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Bosque Ecosystem Monitoring Program

BOSQUE SCHOOL

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BOSQUE ECOSYSTEM MONITORING PROGRAM (BEMP) SITE MONITORING REPORT FOR 2015

2015 ANNUAL SITE MONITORING TECHNICAL REPORT

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Bosque Ecosystem Monitoring Program (BEMP)

Report on 2014-15 Education and Monitoring
March, 2016

Objective: To collect and analyze abiotic and biotic data at BEMP sites in the Middle Rio Grande Bosque. Also, to involve K-12 and university students in the learning about and monitoring of the bosque and river system.

Data collected are posted on the BEMP website: bemp.org under "Science -> Data". Reports are also available under "Science -> Reports".

Scope of work: The Bosque Ecosystem Monitoring Program (BEMP) combines long-term ecological research with community outreach by involving K-12 teachers and their students in monitoring key indicators of structural and functional change in the Middle Rio Grande riparian forest, or "bosque." In 1997, BEMP began as a collaboration between the Department of Biology at UNM and Bosque School in Albuquerque, with fewer than 200 participants. Now BEMP averages 6000 participants each year. The experiences of these community members support science education reform efforts and help to increase each person's understanding and appreciation of science in general and the Rio Grande riparian ecosystem in particular. BEMP findings derived from K-12 student-gathered data are used by government agencies to inform multi-million dollar river and riparian management decisions.

BEMP has 32 monitoring sites along 300 miles of the Rio Grande, including 29 sites within the Middle Rio Grande (Figure 1). BEMP monitors abiotic factors including depth to groundwater; water level in the ditches; precipitation; temperature; and water quality of the river, ditches, and groundwater. BEMP monitors biotic factors including litterfall of native and exotic trees; vegetation cover (includes species richness, abundance, and diversity); cottonwood monitoring (size and sex); woody debris/fuel load; surface-active arthropods; and tamarisk leaf beetle presence, abundance, and impact. BEMP tracks the impacts of restoration projects (mechanical clearing, wood chipping, mastication, bank-lowering), flooding, and fire on the biotic and abiotic variables mentioned above (Table 1).

BEMP data and interpretations are presented at three BEMP-hosted events throughout the year: the BEMP Fall Field Tour, the BEMP Data Users Meeting (in the summer), and the Crawford/Green Trails Symposium (February/March). The Field Tour and Data Users Meeting will be combined as of 2016.

Students from nearly 50 schools from Rio Arriba, Sandoval, Bernalillo, Valencia, Socorro and Doña Ana counties are involved with BEMP (Table 1). BEMP involves traditional public, charter, parochial, private, alternative and home school students. Throughout the school year, BEMP staff deliver Common Core correlated classroom and field educational experiences. At the end of the school year, BEMP hosts two annual seminar-type student congresses in partnership with a variety of local agencies and organizations. Students present and share their experiences at their sites and in relation to classroom activities. Students also present at the Long-Term Ecological Research (LTER) Schoolyard Spanish Webinar in May. This is a symposium that connects BEMP Spanish-speaking students with Spanish-speaking students from other LTER sites (at this point, specifically, Puerto Rico).

Data collection dates: Depth to groundwater, water level in the nearby ditch or drain, precipitation, and litterfall are collected each month during the week of the third Tuesday. Surface-active arthropods are collected three times each year, in May, June and September. Vegetation cover is collected once a year in August/September. All other datasets are collected as funding permits (woody debris in the fall/winter; tamarisk leaf beetle in the summer).

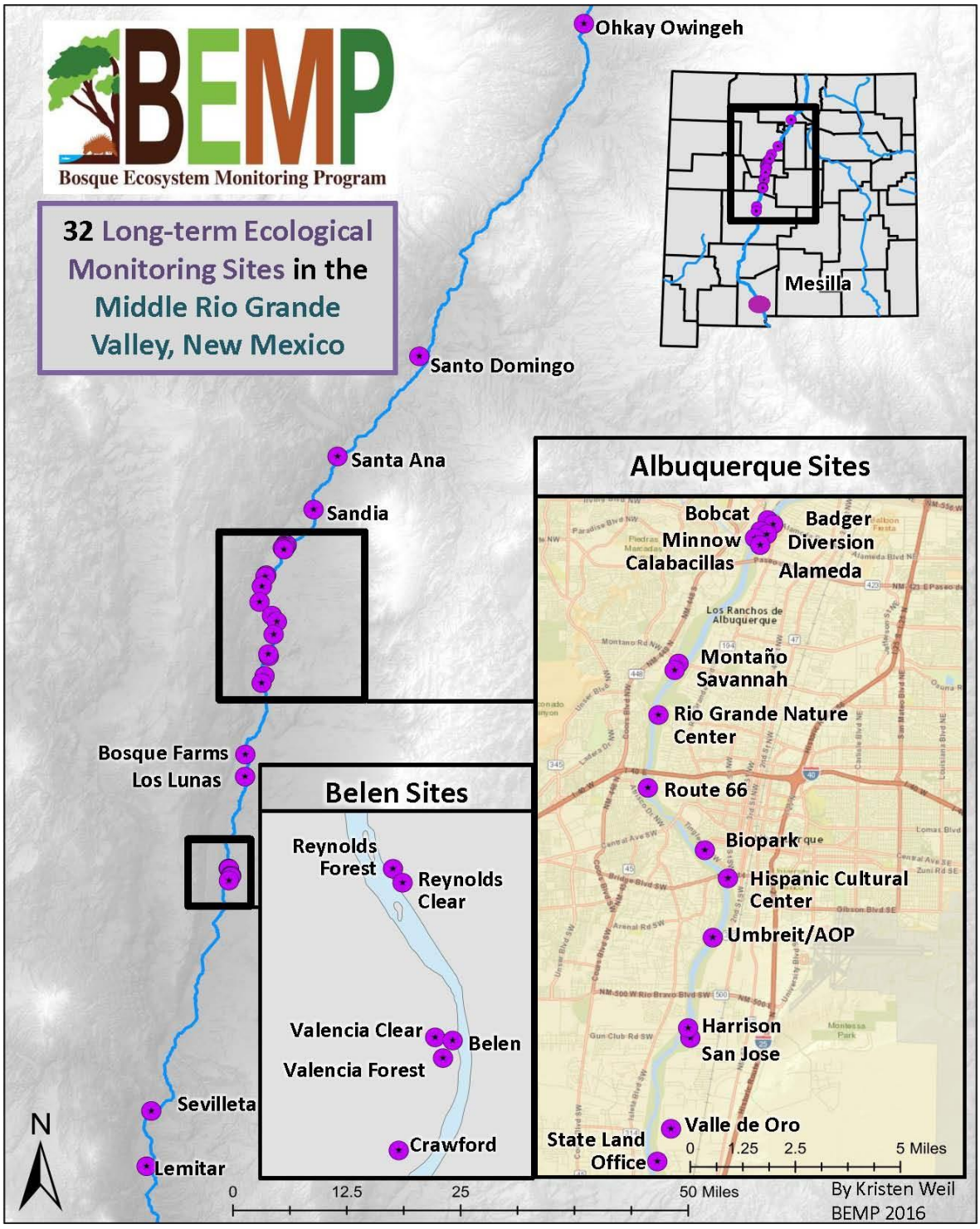
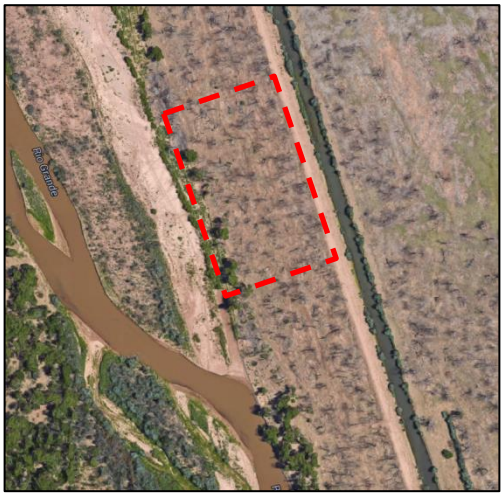


Figure 1: Map of 32 BEMP sites along the Rio Grande

New Site Descriptions: The 31st BEMP site, San Jose, was installed in December 2015, about a half mile south of the Southside Wastewater Reclamation Plant along the east side of the Rio Grande. The site was named after the San Jose Drain, which runs along the east side of the site. The Army Corp of Engineers completed an extensive restoration project in 2014, which included bank terracing, willow swale construction, and a high flow channel that begins to inundate with surface flows around 2,500 cfs. The site encompasses the majority of the

larger willow swale and high flow channel (Figure 2); however, the bank terracing was too far away to be incorporated into the site. San Jose is being monitored by three rotating classes of 3rd graders from Mountain View Elementary School. Kristen Weil, BEMP Ecologist, has worked with all three classes and says, "they are all very engaged and having a great time in the field. They ask wonderful questions, enjoy exploring different parts of the bosque, especially right along the river, and they loved seeing a bald eagle flying overhead."

Figure 2: Left - Aerial imagery of San Jose within the green willow swale with light blue high flow channel through the center and dark blue bank terracing along the river's edge. The dots represent planted native shrubs. **Right -** *Students from Mountain View Elementary participate in monthly monitoring data collection.*



The 32nd BEMP site, named Sandia, was installed on Sandia Pueblo in early March 2016 (Figure 3). This area of the bosque experienced a high intensity burn in 2012, which killed the majority of the vegetation including the cottonwood trees. There are many standing and down snags throughout the site. Charcoal can be seen on the soil surface, which is highly exposed due to the lack of canopy cover. The Army Corps of Engineers in collaboration with the Pueblo of Sandia Natural Resources Department planted native shrubs and grasses in the area in an effort to restore habitat. Herbaceous ground cover included silverleaf-nightshade (*Solanum elaeagnifolium*) and sunflower *(Helianthus annuus*). The site is being monitored by high school students from the Native American Community Academy (NACA) and assisted by BEMP Biologist, Sean O'Neill.

Figure 3: Aerial image of the Sandia site, BEMP's 32nd monitoring plot.

Results:

Education Outreach

In the 2014-2015 school year, 9766 community members (students, teachers, etc.) participated in science-related outreach activities in the Middle Rio Grande Valley (MRGV), Ohkay Owingeh, and Mesilla Valley Bosque State Park (Figure 4). There were 6072 students in the field collecting long-term data about ecosystem variables and the ecological drivers of flood, fire, river flow, wildlife, climate and management for our University of New Mexico database. Of those, over 1000 students were involved in year-round monitoring with Common Core correlated classroom follow-up sessions. This number continues to remain steady and is still limited due to staff time constraints and budgeting needs.

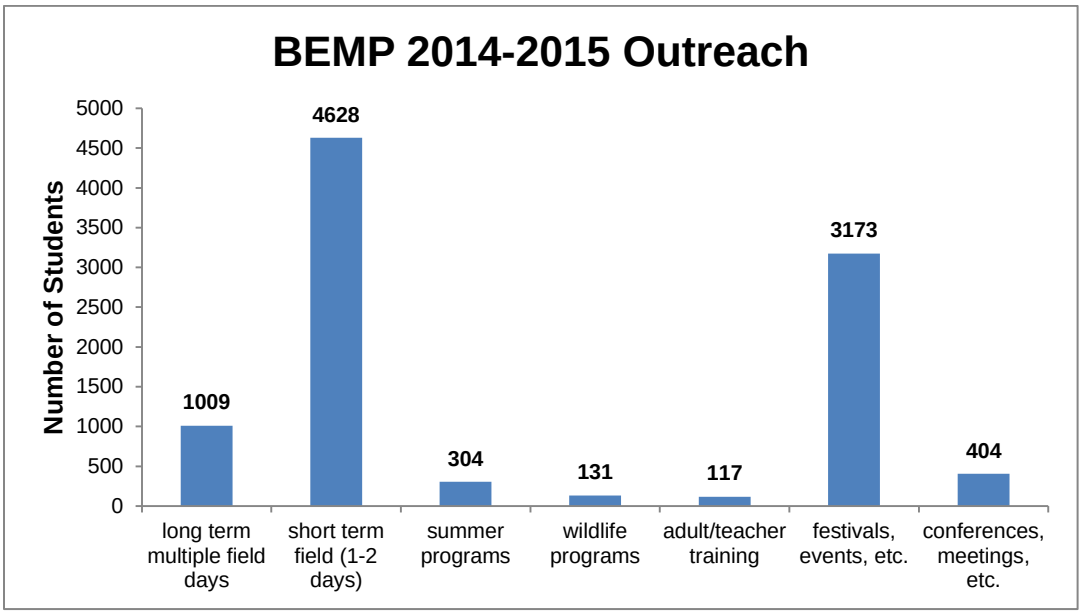


Figure 4. BEMP outreach numbers for the 2014-2015 school year

Local students monitor the Bosque Farms BEMP site.

Table 1. Summary of BEMP sites, including establishment date, monitoring group, the geographical location of the site, and a brief description of vegetation or site history.

Site Name	Date Established	Monitored by	Grade (s)	County	GPS Coordinates (NAVD 88 decimal degrees)	Site Description
Alameda	Apr 1997	Bosque School	6	Bernalillo	35.1880506, -106.646919	olive understory; one of the most native (90%) sections of the bosque throughout ALbuquerque; oldest BEMP site
Albuquerque Overbank Project	established in 1998, BEMP took over in March 2014	La Academia de Esperanza HS	9-12	Bernalillo	35.04546, -106.6657	mature cottonwoods along east side of site, west side was lowered and experiences overbank flooding during high flows, lots of young cottonwoods and willows
Badger	Dec 2004 wells; Jul 2006 rest of site	Rio Rancho Cyber Academy	6	Bernalillo	35.19556856, -106.6416219	cottonwood-dominated bosque with elm sub-canopy; most wells have automated groundwater recording device as part of a collaboration between the US Army Corps of Engineers Urban Flood Demonstration and the University of New Mexico.
Belen	Feb 1998	Rio Grande Elementary	2	Valencia	34.6484315, -106.7377022	15 year-old cottonwoods, willows and Russian olives; experiences overbank flooding with high surface flow
BioPark	Feb 2007	Albuquerque Institute of Math and Science	7	Bernalillo	35.06688861, -106.7202778	medium sized cottonwoods over elm and Russian olive sub-canopy; wetland to the west of site, pond to the northwest of site
Bobcat	Dec 2004 wells; Aug 2006 rest of site	La Cueva	10 - 12	Bernalillo	35.19705633, -106.6439494	cottonwood-dominated bosque with a couple Gooding's willows; C well has automated groundwater recording device as part of a collaboration between the US Army Corps of Engineers Urban Flood Demonstration and the University of New Mexico.
Bosque Farms	Feb 2012	UNM interns	.	Valencia	34.848851, -106.714722	first site immediately south of Albuquerque; cottonwood-dominated bosque with some native grasses and willows on the east side, closer to the river
Calabacillas	Jan 2003	Volcano Vista HS	9-12	Bernalillo	35.19056822, -106.6491626	mature cottonwood-dominated bosque with little to no understory
Crawford	Sep 2008	UNM interns	.	Valencia	34.6375111, -106.7434661	strongly hydrologically connected, seep floods occuring at higher flows; northern section: cottonwoods in low-lying areas with saltcedar and kochia in higher areas, lots of cocklebur; southern section: yerba mansa, rushes and sedges, CFRP site
Diverson	Nov 2002	Bosque School	6	Bernalillo	35.191958, -106.6441893	sparse, pole-planted cottonwoods, few elm; very open and sandy site; DWDD located directly north of site;
Harrison	Spring 2003	Highland HS	9 - 12	Bernalillo	35.01505603, -106.6736953	located on a sand bar; covered with young cottonwoods, lots of willows, some seepwillow and some Russian olives; floods when river is high
Hispanic Cultural Center	fall 2001 started, finished Apr 2002	School on Wheels	10 - 12	Bernalillo	35.06881267, -106.6580575	cottonwood-dominated bosque with light understory of elm, Russian olive and Gooding's willows; tall wheatgrass getting denser each year
Lemitar	Sep 2002	Parkview Elementary	3	Socorro	34.16703188, -106.8899486	north of Socorro Nature Area; site outside the levee; xeric site; open landscape with a sparse cover of grasses, forbs, broom dalea, sand sage, and four-wing saltbush; handful of stunted cottonwoods and clumps of saltcedar
Los Lunas	Oct 1997	Los Lunas High School	9-12	Valencia	34.81236936, -106.7144580	large, older cottonwood overstory with mostly native understory of willow, New Mexico olive, wild currant, some Russian olive and saltcedar; yerba mansa covers much of the ground; experiencing more and more large branches falling; seep flood through a trough that runs through the center of the site

Site Name	Date Established	Monitored by	Grade (s)	County	GPS Coordinates (NAVD 88 decimal degrees)	Site Description
Mesilla	Jun 2011	John Paul Taylor	5	Doña Ana	32.248328, -106.821014	primarily kochia with sparse wood chip piles and some native forbs
Minnow	Dec 2002	Bandelier Elementary	5	Bernalillo	35.1931509, -106.646915	cottonwood-dominated bosque with a couple Gooding's willows, otherwise little understory; wells have automated groundwater recording devices as part of a collaboration between the USACE Urban Flood Demonstration and UNM.
Montaño	May 2004	Bosque School	6	Bernalillo	35.14528819, -106.6803699	contains a few cottonwoods; northern section covered in kochia and tumbleweed; middle of site thick with tree of heaven
Ohkay Owingeh	Mar 2002	OOCS	4-5	Rio Arriba	36.0618, -106.0761	located by an extensive constructed wetland; periodically flooded by rising wetland water and a correspondingly rising adjacent water table; few large cottonwoods,history of few large fires, mostly native shrubs, vines, forbs and grasses
Reynolds Cleared	Spring 2004	Infinity High School	9-12	Valencia	34.65966431, -106.7421328	fairly open site with young cottonwood canopy of pole plantings, with kochia and tumbleweed and also NM olive planted by river
Reynolds Forest	Spring 2004	School of Dreams Academy	9-12	Valencia	34.66054583, -106.7429525	cottonwood overstory with a saltcedar and Russian olive understory; yerba mansa patches in northern section of site, wild currant interspersed; site continues to experience cottonwood dieback leading to the high woody debris load (prior to clearing in Feb 2012) - post 2013 clearing: kochia understory with thick woodchips from exotic clearing
Rio Grande Nature Center	Jun 1997	Wilson MS	6	Bernalillo	35.12675286, -106.6884322	numerous thin cottonwoods with some Russian olive understory; lots of clover; very open site
Route 66	Sep 2004	Jefferson MS	6-8	Bernalillo	35.1006408, -106.6914783	natural seep or trough in the center of the site that is thickly vegetated with willows with some elm and Russian olive; cottonwoods line the trough; east and west sides of the trough cleared by Albuquerque Open Space every few years and are vegetated by kochia and tumbleweed
Sandia	Feb 2016	Mountian View ES	3	Bernalillo	35.255, -106.5907	high intensity burn (2012) site with many dead standing and down cottonwoods (few living), revegetated with seepwillow and native grasses; some sunflowers, silverleaf nightshade, and occassional Russian olive.
San Jose	Dec 2015	NACA	12	Bernalillo	35.012375, -106.6727833	site installed in USACE constructed willow swale. High flow channel runs through the center of the swale and innundates around 2,500 cfs. Mature cottonwoods on west side of site
Santa Ana	Jul 1999	Bernalillio MS	7	Bernalillo	35.34284, -106.5458	Dying cottonwood gallery forest with understory of kochia
Santo Domingo (Kewa)	Jan 2008	Santo Domingo Nat Res Dept	.	Sandoval	35.50989, -106.3896	sparse cottonwood overstory with scattered juniper, New Mexico olive and willow understory; lots of grasses; horse activity at site
Savannah	Mar 2000	Bosque School	6	Bernalillo	35.14285294, -106.6819814	grasses and forbs with pockets of overstory cottonwood stretching above an understory of Russian olive and saltcedar
Sevilleta	Spring 2003	Cottonwood Valley Charter School	4	Socorro	34.25834233, -106.8831845	southern boundary of Sevilleta NWR upstream of San Acacia Diversion Dam; dense woody vegetation of mostly Russian olive and saltcedar mixed with smaller cottonwoods and a patchy understory of coyote willow; site has high groundwater salinity and soils contain heavy clay; occasional saltgrass dominated swards occur among trees

Site Name	Date Established	Monitored by	Grade (s)	County	GPS Coordinates (NAVD 88 decimal degrees)	Site Description
State Land Office	June, 2014	The International School	3-4	Bernalillo	34.96785, -106.6856	moderately dense mature cottonwood overstory with two large channels dug through site intended for stormwater runoff drainage to the river; some trenches with permentant standing water supporting coyote willow stands. Much of site outside of ditches covered with tumbleweed and kochia
Valencia Cleared	Spring 2003	Belen HS	9-12	Valencia	34.64863444, -106.7391728	few cottonwoods, Gooding's willows, Russian olives with large patches of wolfberry and ground cover of yerba masa
Valencia Forest	Spring 2003	Belen Family Schools	3-6	Valencia	34.64716225, -106.738482	was uncleared and dominated by cottonwood, Russian olive, saltcedar with a saltgrass meadow at the south end of the site; after fire and clearings, now almost entirely covered by kochia and tumbleweed with small patches of yerba mansa and saltgrass
Valle de Oro	January 2014	South Valley Academy	9-12	Bernalillo	34.97895, -106.6801	site was installed ouside of levee system on a fallow farm field. No trees or shrubs, primarily various forb ground cover

Monitoring Data:

Groundwater

From 2013 to 2015, groundwater levels have increased at all sites, with four exceptions (Table 2). Declines in groundwater level between 2013 and 2014 ranged from 12 to 3 cm while increases in groundwater levels ranged from 1 to 10 cm. Between 2014 and 2015, there was only one site with a decrease in groundwater levels (of 3 cm), while the remaining 25 sites had increases ranging from 4 cm to 28 cm. As was seen during the drought years of 2008 to 2013 with the decline in groundwater levels, the recent incline is closely correlated with increases in river flow. The groundwater levels at most sites closely tracks river flow, with 50-82% correlation to river flow (Figures 5 -15; Table 2). There are a few exceptions to this. Both Badger and Bobcat are just above the Drinking Water Project Diversion Dam (Figure 5), and Sevilleta is just above the San Acacia Dam (Figure 15), and these sites are likely impacted by these nearby dams. The groundwater levels in Lemitar do not correlate to changes in river flow, but remain fairly deep (Figure 15). As this site is outside the levee and further from the river compared to other BEMP sites, this is not unexpected. Both Sevilleta and Lemitar have stronger correlations between groundwater and river flow when the highest river flow is removed, as the groundwater response to flows of over 6000 cfs are not as strong as at other sites. This is likely a delayed or attenuated response at Lemitar, as this site is further from the river than other sites. Similar to Lemitar, Valle de Oro (VDO), is outside the levee, and groundwater levels are likely more impacted by water in the Barr drain running through the site (Figure 9). Finally, the State Land Office (SLO) site consists of upland areas and wetlands, with differences in groundwater levels between the two areas ranging from 266 cm to **290 cm** (Figures 9 & 10). While the upland areas have deep groundwater levels, the wetland areas often have standing water and seem to respond both to increases in river flow as well as to heavy precipitation events.

Table 2. Correlation between depth to groundwater (cm) and river flow (cfs) and mean annual depth to groundwater at each site. Sites are listed from north to south. Increasing groundwater levels from 2013 to 2015 are tightly correlated at most sites to increases in river flow. Cells highlighted in green indicate a 60-82% strong correlation (R2 value) between groundwater and river flow. Cells highlighted in purple indicate a moderate correlation of 42-59%. Cells highlighted in yellow indicate years when the groundwater levels declined rather than increased.

site name	site location	R^2 (correlation between) groundwater and river flow	2013 mean depth to groundwater (cm)	2014 mean depth to groundwater (cm)	2015 mean depth to groundwater (cm)
Badger	Albuquerque (above DWP Dam)	0.1264	244.665	237.187	229.822
Bobcat	Albuquerque (above DWP Dam)	0.4186	114.062	108.112	98.378
Diversion	Albuquerque	0.4145	248.003	241.453	222.603
Minnow	Albuquerque	0.7189	162.807	157.523	138.159
Calabacillas	Albuquerque	0.7775	176.39	168.82	140.731
Alameda	Albuquerque	0.6515	289.771	279.763	262.663
Montano	Albuquerque	0.587	175.012	165.238	155.245
Savannah	Albuquerque	0.6463	118.39	108.598	97.207
RGNC (Rio Grande Nature Center)	Albuquerque	0.5338	201.603	194.937	183.387
Rt 66	Albuquerque	0.6009	113.703	110.92	100.828
BioPark	Albuquerque	0.6215	147.733	150.608	133.11
National Hispanic Cultural Center (HCC)	Albuquerque	0.8127	132.451	130.509	117.052
Albuquerque Overbank Project (AOP)	Albuquerque	0.635		123.565	105.22
Harrison	Albuquerque	0.7611	117.936	111.038	97.039
Valle de Oro (VDO)	Albuquerque	0.0144		127.658	130.695
SLO (State Land Office)	Albuquerque	0.0386		134.732	130.09
Bosque Farms	Bosque Farms	0.7171	117.173	120.334	
Los Lunas	Los Lunas	0.558	152.953	152.065	129.173
Reynolds Forest	Belen	0.7248	134.445	128.278	111.612
Reynolds Cleared	Belen	0.7833	138.598	133.109	112.96
Valencia Cleared	Belen	0.7062	109.067	102.324	88.442
Belen	Belen	0.8168	134.015	131.007	112.466
Valencia Forest	Belen	0.6637	163.735	158.747	146.022
Crawford	Belen	0.7879	144.144	141.572	120.393
Sevilleta	Sevilleta National Wildlife Refuge	0.0095	170.79	182.673	165.798
Lemitar	Lemitar	0.0068	278.169	271.044	267.032

The Solinst water level meter (beeper) tape is used to demonstrate how deep cottonwood roots must be to reach the groundwater.

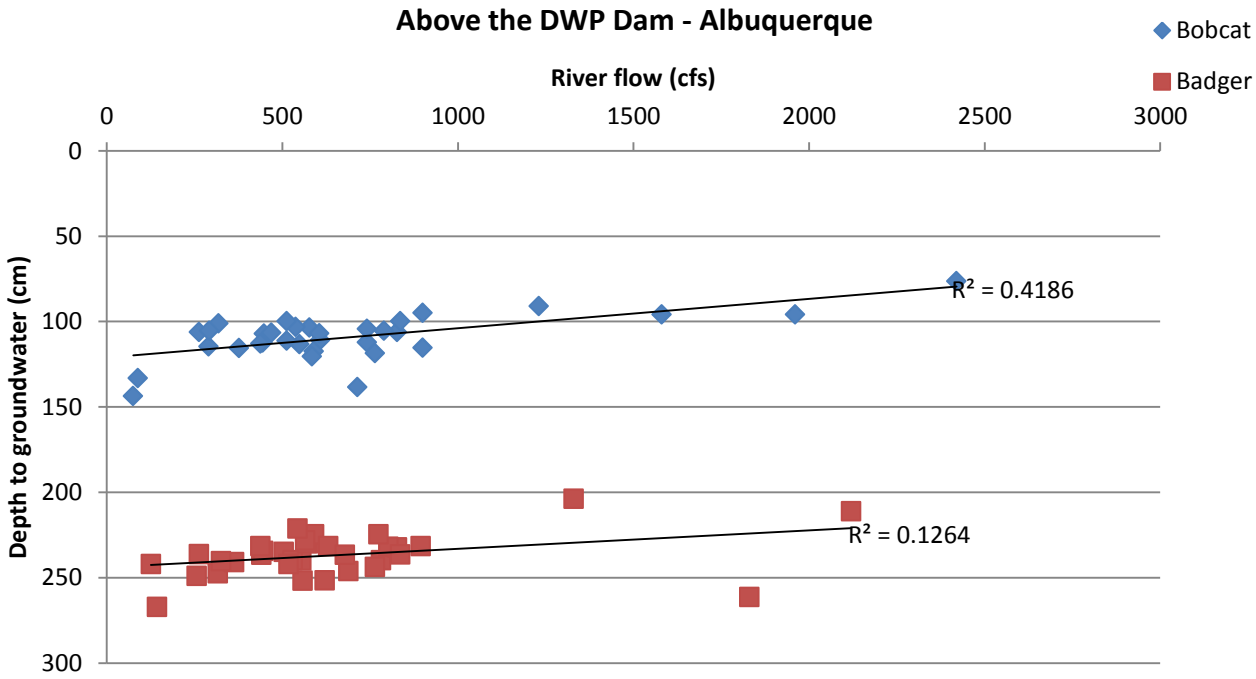


Figure 5. Depth to groundwater vs. river flow at the two Albuquerque BEMP sites above the Drinking Water Project (DWP) diversion dam. Trend lines and R^2 values show weak correlations between groundwater level and river flow.

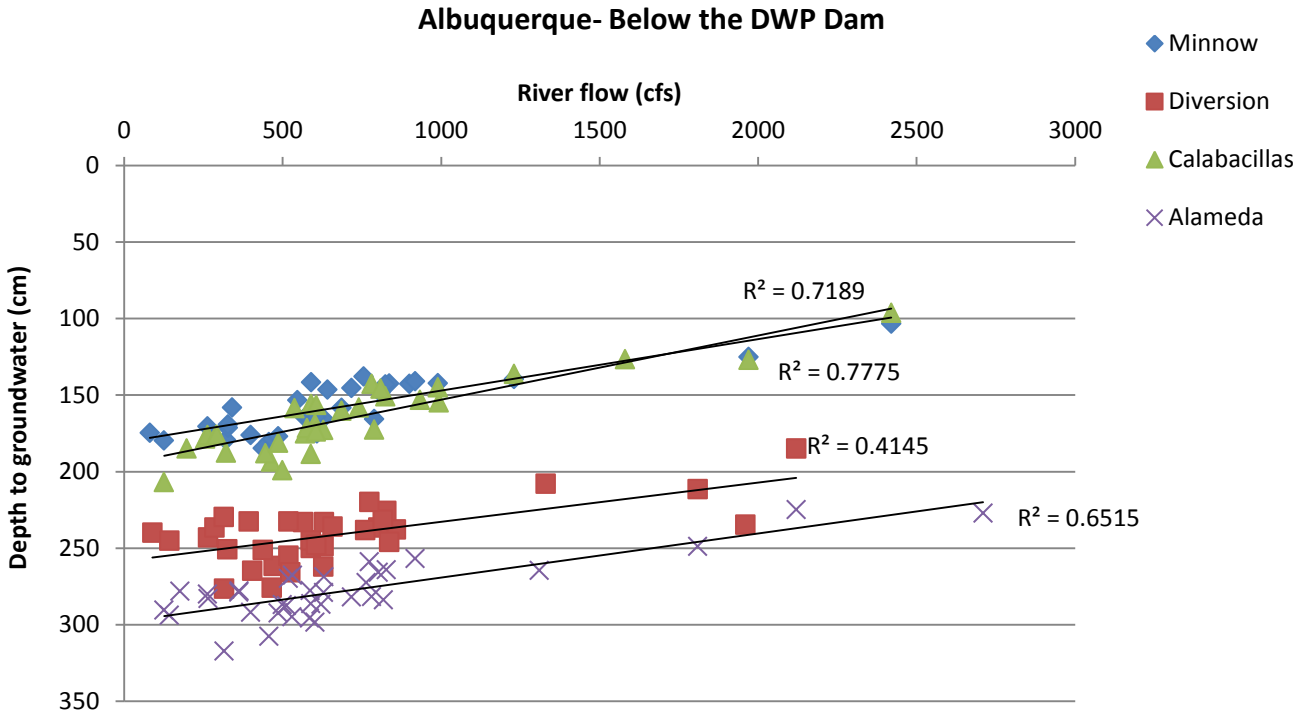


Figure 6. Depth to groundwater vs. river flow at the four Albuquerque BEMP sites just below the DWP diversion dam. Trend lines and R^2 values show strong correlation between groundwater level and river flow.

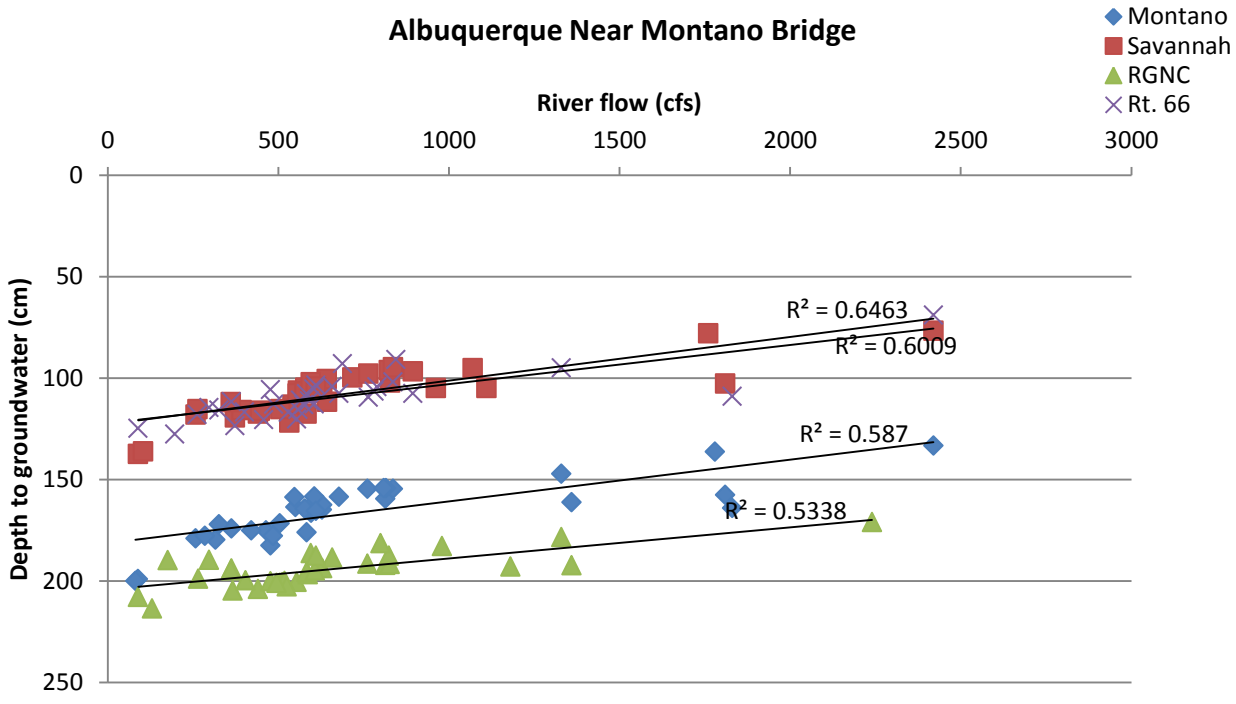


Figure 7. Depth to groundwater vs. river flow at four Albuquerque BEMP sites below the Montaño Bridge. Trend lines and R^2 values show strong correlation between groundwater level and river flow.

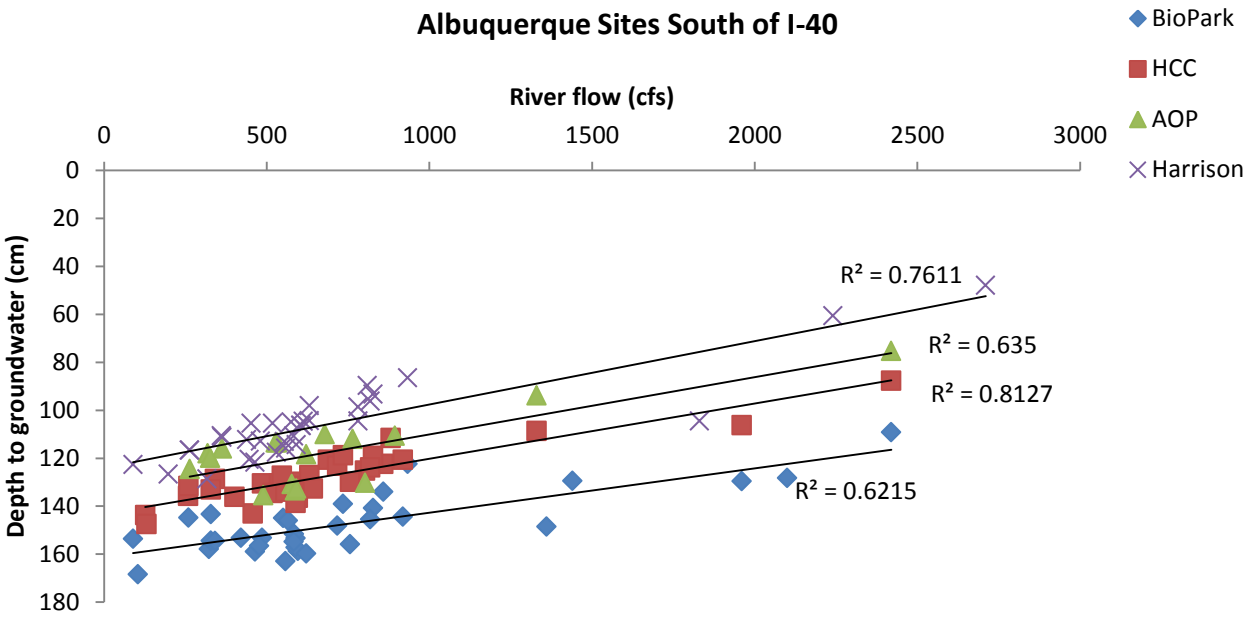


Figure 8. Depth to groundwater vs. river flow at four Albuquerque BEMP sites. Trend lines and R^2 values show strong correlation between groundwater level and river flow.

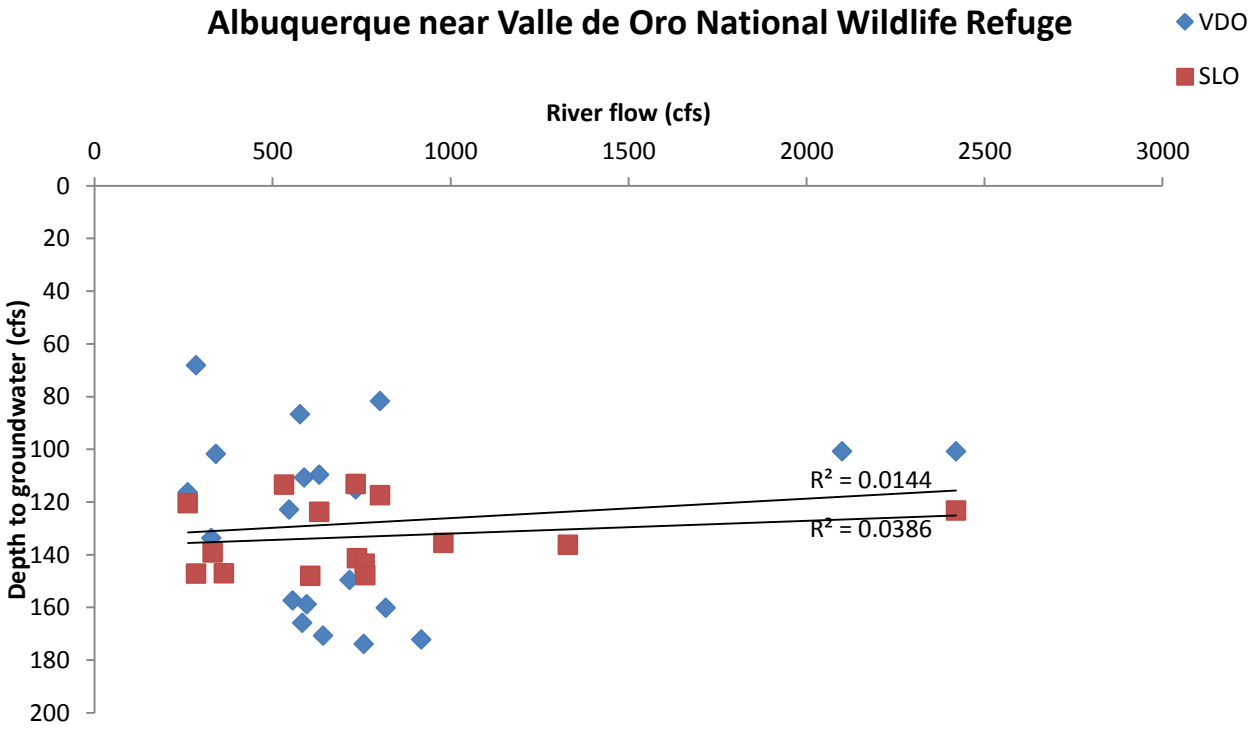


Figure 9. Depth to groundwater vs. river flow at the two Albuquerque BEMP sites at Valle de Oro National Wildlife Refuge and in the bosque near the Refuge. Trend lines and R^2 values show weak correlations between groundwater level and river flow.

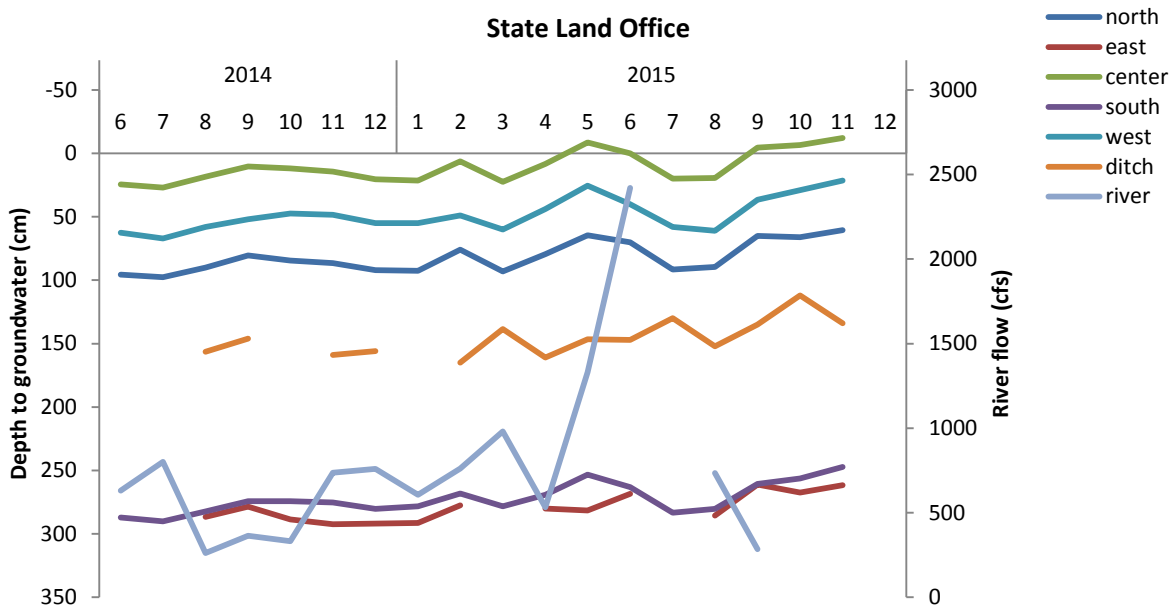


Figure 10. Depth to groundwater, depth to water in the nearby ditch, and river flow at the State Land Office BEMP site in southern Albuquerque. Groundwater levels range by almost 3 meters at this site between the wetland areas and the upland areas.

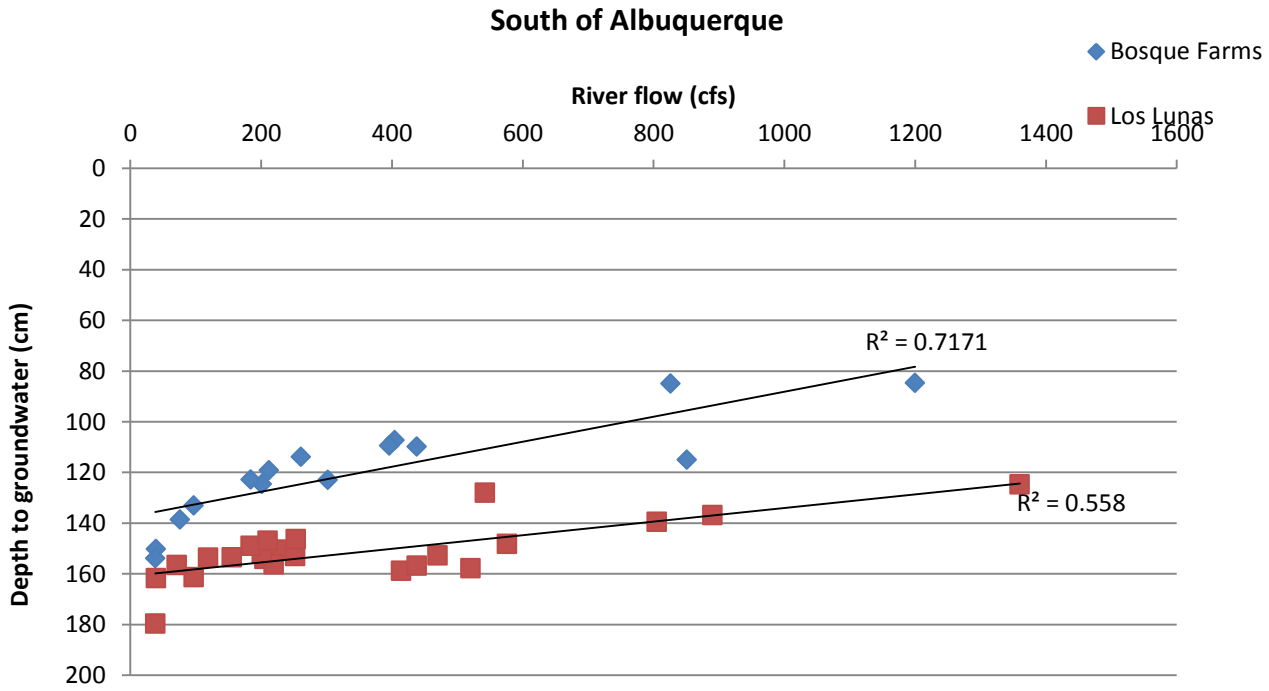


Figure 11. Depth to groundwater vs. river flow at Bosque Farms and Los Lunas (below Albuquerque). Trend lines and R^2 values show strong correlation between groundwater level and river flow.

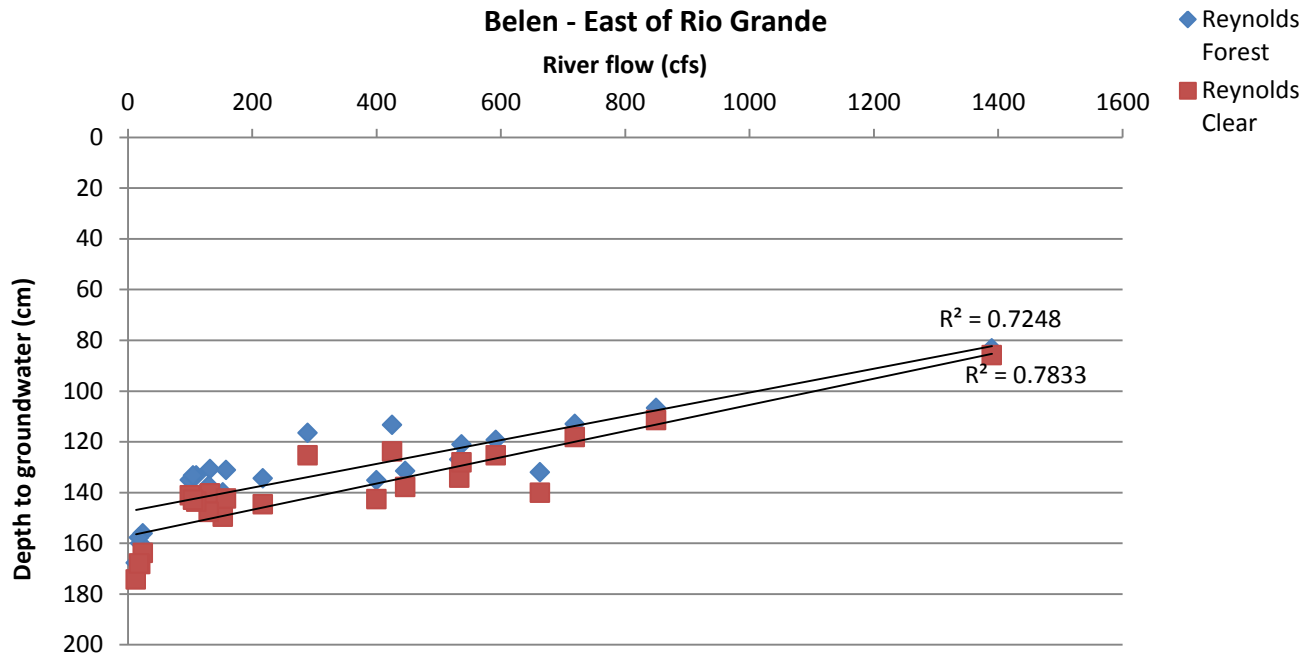


Figure 12. Depth to groundwater vs. river flow at two Belen BEMP sites. Trend lines and R^2 values show strong correlation between groundwater level and river flow.

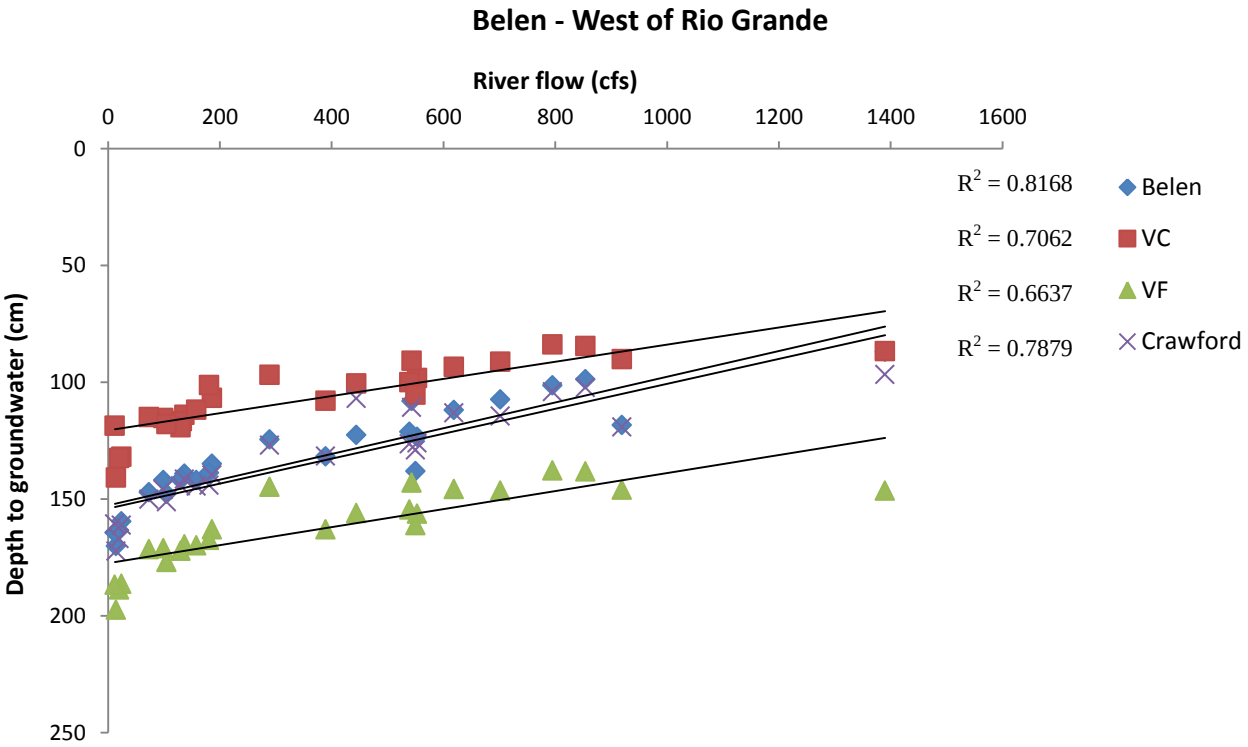


Figure 13. Depth to groundwater vs. river flow at four Belen BEMP sites. Trend lines and R^2 values show strong correlation between groundwater level and river flow.

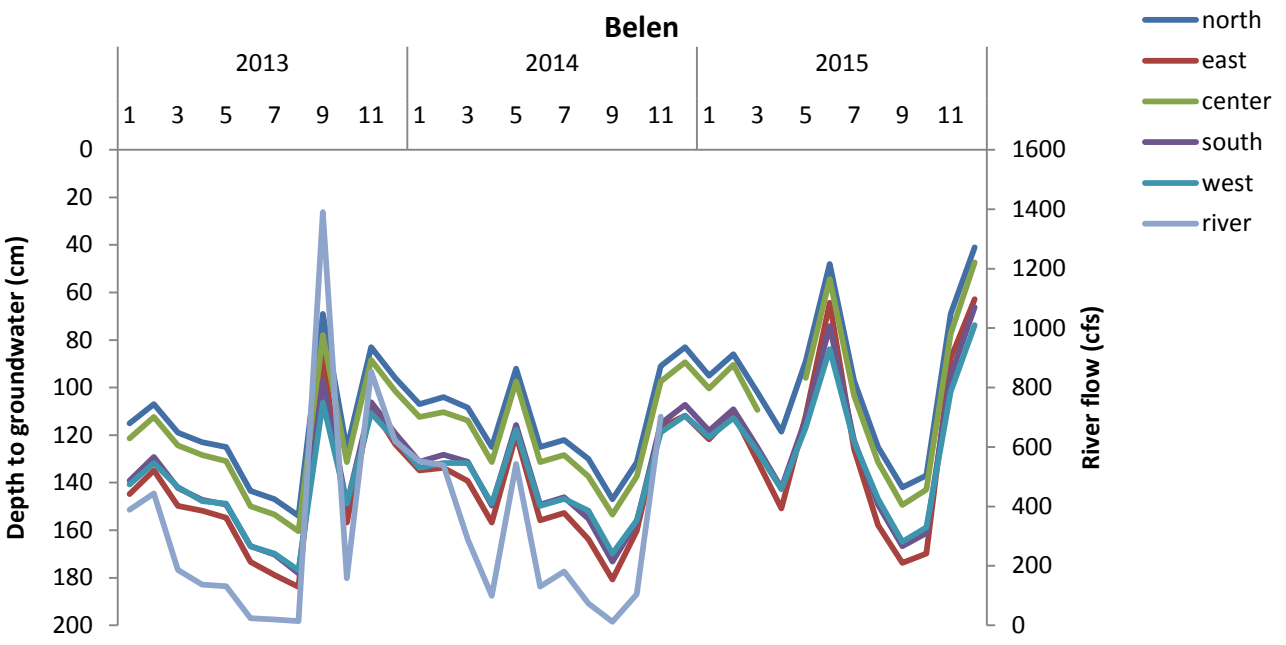


Figure 14. Depth to groundwater and river flow at the Belen BEMP site. Groundwater levels track closely with river flow (R^2 = 0.81).

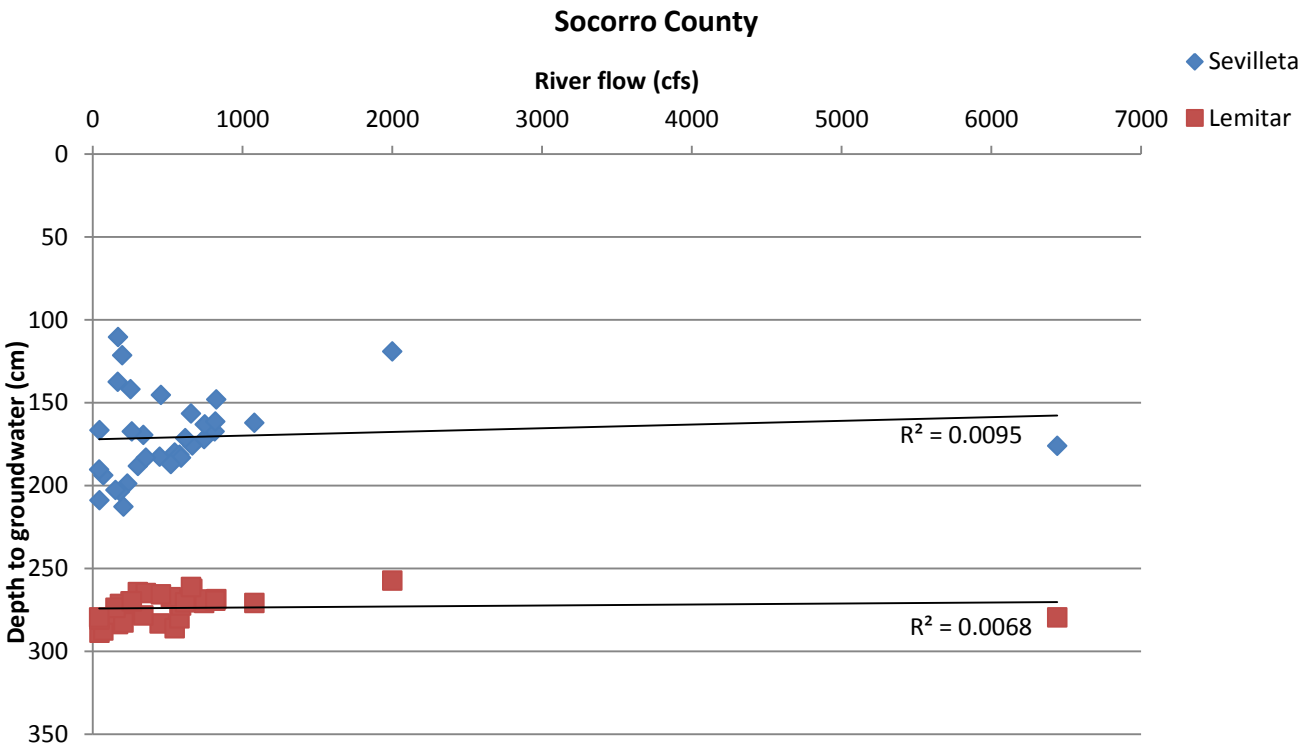


Figure 15. Depth to groundwater vs. river flow at the two southernmost BEMP sites in the Middle Rio Grande. Trend lines and R^2 values show weak correlations between groundwater level and river flow.

Precipitation

Precipitation peaks continue to occur in August (Figure 16). Late season tropical storms are leading to higher levels of precipitation late in the year. Evidence for monsoons shifting to later in the year are now present in BEMP data.

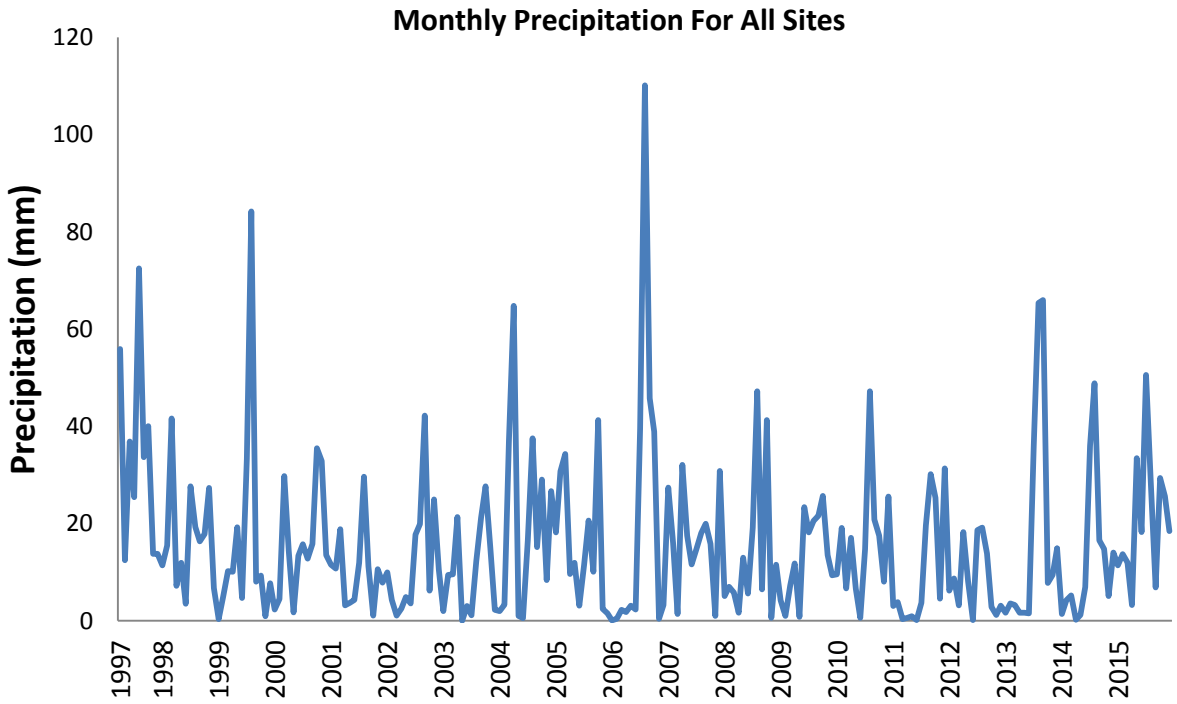


Figure 16. Precipitation averaged across all sites for each month.

Litterfall

Cottonwoods remain the dominant species in leaf litter at 18 of the 30 sites (Figures 17 & 18). Exotic tree species make up 0 to 41% of the leaf litter at BEMP sites (Figure 18). Coyote willow or other native tree leaf fall can be as high as 30% of the leaf litter at a site, though as seen in the vegetation cover section, the cover of coyote willow is on a par with or exceeds cottonwood cover at a few sites.

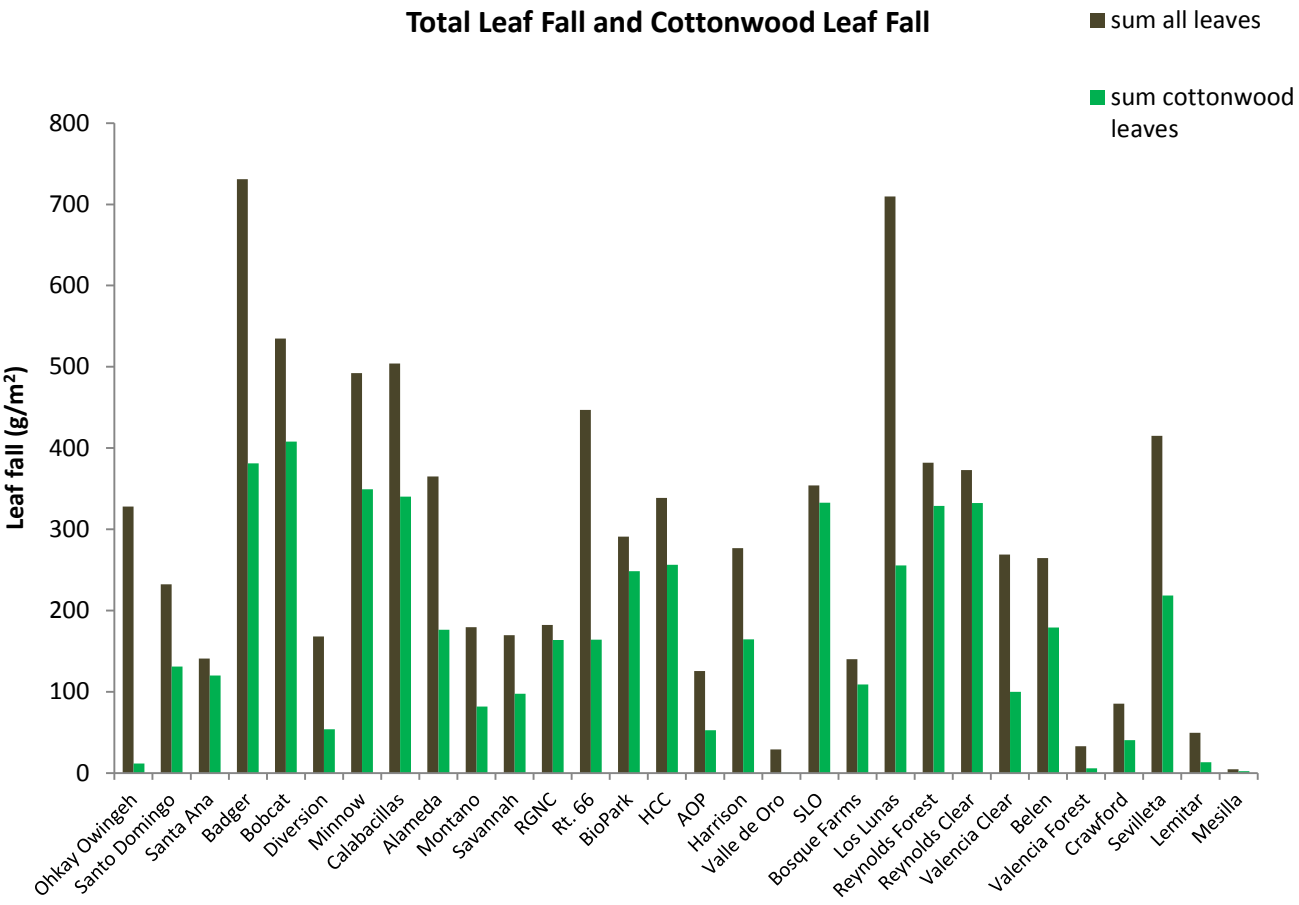


Figure 17. Sum of all litterfall (black) and cottonwoods only (green) across 30 sites from north to south

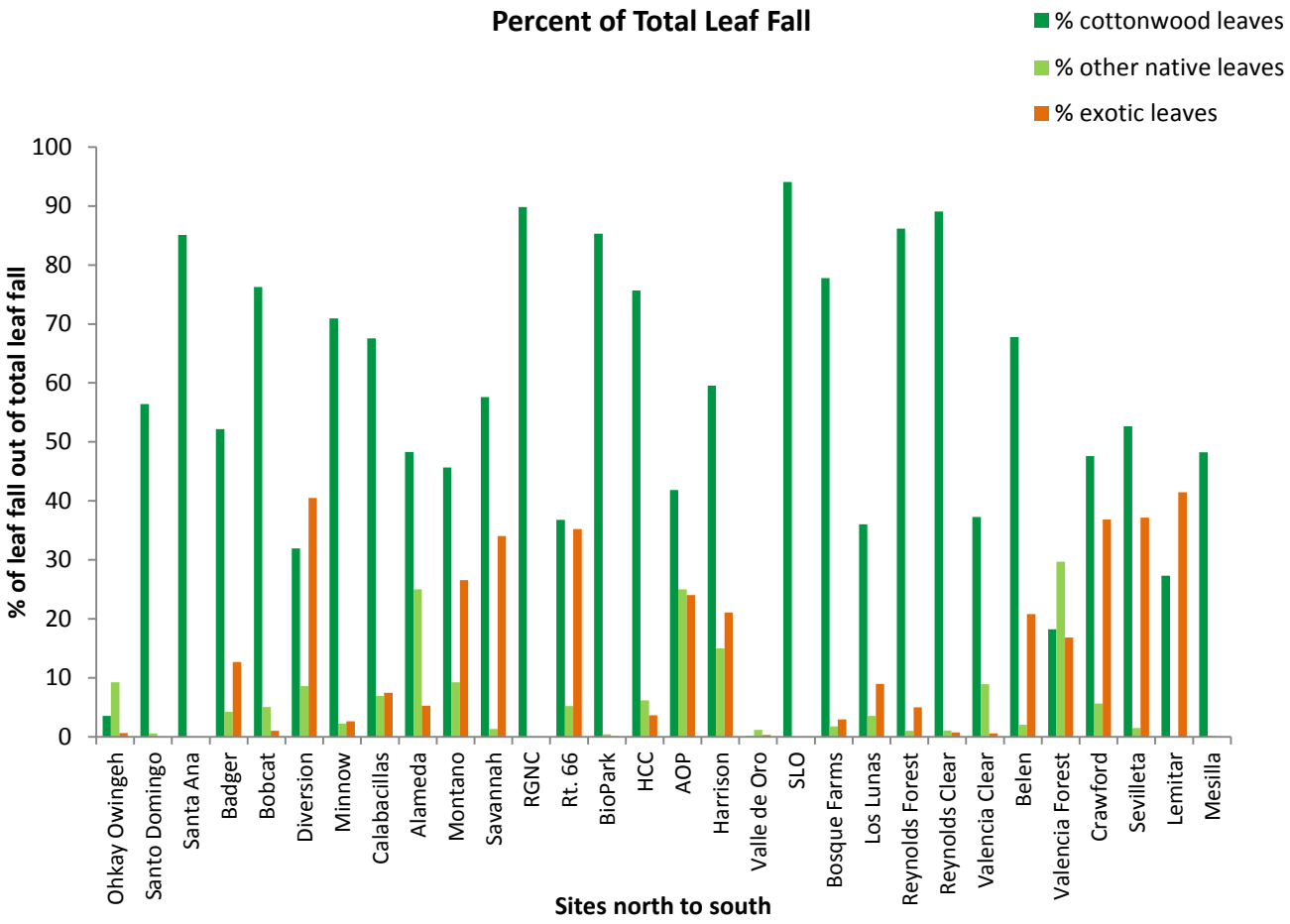
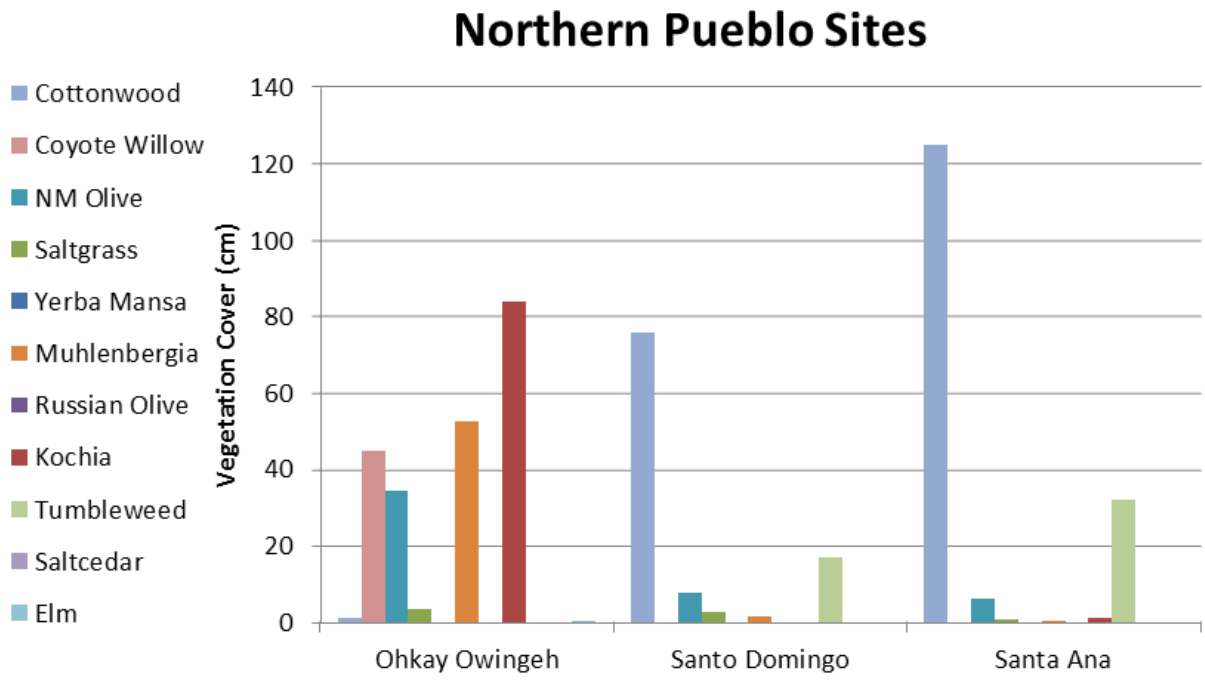


Figure 18: Percent of litterfall as cottonwood leaves (green), other native tree leaves (light green), or exotic tree leaves (orange) across 30 BEMP sites from north to south.

After collecting the leaves, second graders examine what lies underneath a litterfall tub at Belen.

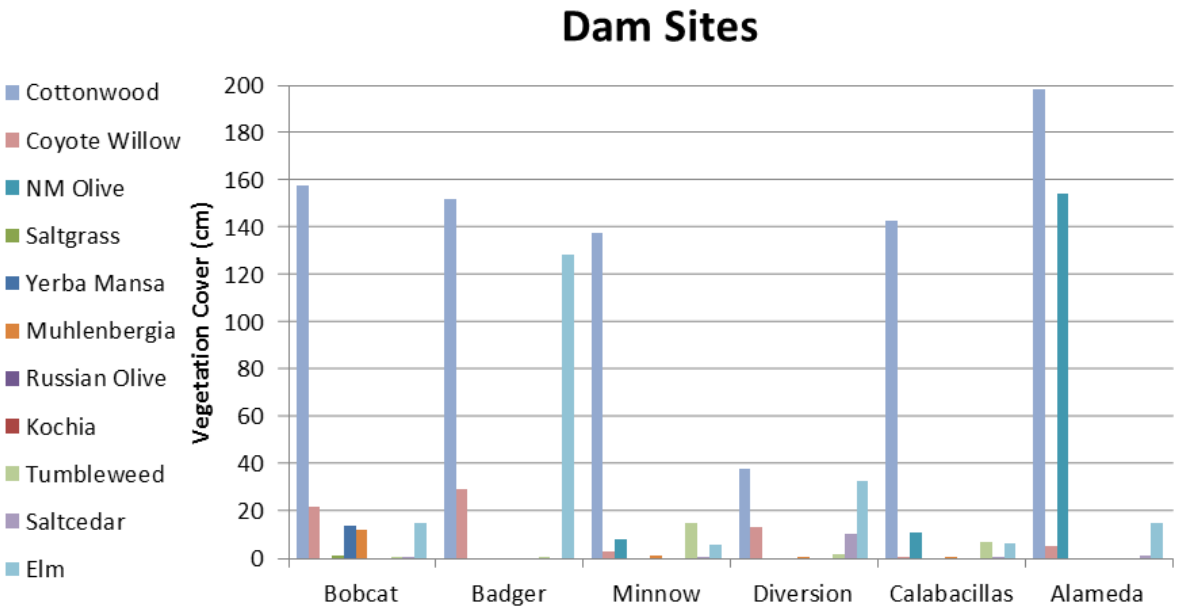
Vegetation Cover 2014

Vegetation cover surveys are conducted in August/September. The botanists recently completed identifying samples in the herbarium and the final datasheets for 2015 were received in early March. These data are now being entered, QA/QC'ed, and will be analyzed for the next report. The 2014 vegetation cover data are presented here. Figures lump sites and are presented from north to south. As seen in the litterfall data, cottonwoods are the dominant species at most sites (Figures 19-24). Sevilleta and Lemitar (to the south) are both dominated by saltcedar (Figure 24). Sites with disturbance have high Kochia and/or tumbleweed cover.



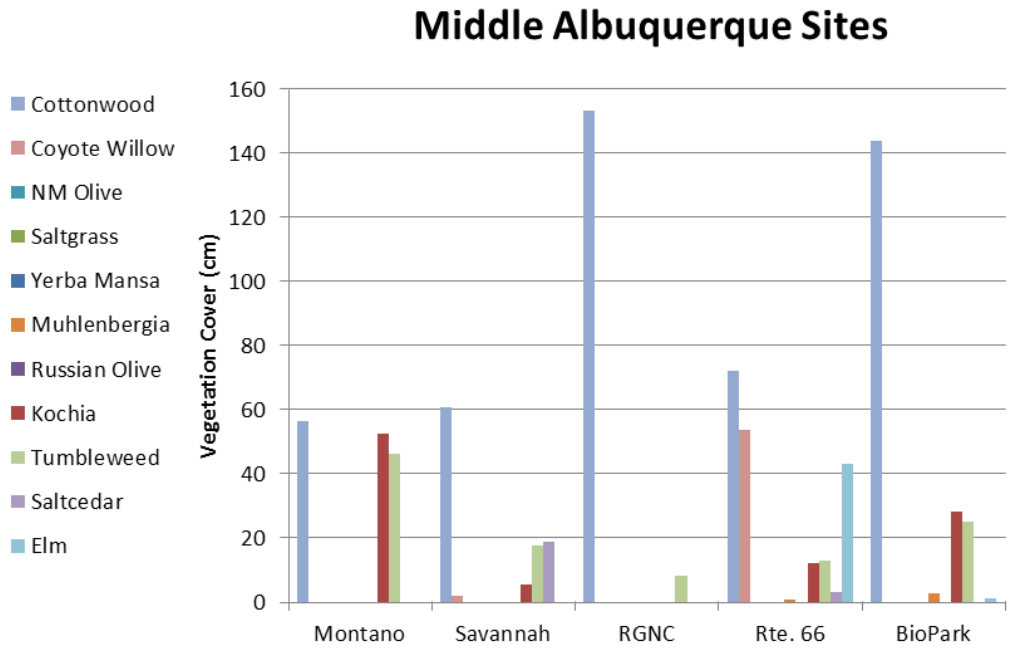
Total Cover	441.24	251.13	212.3
Total # of Species	47	51	15

Figure 19. Total vegetation cover in centimeters and number of species found at sites north of Albuquerque: Ohkay Owingeh, Santo Domingo, and Santa Ana.



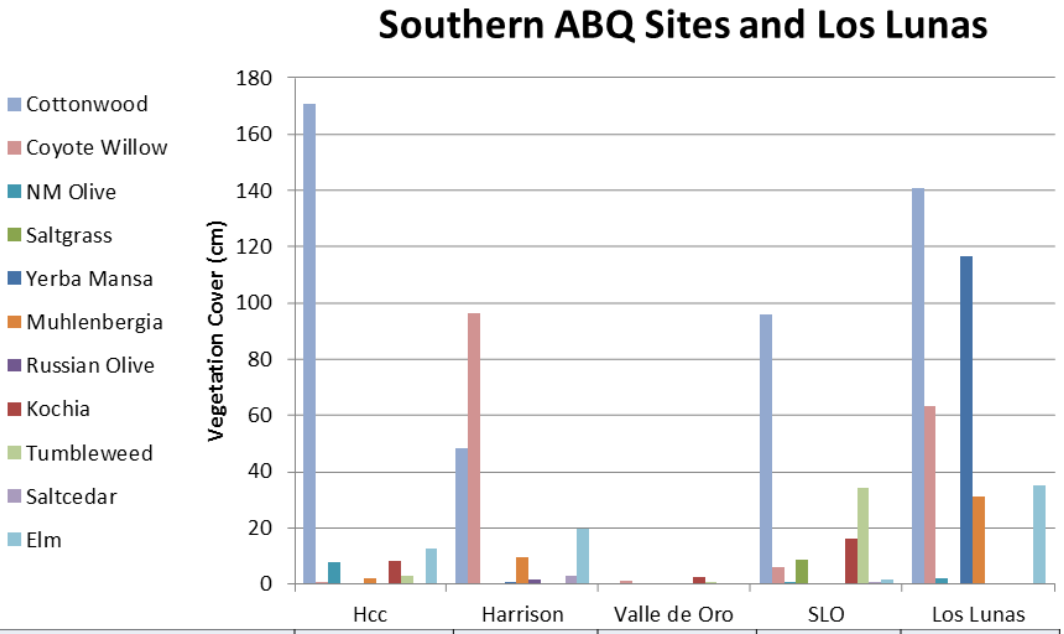
Total Cover	307.01	366.42	204.02	164.06	191.47	381.72
Total # of Species	36	25	32	48	30	13

Figure 20. Total vegetation cover in centimeters and number of species found at the sites bordering the Albuquerque Drinking Water Diversion Dam: Bobcat, Badger, Minnow, Diversion, Calabacillas, and Alameda.



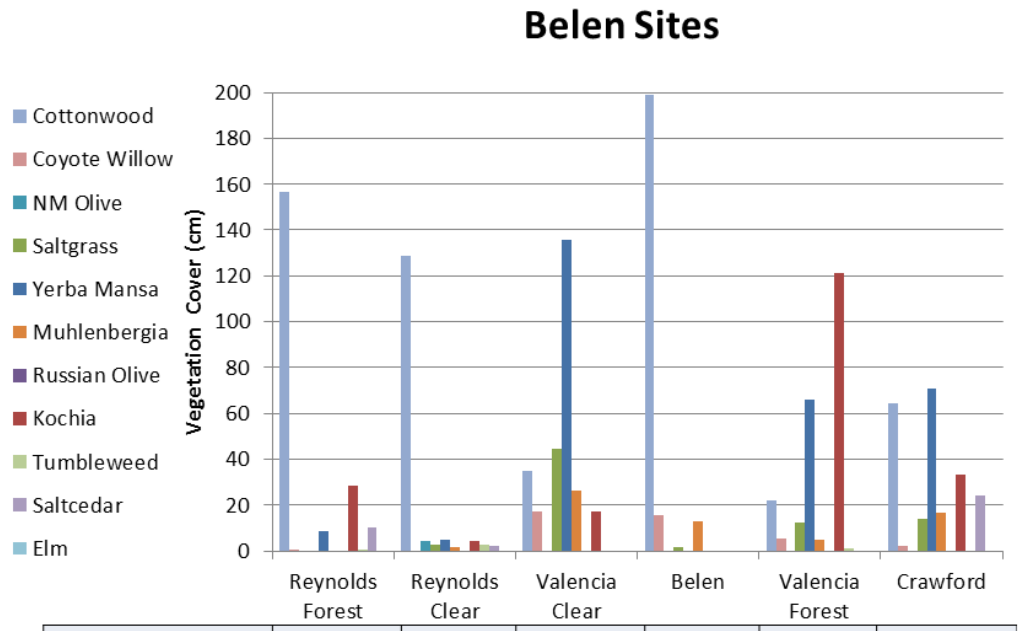
Total Cover	283.84	312.16	213.47	283.59	246.74
Total # of Species	33	28	26	22	36

Figure 21. Total vegetation cover in centimeters and number of species found at the sites in central Albuquerque: Montano, Savannah, Rio Grande Nature Center (RGNC), Rt. 66, and BioPark.



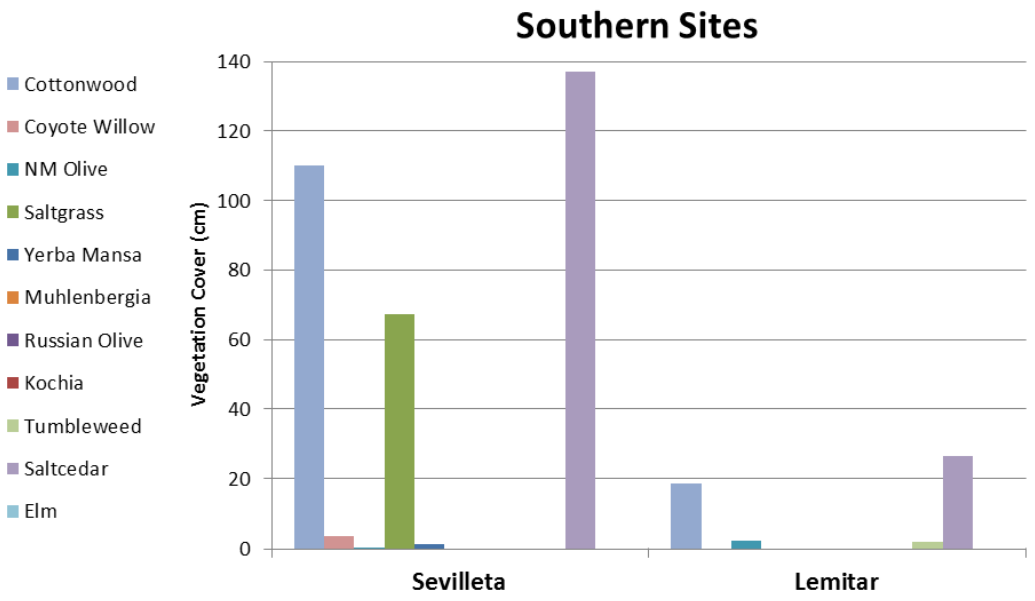
Total Cover	381.27	403.23	341.78	183.27	495.91
Total # of Species	40	68	42	30	20

Figure 22. Total vegetation cover in centimeters and number of species found at the sites in southern Albuquerque and Los Lunas: Hispanic Cultural Center (HCC), Harrison, Valle de Oro, State Land Office (SLO), and Los Lunas.



Total Cover	228.41	160.49	323.91	380.13	240.86	284.81
Total # of Species	11	20	13	25	11	26

Figure 23. Total vegetation cover in centimeters and number of species found at the six sites in Belen: Reynolds Forest, Reynolds Clear, Valencia Clear, Belen, Valencia Forest, and Crawford.



Total Cover	412.37	207.40
Total # of Species	14	23

Figure 24. Total vegetation cover in centimeters and number of species found at two sites south of Albuquerque: Sevilleta and Lemitar.

Lush yerba mansa ground cover at Valencia Clear, with sparse cottonwood and Russian olive canopy.

Tamarisk leaf beetle

BEMP continued monitoring for tamarisk leaf beetle in 2015, but due to restrictions in funding, sampling was done at only sixteen sites spanning 260 miles of the Rio Grande. Of the sites sampled, all but three sites had beetles present (Figures 25 & 26). The three southernmost sites (Mesilla, Lemitar, and Sevilleta) did not have tamarisk leaf beetles in 2015, although the beetles were found in very low numbers at Lemitar in 2013 and 2014. In general, the high beetle numbers that were recorded at the pueblo sites north of Albuquerque in 2013 and 2014 decreased in 2015, while the low numbers counted at the Belen sites in 2013 and 2014 increased in 2015. Although overall beetle numbers were lower in Valencia County than in Albuquerque, severe defoliation to the saltcedar trees was evident in both areas (see picture below). Saltcedar defoliation levels ranged from severe to minimal at the BEMP sites, and refoliation occurred at only one site. For more detailed information, go to bemp.org/reports for the BEMP Tamarisk Leaf Beetle Monitoring (2015) report.

UNM intern uses a sweep net to sample for tamarisk leaf beetles at the Crawford site in Belen.

Saltcedar in August, 2015 at the Crawford site in Belen.

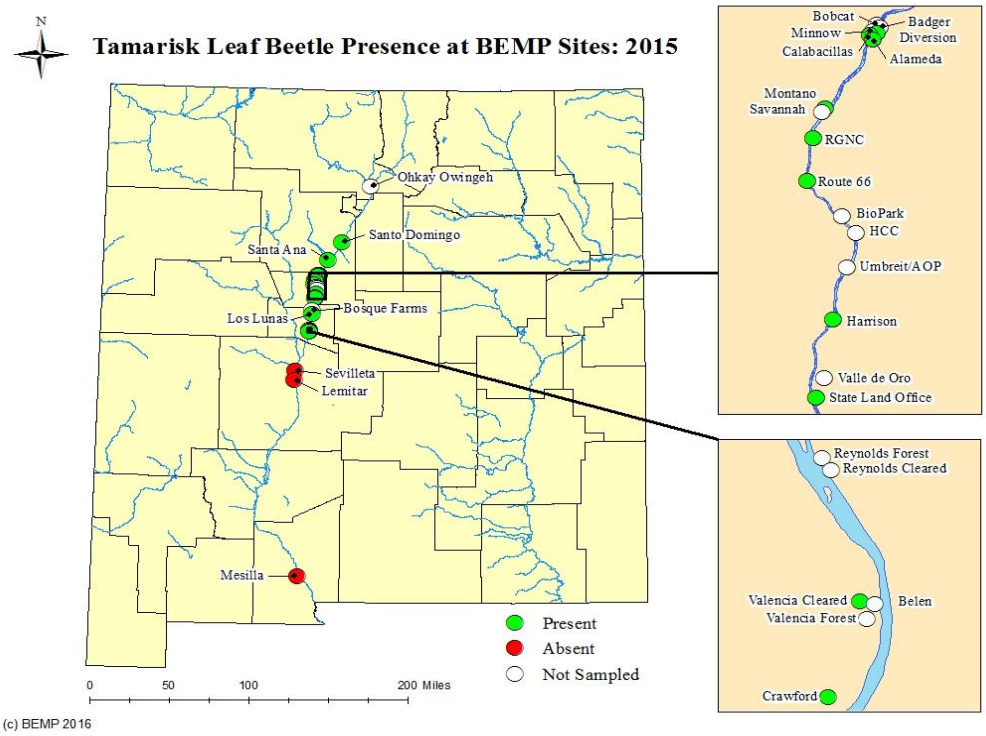


Figure 25. 2015 map of tamarisk leaf beetle presence at BEMP sites.

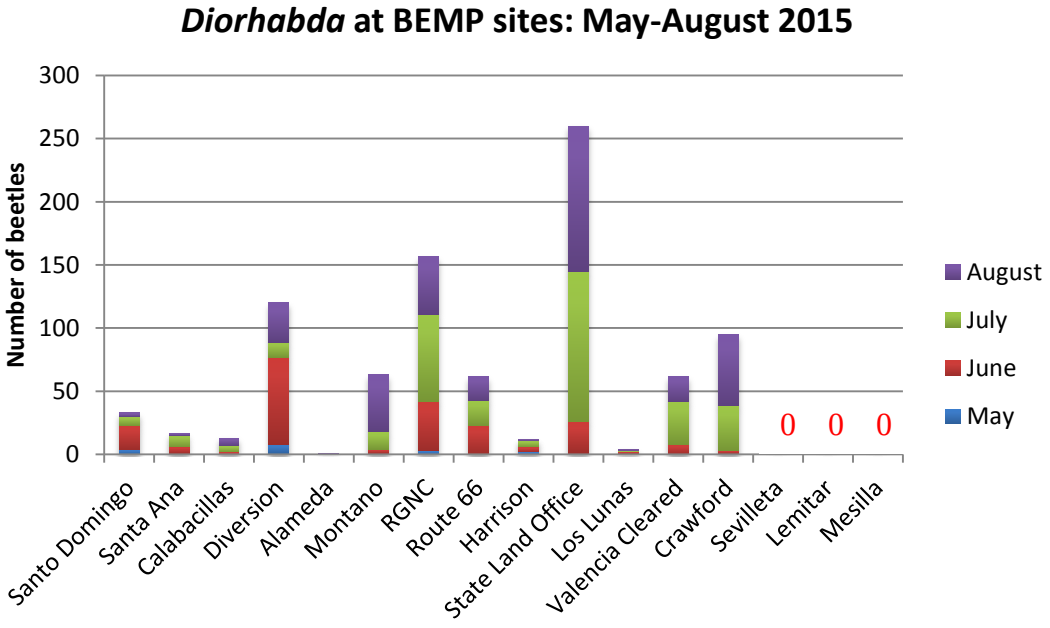


Figure 26. 2015 total numbers of tamarisk leaf beetle adults and larvae found at the 16 BEMP sites sampled. Sites are listed from north to south.

Woody Debris

Woody debris/fuel load sampling is conducted each year at Albuquerque sites, and at all sites every 3-4 years (depending on funding). Woody debris will be conducted at all sites in 2015/16. In 2014, of the sites sampled, there were only three sites with fuel loads above the 12 tons/acre catastrophic fire hazard limit (Figure 27). If the largest diameter class of fuel (20.1-30") were removed, then none of the sites would be in the catastrophic fire hazard category, and only two sites would approach that category (Figure 27). In 2015, of the sites sampled, there were four sites with fuel loads above the 12 tons/acre catastrophic fire hazard limit (Figure 27). If the largest diameter class of fuel (20.1-30") were removed, then two of the sites would still be in the catastrophic fire hazard category (Figure 28). The most dramatic shift between 2014 and 2015 was the increase in size 10.1-20" diameter fuel at the Hispanic Cultural Center (HCC) site, which almost doubled the fuel load and pushed HCC well above the catastrophic fire hazard category. Fuel loads at the Rt. 66 site also doubled, though this was made up of almost entirely the largest size class of fuel (Figure 28). Increases in larger diameter wood may be due to older cottonwoods dropping larger limbs following high wind storms.

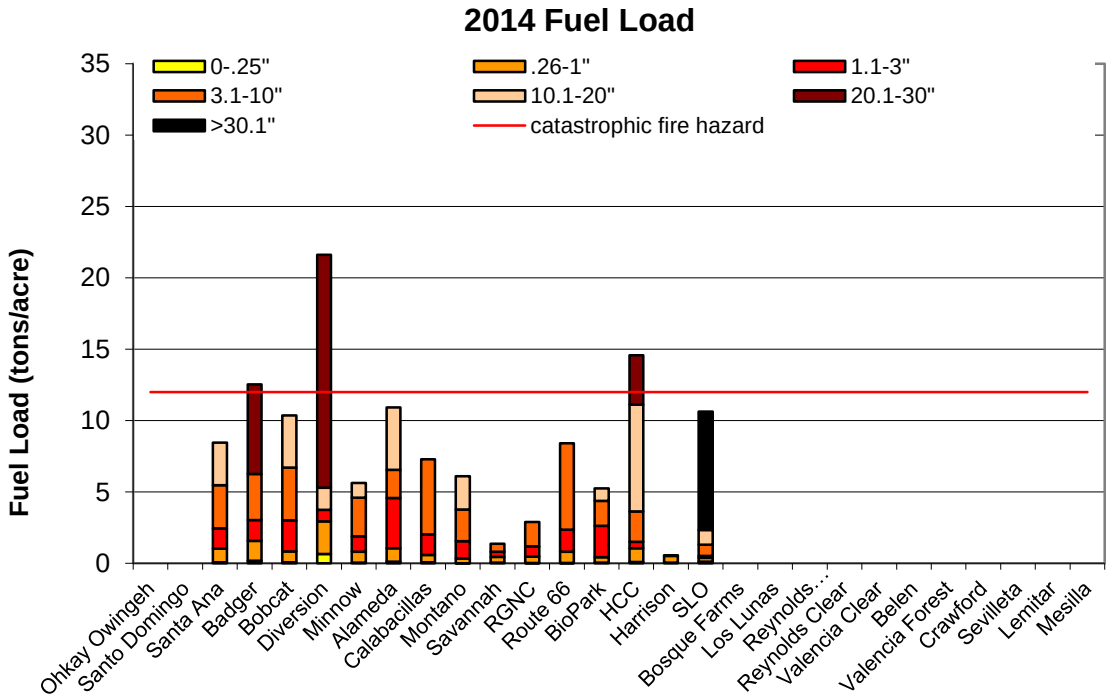


Figure 27. Woody debris analysis from 2014 with sites from north to south. The red trend line indicates catastrophic fire hazard fuel load (12 tons/acre). Only Santa Ana and Albuquerque sites were sampled.

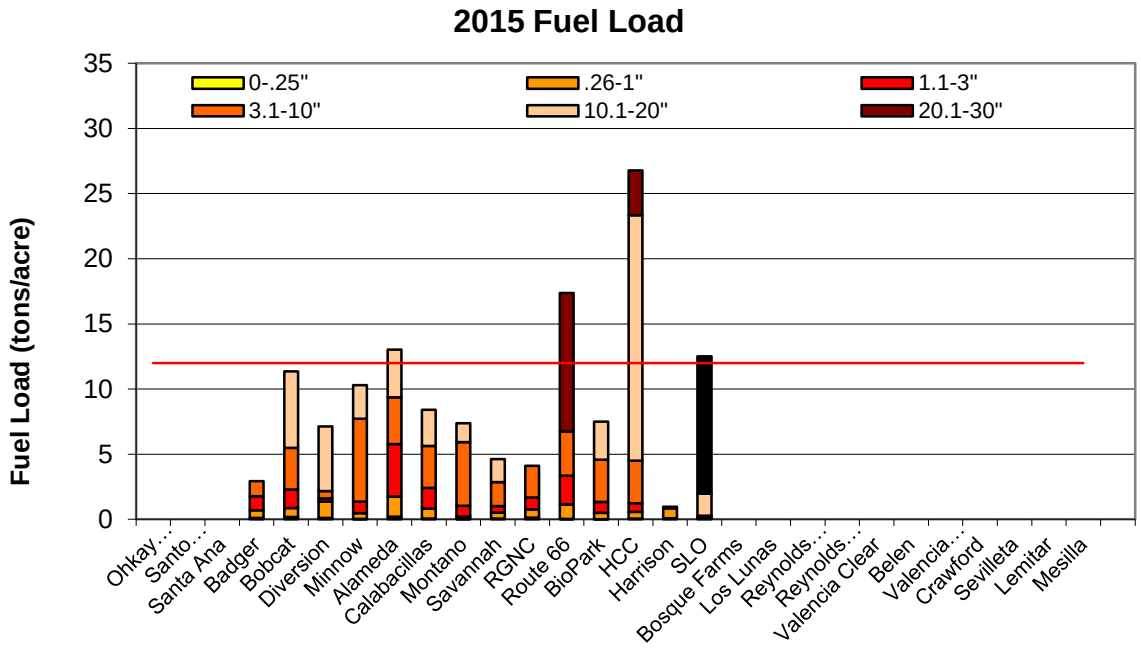


Figure 28. Woody debris analysis from 2015 with sites from north to south. The red trend line indicates catastrophic fire hazard fuel load (12 tons/acre). Only Albuquerque sites were sampled.

Surface-active arthropods

Pitfall samples from 2015 are still being identified in the lab, and data are still being entered and checked. The annual sum of abundance for sites in 2014 show the highest abundances at Los Lunas and Belen, although not all sites in Belen, nor the wettest sites (Figure 29). Isopods represent the dominant arthropod captured at nine sites: Ohkay Owingeh, Santa Ana, Bobcat, BioPark, HCC, Los Lunas, Reynolds Clear, Valencia Clear, and Belen (Figure 29). Non-beetle insects represent the dominant arthropod captured at twelve sites: Minnow, Alameda, Montano, RGNC, AOP, Harrison, SLO, Valencia Forest, Crawford, Sevilleta, Lemitar and Mesilla (Figure 30). Beetles represent the dominant arthropod captured at three sites: Badger, Savannah, Valle de Oro (Figure 30).

Two families of beetles are often used as habitat indicators. Carabid beetles (or ground beetles) often indicate flood or wet habitat. Tenebrionid beetles (or darkling beetles) often represent dry habitat, though many can be found in moist bosque habitats. At Los Lunas, a seep flood site with dense native understory cover (Table 1), carabid beetles make up 51% of the beetles captured (Figure 31). At Valencia Clear, another site with dense understory cover and occasional seep flooding (although neither of these to the extent found at Los Lunas) (Table 1), carabids make up 29% of the beetles captured (Figure 31). At 15 of the 24 sites sampled, tenebrionid beetles make up the majority of the beetles captured (53 to 85%) (Figure 31). The sites with high tenebrionid captures do not consist solely of perched sites, but range from perched sites that do not experience flooding (Santa Ana, Bobcat, Minnow, Alameda, Montano, RGNC, Reynolds Clear, Valencia Forest, Lemitar, Mesilla) to sites that experience seep flooding (AOP, Valencia Clear, Sevilleta) to sites that overbank flood (Harrison, Crawford).

On the left, carabid beetles are found in relatively high numbers at moist sites. On the right, a New Mexico whiptail lizard is rescued from a pitfall trap.

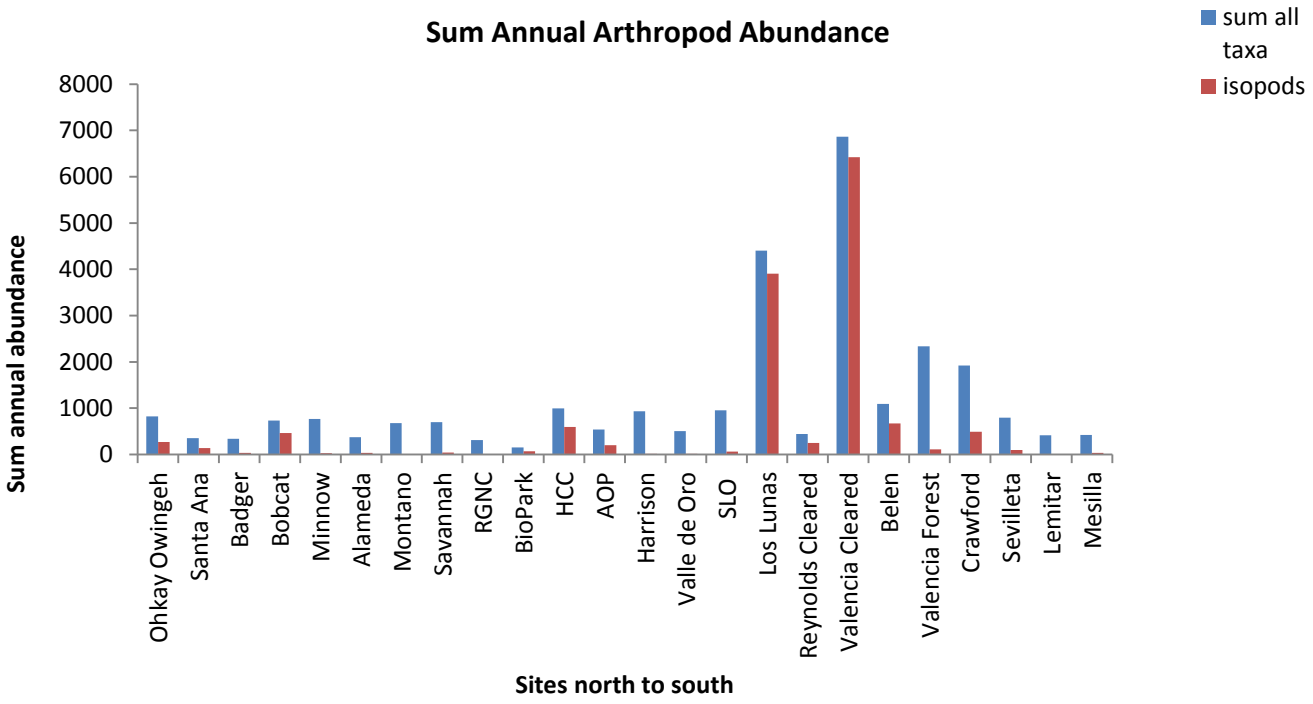


Figure 29. Total sum of annual arthropod abundance (based on three pitfall sessions per year) at sites north to south, and total annual isopod abundance.

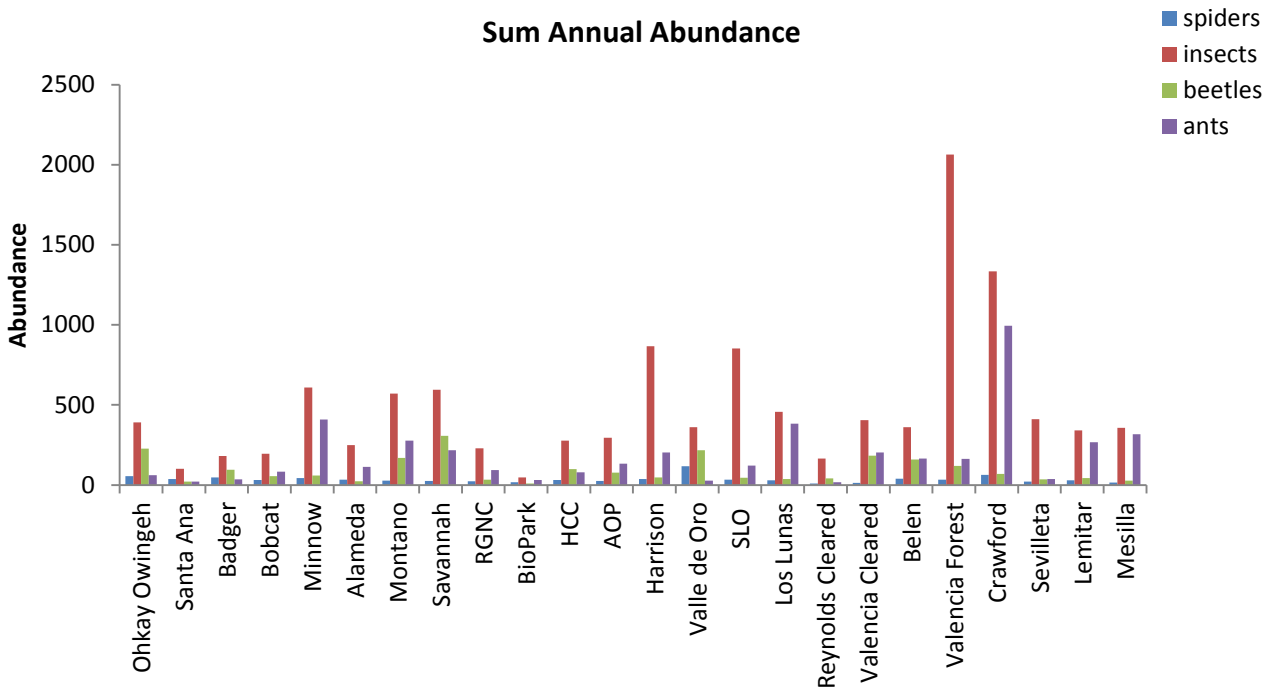


Figure 30. Total annual sum of spiders, insects, beetles and ants at all sites (listed north to south).

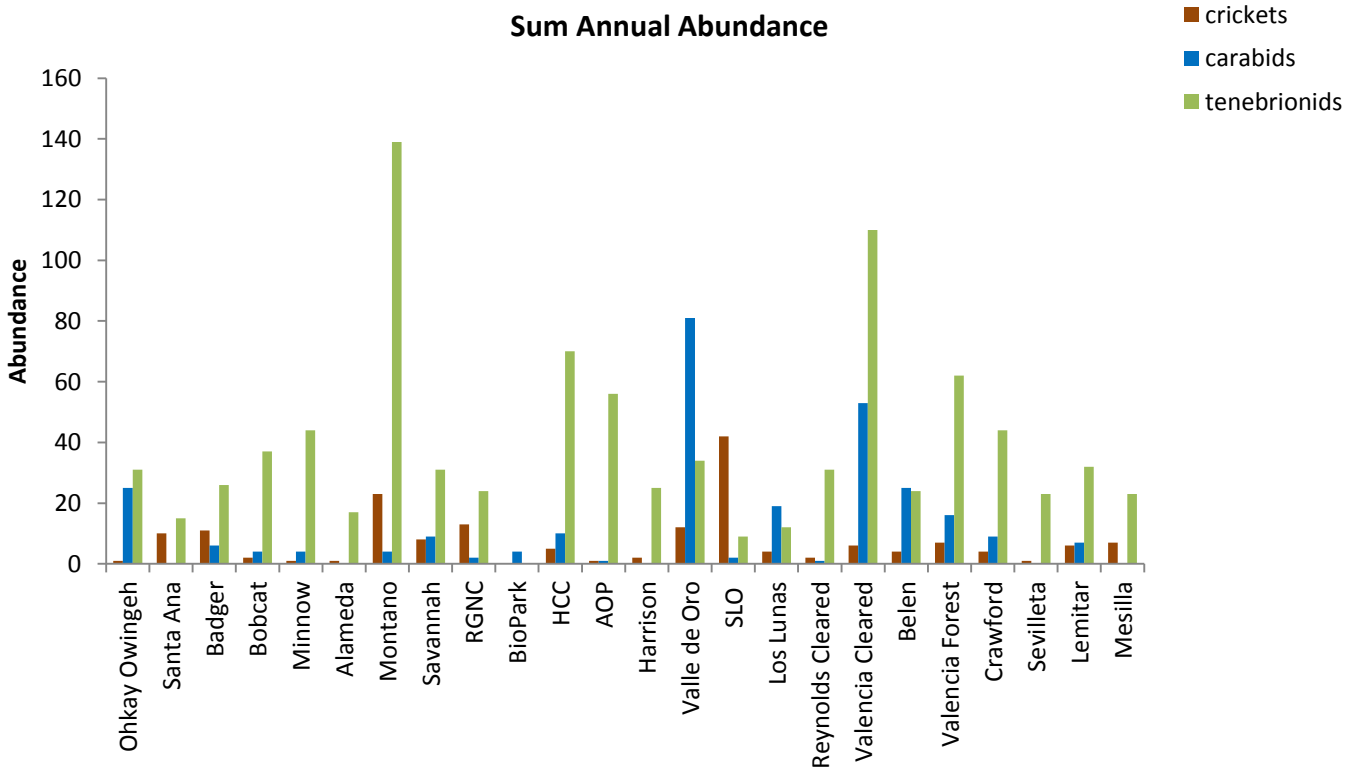


Figure 31. Total annual sum of crickets, carabid beetles and tenebrionid beetles at all sites (listed north to south).

Concluding Remarks:

There were over 1000 students involved in *year-round* monthly monitoring during the 2014-15 schoolyear, and another 5000 students involved in hands-on field work.

Most BEMP sites have a strong hydrological connection between groundwater and river flow; as annual river flow fluctuates, the groundwater depth responds. Southern sites tend to be less perched than sites to the north, and overbank flooding still occurs at a couple of Albuquerque sites and many Valencia County sites. Vegetation at sites is often indicative of the site's connection to the river, and native plants are dominant at sites that have some sort of flooding (overbank or seep).

The information in this report is based upon BEMP's non-proprietary datasets, collected between January 2015 and December 2015. All data are available upon request. We would like to thank the US Army Corps of Engineers, US Bureau of Reclamation, Bernalillo County, Valencia Soil and Water Conservation District, Middle Rio Grande Conservancy District, City of Albuquerque Open Space, Environmental Protection Agency – Urban Waters, NM State Land Office, National Science Foundation (through Sevilleta Long-Term Ecological Research), NM State Parks, Albuquerque Community Foundation, McCune Foundation, Davidson Foundation, Goodman Foundation, Intel, Greater Rio Grande Watershed Association, Middle Rio Grande Stormwater Quality Team, and the Black Institute for their ongoing support of this vital monitoring and education work along the Middle Rio Grande.