Santa Fe River

Riparian Vegetation Monitoring

Report 2006

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BUREAU OF LAND MANAGEMENT

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Santa Fe River Riparian Vegetation Monitoring[1]

Report 2006

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Introduction

The Taos Field Office of the Bureau of Land Management (BLM) has initiated a riparian vegetation monitoring program for its lands along the lower Santa Fe River just west of La Cienega. The intent of this program is to detect long-term trends in abundance, diversity, and distribution of riparian plant communities within a two-mile reach of the river that has been recently excluded from livestock grazing. Historically, the allotment was subject to livestock grazing year round while under BLM management, which continued through the spring of 2004. In 2003, Natural Heritage New Mexico (NHNM) established a set of vegetation transects to determine baseline conditions under grazing for comparison to later surveys following livestock removal. The vegetation sampling was designed in the context of breeding bird surveys that were begun within the same riparian zone in 2002, with the intent of providing data on the relationship between bird densities and vegetation structure and composition through time[2]. Vegetation composition and abundance was measured on the transects in 2003, 2004 and 2005 (Milford et al. 2006). In 2006 a protocol for assessing changes in number of individuals and stems for woody species was initiated using the same transects that were established in 2003 for vegetation cover measurements. We report here on the project design, methodologies, and the data collected from 2006.

Methods

Study area

The study area is located 26 km (16 miles) southwest of Santa Fe within the lower portion of the Santa Fe River Area of Critical Environmental Concern (ACEC) managed by the BLM (Figure 1). The study reach is approximately 3.5 km (2.2 miles) long with elevations that range from 1768 m (5800 ft) upper end to 1737 m (5700 ft) at the lower end resulting in a gentle stream gradient (approximately 1%). The floodplain averages only about 100 m in width and is constrained within a deep canyon, bounded by mesas capped with ancient basalt lava flows. The

[1] Final report Cooperative agreement No. GDA-010009, Task Order No. 7, Modification 3.
[2] Hawks Aloft Inc. of Albuquerque, NM is conducting the breeding bird surveys on behalf of the Bureau of Land Management.

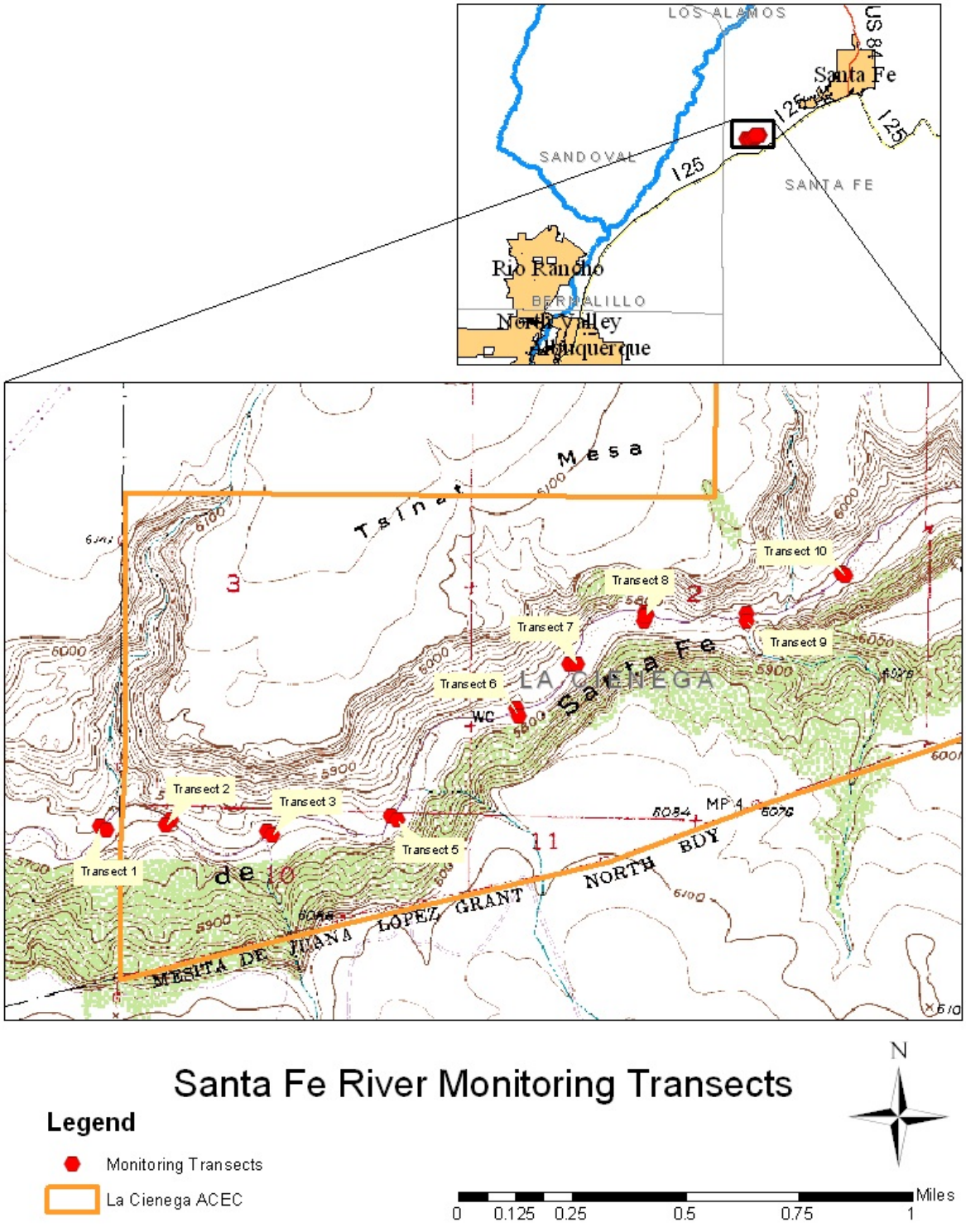


Figure 1. Study area for the Santa Fe River ACEC riparian monitoring program.

river has a perennial flow sustained by a combination of natural discharge from a drainage basin of 45.5 km^2 (18.20 sq. miles) and from the city of Santa Fe sewage treatment facility south of town.

The study area has a long history of human use as evidenced by numerous archeological sites within the canyon. Over the past century, livestock grazing has been the primary land use, typically on a year-round basis, and the site is part of an active BLM grazing allotment. At the time sampling began in 2003, cattle had been heavily using the site through the summer season since forage elsewhere in the allotment was in short supply due to drought conditions. An attempt was made to limit grazing within the allotment in 2004 and 2005. However, for several months during both summers cattle were present on the allotment and there was grazing within the active floodplain, again because of limited forage elsewhere.

Sampling design

Nine monitoring transects were established in September 2003 along the lower two-mile stretch of the Santa Fe River within the ACEC (Figure 1). Sampling was focused on riparian and wetland vegetation within the active floodplain with the intent of detecting major changes in species composition and structure. Hence, transects were more or less evenly distributed along the reach and generally across straight reaches between river bends where the widest zones of riparian vegetation occurred.

Transects averaged 26 m (85 ft) in length, but varied, depending on the width of the channel, from 16.8 to 38.2 m (55 to125 ft). All transects started on the right (northern) bank terrace above the river channel and the active floodplain, and extended perpendicularly across the river and up onto the left bank terrace. Three to five meters of terrace were included on either side of the active channel. Rebar stakes tagged with aluminum tags were used to monument both ends of the transect on the terraces, with two additional tagged stakes located along the transect within the active floodplain to improve repeatability. The locations of the end-point stakes were recorded with a Garmin GPS with an accuracy of +/- 3 m (Appendix A). Each year, including 2006, four monitoring photographs were taken along each transect: one from the start stake to end stake and vice-versa, then two more photographs, one looking upstream and one looking downstream, were taken from a point upstream of the transect at a distance measured and recorded off the right bank floodplain stake. Appendix B contains a series of four photos from 2003 to 2006 for each transect. These photos are down the transect lines from the start to end stakes. A complete set of digital monitoring photographs is provided on the CD included with this report.

In 2006 a woody stem count was conducted along the nine transects. Four by half-meter quadrats were centered on the transect tape, such that each quadrat covered half a meter along the transect tape, with two meters of width extending upstream from the tape and two meters extending downstream. The quadrats started at 0 meters and were read consecutively every ½ meter. Counts within the quadrat included the total number of individual plants divided into five size classes: <2"/<4.5' (less than two inches diameter, less than four and a half feet tall), <2"/>4.5' (less than two inches diameter, greater than four and a half feet tall), 2-4" (two to four inches diameter, any height), 4-6" (four to six inches diameter any height), >6" (greater than six

inches diameter). For individuals and stems >6" an exact measurement of diameter was obtained at the root crown using a DBH tape. These same size classes were also used to count individual stems with in the quadrat.

The data was entered using Microsoft Access into the NHNM ecology database with tables specifically designed for this project. Over the past decade the NHNM ecology database has been developed and populated with over 9,000 plot records from around the state and Southwest. Accordingly, there is a set of data entry protocols that have been implemented that ensure data quality including independently proofreading the data for accuracy. All of the raw data has been made available in an Access database form on compact disk along with appropriate exported ASCII files of the data, photo point files, and this report.

Results and Discussion

Seven woody species were encountered along the transects during the 2006 survey. Among these, four were native: rubber rabbitbrush (*Chrysothamnus nauseosus*), trumpet gooseberry (*Ribes leptanthum*), oneseed juniper (*Juniperus monosperma*) and Goodding's willow (*Salix gooddingii*). The other three were exotic: Russian olive (*Elaeagnus angustifolia*), saltcedar (*Tamarix ramosissima*), and Siberian elm (*Ulmus pumila*) (Table 1). While the native Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*) and coyote willow (*Salix exigua*) were absent on the transects, they did occur within the canyon as scattered individuals. The most common shrubs overall were rubber rabbitbrush, Russian olive and saltcedar. Oneseed juniper is an upland species that was dominant on the canyon slopes and upper terraces, but occurred only incidentally at the edge of the floodplain. Goodding's willow, like coyote willow and cottonwood, was rare, forming scattered patches of young individuals along with coyote willow. Young plants of all three species are palatable, and may be removed by livestock before they can become established. Scattered Siberian elm are present on the floodplain terraces within the canyon, but have not yet become a major component of the woody riparian vegetation within the canyon.

Previously, we described vegetation zones for this reach of the Santa Fe river (Milford et al. 2006), that will be used here for the analysis of woody species distribution (Table 2). Rubber rabbitbrush was most common within the Arroyo Riparian vegetation zone where it averaged over 1.5 individuals/m2 (Figure 2). It also occurred within the Woody Riparian zone and the Upper Herbaceous Wetland, but in these zones it was considered a transitional species. However, an increase in rubber rabbitbrush over time within the Upper Herbaceous Wetland zone might indicate a hydrologic disconnect of that zone with the water table. Rubber rabbitbrush was very rare in the active floodplain, and is expected to remain so as long as there is sufficient perennial flow in the river.

Russian olive was the dominant riparian tree species. Large, mature individuals grow in dense patches along the terrace edges just beyond the active floodplain. They occupied a narrow zone between the floodplain and the higher and drier terraces. Our count data showed that the majority of individuals that were over two inches in diameter occurred within the Woody Riparian zone on the low terraces (Figure 3), but a few larger individuals did occur in the Arroyo

Table 1. Average number of individuals and stems per quadrat for each transect, grouped by floodplain location and species.

	# of	<2"<4.5'		<2">4.5'		2-4"		4-6"		>6"	
	Quads	Inds	Stems	Inds	Stems	Inds	Stems	Inds	Stems	Inds	Stems
03SF001											
Active Floodplain											
Saltcedar	27	0.19	0.19								
Terrace											
Rubber Rabbitbrush	25	1.96	5.04	0.04	0.16	0.56	0.92	0.04	0.04		
Saltcedar	25	0.08	0.08	0.04	0.04	0.04	0.04	0.04	0.04		
Trumpet Gooseberry	25	0.04	0.36								
03SF002											
Terrace											
Rubber Rabbitbrush	18	0.22	1.00			0.22	0.22				
Russian Olive	18		0.78		0.50	0.22	0.22		0.06	0.11	0.06
Saltcedar	18		0.33			0.06		0.06			
03SF003											
Terrace											
Rubber Rabbitbrush	27	0.52	1.52			0.30	0.41	0.07	0.07		
Saltcedar	27	0.41	0.52	0.44	0.59	0.44	0.52	0.19	0.15		
03SF005											
Active Floodplain											
Russian Olive	25	0.04	0.04								
Terrace											
Oneseed Juniper	21			0.05	0.10	0.19	0.33	0.10			
Rubber Rabbitbrush	21	0.38	0.62			0.10	0.10				
Russian Olive	21						0.10	0.05			
03SF006											
Terrace											
Rubber Rabbitbrush	16		0.13			0.06	0.19	0.13	0.13		
Russian Olive	16				0.06			0.06	0.06	0.13	0.25
03SF007											
Active Floodplain											
Rubber Rabbitbrush	26	0.38	0.46								
Saltcedar	26	0.04	0.31	0.12	0.19						
Terrace											
Goodding's Willow	30		0.07			0.03	0.03				
Rubber Rabbitbrush	30	3.20	6.47			0.03	0.03	0.07	0.07		
Russian Olive	30	0.30	0.37	0.03	0.13	0.03	0.17	0.07			
Saltcedar	30		0.10	0.03	0.20	0.13	0.07				
Siberian Elm	30		0.03	0.03							
03SF008											
Active Floodplain											
Rubber Rabbitbrush	57	0.72	0.75			0.02	0.02				
Russian Olive	57	0.04	0.02		0.02						
Saltcedar	57	0.14	0.26	0.12	0.28	0.07					
03SF009											
Active Floodplain											
Russian Olive	38	0.03	0.03								
Terrace											
Rubber Rabbitbrush	18	1.28	2.11	0.11	0.06	0.17	0.33				
Russian Olive	18	0.17	0.22			0.06	0.06				
03SF010											
Active Floodplain											
Rubber Rabbitbrush	19	0.11	0.47								
Russian Olive	19	0.16	0.37								
Terrace											
Rubber Rabbitbrush	14	1.00	2.43			0.64	0.71				
Russian Olive	14	0.64	1.21	0.64	1.00	0.36	0.36	0.21	0.14		

Table 2. Riparian vegetation zone and subzones along river cross-sections of the BLM Santa Fe River ACEC. Codes are NHNM acronyms for the scientific names or physical elements of the subzone name. Channel location refers to the primary landscape position of the subzones. Active Channel is the location of the current river and is usually filled with water; the Floodplain adjacent to the channel is typically flooded every one to two years up to ten; Terrace is upper alluvial terraces that are only rarely flooded (> 10 years return interval).

Vegetation Zone	Sub-Vegetation Zone Name	Code	Channel Location
Active Channel	Open Water - little or no vegetation	OPEN WATER	Active Channel
	Watercress-Water Speedwell Aquatic Vegetation (*Rorippa nasturtium-aquaticum-Veronica anagallis-aquatica*)	RORAQU-VERANA	Active Channel
Mesic Herbaceous Wetland	Creeping Bentgrass-Knotgrass Mesic Herbaceous Vegetation (*Agrostis stolonifera-Paspalum distichum*)	AGRSTO-PASDIS	Active Floodplain
	Common Threesquare Sparse Herbaceous Wetland (*Schoenoplectus pungens*)	SCHPUN	Active Floodplain
Upper Herbaceous Wetland	Tall Fescue-Alkali Muhly Upper Herbaceous (*Festuca arundinaceae-Muhlenbergia asperifolia*)	FESARU-MUHASP	Terrace slope
	Yerba Mansa/Alkali Muhly Upper Herbaceous (*Anemopsis californica-Muhlenbergia asperifolia*)	ANECAL/MUHASP	Terrace slope
	Sparse Upper Herbaceous	SPARSE UPPER HERB	Terrace slope
Woody Riparian	Russian Olive Riparian Woodland (*Elaeagnus angustifolia*)	ELAANG	Terrace
	Russian Olive/Rubber Rabbitbush Riparian Woodland (*Elaeagnus angustifolia/Chrysothamnus nauseosus*)	ELAANG/CHRNAU	Terrace
	Saltcedar Riparian Shrubland (*Tamarix ramosissima*)	TAMRAM	Terrace
Arroyo Riparian	Rubber Rabbitbush Riparian Shrubland (*Chrysothamnus nauseosus*)	CHRNAU	Terrace

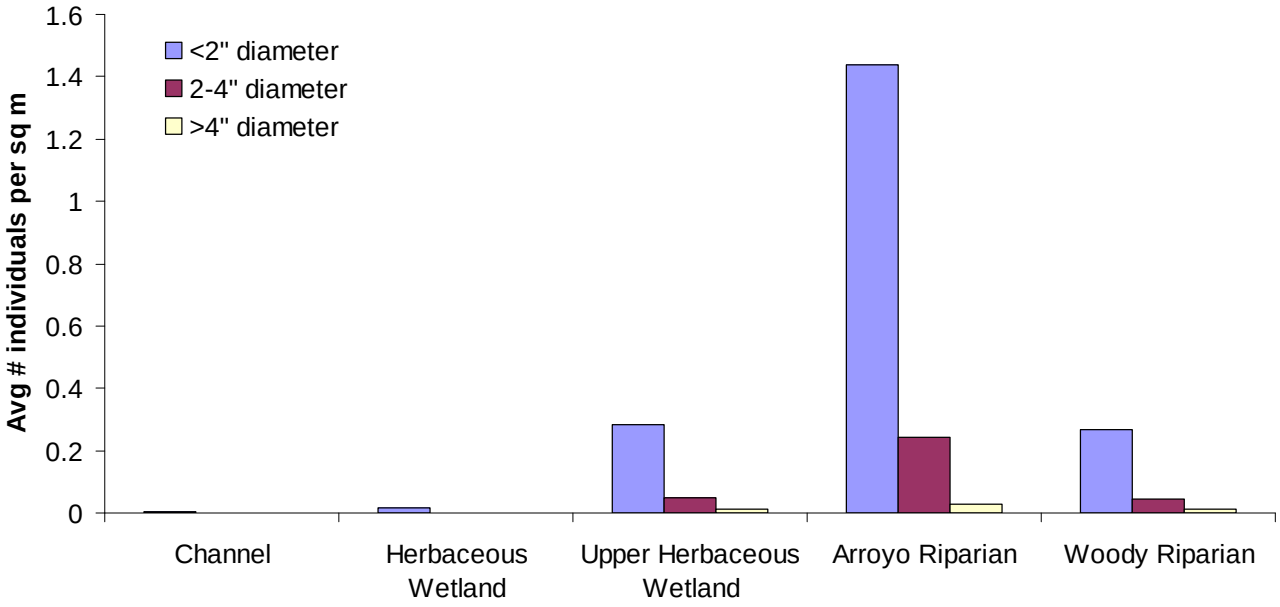


Figure 2. Number of individuals of rubber rabbitbrush by diameter size class and vegetation zone.

Riparian zone and the Upper Herbaceous Wetland. The majority of stems of all sizes also occurred within the Woody Riparian vegetation zone, with a number of smaller stems also occurring in the Upper Herbaceous Wetland on the terrace slope (Figure 4). There were a number of smaller individuals in the Upper Herbaceous Wetland that may represent continued invasion and need to be monitored closely. While there were almost no Russian olive individuals within the active floodplain, whether this is a function of hydrologic regime or grazing pressure remains to be seen.

Saltcedar also formed dense patches along the terrace edges and was scattered throughout the reach. Large individuals tend to be concentrated in the Arroyo riparian zone (Figure 3). Moderately large to small individuals occurred regularly in the Upper Herbaceous Wetland and Arroyo riparian zones, but were present in all the vegetation zones, even within the active channel. Saltcedar stems show a similar pattern (Figure 4). Saltcedar appears to be invasive in all zones, and it will be important to monitor its response to changing grazing intensity. A key question is whether native riparian species will be able to compete with saltcedar in the wetland zones once they are no longer being removed by livestock.

With the removal of livestock in succeeding years we will have an opportunity to accurately gauge the response of the riparian system in the absence of grazing pressure. The sampling system that has been installed will allow the detection of subtle changes in species composition and abundance, major shifts in vegetation zones, and the restructuring of the floodplain. The expectation is that wetland and riparian vegetation zones will expand, which may have significant implications for wildlife and fisheries habitat. Regardless, continued monitoring of this system is key to establishing a good baseline of information on the current state of the system that will allow for clear and statistically defendable statements about change to support effective adaptive management.

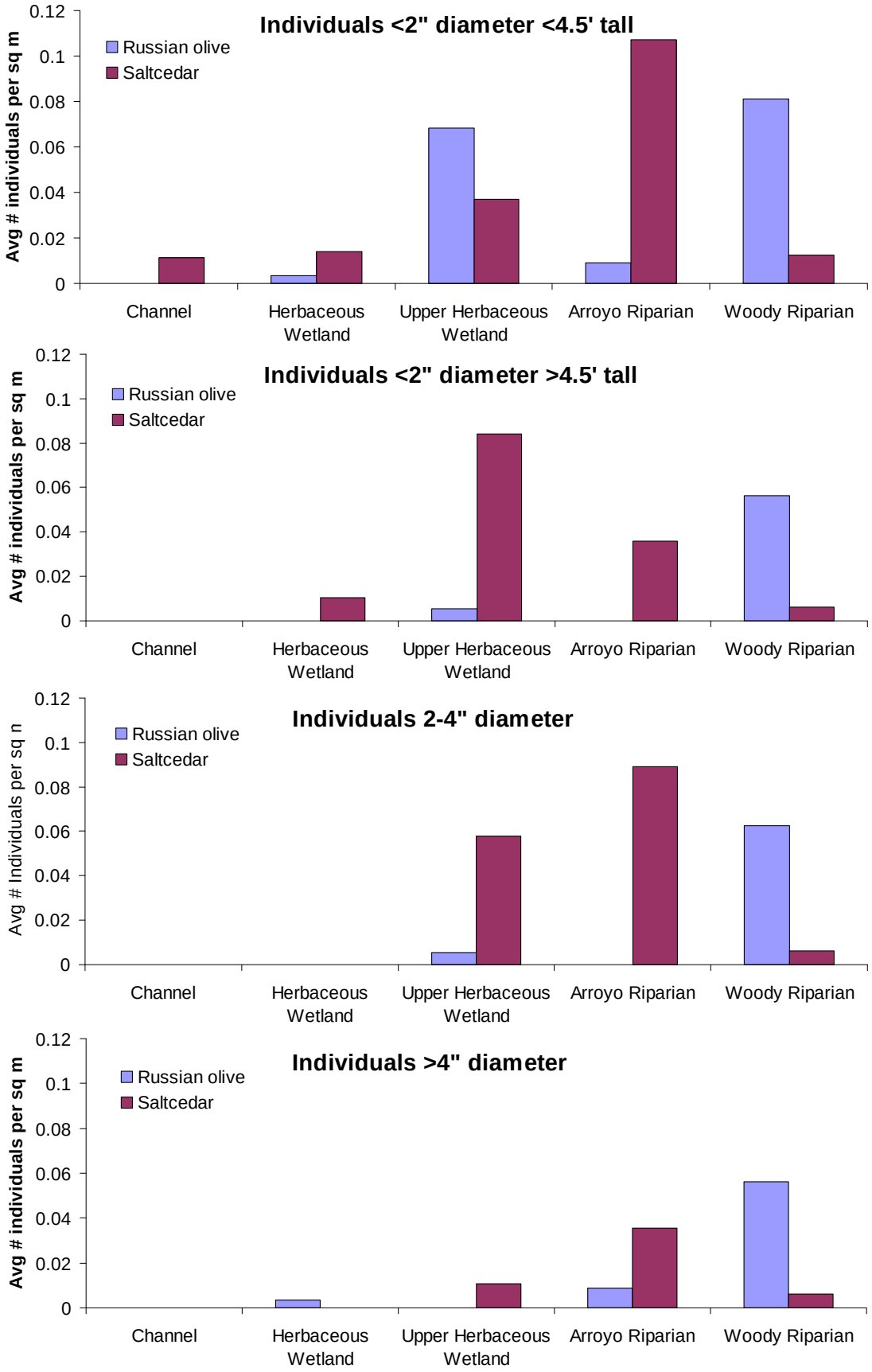


Figure 3. Average number of individuals for Russian olive and saltcedar by size classes and Upper Vegetation Zone.

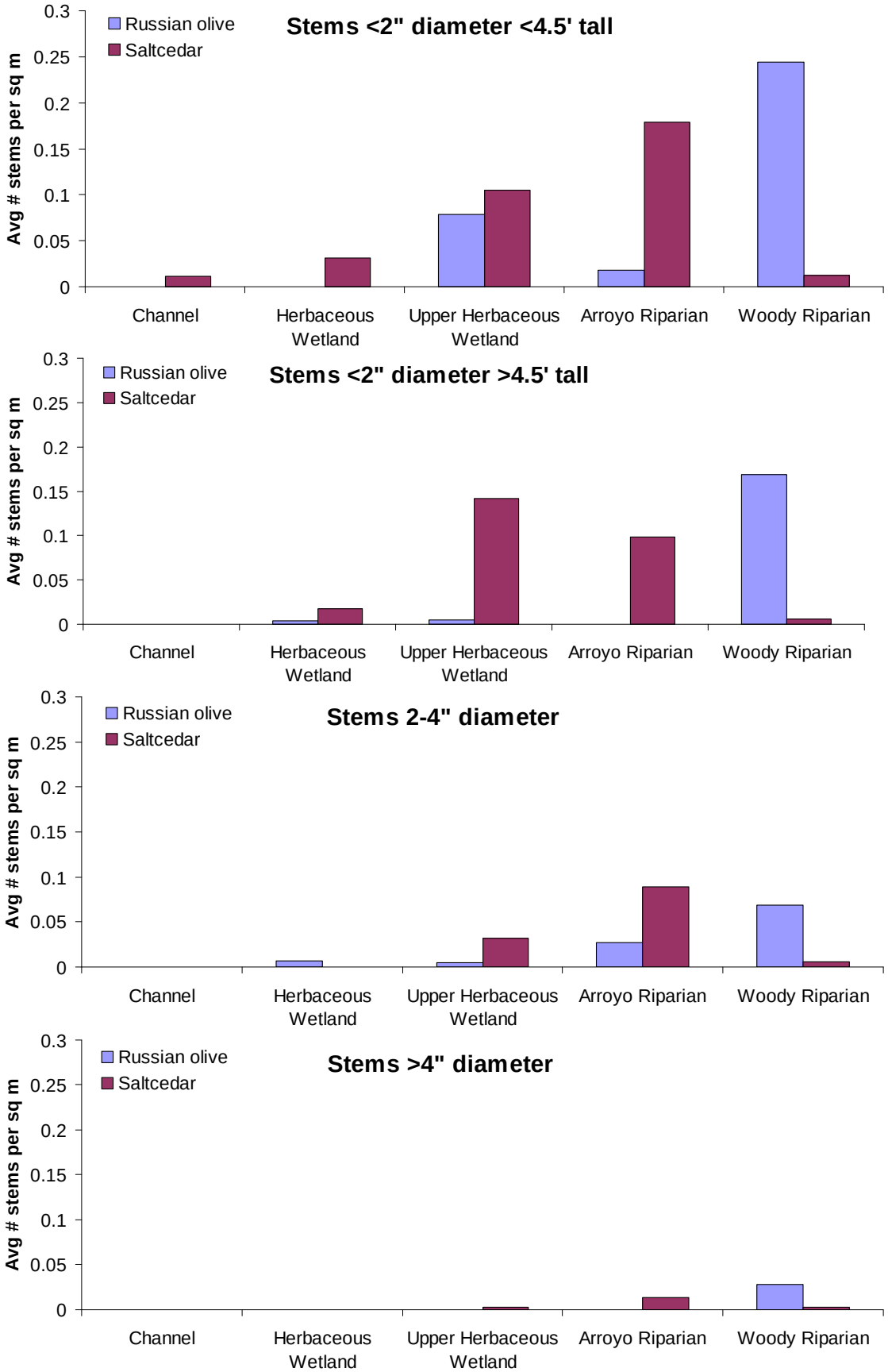


Figure 4. Average number of stems for Russian olive and saltcedar by size classes and Upper Vegetation Zones.

References

Milford, E., E. Muldavin, Y. Chauvin, and A. Browder. Santa Fe River Riparian Vegetation Monitoring: Report 2006. Unpublished report submitted to Taos Field Office, Bureau of Land Management.

Appendix A

UTM coordinates for the end point rebar of all the transects.

UTM locations for transect end point rebars

Datum: NAD27 Zone: 13

Transect	Rebar #	Easting	Northing
03SF001	1	392051	3934550
03SF001	4	392073	3934538
03SF002	1	392302	3934572
03SF002	4	392286	3934558
03SF003	1	392643	3934534
03SF003	4	392662	3934518
03SF005	1	393083	3934587
03SF005	4	393102	3934574
03SF006	1	393524	3934969
03SF006	4	393532	3934941
03SF007	1	393711	3935125
03SF007	4	393739	3935123
03SF008	1	393982	3935310
03SF008	2b	393984	3935298
03SF008	3a	393981	3935293
03SF008	4	393979	3935275
03SF009	1	394340	3935302
03SF009	4	394339	3935279
03SF010	1	394674	3935447
03SF010	4	394688	3935437

Appendix B

Monitoring photos down transects lines from zero to end-point for all transects 2003-2006.

Transect: 03SF001
Position: 5m-26m
Azimuth: 119°

September 2003

September 2004

August 2005

October 2006

Transect: 03SF002
Position: 23.4m-0m
Azimuth: 40°

September 2003

September 2004

August 2005

October 2006

Transect: 03SF003
Position: 0m-25m
Azimuth: 130°

September 2003

September 2004

August 2005

October 2006

Transect: 03SF005
Position: 0m-23.1m
Azimuth: 125°

September 2003

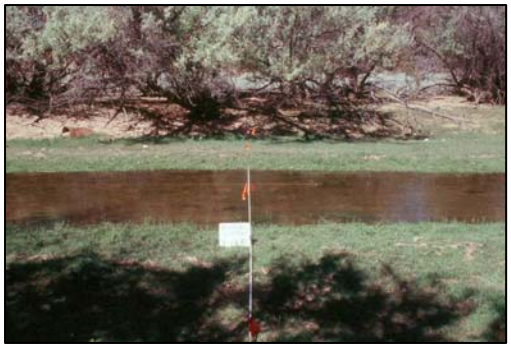
September 2004

August 2005

October 2006

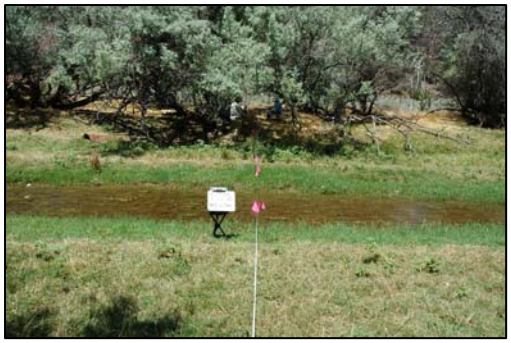
Transect: 03SF006
Position: 24.5m-0m
Azimuth: 350°

September 2003



September 2004

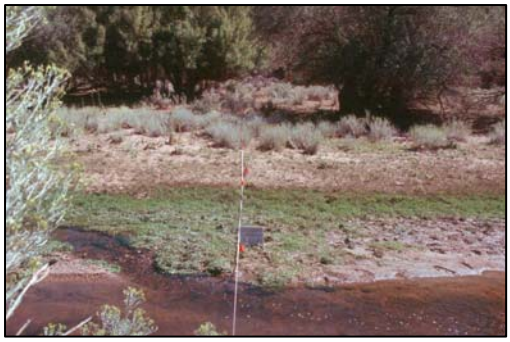
July 2005



October 2006

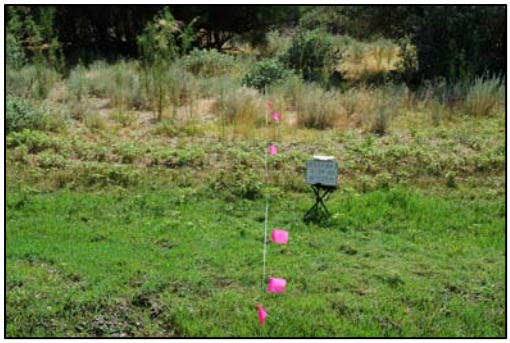
Transect: 03SF007
Position: 2m-28.2m
Azimuth: 95°

September 2003



September 2004

July 2005



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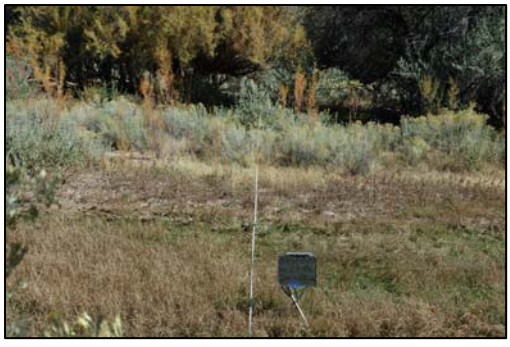
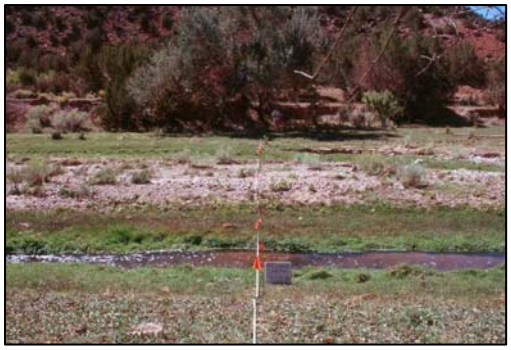


Transect: 03SF008
Position: 1m-38.2m
Azimuth: 190°

September 2003



September 2004

July 2005

October 2006

Transect: 03SF009
Position: 3m-28.4m
Azimuth: 170°

September 2003

September 2004

July 2005

October 2006

Transect: 03SF010
Position: 0m-16.8m
Azimuth: 120°

September 2003

August 2004

July 2005

October 2006