River Bars of the Middle Rio Grande
Progress Report
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by

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Introduction

This report reviews the work completed in the first year of a multi-year project to study the vegetation of river bars in the Albuquerque reach of the Middle Rio Grande[1] in relation environmental and biological factors. The river bars occur along the margins of the active channel (alternate bars or pointbars) or in the channel itself (island bars), and typically support young wetland vegetation that is subject to varying stream flows, ground water fluctuations and shifting sediment loads. Because of this continuous natural disturbance, plants that occupy bars tend to be fast-growing, disturbance-tolerant species that also contribute to soil stability by virtue of high stem and root mass density (Hupp 1992). River bars are a critical element in flood plain and terrace development, and possibly the most diverse and biologically active component of the bosque ecosystem.

Historically, river bar biota and configurations have shifted with fluctuating water flow and associated differential depositional events. However, in the last fifty years, flood control structures (Jemez and Cochiti dams, jetty jacks) erected along the Middle Rio Grande have restricted and altered natural flows such that river bars have become much more permanent features of the channel. At the same time, invasions by exotic species such as Russian olive, salt cedar and Siberian elm are also occurring on the bars, potentially leading to a loss in ecological value. In this context of an altered hydrological regime and exotic invasions, our study focuses on developing a clear understanding of the range of biological variability on these sites in relation to environmental characteristics. This work will aid conservation and restoration in the riparian zone of the Rio Grande.

In the first year, we developed a study designed to contrast exotic versus native elements of the system, that is, stands dominated by the native coyote willow (*Salix exigua*) or a mix of coyote willow and the non-native Russian Olive (*Elaeagnus angustifolia*). This was followed by extensive reconnaissance and site selection, study plot setup, and the collection of initial data on vegetation and water table characteristics.

[1] Defined as the river and associated riparian area between Cochiti and San Marcial (Whitney 1996)

Methods and Materials

Site Selection and Location In the summer of 1998, we performed a nearly complete reconnaissance of vegetation on all river bars between Bernalillo and Belen, marking the dominant species on aerial photos. Bars were either barren, dominated by annual forbs and grasses, or dominated by shrubs and trees, primarily coyote willow (*Salix exigua*), Russian olive (*Elaeagnus angustifolia*) or a mixture of the latter two. Our criteria for study site selection was based on the presence of established, perennial vegetation (which eliminated the barren and weedy bars), large size, and accessibility in terms of both land ownership and travel time. From a set of approximately 50 bars, we chose six sites dominated by willow (willow vegetation type) and six with a mixture of willow and Russian olive (mixed vegetation type). The mixed bars represent a range of invasion by Russian olive into coyote willow, from scattered trees to nearly pure stands. The sites are located along the Rio Grande from north to south and are accessed at the NM 44 bridge (Figure 1), the town of Corrales at Rio Bravo (Figure 2), Alameda Bridge (Figures 3 & 4), Central Bridge (Figure 5), Bridge Street Bridge (Figure 6) and Rio Bravo Bridge (Figures 7, 8). Table 1 is a list of site names and locations cross-referenced to the map figures, and also includes the dominant vegetation type of each site with brief directions.

Sampling Methods Within each site, we selected stands of representative, relatively homogenous vegetation on uniform geomorphic substrates, and which were away from obvious public access routes and impacts. To measure and monitor vegetation, we set out grids composed of 32 points in a 4 x 8 configuration, each five meters apart. To accommodate the narrow linear nature of one site (Paseo Island), we set up a 3 x 11 grid. We adopted a grid configuration because we think it will allow us to more tightly correlate environmental factors, such as water level and surface topography, with the measured vegetation. Grid set-up was facilitated by a method devised to accurately position points within the dense vegetation (suggested by Brian Jenkins). We constructed two lengths of flexible PVC pipe, each 5m long, with an extension for one length to make it 7.20 meters long, or the length of the hypotenuse of a 5m square. These pipe lengths were easily threaded through vegetation in a relatively straight line, and avoided the problem of trampling the site. To start a grid, we first set up two points, 5m apart and then used a 5m length and the 7.20 hypotenuse length to square up the $5m^2$ plot. Once we had a full square, we worked off it to complete the grid, using the hypotenuse length at the end of each line. Each gridpoint was monumented with a four-foot rebar stake and labeled with aluminum tags for later identification. Corner stakes were jacketed with white PVC pipe to help mark the site, and a GPS position was taken at one corner.

To measure vegetation at each grid point, we laid a meter square quadrat made of rigid PVC, so that the rebar stake marked one corner of the plot. The opposite diagonal was marked with a wooden dowel in the ground so that future readings will be at exactly the same place. The orientation of the quadrats was noted on the data sheets. All vegetation in the quadrat was recorded and cover estimated, with voucher specimens taken of unknown specimens. Total cover of the herbaceous layer, litter, soil, gravel and rock was also recorded for each quadrat. Tree stems were counted within classifications of stem diameter, with estimated height, and we also did a stem count of trees in the larger 5m x 5m plot. Plots were sampled in September 1998.

To measure ground water fluctuations, we established a single PVC pipe well (piezometer) at each site. We placed wells along one, easily accessible side of each grid to avoid site disturbance. The wells are constructed of two lengths of PVC pipe, each about 1.5m long. The bottom end is perforated to allow water seepage and capped with a pointed tip to ease drilling. It is coupled to a solid top end which is capped by a rounded point. We augured into the ground until we reached the water table, then drove the pipe with a sledge-hammer as deep as possible (most are about 2.0m in depth from the surface). All pipes were cut to 1m above ground and labeled. Wells were established in October and monthly readings started in November 1998.

All data was entered into a Microsoft Access database following NMNHP quality controls. GPS positions were corrected using base station data from the University of New Mexico and New Mexico State University. Species identifications were made using the voucher specimens and the resources of the UNM herbarium, where they will be deposited.

Figure 1: Map showing location of Coronado site (Bernalillo 7.5' quad map)

Figure 2: Map showing location of Corrales site (Bernalillo 7.5' quad map)

Figure 3: Map showing location of Alameda site (Los Griegos 7.5' quad map)

Figure 4: Map showing location of Paseo Island site (Los Griegos 7.5' quad map)

Figure 5: Map showing locations of I-40, Biopark, and Tingley sites (Albuquerque West 7.5' quad)

Figure 6: Map showing locations of AOP Willow and Russian Olive sites (Albuquerque West 7.5' quad map)

Figure 7: Map showing locations of North Rio Bravo and South Bravo Powerline sites (Albuquerque West 7.5’ quad map)

Figure 8: Map showing location of South Bravo Mixed site (Isleta 7.5' quad map)

Results

Habitat Characterization Stem counts for the grids are tabulated in Table 2. These figures are the more inclusive counts of the larger 5m x 5m plots (with the exception of one site), and are presented here for information on the range of density of the dominant tree species that defined our site selection. The I-40 and North Rio Bravo are clearly the purest Russian Olive stands, with Alameda and North Bravo the most mixed. The Biopark site appears to be the most evenly mixed, but this distribution is patchy, with willow nearer the river and Russian olives further back towards the terrace. Overall, it is evident that Russian olive dominance is marked by fewer, but larger stems than willow.

Species Diversity We found a total of 68 species at all sites combined. Diversity is higher at the willow sites which have a total of 57 species compared with 40 at the mixed sites, and far more species (27) are unique to the willow sites than those found only on mixed sites (10 species). Tables 3 and 4 are summary tables of plant cover for all species grouped by habitat type (willow or mixed) and ordered by decreasing frequency.

Although trees have the highest densities and cover values within both habitats, they represent less than 20% of the total number of species. As the table below shows, graminoids and forbs make up the bulk of the species diversity, with four to five times more species than trees or shrubs.

Lifeform	**Willow Habitat Type (Number/%)**	**Mixed Habitat Type (Number/%)**
Trees	5 (8.7%)	4 (10%)
Shrubs	4 (7%)	4 (10%)
Forbs	28 (49%)	15 (37.5%)
Graminoids	20 (35%)	17 (42.5%)

Total understory herbaceous cover is about the same for the two types: an average of 37.7% on mixed bars and 36.3% on willow sites. Most herbaceous species are, predictably, ruderal or 'weedy' species. By far the most common herbaceous species is Cuman ragweed (*Ambrosia psilostachya*). Western goldenrod (*Euthamia occidentalis*) and Canadian horseweed (*Conyza canadensis*) were common in willow stands; heath aster (*Aster ericoides*) in mixed stands. Grasses were represented by Indian grass (*Sorghastrum nutans*) and alkali muhly (*Muhlenbergia asperifolia*) at all sites, with alkali sacaton (*Sporobolous airoides*) a strong presence at the mixed sites. Indianhemp (*Apocynum cannabinum*) was the most common shrub in willow stands; seepwillow (*Baccharis salicifolia*) in mixed stands. Vegetation summaries for each site are provided in Appendix A, with scientific and common names, frequency (number of plots in which the species was recorded) as well as percent cover averages, maximums and minimums.

Table 2: Stem count totals of trees for each site

	Eleagnus angustifolia	*Salix exigua*	*Populus deltoides var. wizlensii*	*Tamarix ramosissima*	*Ulmus pumila*	*Morus alba*
Willow Habitat Type						
Coronado	1	986	3	0	0	0
Corrales	1	553	1	18	10	0
Paseo Island	5	498	89	18	24	4
Tingley	10	103*	21	15	11	0
AOP Willow	0	518	30	0	3	10
South Bravo Powerline	1	797	227**	12	119	0
Mixed Habitat Type						
Alameda	26	181	3	34	0	0
South Bravo Mixed	27	255	0	0	0	0
AOP Russian Olive	100	39	1	0	5	1
North Rio Bravo	91	1	0	0	0	0
Biopark	64	67	58	0	8	0
I-40	192	67	29	0	0	0

* This count represents the number of willows within the meter square quads only

** This count represents a large number of seedlings within a small area of the entire grid

Table 3: Summary of Vegetation Cover For All Mixed Russian Olive/Willow Sites

(= species unique to mixed stands)*

n = 192 plots

Species Name	***Common Name***	***Native/Introduced?***	***Frequency***	***% Average Cover***	***Wetland Status***
Ambrosia psilostachya	Cuman ragweed	N	166	11.59	FAC
Elaeagnus angustifolia	Russian olive	I	126	40.79	FACW-
Salix exigua	coyote willow	N	59	8.21	OBL
Equisetum laevigatum	smooth horsetail	N	46	0.15	FACW
Muhlenbergia asperifolia	alkali muhly	N	42	2.17	OBL
Sporobolus airoides	alkali sacaton	N	41	5.40	FAC
Aster ericoides	heath aster	N	40	2.18	FACU
Sorghastrum nutans	Indiangrass	N	32	3.76	NI (FACW)
Solidago sp.	goldenrod	N	28	1.78	
Baccharis salicifolia	seepwillow	N	26	6.03	FACW
Helianthus annuus	common sunflower	N	23	0.37	FAC-
Panicum obtusum	vine mesquite	N	21	5.60	FAC (FACW)
Sporobolus compositus var. compositus	tall dropseed	N	18	2.71	NI (UPL)
Populus deltoides ssp. wislizenii	Rio Grande cottonwood	N	16	3.63	FACW (OBL)
Trifolium spp.	clover		16	0.27	
Melilotus officinalis	yellow sweetclover	I	14	0.29	FACU+
Tamarix ramosissima	saltcedar	I	10	1.85	NI (FACW)
Sporobolus cryptandrus	sand dropseed	N	8	0.13	FACU- (FAC)
Euthamia occidentalis	western goldenrod	N	7	0.24	FACW
Asclepias subverticillata	whorled milkweed	N	7	0.52	FACU
Apocynum cannabinum	Indianhemp	N	6	0.34	FAC+ (FACW)
*Phragmites australis**	common reed	N	5	0.32	FACW+
Conyza canadensis	Canadian horseweed	N	4	0.04	FACU (FAC)

Table 3: Summary of Vegetation Cover For All Mixed Russian Olive/Willow Sites

(= species unique to mixed stands)*

n = 192 plots

Species Name	Common Name	Native/Introduced?	Frequency	% Average Cover	Wetland Status
Distichlis spicata	inland saltgrass	N	4	0.19	FACW
Lactuca serriola	prickly lettuce	I	4	0.09	FAC
*Gaura parviflora**	velvetweed	N	4	0.07	NI (FACU)
*Chloracantha spinosa**	spiny chloracantha	N	3	0.15	FACW
Ulmus pumila	Siberian elm	I	3	0.61	NI (UPL)
*Bothriochloa laguroides ssp. Torreyana**	silver beardgrass	N	3	0.48	NI (UPL)
Convolvulus arvensis	field bindweed	I	2	0.02	NI (UPL)
Muhlenbergia racemosa	marsh muhly	N	2	0.47	FACW
Elymus canadensis	Canada wildrye	N	2	0.05	FAC (FACW)
Cynodon dactylon	bermudagrass	I	1	0.04	FACU (FACW)
Morus alba	white mulberry	I	1	0.38	NI (UPL)
*Linum lewisii**	prairie flax	N	1	0.01	
Unidentified grass		N	1	0.04	
Muhlenbergia spp.	muhly		1	0.02	
Oenothera elata ssp. hirsutissima	Hooker's eveningprimrose	N	1	0.01	FACW
*Sphaerophysa salsula**	alkali swainsonpea	I	1	0.05	
*Bromus spp.**	brome		1	0.00	

Table 4: Summary of Vegetation Cover For All Willow Sites

n = 193 plots

Species Name	*Common Name*	*Native/Introduced?*	*Frequency*	*%Average Cover*	*Wetland Status*
Salix exigua	coyote willow	N	184	51.07	OBL
Ambrosia psilostachya	Cuman ragweed	N	86	7.66	FAC
Euthamia occidentalis	western goldenrod	N	59	4.94	FACW
Conyza canadensis	Canadian horseweed	N	57	2.15	FACU (FAC)
Trifolium spp.	clover		46	1.40	
Apocynum cannabinum	Indianhemp	N	33	7.39	FAC+ (FACW)
Sorghastrum nutans	Indiangrass	N	32	3.02	NI (FACW)
Oenothera elata ssp. hirsutissima	Hooker's eveningprimrose	N	28	1.93	FACW
Aster ericoides	heath aster	N	26	1.01	FACU
Muhlenbergia asperifolia	alkali muhly	N	25	0.97	OBL
Populus deltoides ssp. wislizenii	Rio Grande cottonwood	N	21	1.19	FACW (OBL)
Equisetum laevigatum	smooth horsetail	N	19	0.05	FACW
Solidago sp.	goldenrod	N	16	0.73	
Sporobolus cryptandrus	sand dropseed	N	14	0.40	FACU- (FAC)
Helianthus annuus	common sunflower	N	12	0.32	FAC-
*Agrostis gigantea**	redtop	I	12	0.99	FACW+
Melilotus officinalis	yellow sweetclover	I	12	0.70	FACU+
*Grindelia squarrosa**	curlycup gumweed	N	12	0.24	FACU
Ulmus pumila	Siberian elm	I	12	1.31	NI (UPL)
Tamarix ramosissima	saltcedar	I	9	0.74	NI (FACW)
*Xanthium strumarium**	rough cocklebur	N	9	0.09	NI (FACW)
*Sedge**			9	0.15	
*Elymus elymoides**	bottlebrush squirreltail	N	8	0.07	NI (FACU)
Elymus canadensis	Canada wildrye	N	8	0.14	FAC (FACW)
*Gnaphalium stramineum**	cottonbatting cudweed	N	8	0.18	FAC
*Lycopus americanus**	American bugleweed	N	8	0.29	OBL

Table 4: Summary of Vegetation Cover For All Willow Sites

n = 193 plots

Species Name	*Common Name*	*Native/Introduced?*	*Frequency*	*%Average Cover*	*Wetland Status*
*Polypogon monspeliensis**	annual rabbitsfoot grass	I	8	0.09	FACW+ (OBL)
*Poa pratensis**	Kentucky bluegrass	N	8	0.75	FACU
Elaeagnus angustifolia	Russian olive	I	7	1.67	FACW-
Gnaphalium spp.	cudweed		6	0.31	
Muhlenbergia racemosa	marsh muhly	N	4	0.20	FACW
*Panicum capillare**	witchgrass	N	4	0.02	FAC
Baccharis salicifolia	seepwillow	N	3	0.74	FACW
*Bidens pilosa**	Spanish needles	N	3	0.05	FACW
*Hordeum jubatum**	foxtail barley	N	3	0.02	NI (FAC)
Lactuca serriola	prickly lettuce	I	3	0.03	FAC
Morus alba	white mulberry	I	3	0.33	NI (UPL)
Cynodon dactylon	bermudagrass	I	2	0.03	FACU (FACW)
*Sphenopholis obtusata**	prairie wedgescale	N	2	0.12	
*Salix gooddingii**	Goodding's willow	N	2	0.23	OBL
*Plantago major**	common plantain	I	2	0.05	FACW
*Chamaesyce spp.**	spurge		2	0.01	
Convolvulus arvensis	field bindweed	I	2	0.01	NI (UPL)
Distichlis spicata	inland saltgrass	N	2	0.17	FACW
*Echinochloa crus-galli**	barnyardgrass	I	2	0.03	FACW- (FACW)
*Mentha arvensis**	wild mint	N	2	0.19	FACW
*Heterotheca villosa**	hairy goldenaster	N	1	0.00	
*Panicum hirticaule**	Mexican panicgrass	N	1	0.01	
Juncus spp.	Rush	N	1	0.00	
Machaeranthera spp.	tansyaster	N	1	0.01	
*Machaeranthera canescens**	hoary aster	N	1	0.03	FAC
*Senecio flaccidus**	threadleaf ragwort	N	1	0.00	

Table 4: Summary of Vegetation Cover For All Willow Sites

n = 193 plots

Species Name	Common Name	Native/Introduced?	Frequency	%Average Cover	Wetland Status
Asclepias subverticillata	whorled milkweed	N	1	0.01	FACU
Asclepias spp.	milkweed	N	1	0.03	NI (UPL)
*Juncus balticus**	Baltic rush	N	1	0.11	OBL
Ambrosia spp.	ragweed.		1	0.01	
Sporobolus compositus var. compositus	tall dropseed	N	1	0.02	NI (UPL)
Panicum obtusum	vine mesquite	N	1	0.01	FAC (FACW)

Wetland Status One of the perceptions that prompted this study is that the river bars within the Middle Rio Grande are becoming hydrologically disconnected from the river channel itself due to restricted flows that decrease overbank flooding and associated sediment movement. The degree to which this is occurring should be reflected in the numbers and kinds of wetland indicator species: bars which are more closely linked to the river should have a greater number of obligate and facultative wetland species.

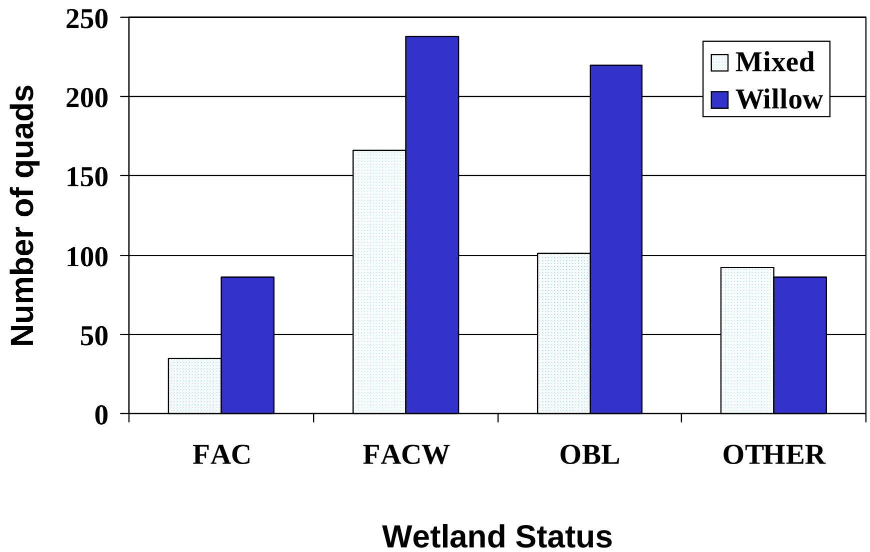
Wetland indicators, as defined by Reed (1988), are broken down into five groups that represent the spectrum of plant affinity for wet to dry habitats:

Obligate wetland plants (OBL) - occur almost always (estimated probability of >99%) in wetlands.
Facultative wetland plants (FACW) – usually occur in wetlands (estimated probability of 67 to 99%).
Facultative plants (FAC) - share an equal likelihood (estimated probability 33 to 67%) or occurring in either wetlands or non-wetlands
Facultative upland plants (FACU) – usually occur in non-wetlands (estimate probability 67 to 99%)
Obligate upland plants (UPL) – occur almost always (estimate probability >99%) in non-wetlands
Non-indicators (NI) – not indicative or not yet evaluated

Positive (+) or negative signs (-) are used to more specifically characterize the wetland status of the Facultative indicator species (e.g. FACW+ or FACU-). The positive sign indicates that the species occurs more frequently in wetlands while the negative sign indicates that a species occurs less frequently in wetlands. Data from our own watershed studies in the southwestern United States do not always support Reed's concept of the indicator status, and in these cases, we have added a provisional classification in parentheses after the original classification. For instance, *Populus deltoides* ssp. w*islizenii* is classified by Reed as a facultative wetland species, but most studies (e.g. Fenner et al. 1984, 1985) show it to be an obligate wetland species, so we have classified it as FACW(OBL) in the database.

Predictably, willow sites, with the greater diversity, also have a greater of number of species in all wetland status categories. Twenty-four facultative wetland and obligate species were found in willow sites contrasted with 17 at mixed sites. Likewise, facultative and upland plants at willow sites outnumber those at mixed sites by 21 to 15. More telling is the comparison of the frequency (number of quads) of plants within each wetland category between habitat types (Figure 9). Species in facultative, facultative wetland and obligate categories on willow sites occur significantly more often than they are on mixed sites. The frequency of all other species (facultative upland, upland and non-indicators) is about the same on both habitat types, although slightly less on willow sites.

Figure 9: Frequency of Plants by Wetland Status on Mixed and Willow Sites



Geographic Origin Another important ecological issue of this study is the number and kinds of exotic species. Exotic species can readily outcompete or displace native flora, without filling the functional niche of the original flora (Forcella and Harvey 1983). Large-scale invasions of a particular species can affect basic system processes, such as fire frequency and seasonality, water discharge or erosion rates, which in turn have a cascading effect on the system as a whole (Vitousek 1990). The Natural Heritage Program has initially categorized the geographic origin of species into two categories: those native to North America (N), and those not native to North America and introduced either deliberately or accidentally (I).

Table 4 lists the exotic species found in each habitat, their wetland status and the number of quadrats they were encountered on (n= 193 quads for willow habitat, 192 for mixed habitat). Overall, frequency of exotic species is fairly low, with the exception of Russian olive on the mixed sites. Exotic species diversity is greater in willow habitats (12 species) than in mixed habitats (8); however the ratio of exotic to native species is about 1:5 for each habitat type. Within each habitat type, exotic species are about evenly split between wetland indicators (FACW, OBL) and upland species (FAC, FACU, UPL).

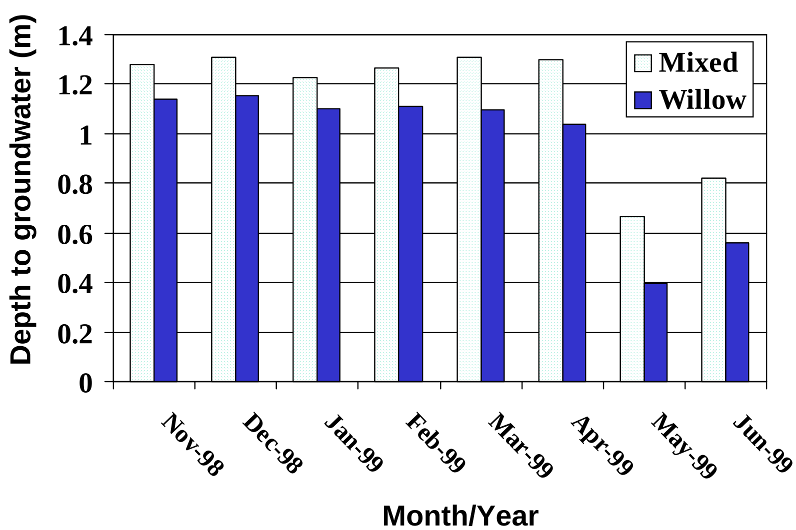
Table 5: Exotic Species at each Habitat Type and their associated Wetland Status

Wetland status follows that of Reed (1988) and the New Mexico Natural Heritage Program database

Species	Wetland Status	Frequency	
		Willow Habitat Type	Mixed Habitat Type
TREES			
Elaeagnus angustifolia	FACW-	7	126
Morus alba	NI (UPL)	3	1
Tamarix ramosissima	NI (FACW)	9	10
Ulmus pumila	NI (UPL)	12	3
FORBS			
Convolvulus arvensis	NI (UPL)	2	2
Lactuca serriola	FAC	24	4
Melilotus officinalis	FACU+	12	14
Plantago major	FACW	2	
GRASSES			
Cynodon dactyloides	FACU (FACW)	2	1
Agrostis gigantea	FACW+	12	
Echinochloa crus-galli	FACW-	2	
Polypogon monospielensis	FACW+	8	

Groundwater Levels Distance to groundwater has been measured monthly at each site since November 1998. Average depth to groundwater is consistently and significantly deeper at mixed sites than at willow sites (one-way ANOVA, $p < .0074$). This difference is especially pronounced during April, May and June when the average difference between the two vegetation types climbed from about 10cm to 20+cm. The graph also reflects the heavy rains and snows in northeastern New Mexico during May 1999 which contributed to high flows during May and June.

Figure 10:
Average Depth to Groundwater



Discussion

These data from the first year show solid differences between willow and mixed sites. Willow sites have high water tables, higher species diversity, a higher number of exotics and a greater frequency of wetland indicator species. In short, willow bars seem to be more hydrologically connected to the river than the mixed bars. Although flow in the Middle Rio Grande is regulated, willow bars probably experience higher water levels and a greater degree of sediment shifting compared to mixed bars. This type of disturbance, normally inherent in riverine systems, may contribute to the higher species diversity, especially of exotics, on willow sites. Many exotics are ruderal or weedy species that are adapted to disturbed environments, and many natives that colonize river bars are disturbance increasers as well.

The vegetation and wells will continue to be monitored in succeeding years, and we will be then be able to conduct multivariate and multiyear comparisons and provide a detailed picture of vegetation composition and dynamics in relation to watertable heights on the bars. These vegetation and hydrological analyses will serve as the foundation for additional comparative work on arthropods and soil characteristics. In the coming year, we hope to dig soil pits at each site and describe the profiles in detail. It might also be valuable to conduct infiltration studies at various places within stands (herbaceous vs. woody vegetation, bare patches vs. grassy swaths) to get an index of soil permeability. The elevation of the wells and the sites relative to the channel is also important to interpret or predict groundwater fluctuation or overland flow. We also plan to initiate complimentary arthropod studies on the bars in 1999, focussing on ground dwelling beetles as indicators of diversity over the range of sites.

An unexpected discovery of this years' work is that the river bar area appears to be somewhat underbotanized. This may be because ruderal species are often overlooked as being too common to collect and also because Russian olive stands are difficult and unpleasant to access and work in. At any rate, our voucher of tall dropseed (*Sporobolous compositus* var. *compositus*) represents the first collection of this species in Bernalillo County. Dr. Kelly Allred of New Mexico State University is verifying this collection. Western goldenrod (*Euthamia occidentalis*) and common reed (*Phragmites australis*) are represented by only a few specimens in the UNM herbarium. Species composition can be expected to change seasonally and annually, and there may be many more under-represented or new records on these dynamic sites. This underscores the importance of continuing to examine full vegetative diversity. This knowledge is also useful to the manager planning restoration: since most species are disturbance increasers and most restoration of rivers involves massive initial disturbance, our data could help predict the first response to such a project.

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