=106	Livestock on/off dates: N/A			
	Scientific Name	Common Name	Cover	Relative Cover	Ave ht (in)
Total Vegetation Cover			96.2		
Water			2.8		
Bare Soil			0.9		
Total Ground Cover			99.1		
Cool season perennial grasses					
	Agrostis sp		5.0	5.1	
	Glyceria striata	Fowl mannagrass	5.6	5.7	12.6"
	Unkown wheatgrass		1.1	1.1	
				11.9	
Grasslike plants					
	Carex aquatilus	Water sedge	1.1	1.1	
	Carex languinosa	Sedge	2.6	0.6	
	Carex spp	Sedges	1.1	1.1	
	Eleocharis palustris	Common spikerush	1.1	1.1	
	Equisetum arvense	Field horsetail	10.6	10.8	13.5"
	Juncus balticus	Baltic rush	32.2	33.0	23.5"
	Juncus ensifolius	Sword leaf rush	1.7	1.7	
				49.4	
Introduced perennial grasses					
	Poa pratensis	Kentucky bluegrass	10.0	10.2	13.5"
				10.2	
Perennial forbs					
	Epilobium halleanum	Hall's willowherb	0.6	0.6	
	Geum macrophyllum	Large leaf avens	0.6	0.6	
	Mentha arvensis	Field mint	1.1	1.1	
	Mimulus guttatus	Monkey flower	2.8	2.8	
	Sidalcea neomexicana	Checkermallow	0.6	0.6	
	Stellaria longifolia	Stitchwort	2.2	2.3	
				8.0	
Shrubs					
	Betula occidentalis	Water birch	1.7	1.7	
	Rosa woodsii	Woods Rose	0.6	0.6	
	Salix bebbiana	Bebb's willow	3.3	3.4	
				5.7	
Trees					
	Juniperus scopulorum	Rocky Mountain Juniper	7.6	8.0	
	Picea engelmannii	Engelamnn spruce	2.2	2.3	
	Populus tremuloides	Aspen	4.4	4.6	
				14.8	

Floodplain connectivity ratio: 1.2 (very good)

87 2nd hits (82%)

Ground Cover	
Bare soil	28
Litter	50
Rock	1
moss	15
Water	6

Big Twist Creek
Riparian Area June 20, 2011

Big Twist Creek Riparian area June 20, 2011	n=78	South Beaver Allotment/ Twist Pasture Livestock on/off dates June 14 - July 15			
	Scientific Name	Common Name	Cover	Relative Cover	Ave ht (in)
Total Vegetation Cover			44.8		
Water			10.2		
Litter			26.9		
Bare Soil			16.7		
Total Ground Cover			83.3		
Cool season perennial grasses					
	Other cool season perennial grasses		1.1	1.9	
		Sub-total		1.9	
Grasslike plants					
	Juncus balticus	Baltic rush	2.1	3.8	6"
		Sub-total		3.8	
Introduced perennial grasses					
	Bromus inermus	Smooth brome	1.1	1.9	
	Poa pratensis	Kentucky bluegrass	2.1	3.8	7"
		Sub-total		5.7	
Annual grasses					
	Bromus tectorum	Cheatgrass	2.1	3.8	
		Sub-total		3.8	
Perennial forbs					
	Senecio integerrimus	Groundsel	2.1	3.8	
	Taraxacum officinale	Common dandelion	1.1	1.9	
	Veronica serpyllifolia	Thyme-leaved speedwell	7.4	13.5	
		Sub-total		19.2	
Annual and biennial forbs					
	Collomia linearis	Collomia	1.1	1.9	
	Plantago patagonica	Pursh's plantain	1.1	1.9	
	Unknown Apiaceae		1.1	1.9	
		Sub-total		5.7	
Shrubs					
	Artemisia tridentata	Big sagebrush	3.2	5.8	30"
	Quercus gambelli	Gambel's oak	6.3	11.5	
	Rosa woodsii	Woods rose	1.1	1.9	
		Sub-total		19.2	
Trees					
	Juniperus scopulorum	Rocky Mountain Juniper	11.6	21.1	
	Populus angustifolia	Narrow leaf cottonwood	10.5	19.2	
		Sub-total		40.3	

17 second hits (22%)

Ground Cover	
Water	10%
Litter	59%
Bare soil	31%

Big Twist Creek
Greenline June 20, 2011

Big Twist Creek Greenline June 2011	n=113	South Beaver Allotment/ Big Twist Pasture Livestock On/Off dates: June 14- July 15			
	Scientific Name	Common Name	Cover	Relative cover	Ave ht (in)
Total Vegetation Cover			63.7		
Litter			2.6		
Rock			6.2		
Bare Soil			27.4		
Total Ground Cover			72.6		
Cool season perennial grasses					
	Other cool season perennial grasses		3.2	5.9	
				5.9	
Grasslike plants					
	Carex nebrascensis	Nebraska sedge	0.8	1.2	
	Carex spp	Sedges	7.9	11.9	2.4"
	Juncus balticus	Baltic rush	3.2	4.8	3.3"
	Juncus ensifolius	Sword leaf rush	1.6	2.4	
				20.3	
Introduced perennial grasses					
	Poa pratensis	Kentucky bluegrass	9.5	14.3	2.8"
				14.3	
Annual grasses					
	Bromus tectorum	Cheatgrass	0.8	1.2	
				1.2	
Perennial forbs					
	Achillea millefolium	Yarrow	1.6	2.4	
	Taraxacum officinale	Common dandelion	1.6	3.6	
	Trifolium repens	Clover	6.3	9.5	1"
	Veronica serpyllifolia	Thyme-leaved speedwell	0.8	1.2	
				16.7	
Shrubs					
	Artemisia tridentata	Big sagebrush	5.6	8.3	
	Quercus gambelli	Gambel's oak	3.9	5.9	
	Rosa woodsii	Woods rose	4.8	8.3	
				22.5	
Trees					
	Juniperus scopulorum	Rocky Mountain juniper	4.8	7.1	
	Populus angustifolia	Narrow leaf cottonwood	7.9	11.9	
				19.0	

Floodplain connectivity 2.6 (poor)

13 second hits (12%)

Ground Cover	
Bare soil	78%
Litter	10%
Rock	9%
moss	3%