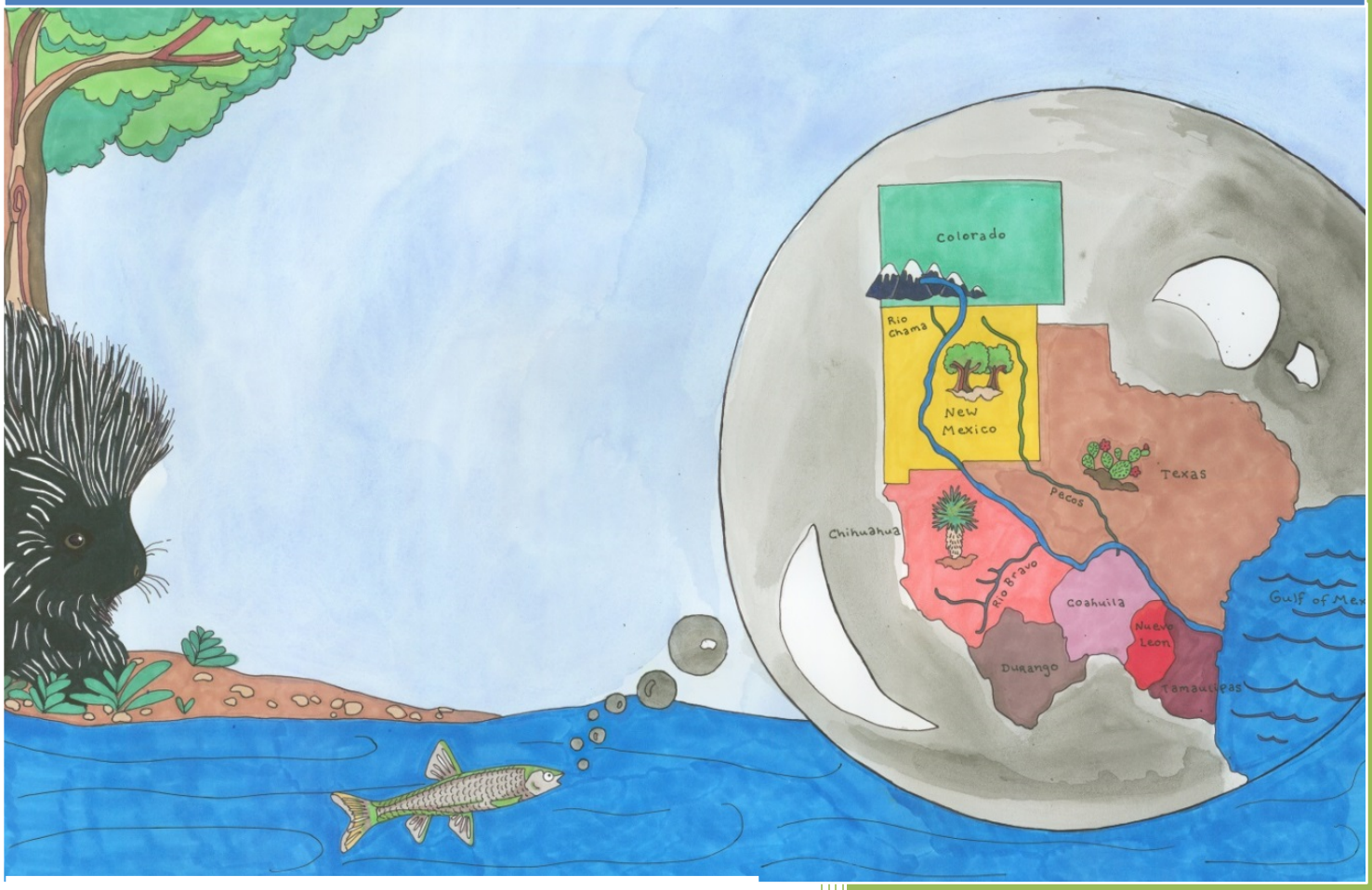
The Albert J. and Mary Jane Black Institute for Environmental Studies 2012-13 Year in Review



The Albert J. and Mary Jane Black Institute for Environmental Studies at Bosque School is a center for bosque, riparian, and watershed research, environmental education, and sustainability with a primary focus on the Rio Grande watershed.

Bosque School
Albuquerque, NM

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www.bosqueschool.org/BEMP.aspx

The Albert J. and Mary Jane Black Institute *for* Environmental Studies

As a center for *bosque* and environmental education and research, the **Albert J. and Mary Jane Black Institute for Environmental Studies at Bosque School (Black Institute)** strives to build connections between students, their community, and the riverside forest and associated watersheds that sustains and binds them all.

The work of the Black Institute does <u>three</u> things:

1. ***It orchestrates learning opportunities*** to help people understand river ecosystems and their supporting watersheds.

2. It provides community members with time in an urban, riverside forest to allow them to have first-hand experiences with their local environment and develop a sense of place within it.

3. It supports people as they take action to restore and sustain the ecological integrity of the Rio Grande and its watershed.

The Black Institute works under the premise that to be wise stewards of their home environment, communities must both know facts about how a particular ecosystem functions and also have a personal connection with that place. The Black Institute readily and consistently seeks out schools, community groups, government agencies and other organizations to partner with in meeting its goals. In the 2012-2013 school year the Black Institute supported over **8,060** participants in its programs.

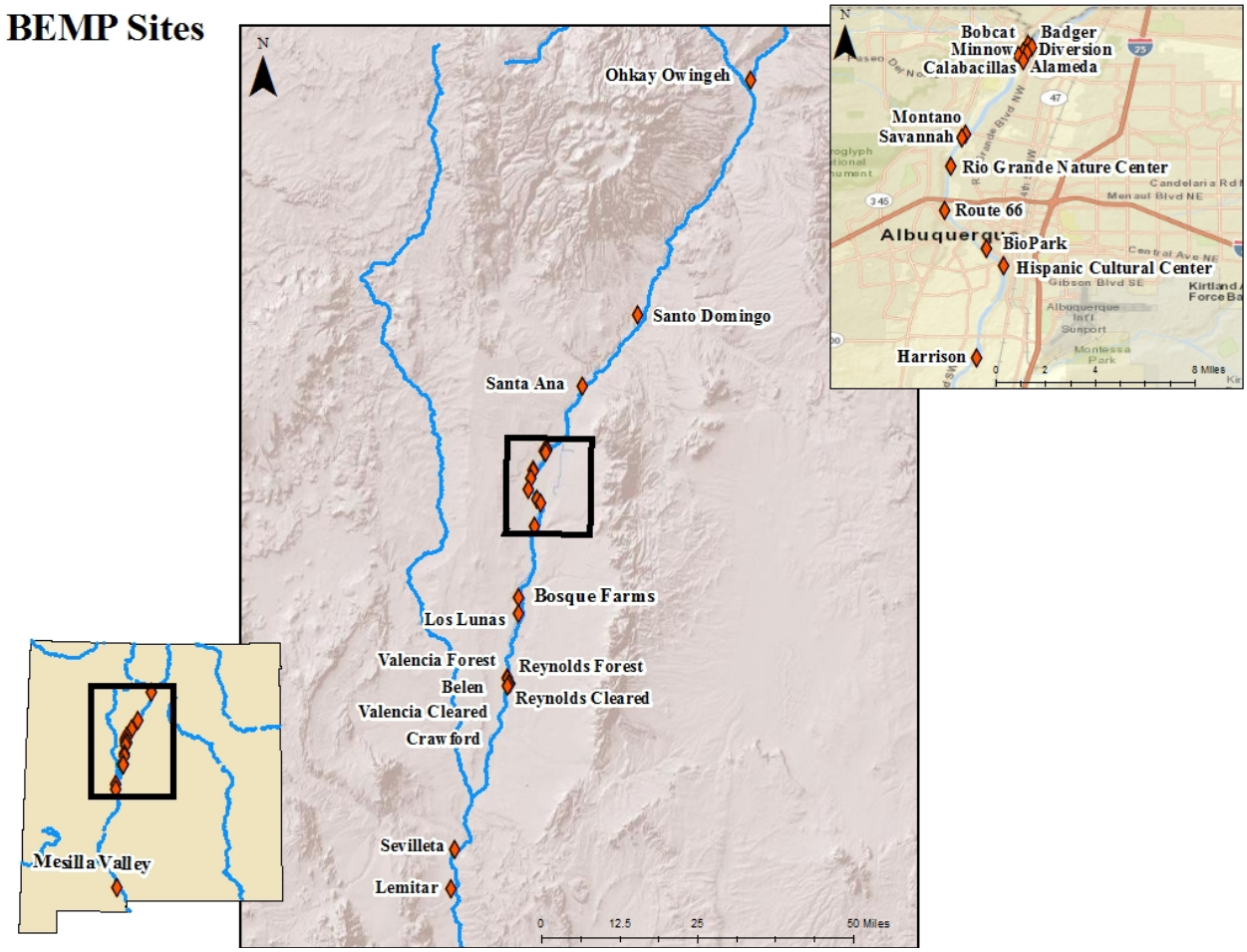
Programs within the Black Institute

The Bosque Ecosystem Monitoring Program (BEMP) is a joint project of the University of New Mexico's Biology Department and Bosque School's Black Institute. BEMP annually involves over 5,500 people in research, education, and stewardship of the Rio Grande and its riverside forest, the bosque. This includes supporting over 3,200 K-12 grade students and their teachers in direct environmental field monitoring of the bosque. Key data and findings about the functioning of the Rio Grande and its bosque are compiled, analyzed, and presented in scientific publications issued by the University of New Mexico (reports can be found online at www.bosqueschool.org/BEMP.aspx) and subsequently used by government agencies to inform multi-million dollar decisions about this ecosystem.

2012-2013 Bosque Ecosystem Monitoring Program Overview

BEMP completed its 17th year in the 2012-2013 school year.

BEMP now stretches over **300 miles** of the Rio Grande between Ohkay Owingeh Pueblo and Las Cruces. Sites are located in urban, rural, agricultural, and tribal communities. Each site offers researchers and managers a unique perspective on the Rio Grande and its bosque. Of the BEMP sites, over 20 were put into operation at the request of a government agency to monitor either a restoration or management concern. End data users continue to include federal, tribal, state, regional, and local government agencies and researchers.



BEMP Research

BEMP research considers the impacts of climate, fire, flood, restoration, and management activities as ecological drivers acting upon the Rio Grande and its riverside forest. BEMP works in partnership and uses the protocols and research methods developed or needed by the Rio Grande's and bosque's natural resource managers.

Students "beep" a groundwater well.

BEMP Data Sets

Collected monthly since 1997

- Groundwater Wells: Depth to shallow ground water
- Litterfall: Primary productivity of native and exotic plants
- Precipitation: Gauges in an open area and under the forest canopy

Collected at specific intervals

- Surface-active arthropods
- Tamarisk leaf beetle
- Cottonwood diameter at breast height
- Fuel load/woody debris
- Basic field parameters of ground, river and ditch water chemistry
- Above- and below-ground temperature
- Ground water depths using pressure transducers

Based on requests by funders

- Fecal coliform or *E. coli* and associated field parameters
- Topographical elevations of wells using GIS technology
- Other data as requested

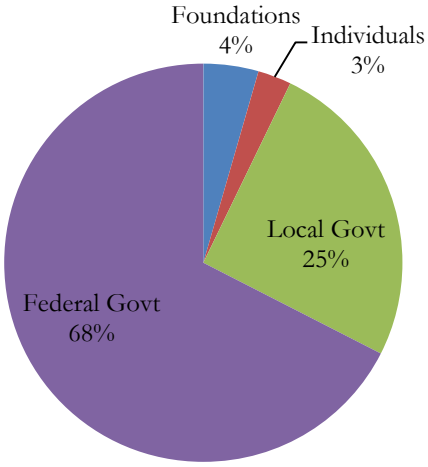


All BEMP data are nonproprietary and can be accessed at www.bosqueschool.org/Data_Sets__Forms.aspx. To request current data analyses and/or effects of land management strategies at BEMP sites, please contact BEMP Co-Director, Kim Eichhorst, PhD at kimde@unm.edu.

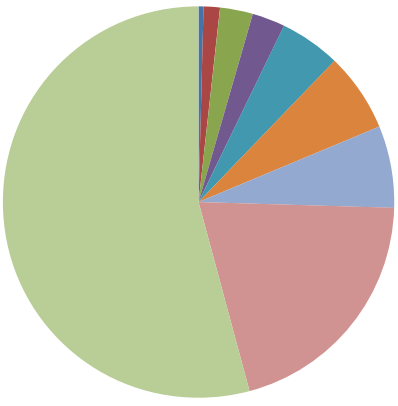
BEMP Funding Agencies
2012-2013

Albuquerque Bernalillo County Water Utility Authority
Albuquerque Community Foundation
Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA)
Bernalillo County Open Space Division
Conoco Phillips
Goodman Family Foundation
Los Alamos National Labs Foundation
Middle Rio Grande Conservancy District
National Science Foundation Long Term Ecological Research
New Mexico Stormwater Quality Team
Socorro Bureau of Land Management
U.S. Army Corps of Engineers
U.S. Department of the Interior, Bureau of Reclamation

BEMP Funding by Type



BEMP Sources of Funding: 2012-2013



- Los Alamos National Labs Foundation
- Crawford Foundation
- Albuquerque Community Foundation
- Goodman Foundation
- Stream Team Ed (Cooney Watson/AMAFCA)
- University of New Mexico – National Science Foundation
- US Bureau of Reclamation Vegetation
- Bernalillo County
- US Army Corps of Engineers

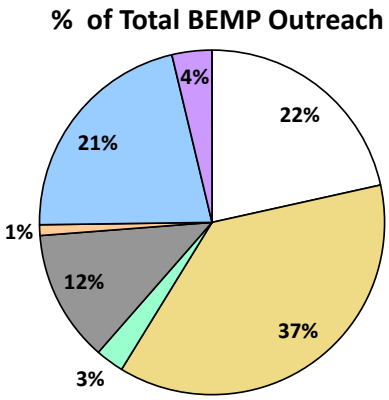
As seen in the charts above, the majority of BEMP's funding is from federal sources (68%). Local government contributes 25% and foundations and individuals seven percent. All of BEMP's funding is allocated on an annual basis (so-called "soft money"). **We are continuously seeking sustainable sources of funding.**

BEMP thanks our funders for their ongoing support.

BEMP Education and Outreach

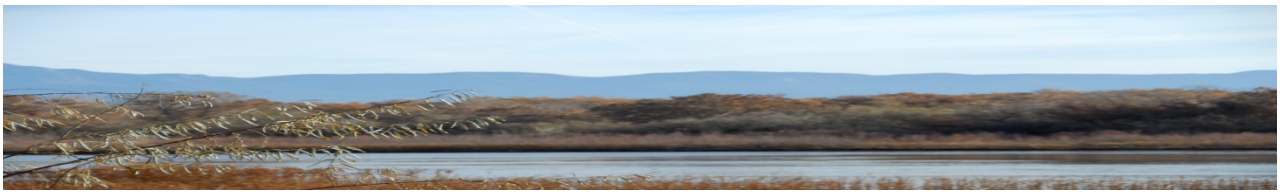
Since BEMP was founded, 40,745 community members have participated in our program!

2012-2013 Outreach Numbers

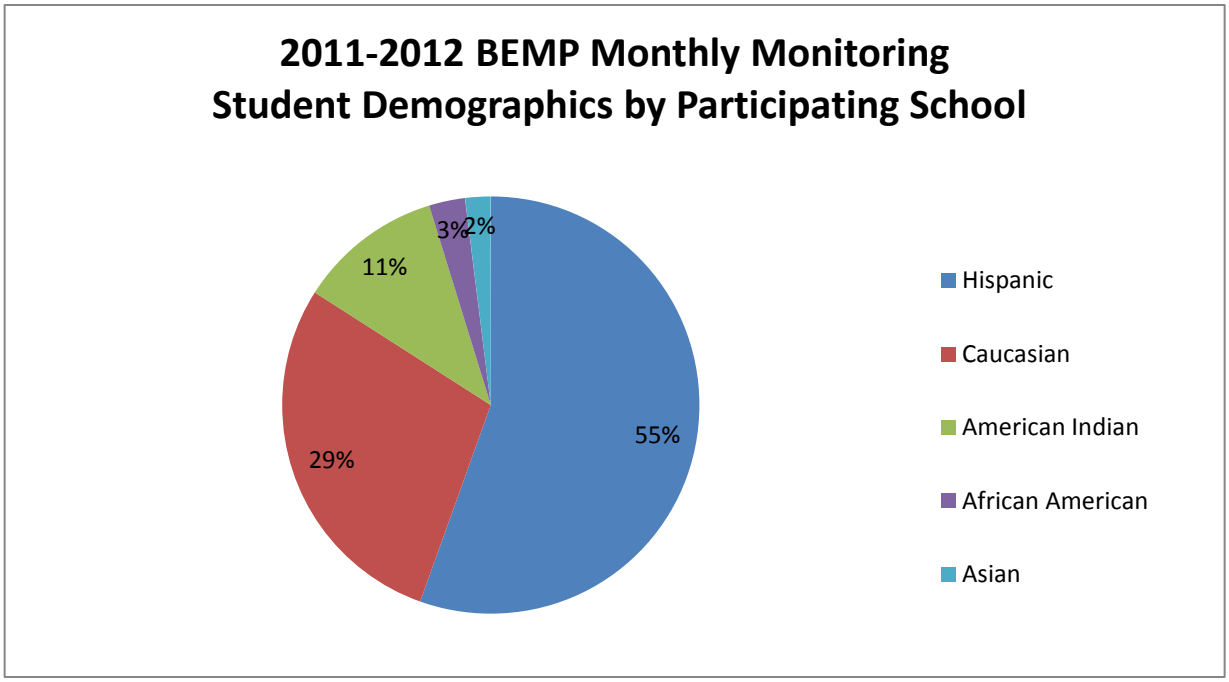


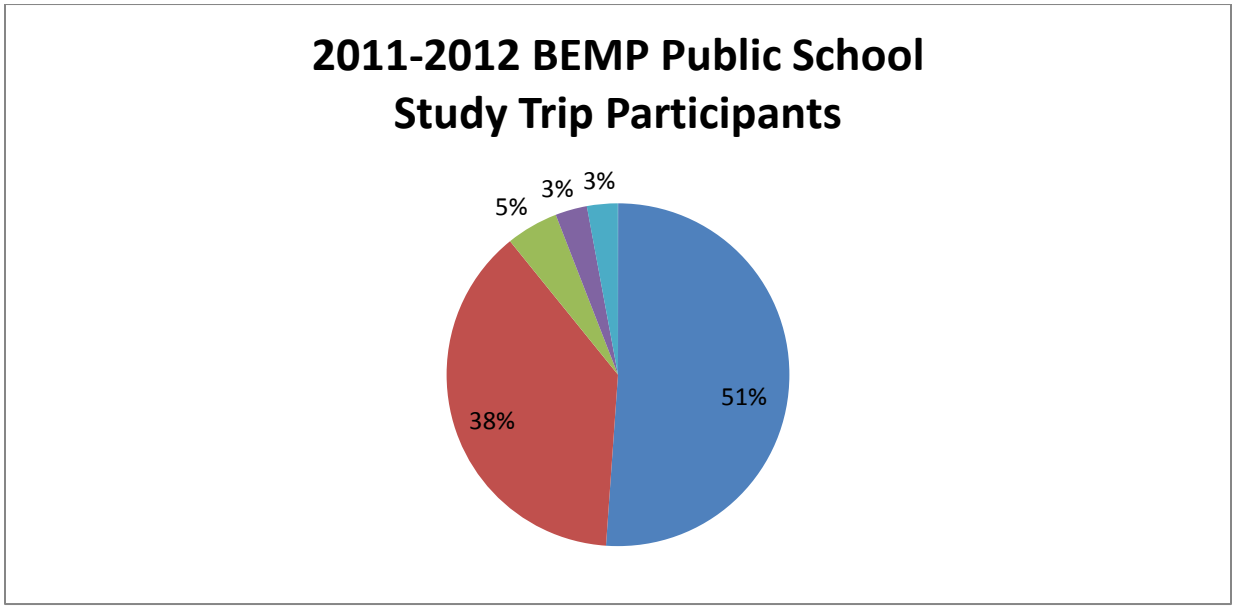
BEMP 2012-2013 Outreach	students	adults	total
monthly monitoring - long term multiple field days	1086	149	1235
study trips - short term field (1-2 days)	1713	423	2136
summer programs	121	32	153
wildlife programs	612	96	708
adult/ teacher training	1	57	58
festivals, classroom only, events, etc.	1024	207	1231
conferences, meetings, etc.	47	168	215
	4604	1132	**5736**

BEMP's core work is monthly monitoring, which is long-term, multiple days in the field. During monthly monitoring, K-12 students and teachers collect data and develop in-depth knowledge of bosque sites, as well as a stewardship ethic. Study trips are one to two day experiences in the bosque so that schools that cannot commit to monthly monitoring still have the opportunity to get to gain a familiarity with their local environment. Summer programs include week long camps. Wildlife programs include Bosque School high school juniors and seniors as well as students involved in redtail hawk presentations and Sevilleta National Wildlife Refuge quarterly jackrabbit surveys. Adult/teacher training includes Watershed Watch trainings, Project Wet trainings and participation in events where BEMP shares its protocols and experiences with the scientific and education community. Festivals include Rio Rancho water festival, Otter Day, and community education events. Conferences and meetings refer to BEMP Congresses, focus groups and site visits.



BEMP Public School Student Demographics

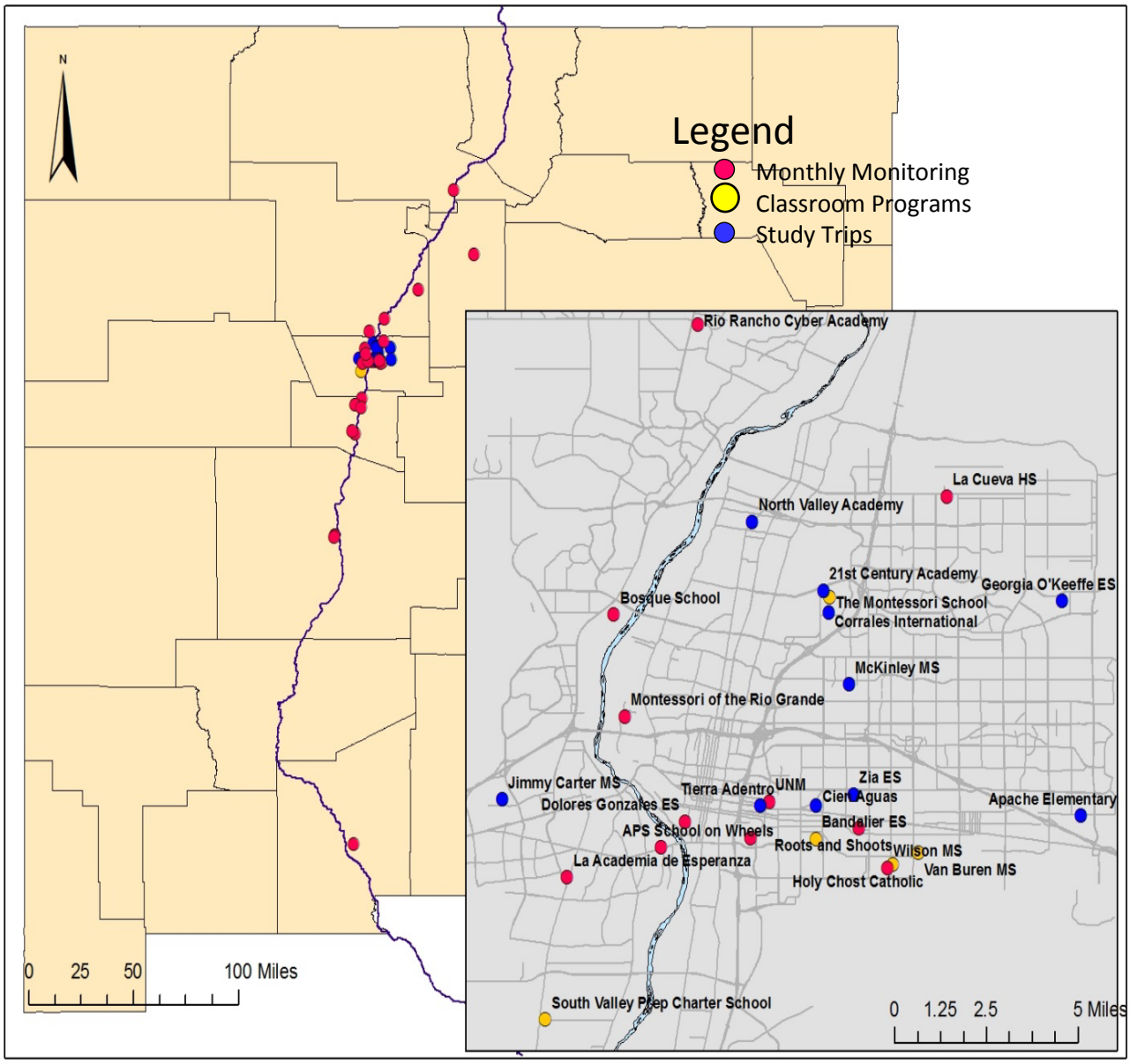




Data from 2011-12 NM Public Education Department School Accountability Reports, the most recent available as of September 2013. Does not include private or parochial schools.

BEMP's participants reflect the demographics of the state of New Mexico.

2012-2013 BEMP Monthly Monitoring and Study Trip School Participants



The map above shows the distribution of schools that participate in BEMP monthly monitoring and study trips. The red dots indicate monthly monitoring schools, the yellow schools that had participated in BEMP classroom programs, and blue those that went on study trips. The majority of schools are in the greater Albuquerque area, which corresponds to the middle reach of the Rio Grande, where there are 25 BEMP sites.

BEMP Congresses occur each year in April, BEMP hosts gatherings of monthly monitoring participants to share information and the experience of collecting scientific data in their stretch of the bosque. Congresses occur at El Rancho de las Golondrinas (grades 7-12), Bosque School (grades 4-6) and this year we added a third event at the Sevilleta National Wildlife Refuge for grades K-2. Together with the New Mexico Department of Game and Fish's Watershed Watch program, BEMP convened nearly 200 7-12th graders to present their year of data collection. The ceremonies started with poet and musician Ilan Shamir drumming and sharing his *Advice from a River*. On the Bosque School campus, BEMPers in grades 4-6 rotated through ecological learning stations. Visiting presenters included Albuquerque Open Space, Avian Ambassadors, New Mexico Herpetological Society, Sandia Mountain Natural History Center, the City of Albuquerque BioPark and Zoo to You. At Sevilleta, more than 120 K-2nd graders from Belen visited the new visitors' center and the Sevilleta/San Acacia BEMP site for a picnic.

Advice from a River

Dear friend,

Go with the flow

Be thoughtful of those downstream

Slow down and meander

Follow the path of least resistance for rapid success

Immerse yourself in nature, trickling streams, roaring

waterfalls, sparkles of light dancing on water

Delight in life's adventures around every bend

Let difficulties stream away

Live simply and gracefully in your own true nature moving,

flowing, allowing, serene and on course

It takes time to carve the beauty of the canyon

Rough waters become smooth

Go around the obstacles

Stay current

The beauty is in the journey!

UNM 408/508L Bosque Internship Class

A UNM student and middle school student from Los Lunas, NM collect woody debris data

Each year at the University of New Mexico (UNM), BEMP staff teach about 60 undergraduate and graduate students (20 per semester) about the ecology of the river and its riparian forest. These students provide quality control by accompanying K-12 students in the field while gaining experience in hands-on science and environmental education. UNM students also learn to identify and weigh leaf species collected in litterfall bins, thus estimating primary productivity of the forest. They count and identify surface-active arthropods collected three times a year at BEMP sites. Some students participate in special field data collections such as ground, ditch and river water chemistry as well as woody debris (fuel load), which is a measure of fire potential at sites. The UNM interns also serve as mentors and convey to K-12 students that college is a real possibility for them.

Crawford Symposium: Green Trails for the Next Generation

is an annual conference that brings students, scientists, government agencies, tribes and pueblos, and interested community members together to share information and research about the bosque. The featured presenter this year was Dr. David Gutzler, UNM Climatologist, who highlighted trends in drought throughout the Southwest. High school groups from Albuquerque Academy and Bosque School presented on threats to local riparian areas, overviewed ongoing wildlife projects, and sparked conversation about development and wildlife habitats.

From left to right: Bosque School students present their research on the pika in Valles Caldera. Dr. David Gutzler chats with a student about his research paper.

Otter Day is an Earth Day celebration that focusses on the return of the North American river otter (***Lontra canadensis***) to New Mexico's waterways. In 1953, the last known river otter in New Mexico was found dead in a beaver trap in 1953. Over 50 years later in 2008, five otters were reintroduced by Taos Pueblo on the Rio Pueblo de Taos. By 2010, thirty-three otters had been released at this site. Students from Bosque School's Wildlife Biology class teach first graders from Albuquerque Public Schools about the otter, other river inhabitants and the aquatic ecosystem to celebrate the return of this important species. In 2012-13, 242 first grade students and many of their parents participated in the program.

From left to right: Bosque School Wildlife students teach about otter habitats. First graders from Albuquerque celebrate Otter Day.

Native Fish in the Classroom is a program through the US Fish and Wildlife Service (USFWS) to generate enthusiasm about native fish and to develop caring attitudes about fish species and their habitats. This program involves rearing warm-water fish, checking water quality, and maintaining journals and logs. The native fish are later released into the Rio Grande. Bosque School Wildlife Biology students participated in the program and hosted students from Valle Vista, Laguna Acoma, and Emerson elementary schools at Bosque School campus to release the fish into the Rio Grande. These fish also contribute to the education experience of students participating in study trips. Special thanks to Angela James (USFWS) for coordinating this important program!

Additional BEMP Education Programs

Stormwater Science

The Rio Grande Stormwater Quality Team has funded BEMP to implement an outreach education program on the topic of stormwater runoff. BEMP developed a classroom program called *Stormwater Science* with the main objective of teaching students that the health of the Rio Grande is directly related to the health of the surrounding watershed. This 1 ½ hr *Stormwater Science* classroom presentation was delivered to 616 students in 29 classrooms at 11 different schools during the 2012-2013 school year. BEMP also offers the aforementioned day long study trips where the importance of keeping a clean watershed is discussed and the 'scoop the poop' message is enforced. This year, 627 students in 31 different classrooms participated in BEMP study trips. A third Stormwater Quality Team supported educational effort is the *Stormwater Science Field* extension, which is an expansion of the concepts taught during the classroom presentation. One hundred forty students from nine different classes participated in a Stormwater Science Field event this school year.

BEMP EcoScience Summer Camps include *Weird and Wacky Wildlife*, *Bosque Biology Bonanza* and *Spunky Science*. Each camp finds fun, active ways to integrate local Keep your eyes out next spring for a chance to participate in our 2014 Summer Camps experiences based out of Bosque School!

Left to Right: Summer programmers create a sidewalk chalk mural of the Rio Grande bosque. A student finds a Woodhouse's toad at Bosque School during Weird and Wacky Wildlife.

Sharing BEMP Data with the Community

BEMP Site Visits, Belen, NM, October 2012


Dr. Kim Eichhorst illustrates a bosque meadow and an overbank flooded site showing cottonwood growth outcompeting invasive growth.

Each year BEMP invites resource managers, nonprofit organizations, and community members to visit a series of monitoring sites along the river. In fall 2012, we visited three BEMP sites in Valencia County: Crawford, Valencia Cleared and Valencia Forest. The sites in Valencia County were a primary research area due to the collaboration between BEMP, the Interstate Stream Commission, Hawks Aloft, MRGCD, the National Heritage Program, and Valencia Soil and Water Conservation.

Site Name	Site Description	Treatment Type and Date
Crawford	strongly hydrologically connected, with seep floods occuring at higher flows; northern section: cottonwoods in low-lying areas with saltcedar and kochia in higher areas, lots of c ocklebur; southern section: yerba mansa, rushes and sedges, kochia; vegetation almost equally native and exotic; Collaborative Forestry Research Program (CFRP) site	Feb 2007 burned; Jun 2007 MRGCD chopped and cleared resprouting exotic trees and larger dead cottonwoods; Jan-Feb 2009 MRGCD cleared site again; Feb 2009 Interstate Stream Commission lowered terrace and adjacent banks creating a backwater area when river flows reach 2500 cfs; May 2009 flood; May 2010 flood
Valencia Cleared	In summer 2003, this site was dominated by cottonwood, Russian olive and saltcedar. After clearing, it was an open area of wood chips with a few cottonwoods, Godding's willows and yerba mansa. The site was rapidly take over by regrowth of the cut trees and native and exotic understory. It served as a staging ground for firefighters to create a firebreak to stop the 2007 Belen fire.	May 2003 Valencia SWCD cleared and chipped; 2008 re-cleared; road through eastern edge of site Oct 2012
Valencia Forest	Adjacent to the Valencia Cleared site. Established in 2003 but uncleared and dominated with cottonwood, Russian olive and saltcedar, with a saltgrass meadow at the south end of the site.	Feb 2007 site burned; May 2008 MRGCD cleared and piled dead cottonwoods and much saltcedar and Russian olive regrowth; Oct 2008 more piles of wood created, bulldozing, S well destroyed; Apr 2009 cleared and chopped wood; Mar 2010 more clearing; Mar 31, 2010 masticated large wood piles

BEMP Focus Groups June 2013

The purpose of BEMP's annual focus groups for educators and data users is to solicit feedback from our stakeholders about how to improve our program. This year, BEMP Education Coordinator Kimi Scheerer debuted BEMP's alignment to Common Core standards and received feedback from the education community. BEMP Science Coordinator, Jennifer Schuetz, organized the natural resource managers to provide analysis of BEMP data on the effects of disturbance on vegetation in the bosque. Specifically, when flooding occurs a site, native vegetation dominates as seen in the summary table below, "Effects of Bosque Disturbances on Exotic Understory, Native Understory, Exotic Canopy and Native Canopy." This meeting ended with a visit to the Santa Ana BEMP site, with permission of the Pueblo of Santa Ana, to observe cottonwood and shrub dieback potentially resulting from decreased hydrological connectivity between groundwater and river flow."

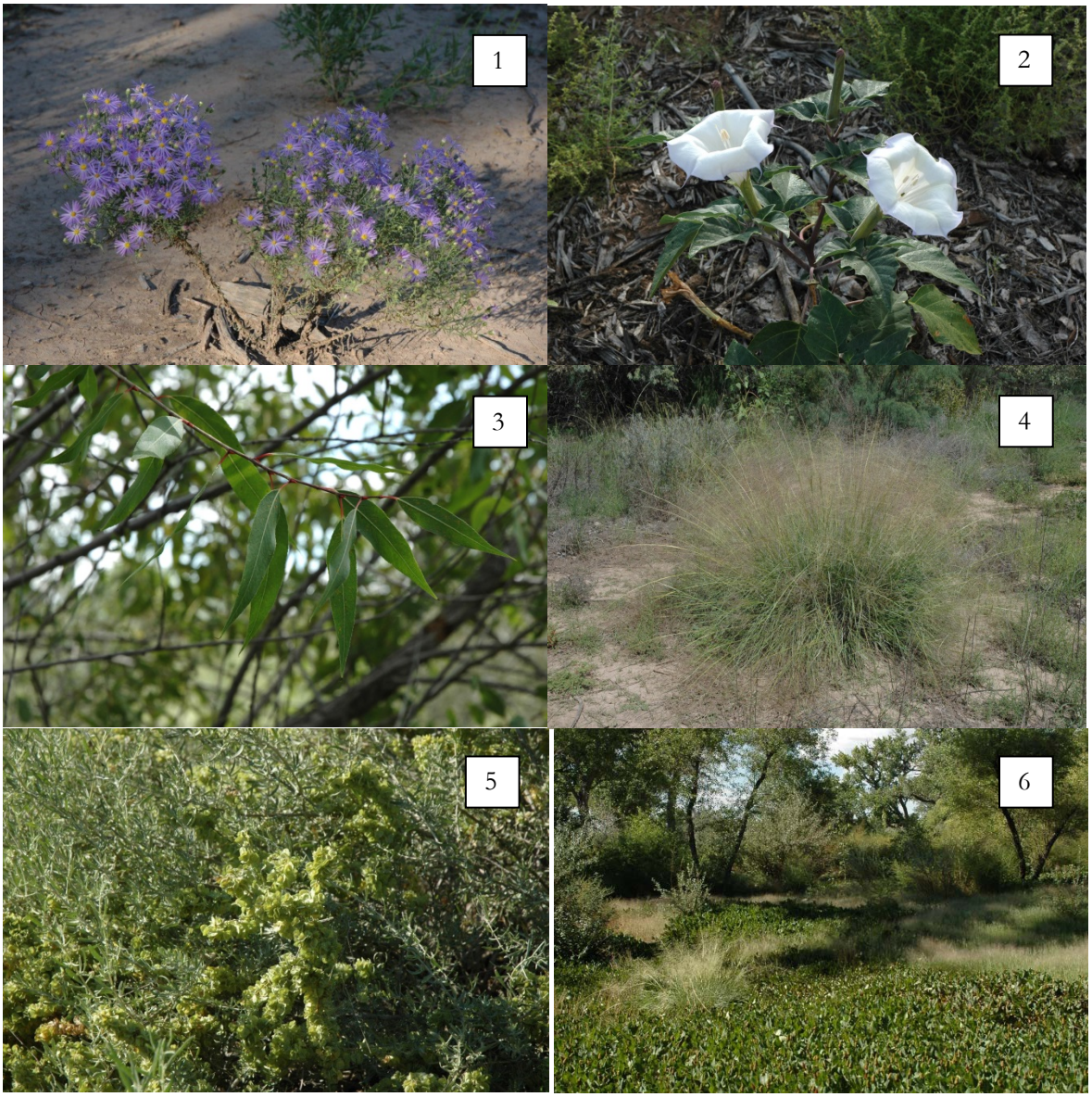
Summary Table: Effects of Bosque Disturbances on Exotic Understory, Native Understory, Exotic Canopy and Native Canopy

disturbance	exotic understory	native understory	exotic canopy	native canopy	what next?
fire, no flooding	exotic understory increases after fire, especially in areas that were previously bare or covered with plant litter	native understory recovers quickly after fire	saltcedar recovers quickly after fire, regaining height within 6 months; Russian olive recovers moderately well after fire	cottonwoods recover poorly or not at all after moderate and hot fires; resprout survival depends on depth to groundwater and presence of herbivores. Willow responds moderately well after fire	if there is no possibility of flooding after fire, seeding and long-stem pole plants should be considered in areas where native vegetation was not previously present. Areas with natives recovering should be left alone (minimal disturbance brings in minimal exotic understory)
fire, followed by flooding	exotic understory increases slightly	native understory dominates	exotic canopy recovers quickly	native canopy dominates	
mowing or bulldozing	exotic understory increases	native understory recovers, may decline	exotic canopy recovers quickly	coyote willows recover quickly in most areas	not recommended in dry areas
clearing (thin layer to no wood chips)	exotic understory establishes in bare, disturbed areas; often declines over time	native understory recovers quickly, may decline, more often increases	exotic canopy usually recovers quickly (esp. Russian olive) without retreatment; exotics cleared in summer through fall tend to resprout; exotics cleared in fall and winter do not recover as well	damage is minimal or native canopy recovers	allow native areas to recover and reestablish; retreat without heavy machinery or wood chipping. Removal of downed wood from site is recommended. Bare areas can be seeded, or long-stem poles planted. Upland plant species should be considered in areas where flooding or strong connection to the water table is unlikely.
clearing (moderate or thick wood chips)	exotic understory increases	native understory suppressed, declines	exotic canopy usually recovers quickly (esp. Russian olive) without retreatment	native canopy often reduced after clearing, recovers	not recommended
overbank flooding	exotic understory low	native understory dominates	exotic canopy outcompeted by natives	native canopy dominates	

Data Users Focus Group, June 28, 2013

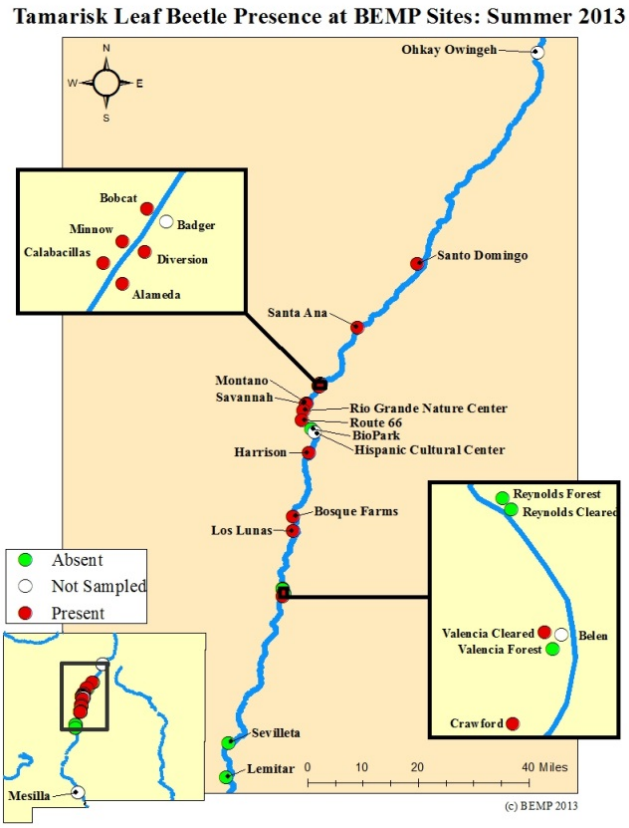
Bosque Vegetation Reports

The data for the "Effects of Bosque Disturbances" response table is from vegetation transect surveys that have been collected in the bosque since 1997 with the support of the U.S. Department of the Interior Bureau of Reclamations. Contracted botanists survey ten 30 meter vegetation transects at each BEMP site once a year. Along the transects, each species is measured and recorded.



Some plant species of the bosque: (1) Dieteria canescens, (2) Datura wrightii, (3) Salix goodingii, (4) Sporobolus airoides, (5)Atriplex canescens,(6) Muhlenbergia asperifolia and Forestiera pubescens

Tamarisk Leaf Beetle Monitoring

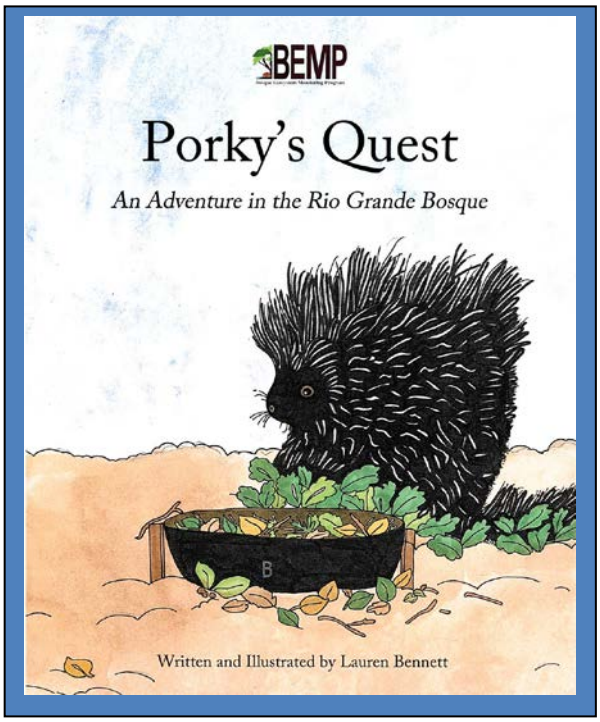


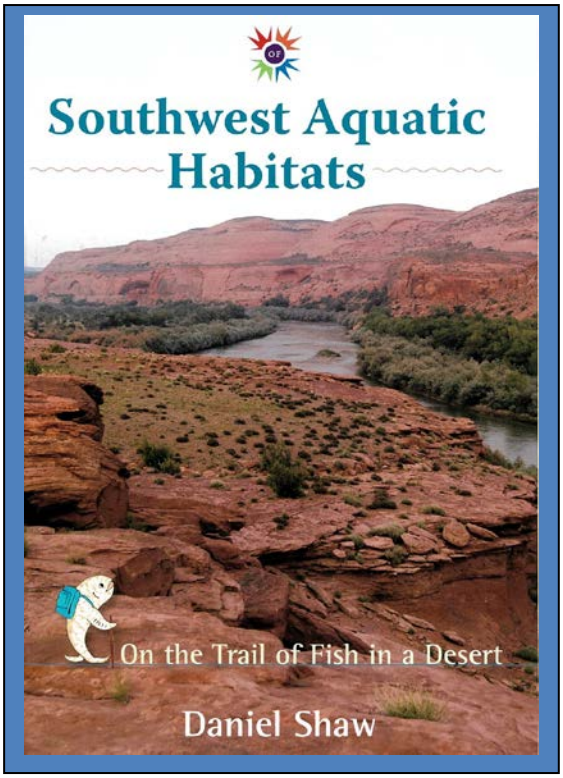
The tamarisk leaf beetle was introduced to Colorado and Texas in order to control the invasive tamarisk population in the US. The beetle has since spread to Utah, Arizona, and now New Mexico. From May to August 2013, BEMP monitored tamarisk leaf beetle populations at all BEMP sites that contain tamarisk. In total, the beetle was found at 19 of 22 sites sampled. Monitoring the tamarisk leaf beetle will aid in assessing its impact on tamarisk populations and the bosque ecosystem at large.

Left to right: Diorhabda spp. (Tamarisk leaf beetle). BEMP *Summer intern Rowan Converse sweep-netting a tamarisk tree.*

BEMP Books

BEMP is the proud publisher of a beautiful children's book featuring Porky the Porcupine that was written and illustrated by Lauren Bennett, a 2012 Bosque School graduate. The book entitled, "Porky's Quest: An Adventure in the Rio Grande Bosque," follows Porky as he adventures through the bosque and discovers ways that children are monitoring their habitat. He meets animals who explain how citizen scientists can help to ensure a healthy future for humans and wildlife. According to Lauren, "Throughout middle and high school I enjoyed being part of BEMP conservation efforts and wanted to leave behind something that would inspire younger students who take part in the program. Hopefully, through this light-hearted illustrated adventure about the bosque ecosystem, the youngest citizen scientists will realize that they can help





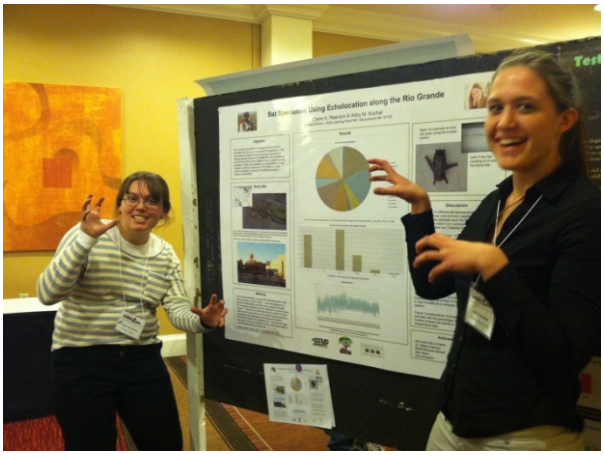
Dan Shaw, Bosque School wildlife teacher and BEMP Co-Director, published his second book in the "Worlds of Wonder Science Series for Young Readers" entitled "Southwest Aquatic Habitats: On the Trail of Fish in a Desert." This book conveys the enthusiasm and imagination of students who are learning about aquatic ecosystems, along with scientific information about watershed health. It's a great read for middle and high school students as well as a resource for environmental educators or anyone who wants to learn more about connecting students with their home watershed. This book was published by University of New Mexico press. The book provides practical

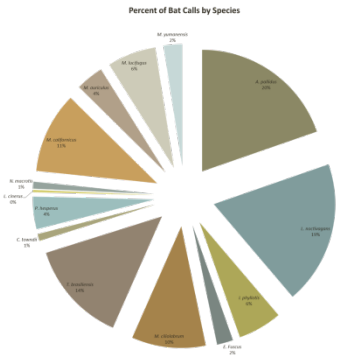
Books are available for purchase at Bookworks on Rio Grande Blvd. in Albuquerque and on Amazon.com.

The Cebrin Goodman Youth, Leadership, and the Environment Project: Responsible Action for Ecological Integrity

The Goodman Project is a series of educational and hands-on events to support and sustain the restoration of the ecological integrity of the Rio Grande and its watershed. The Goodman Project is committed to advocacy emphasizing the importance of students and others taking direct action to create a more sustainable human and environmental community. It also works under the premise that humans are a part of and not apart from the environment. The Goodman Project emphasizes that the path to responsible action is built upon passion guided by accurate information and respectful dialogue and behavior. Goodman Project events are practical examples of hope in the modern era and its complicated environmental realities.

Wildlife and Conservation Biology Research Projects





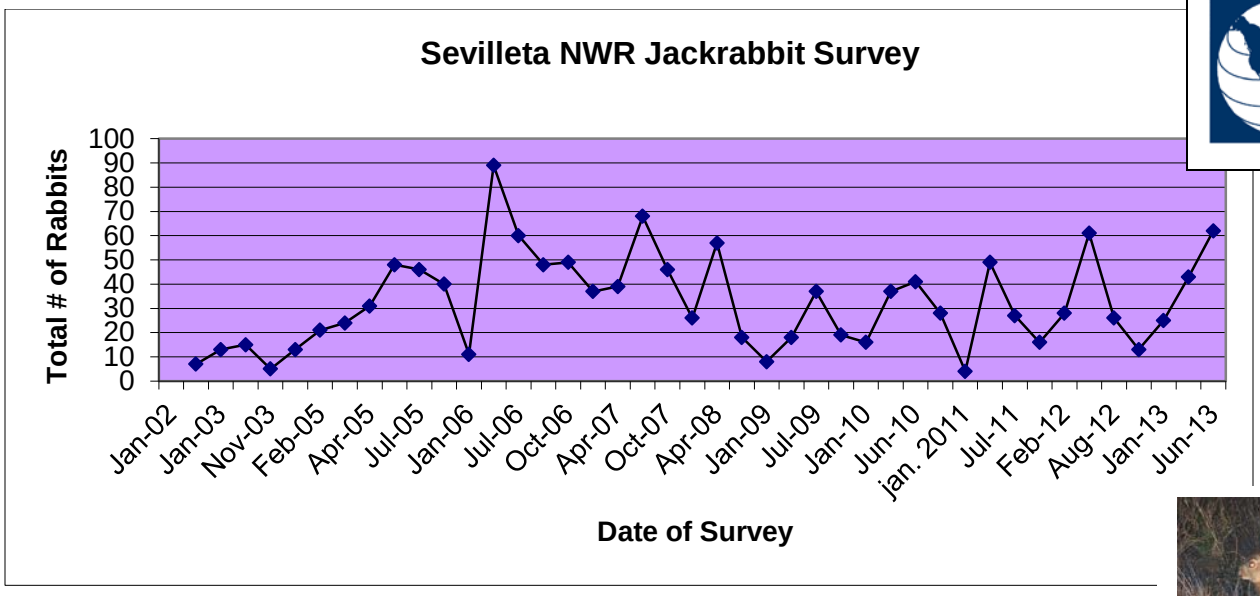
Bat Speciation by Ecolocation along the Rio Grande:
Claire Reardon and Abby Kuchar

"We observed how bat activity fluctuates with the time of year and the precipitation. We also attempted to determine the presence or absence of several species of bats in the Middle Rio Grande Bosque in Albuquerque and which months had the highest level of varying species presence. Finally, we compared our results (taken during drought conditions, summer-fall 2012) with an earlier study conducted in a period of normal precipitation (Gannon 2004-2006)…Since Dr. Gannon's study, there has been an outbreak of the white nose fungus in the Eastern United States… We identified 14 different bat species during the research period. The three most common species, comprising nearly 50% of total bats detected were the Pallid bat (*Antrozous pallidus*), Silver-haired bat (*Lasionycteris noctivagans*) and Mexican free-tailed bat (*Tadarida brasiliensis*)…This study is particularly important because white nose fungus has been spreading southwest and is threatening many bat species, most notably *Myotis lucifugus*, the little brown bat. Our study shows that the New Mexican population of *M. lucifugus* appears to be stable."

Beaver (Castor canadensis) Census Methods Using Hair Snare and Other Methods Along an Urban Southwest River: Lucilla Gerhart and Jonathon Brearley

"We ask—is it possible to obtain hair samples from beaver by using the same hair snare techniques used on other riverine mammals? Can we obtain viable hair samples for DNA analysis through hair snare devices adapted from Ruhn's technique which was previously used with river otter (*Lontra canadensis)?*...We conducted 42 trap nights involving just over 500 trapping hours. We collected three different hair samples…Our results are inconclusive, however, we do conclude that: Noninvasive hair snaring is possible on *Castor canadensis* using the slalom method…the overhanging traps were ineffective in this study."

Sevilleta National Wildlife Refuge Jackrabbit Survey. Since March 2005, BEMP staff, UNM Interns, and Bosque Wildlife and middle school students conduct population census work on jackrabbits four times a year with the full moon. Participants drive a 21.5 mile loop using 2 million-candlepower spotlights and range finders to count jackrabbits within Sevilleta. Keeping track of this herbivore's population in response to climate and vegetation over time provides researches with important information.



North American Porcupine. Students have monitored and studied these large rodents in the 100 acres between the Bosque School campus and the Rio Grande since 1999. Under the supervision of licensed veterinarians, students capture and radio collar porcupines. Once captured, porcupines are weighed and guided into a funnel where they are sedated, measured, microchipped, and radio collared. At the end of the process, they are given a reversal drug and set free. Once radio collared, porcupines can be tracked as they move about the forest. Each collar broadcasts to a different frequency allowing students to track individual porcupines.


In Partnership with NM Game and Fish

Dunes Sagebrush Lizard. In partnership with the New Mexico Department of Game and Fish and Texas A&M University, students assist with research of the Dunes Sagebrush lizard, a candidate for listing as a federal endangered species. It is a habitat specialist and lives amidst shinnery oak and bowl shaped sand dunes. Much of their habitat in west Texas and eastern New Mexico sits atop large deposits of oil and gas, resulting in a loss and fragmentation of habitat. lizards are captured, identified, marked, measured and weighed. In 2009, students helped with the installation of 96 traps to capture and mark snakes in the Dunes Sagebrush Lizard study area to help biologists understand the role snakes play as predators in the landscape. Fecal matter collected from snakes help to identify prey such as lizard species.



Boreal Toad. The Boreal toad is a candidate for federal endangered species status and is listed as endangered by the states of Colorado and New Mexico. It lives in the southern Rocky Mountains between 7,000 and 12,000 feet elevation. The Boreal toad population has declined for several reasons including the spread of the Chytrid fungus, which coats amphibian bodies and interferes with their ability to carry out life function. In response, New Mexico Game and Fish is reintroducing the toad to ponds in northern New Mexico from animals bred in captivity in Colorado. The goal is that the introduced toads with return to the same ponds for breeding and slowly increase the population. Students help to catch and monitor the toad population.

Mexican Gray Wolf. Students regularly assist the US Fish and Wildlife Service with Mexican gray wolf recovery efforts, which is North America's most endangered mammal. Students travel to either the Ladder Ranch west of Truth or Consequences or to the Sevilleta National Wildlife Refuge between Belen and Socorro. Both of these locations are part of a binational (U.S. and Mexico) network of breeding facilities. When wolves need to be transferred between facilities or released into the wild, they must be captured. Students help to form a "wall of people" to block wolf movement within the pen and to assist with capturing. Wolves are weighed, receive a medical exam from a veterinarian, and prepared for transfer or release. Students keep track of blood samples, and assist with fluid therapy, with crating, carrying and releasing the wolves. They have also assisted with processing wolf pups.

BEMP Summer College Interns

Melina Baron-Deutsch

Melina (left) has been monitoring Cooper's hawk nests in Albuquerque (right)

University/Major: Mount Holyoke College; Critical Social Thought and Biology
Summer Projects: Cooper's hawk monitoring, creating an educational "zine" about climate change
In Her Own Words: In addition to Cooper's Hawks monitoring, I've participated on numerous river otter surveys, including one at the very beginning of the summer where we found the first certified evidence of otter reproduction in New Mexico since their official re-release. This was definitely one of the highlights of my summer. Here is an excerpt from my diary that day: "There are no words to describe the level of excitement and disbelief I felt this morning around 7am on a small raft in Taos when Rowan and I found an otter mother and her three pups. This is the first documented evidence of otter activity in New Mexico, which is quite a huge discovery! AND this is also evidence that they are reproducing, which is a great sign. It was like finding a mythical beast after 15+ hours of searching."
Contributing Partners and Agencies: NM Fish & Wildlife, The Black Institute

Madeleine Carey

Madeleine teaches second graders about climate change (left); On the trail (right)

University/Major: Tufts University; Biology and Urban Studies
Summer Projects: Jemez pika monitoring, climate change education
In Her Own Words: Once a week, I traveled down to the Mountain View community center in Albuquerque's South Valley and taught 2nd-5th graders about climate change, both on a local and global level. By far the most challenging part of my summer was finding a tangible and engaging way to explain

climate change to young students. Additionally, the community center we were working with serves a statistically disadvantaged population, which meant that I had to rethink common solutions to climate change, as many of them may be inaccessible to the families in this community.
Contributing Partners and Agencies: Valles Caldera National Preserve, Mountain View Community Center, The Black Institute, The Goodman Foundation

Rowan Converse

Rowan in search of otters on a dawn floating survey (left), One of the first otter pups to be found in NM for over sixty years (right).

University/Major: Wesleyan University; Biology
Summer Projects: River otter surveys, tamarisk leaf beetle monitoring
In Her Own Words: By far the most exciting thing for me this summer was discovering otter pups in Orilla Verde Recreation Area. I began surveying for otter around northern New Mexico for several months last summer without catching sight of a single otter, or even finding any sign of one. This year, on our very first survey, we not only saw one otter, but four of them! I was so ecstatic; for the rest of the survey, I was practically dancing in the boat. On the way home, I called everyone I knew to tell them the news. The otter pups symbolize such a positive change for the Rio Grande. There is so much in our environment that has been damaged or destroyed; I was incredibly grateful to be able to witness a key component of the ecosystem being restored.
Future Plans: Graduate school in wildlife biology or restoration ecology
Contributing Partners and Agencies: Valerie Williams, Jim Stuart, Brian Long, Jon Klingel, Rachel Conn, the Bureau of Land Management, New Mexico Game and Fish, the War Chief of Taos Pueblo and the War Chief Staff, Amigos Bravos

Aaron Gjullin

Aaron with a pika friend!

University/Major: University of Portland; Biology, minor in neuroscience
Summer Project: Jemez pika monitoring

In His Own Words: I was able to take some cousins with me on one of the surveys we did this summer. They are eight and thirteen years old. We left very early in the morning and they slept the whole way, but when we got there and I woke them up their jaws just dropped when they saw Valle Grande that is just south of Redondo Peak. We then began to hike up Rabbit Mountain and they were very curious about everything they could see. I told them about the history of the valley, showed them the different flora and fauna and they always had another question. When we finally got to the site we had to sit for twenty minutes quietly to look and listen for the pika and to my surprise they sat completely silent looking and listening. When we heard the first pika call the youngest turned to me and asked "was that one?" and when I said yes he had such a big smile you couldn't help smile yourself. As we hiked down I asked them if they had fun and the older of the two said "I had so much fun, I can't believe you get paid to do that! I hope I get to do that someday." That really struck me because I think that it's important that the younger generation gets excited about the outdoors and to get them excited about how they can understand their environment and what goes on around them. The changes occurring now will affect them more and their understanding of the changes occurring now will help us to better the world tomorrow.
Future Plans: Medical school, or a graduate degree in ecology or genetics
Contributing Partners and Agencies: Valles Caldera National Preserve, Bob Parmenter, The Black Institute, and The Goodman Project

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River Source

The Bosque School acts as a fiscal agent for River Source, an organization that focusses on community-based watershed education; collaborating on watershed ecology, policy and practice; and watershed monitoring, planning and restoration services. In the last year, River Source programs reached over 2,000 students and 23 teachers. The Black Institute participates in a specific River Source program called "Clean Water Partners" which offers a program called "Youth for a Secure Water Future." Students and teachers learn about policy issues affecting water, wildlife and land health and participate in the legislative process.

Youth for a Safe Water & Climate Future

BEMP High School Summer Interns

With the support of the National Science Foundation, BEMP employs two high school students during the summer to help with the field and lab work who are based at UNM. This summer, we hired two La Cueva High School graduates. This is what they had to say about the experience:

Matt Amato, 2013 New Mexico State University freshman

This summer I came to know the distinctive crisp smell of the bosque as I conducted monthly monitoring. I found it interesting to visit the different sites and witness firsthand the effects that overbank flooding, drought, and other different anthropological impacts have on the Middle Rio Grande environment.

I got comfortable working with insects… with the exception of the Jerusalem cricket (but don't let Science Coordinator Jennifer Schuetz know I said that). With Jennifer and Kristen Weil's (Field Assistant) help, I became an expert in beeping wells and counting arthropods. The people of BEMP made every day a good day. Nobody can keep a straight face when Kimi Scheerer (Education Coordinator) is present; the BEMP staff really did their part at making me feel a part of the team.

The jackrabbit survey would have to be my favorite research I helped with. Spotting jackrabbits with a floodlight, identifying numerous other critters, as well as listening to some late night bagpiping across the Sevilleta landscape should be something everyone gets to experience. BEMP has been very rewarding with all of the opportunities it has provided me with in the lab or out in the field.

Tess DeSerisy, 2013 Eckerd College freshman

I can honestly say working for BEMP has changed my life in more ways than one. This internship taught me more than any regular science class ever did about the environment and the changes occurring in my "neck of the woods." It has opened my eyes to be more water conscious and to be a part of the change we strive to see in the world around us. I gained a new mindset from this internship, one that allows me to just stop and see all of the wonderful creatures that few regular passersby of the bosque might see. On top of all of this, I could not have asked for a more accepting and truly passionate group of staff members who guided me during this job opportunity.

My favorite part of this internship was most definitely the laughs that came along on the job. I will never again be able to drive by Tingley Beach and not think of the cottonwoods that were dyed blue to ward off the 'vicious' beaver population. In my mind there will never be a more scientific piece of equipment than cup on a stick (used for bailing water during my very first week on the job). And who could forget all those days in the lab counting thousands on thousands of *Armadillidium vulgare* (roly polies)!

This internship has shaped what I plan to do in the future and has allowed me so many incredible opportunities I would not have gotten otherwise. I could not be more grateful to have been a part of BEMP staff this summer. Thank you for this experience. It was truly once in a lifetime.

Left to right: Matt and Tess conduct field groundwater chemistry tests. Matt, Tess, and Kristen Weil (BEMP Field Assistant) after a day of monthly monitoring.

BEMP Evaluation

As we work with students to use data to analyze the health of the bosque, BEMP uses data from teachers and students to assess how we are doing and what we can improve. In 2012-13, we administered an online teacher survey through SurveyMonkey to monthly monitoring participants and pre and post surveys for students and teachers who came for one day study trips. Twenty-one of 56 monthly monitoring teachers completed the survey. Thirty-one did not respond at all; one teacher opted out; and three emails bounced. Not all teachers answered all questions.

What We Learned from Monthly Monitoring Teachers

Participant Demographics

- 59% of BEMP teachers have been in the profession from 6-15 years
- 18% have been teaching for less than 5 years
- 58% are elementary teachers and the rest are middle and high school teachers
- 56% teach in a traditional public school and 31% in a public charter school—87% of BEMP participants are public school students
- 35% teach in a designated Title I school
- 35% teach in a school that is predominately Hispanic

We learned most teachers (64%) utilize BEMP to supplement/enrich their regular curriculum.

We learned teachers participate in BEMP for the following overarching reasons:

- To get students experience with real world science and data collection and hands-on science
- Educational fun!
- Expose students to nature

Teachers Agreed – BEMP is Making a Difference!

"Because of BEMP, my students spend more time in the field."

- 59% strong agree
- 29% somewhat agree

"My students are capable of and well suited for BEMP work."

- 76% strong agree
- 18% somewhat agree

"My students appear to clearly understand that the bosque ecosystem is undergoing tremendous change."

- 41% strong agree
- 47% somewhat agree

"My students appear to understand they are part of a research effort that has implications beyond their own classroom."

- 41% strongly agree
- 53% somewhat agree

"Participating in BEMP helps my students to connect to their home landscape."
- 75% strongly agree
- 25% somewhat agree

"Participating in BEMP has made my students advocates for the river and bosque."
- 41% strongly agree
- 52% somewhat agree

Areas for improvement

Given the less than fifty-percent response rate, we would like to increase the number of teachers who respond to our end-of-the-year survey. Possibilities for doing this include emailing teachers in the middle of spring semester so they have plenty of time to respond during the school year; decreasing the number of questions on the survey; making the survey anonymous. We would also like teachers to offer more constructive criticism.

Study Trip Pre and Post Student Surveys

BEMP utilized pre and post student surveys for study trip participants in 2012-13 to try to understand if a one day experience (1) conveyed the idea that the Rio Grande and bosque have been altered by humans and (2) contributed to students wanting to return to the bosque. We also wanted to know how many of the students had been to the bosque before, and with what frequency. We surveyed 14 participating schools and 310 students using the following instruments:

BEMP STUDY TRIP PRE SURVEY

1. Before our class study trip today, I had been the Rio Grande *bosque*/forest (**circle one**):

5 times or more 2-4 times
once never

2. Humans changed the path of the Rio Grande and how it flows (**circle one**):

True False I don't know.

BEMP STUDY TRIP POST SURVEY

1. Humans changed the path of the Rio Grande and how it flows (**circle one**).

True False I don't know

2. Would you like to spend more time doing science in the *bosque* (**circle one**)?

Yes No

3. What are two new, interesting things you learned because of this study trip?

Forty percent of these students had NEVER visited the bosque while 22% had come five or more times. Before the study trip, 43% of students knew that "Human changed the path of the Rio Grande and how it flows." (It is important to note three outliers: 95%, 100% and 100% of students knew the correct answer. In another class, no student knew the correct answer.) After the one day study trip, 70% of students knew that, indeed, humans had changed the Rio Grande.

Just as importantly, after the study trip 87% of students indicated that they would "like to spend more time doing science in the bosque." This surveys support the fact that BEMP is providing an invaluable service for New Mexico students connecting them to their home watershed, and providing them a basic understanding of how the bosque ecosystem has changed.

BEMP Study Trip Teacher Survey

We found that the most interesting information we learned from our survey instrument for teachers participating in Study Trips was their answer to what two new, interesting things they learned.

Sample answers included:

- What beaver tracks look like
- That owls don't stay in their nest all year.
- That most of the cottonwoods in the Middle Rio Grande bosque are 70 years old and only live to be 100.
- "I saw my first porcupine trail in the sand!"
- I learned the identification of a new nightshade.
- Using oil in a rain gauge so that the precipitation within does not evaporate.
- That wolves and coyotes are not the same animal.
- Native vs non-native plants

Areas for Improvement

Again, we need to improve the mechanism for soliciting constructive criticism. The only response we received that revealed room for growth was a suggestion to tie in a little more "take only pictures, leave only footprints" into lesson. We have modified the teacher study trip survey for the 2013-14 school year and hope that it will provide more information to help us improve our program.

Looking Forward to the 2013-2014 School Year

Upcoming Presentations

Science Coordinator, Jennifer Schuetz will present BEMP research results at three conferences: New Mexico Water Resources Research Institute (November), the Tamarisk Coalition (February), and the Ecological Society of America (August).

Upcoming Publications

Science Coordinator, Jennifer Schuetz, is working on a paper that compares litterfall data collected by citizen scientists to vegetation cover data collection data collected by botanists. The purpose is to show how data collected by citizen scientists tracks that collected by professional scientists with regards to productivity of woody vegetation.

Upcoming Events

October 25, 2013	Field Visit highlighting a mosaic vision of the bosque
February 25, 2014	Crawford Symposium: Green Trails for the Next Generation
March 8, 2014	BEMP Teacher Focus Group
April 9 and April 29, 2014	Otter Day
April 23-25, 2014	BEMP Student Congresses
May 2014	First LTER Schoolyard webinar between BEMP/Sevilleta and Luquillo, Puerto Rico sites
June 2014	Data Users Focus Group

Goals

- Collaborating with new partners, such as The Nature Conservancy, Southwest Indian Polytechnic Institute, New Mexico Environment Department and the Tamarisk Coalition

Needs

In June 2011, BEMP established a monitoring site at Mesilla Valley Bosque State Park at the request of the State Parks director at that time. This year with New Mexico State Parks funding and in partnership with the Audobon Society, we created a part-time Outreach and Education Coordinator position to bring students and community members out onto the landscape. The funding for this position will end May 30, 2014. We are seeking sources to fund this position long-term.

BEMP would like to secure ongoing funding for core BEMP staff and activities, such as busses for student transportation and field equipment.