River Bars of the Middle Rio Grande

Progress Report Year III [1]

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September 2001

Introduction

This report reviews the work completed in the third year of a multi-year project to study the vegetation of river bars in the Albuquerque reach of the Middle Rio Grande[2] in relation to 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. River bars are a critical element in flood plain and terrace development, and, implied by our study results thus far, 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 50 years, flood control structures (Jemez and Cochiti dams, levees, 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 of ecological value. In this context of altered hydrological regime and exotic invasion, 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 designed a study 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.

In the second year, we added control study plots in the adjacent cottonwood forest (Bosque), and initiated a ground arthropod survey. Pitfall traps for arthropods were established at every site, and arthropods were collected three times during the growing season. Vegetation data were collected at all sites in September, and wells were monitored every month.

[1] Project jointly funded by the Bureau of Land Management (Coop. Agreement No. 6-FC-40-109890), and the US Fish and Wildlife Service—Bosque Initiative Group (Grant 1448-20181-98); Fiscal Year 2000.
[2] Defined as the river and associated riparian area between Cochiti and San Marcial (Whitney 1996)

In the third year we collected arthropods four times during the growing season using the pitfall traps established in 1999. Complete vegetation data was collected for all eighteen sites in September, and wells continued to be monitored every month.

Methods and Materials

Site Selection and Location In the summer of 1998 we selected and established twelve study sites, six on bars dominated by the native coyote willow (*Salix exigua*) and six on bars dominated by a mix of coyote willow and the non-native Russian olive (*Elaeagnus angustifolia*). (See the 1998 progress report (Wood et al. 1999) for a complete description of site selection criteria.) In 1999 we added six control sites in the bosque adjacent to selected bar sites. (See the 1999 progress report (Milford et al. 2000) for a complete description of the site selection criteria and for maps of all study sites.) Figure 1 is an overview map showing all site locations and table 1 lists the site names and locations, and also includes the dominant vegetation type of each site with brief directions.

Methods The 32-point grids established on the bars in 1998 and the bosque sites in 1999 were maintained and reused in 2000. Each gridpoint was monumented with a four-foot rebar stake. Corner stakes were jacketed with white PVC pipe and labeled with aluminum tags for later identification. See Wood et al. (1999) for a complete description of the grid setup method. The layout of a standard study site is shown in Figure 2.

To sample ground active arthropods, a ten-pitfall grid was established at each site in 1999. See Milford et al. (2000) for a complete description of the grid setup and sampling method. Arthropods were sampled on May 5-8, June 27-30, August 17-20 and September 29-October 2, 2000. All beetle specimens were given to entomological taxonomist Richard Fagerlund of the University of New Mexico for identification. The New Mexico Natural Heritage Program (NMNHP) staff counted isopods and spiders, and identified and counted ants. Although other taxa were collected, they are not being identified due to time and budget limitations.

In September 2000, vegetation at all sites was measured following the 1998 protocol (Wood et al. 1999). Ground water wells, established at the bar sites in November 1998, were read on a monthly basis throughout 2000. The wells at the North Rio Bravo and Rio Bravo Powerline sites had to be replaced because of vandalism and root growth respectively. Wells have not and will not be established at the control sites.

Between October 15, 2000 and June 15, 2001, arthropod samples were sorted and counted at the NMNHP lab and then sent out for identification by specialists. During the same period plant vouchers were identified by a NMNHP botanist using the resources of the UNM Herbarium where they will be archived. The data was then entered into a Microsoft Access database following NMNHP quality controls and statistically analyzed.

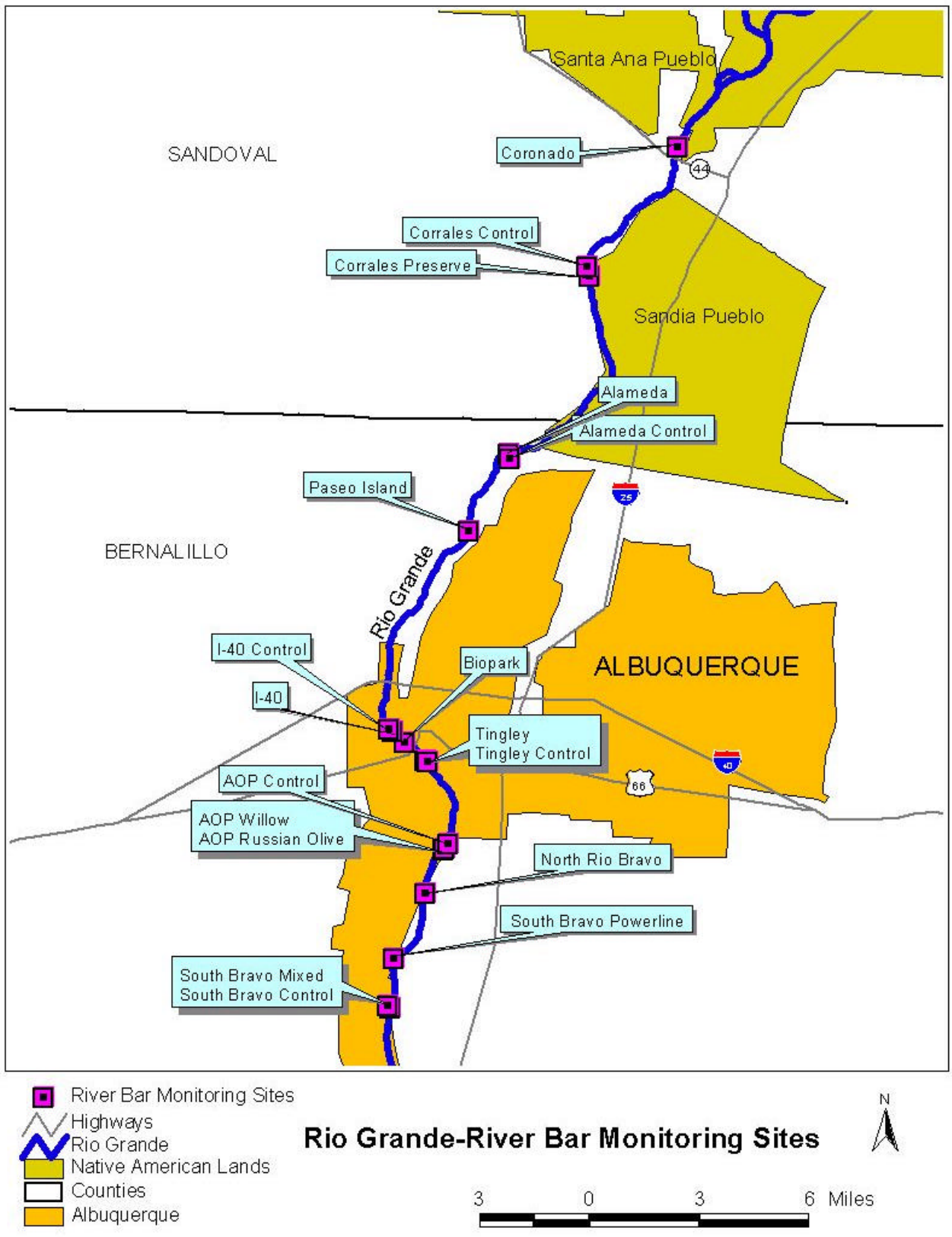

Figure 1. Overview map of the Rio Grande-River Bar Monitoring Sites.

Table 1: Site Information and Location

Site Name	*Major Vegetation Type*	*Nearest Access Point*	*Directions*
Coronado	Willow	Coronado State Monument	Island bar just south of Coronado State Monument, cross river at pullout on road between the camping area and the Monument.
Corrales	Willow	Corrales ditch road	Take SR 448 to north end of Corrales, take ditch side road at boundary between Rio Rancho and Corrales and follow NE to parking lot by river. From parking lot walk south ~ 0.5 miles on riverside trail to bar.
Corrales Control*	Bosque	Corrales ditch road	Take SR 448 to north end of Corrales, take ditch side road at boundary between Rio Rancho and Corrales and follow NE to parking lot by river. From parking lot walk south ~ 0.25 miles on riverside trail to meadow with cottonwood overstory.
Alameda	Mixed	Alameda Bridge	From Alameda road take eastern riverside drain road north 0.6 miles, cross river to island bar.
Alameda Control*	Bosque	Alameda Bridge	From Alameda road take eastern riverside drain road north 0.6 miles. Site in forest ~50m south of trail to river.
Paseo Island	Willow	Access road off Rio Grande Blvd.	Access eastern riverside drain road from Rio Grande Blvd. just south of Paseo del Norte overpass. Go 0.5 miles south from Paseo Bridge then follow bosque trail to river edge bar.
I-40	Mixed	Central Bridge	Take western riverside drain road north from Central Ave. untill it crosses diversion dam (~ 0.7 miles), then follow bosque trail east to bar.
I-40 Control*	Bosque	Central Bridge	Take western riverside drain road north from Central Ave. untill it crosses diversion dam (~ 0.7 miles), then follow bosque trail toward river ~200m, go north under jetty jacks ~25m to site.
Biopark	Mixed	Central Bridge	Eastern side of river, just north of Central Ave.
Tingley	Willow	Tingley Beach	Take Tingley beach road south from Central Ave. ~0.5 miles, walk in on bosque trail.
Tingley Control*	Bosque	Tingley Beach	Take Tingley beach road south from Central Ave. ~0.5 miles, walk in on bosque trail.

Table 1: Site Information and Location (cont.)

Site Name	*Major Vegetation Type*	*Nearest Access Point*	*Directions*
AOP Russian Olive	Mixed	Bridge Street Bridge	Take western riverside drain road south from Cesar Chavez Blvd. (Bridge St.) 1.5 miles. Take road into bar, follow trail to weather station north of AOP site, site in Russian Olives north of Willow site.
AOP Willow	Willow	Bridge Street Bridge	Take western riverside drain road south from Cesar Chavez Blvd. (Bridge St.) 1.5 miles. Take road into bar, follow trail out to weather station north of AOP site, willows in depression just north of fence.
AOP Control*	Bosque	Bridge Street Bridge	Take western riverside drain road south from Cesar Chavez Blvd. (Bridge St.) 1.5 miles.
North Rio Bravo	Mixed	Rio Bravo Bridge	On eastern side of river, just north of Rio Bravo Bridge
South Bravo Powerline	Willow	Rio Bravo Bridge	Take western riverside drain road 1.8 miles south from Rio Bravo Bridge to powerline. Follow trail under powerlines to site.
South Bravo Mixed	Mixed	Rio Bravo Bridge	Take western riverside drain road 3.1 miles south from Rio Bravo Bridge. Follow trail east to bar.
South Bravo Control*	Bosque	Rio Bravo Bridge	Take western riverside drain road 3.1 miles south from Rio Bravo Bridge.

* sites established in 1999.

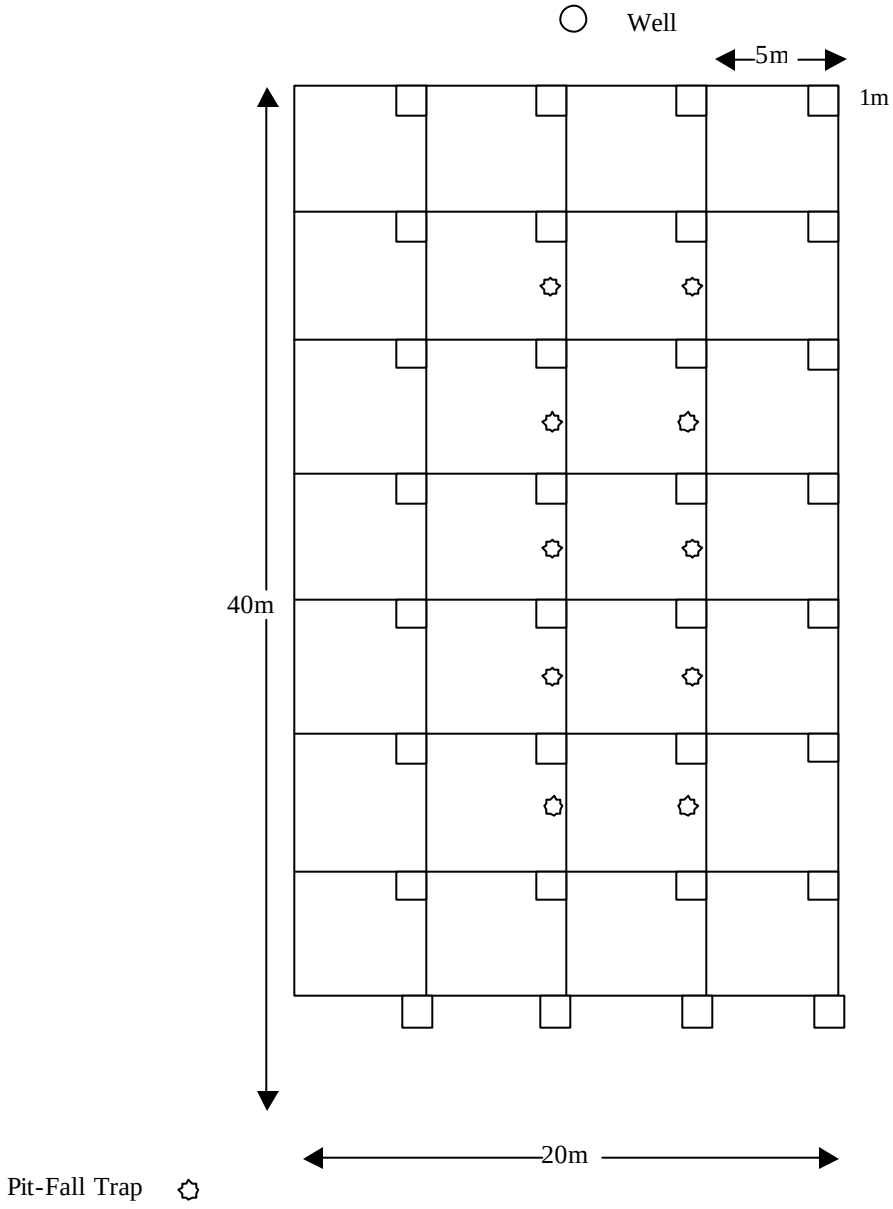

Figure 2: Layout of standard study site.

Results and Discussion

The island and alternate alluvial bars along the main channel of the middle Rio Grande represent significant habitats in the river corridor. These sites typically support younger wetland vegetation communities that are more directly affected by stream flows, ground water fluctuations, sediment loads and other hydrological factors than the more mature forests of the neighboring terraces. Our studies indicate that even under regulated conditions, ground water levels have been found to approach the surface during peak spring flows, and occasionally some sites are inundated (Figure 3). In general the bars with shallower water tables are dominated by willows while those with deeper water tables are dominated by Russian olive. The exception is the two willow bars furthest upstream (Coronado and Corrales), which actually have two of the deepest water tables. This seems to indicate that depth to the water table is only one factor among several determining the dominant vegetation on a bar.

Data on plant and ground dwelling arthropods suggests that the bars and particularly the well-watered willow sites are perhaps the most biologically diverse and dynamic in the Bosque ecosystem (Figure 4-7). We have found many plants and arthropods that are unique to river bars, and new species have been uncovered each year of the study. In addition, after three years of comparative vegetation studies there is an indication that both overall and native plant species richness is greater on native-dominated bars (Figure 4).

With only two years of arthropod data so far, the differences between willow and mixed Russian olive-willow dominated bars remain inconclusive. There has been a great deal of variability in species composition and density between the two years (figures 6-7). There is an obvious difference in species dominance and richness between the Bosque and the bar types. There also appear to be differences in dominant beetle and ant species between the willow and mixed bars (Figure 6 and Table 2) but these trends require more data before conclusive statements can be made.

Models of riparian forest development by Leonard et al. (1992) and Hupp (1992) suggests that bars play a critical role in floodplain development and support the initial stages of new forests to replace the old. In keeping with these models we have found that native tree reproduction occurs only on the bars not in the forest (Figure 8), however this is coupled with a problematic invasion by exotic trees such as Russian olive, salt cedar, tree of heaven and Siberian elm (both on the bars and in the adjacent forest).

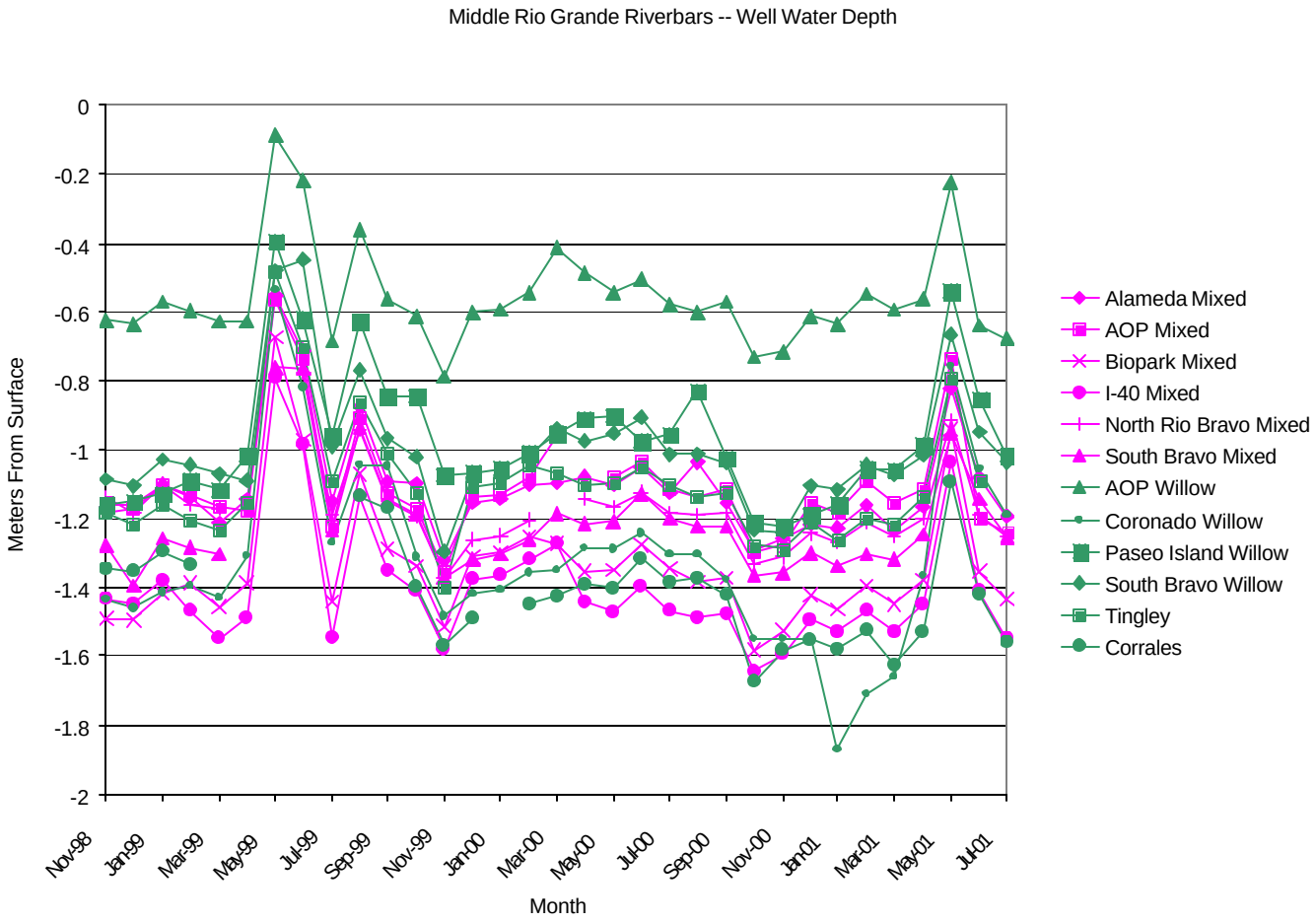

Figure 3. Monthly well water depth readings for each bar site from November 1998 through July 2001. Green lines are willow dominated bars and pink lines are mixed Russian olive-willow. Note that most willow sites have shallower water tables except for Coronado and Corrales, the sites furthest upstream in the study.

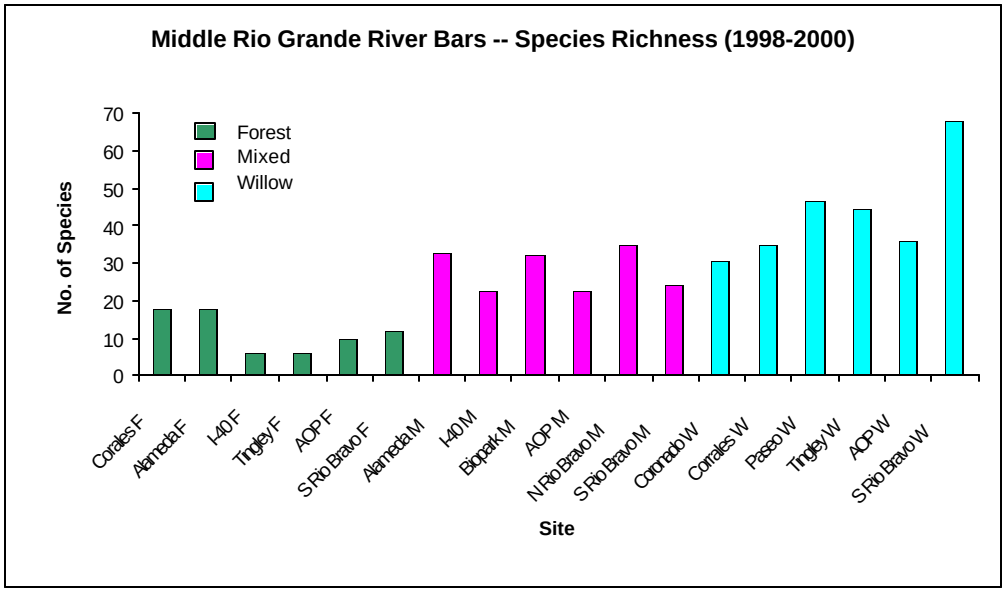

Figure 4. Total number of species found on each bar site and adjacent forest sites

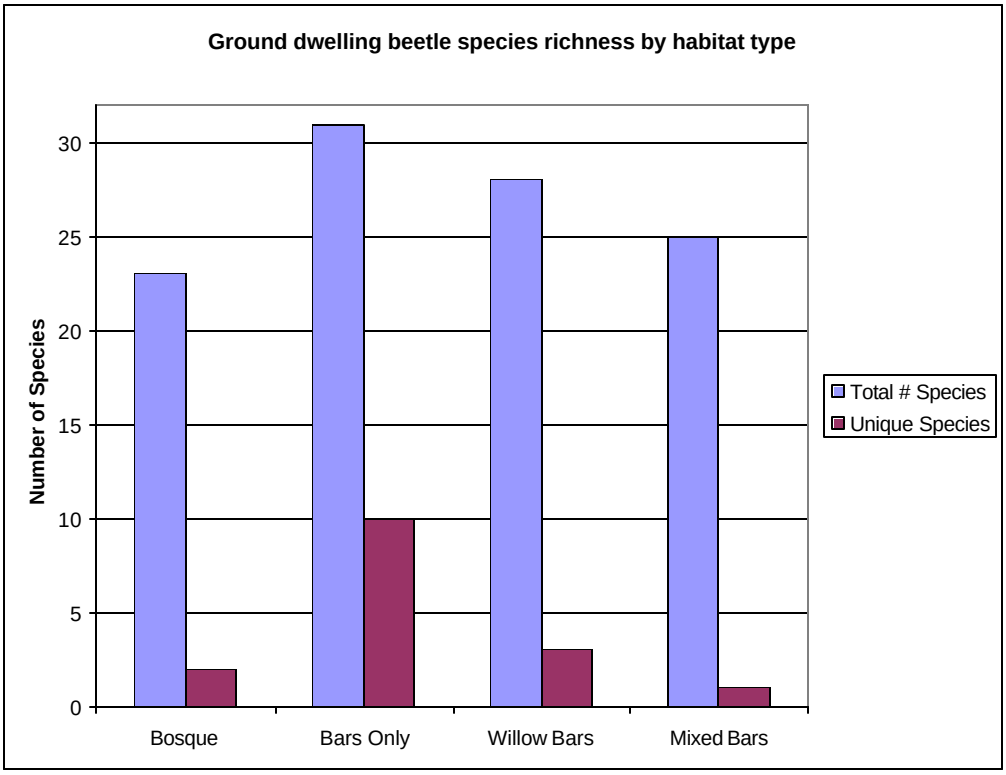

Figure 5. Total and unique number of species by habitat type for five major ground dwelling beetle families. (Five families included are: Carabidae, Cryptophagidae, Elateridae, Staphylinidae and Tenebrionidae)

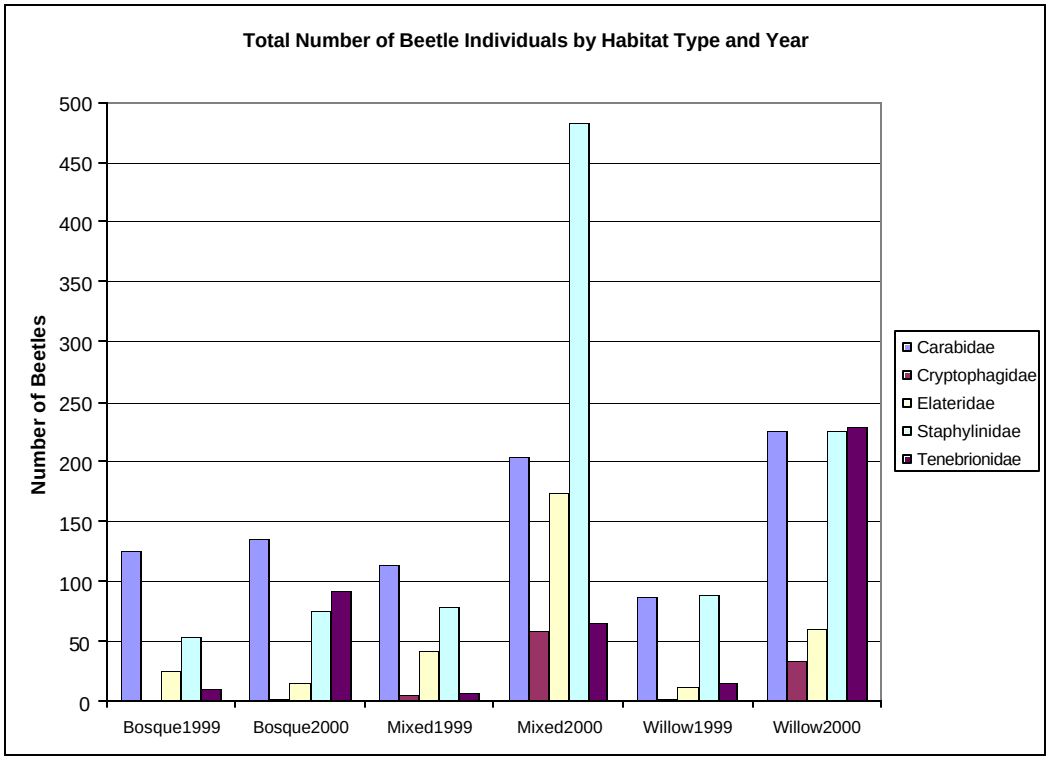

Figure 6. Total number of individual beetles by habitat type and year for five major ground dwelling beetle families. (Five families included are: Carabidae, Cryptophagidae, Elateridae, Staphylinidae and Tenebrionidae)

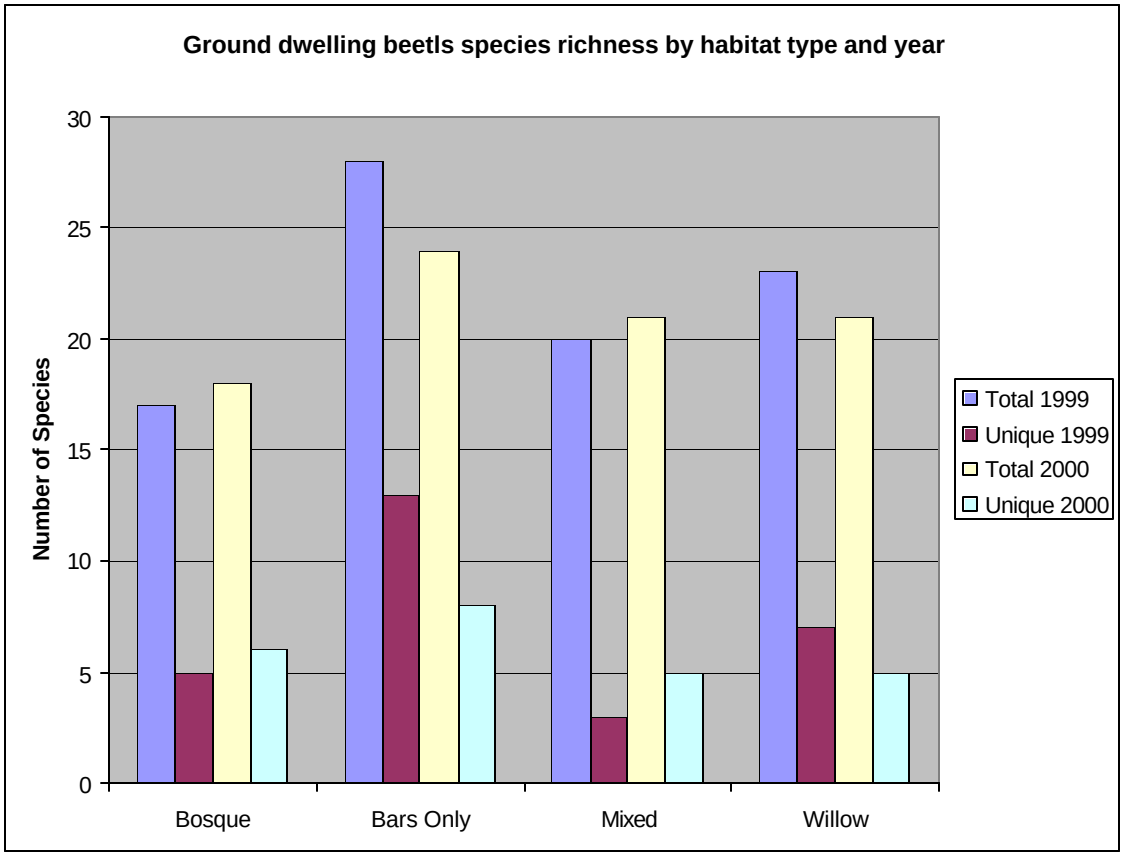

Figure 7. Total and unique number of species by habitat type and year for five major ground dwelling beetle families. (Five families included are: Carabidae, Cryptophagidae, Elateridae, Staphylinidae and Tenebrionidae)

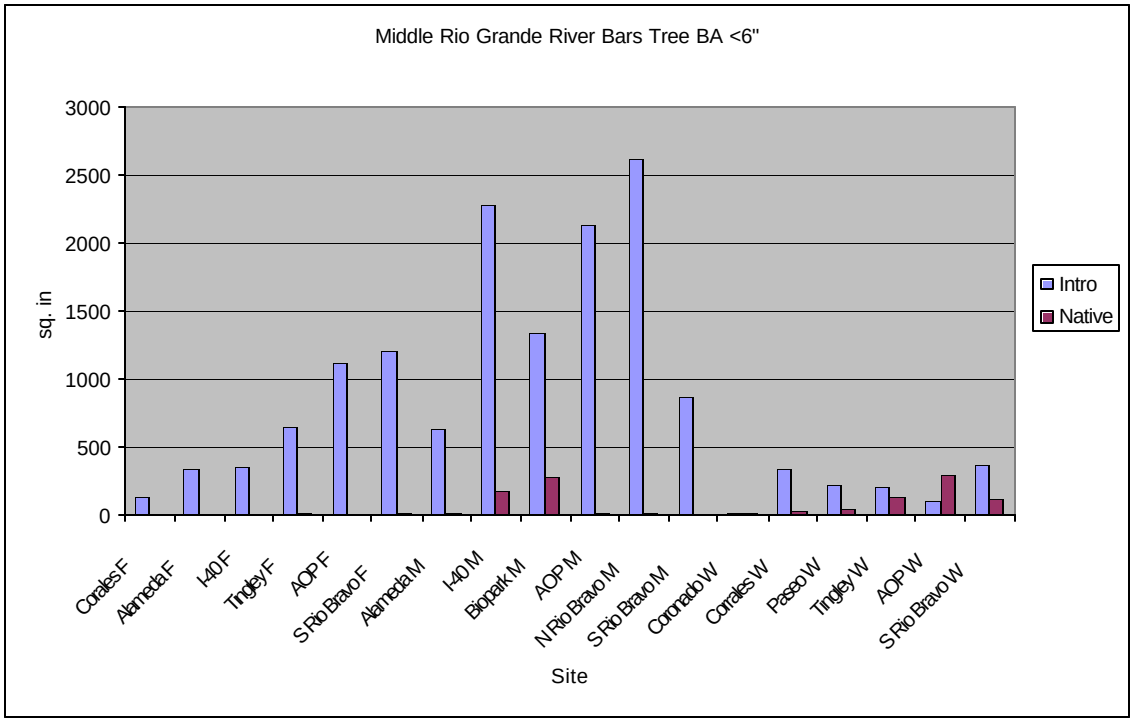

Figure 8. Basal area in square inches of native versus introduced tree species on each site. "F" sites are forest; "M' sites are mixed Russian olive-willow, and "W" sites are coyote willow dominated.

Table 2. Ant species occurrence by habitat type and year. Occurrence equals the number of pitfalls occupied by a species summed over all sample periods for the year. Species are listed in taxonomic order by subfamily.

Ant Species		Bosque		Willow		Mixed	
		1999	2000	1999	2000	1999	2000
Ponerinae							
	Hypoponera opaciceps			5	1	1	1
Ecitoninae							
	Neivamyrmex sp.					2	
Myrmicinae							
	Crematogaster mormonum	11	38	6	15		2
	Leptothorax andrei	13	7				2
	Monomorium minimum	8	12	82	182	110	217
	Myrmicinae			2	1		
	Pheidole hayatti				8		1
	Pogonomyrmex occidentalis	1		30	50	4	18
	Solenopsis krockowi	6	8	35	63	37	74
Dolichoderinae							
	Dorymyrmex insanus	2		18	45	1	5
	Tapinoma sessile	2	2	128	194	34	92
Formicinae							
	Acanthomyops latipes					2	
	Brachymyrmex depilis	1			3	9	5
	Camponotus pennsylvanicus	2	1				
	Camponotus vicinus	6	11				
	Formica sp.	23	37	62	109	20	72
	Lasius flavus	1					
	Lasius pallitarsis	91	179	27	38	25	35

Work in 2001 and beyond

In 2001, we will collect arthropods four times over the growing season (sampling in May, June, August and October), and we will do a complete vegetation sampling in the fall of 2001. We will also do soil profile descriptions of the bar sites in 2001. This will result in a total of three years of data on arthropods and four on vegetation along with the continuing hydrological and site data. With this data-set we will then produce a comprehensive final report on the study in the Spring of 2002 as a concluding document for Phase I of our studies. For Phase II we have initiated in 2001 a project to map the vegetation of the bars in the Albuquerque reach. Current efforts focus on acquiring images and photography and building a preliminary vegetation map to be ground truthed in 2002. The field studies will continue but in a streamlined fashion focusing on specific indicators of riparian ecosystem health and the dynamics of tree establishment.

References

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