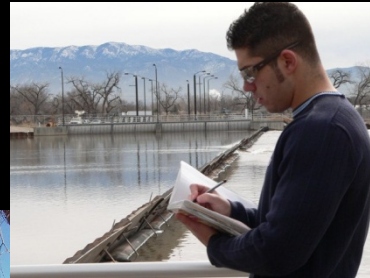


Bosque Ecosystem Monitoring Program

~ community based ecological monitoring ~



Bosque Ecosystem Monitoring Program – www.bosqueschool.org/bemp.htm

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The *Bosque* “the forest” along the Río Grande



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The Rio Grande ~ Rich with Water and Wildlife



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... Well Maybe on a Smaller Scale

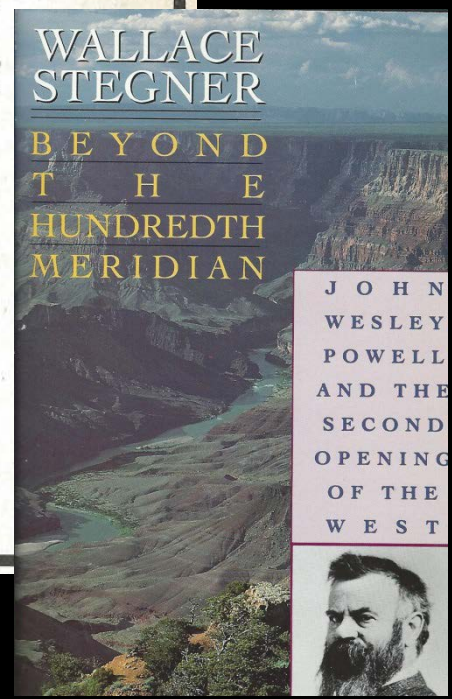
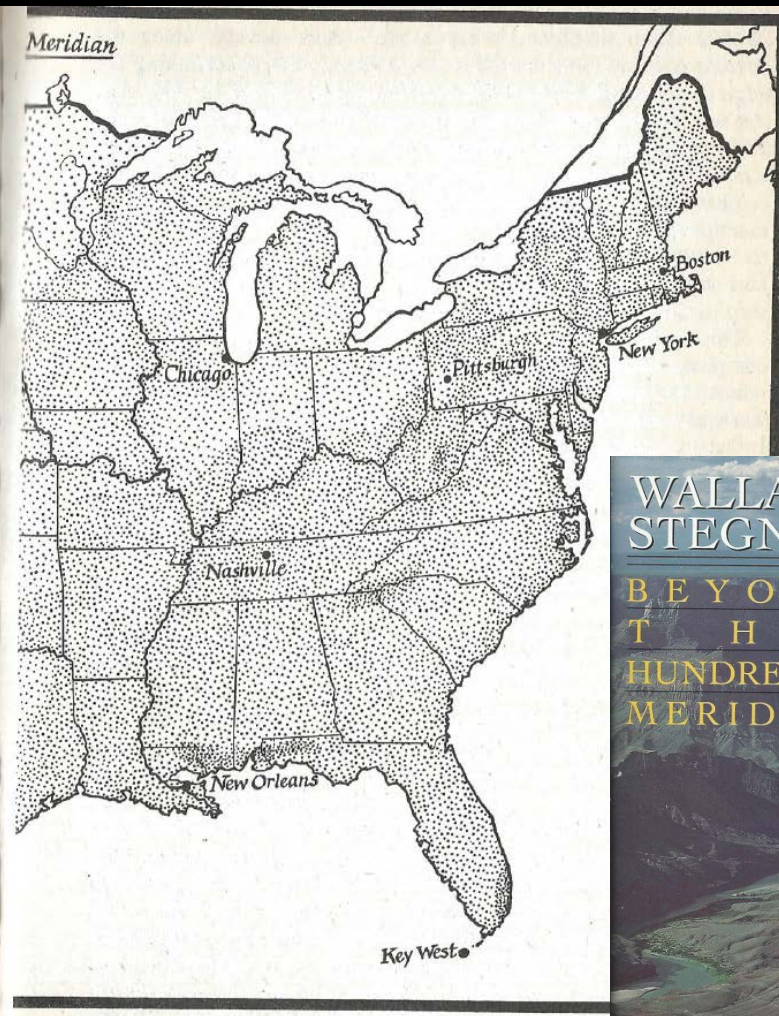
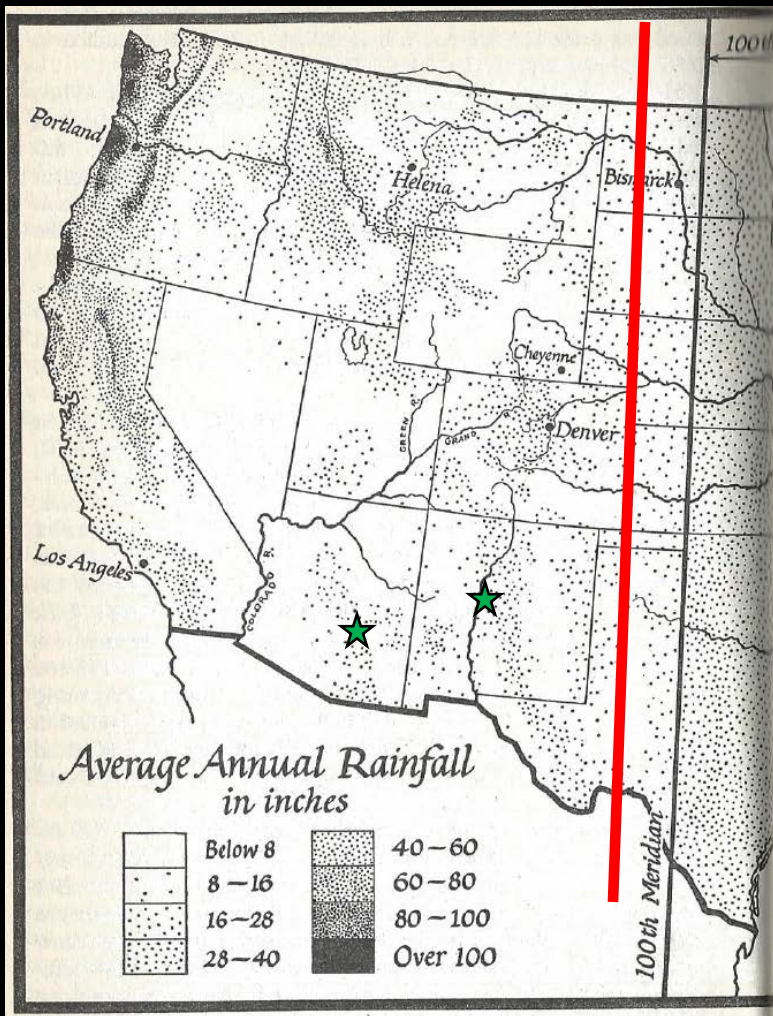


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Base map from: Wallace Stegner 1992. "Beyond the Hundredth Meridian." Penguin. New York.

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Not the law, the land sets the limit.

Here you have no rain when all the earth cries for it, or quick downpour called cloudbursts for violence. A land of lost rivers, with little in it to love; yet a land that once visited must be come back to inevitably. If it were not so little would be told of it.

Mary Austin
[1903] (1974). *Land of Little Water*. Albuquerque,
University of New Mexico Press.



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Salt River Watershed to Phoenix



~150 miles Upstream of Phoenix
Drains 13,700 square miles
Mean discharge ~875 CFS

http://en.wikipedia.org/wiki/File:Salt_River_Map.jpg

Rio Grande Watershed to Albuquerque



~350 miles Upstream of Albuquerque
Drains 14,500 square miles
Mean discharge ~1,250 CFS

http://en.wikipedia.org/wiki/Rio_Grande
<http://waterdata.usgs.gov/nm/nwis/annual>



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The summer came and burned me brown with its energy, and the llano and river filled me with their beauty.



Rudolfo Anaya. 1972. *Bless Me Ultima*. New York. Warner Books.
Image from the 2012 film "Bless Me Ultima."

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Rio Grande Factors



- Over appropriated
- Endangered Species Management
 - Southwest Willow Flycatcher
 - Rio Grande Silvery Minnow
- Agriculture
 - Acequias – small scale traditional
 - Industrial Scale - Agribusiness
- Senior Water Rights – Tribal
- Water Compact with Texas
- Water Delivery to Mexico
- Beneficial use – No In Stream Flow
- Water Quality
 - Turbidity – Erosion, Forest Fires
 - Endocrine disrupters



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V

Sunset over the black water of the Río Grande.

It means something to me.

My soul flutters like a black wing
every time I cross the Río Grande Bridge.

Crows in cottonwoods
form a long black waving path
rustling along the horizon

An old drunk squirms under the bridge
to drink his quart of COORS.

Pack dogs roam - Chicanos cruise in Monte Carlos-
the dead eavesdrop at windows
on women talking at kitchen tables -
children holler in dusty games on dirt roads-
the moon blazes warmly on black water
of the Río Grande.

Jimmy Santiago Baca

1987. Martín and Meditations on the South Valley. New York. New Directions.



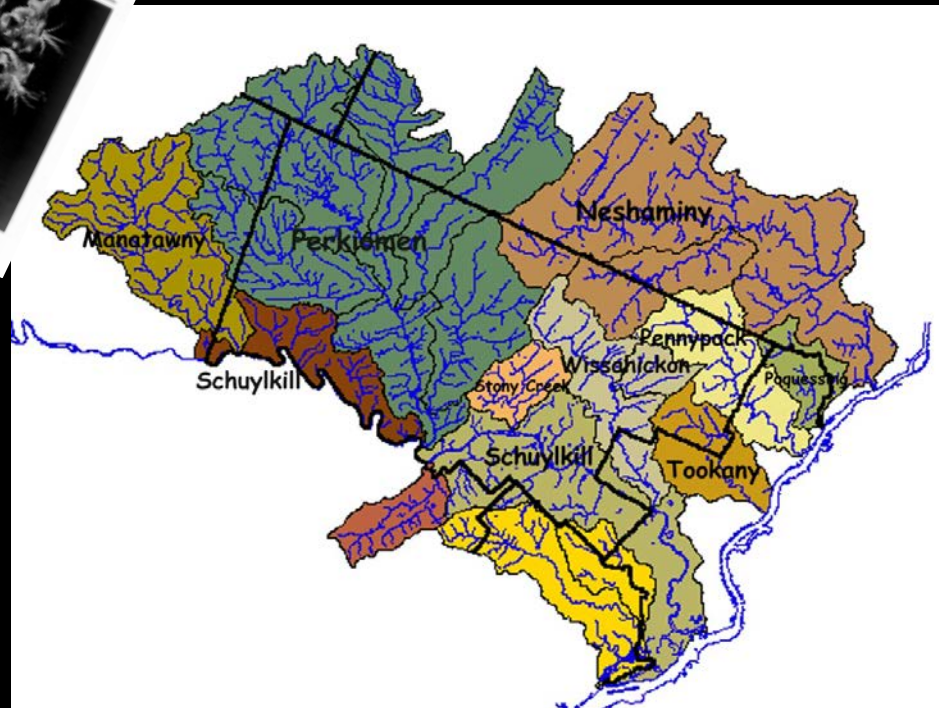
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My Born to Watershed & Kin



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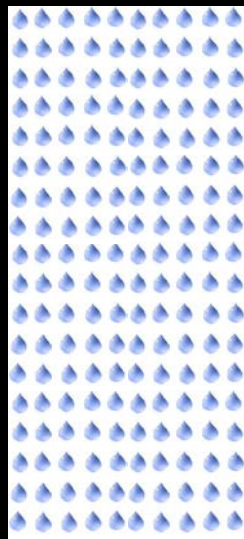
Bosque Ecosystem Monitoring Program – www.bosqueschool.org/bemp.htm

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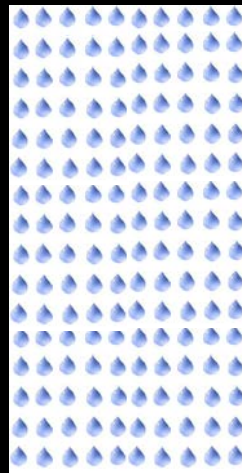
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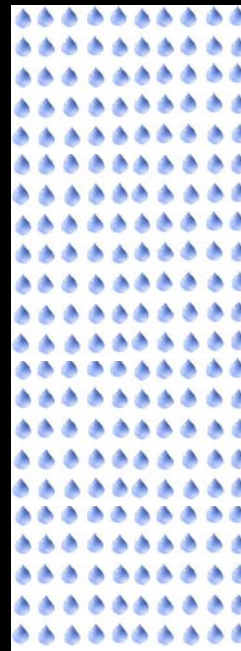
Per Capita Water use Gallons per Day



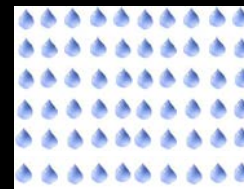
PHX
~180



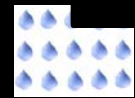
ABQ
~160



Scottsdale
~220



Buckeye
~60



UNM
~12



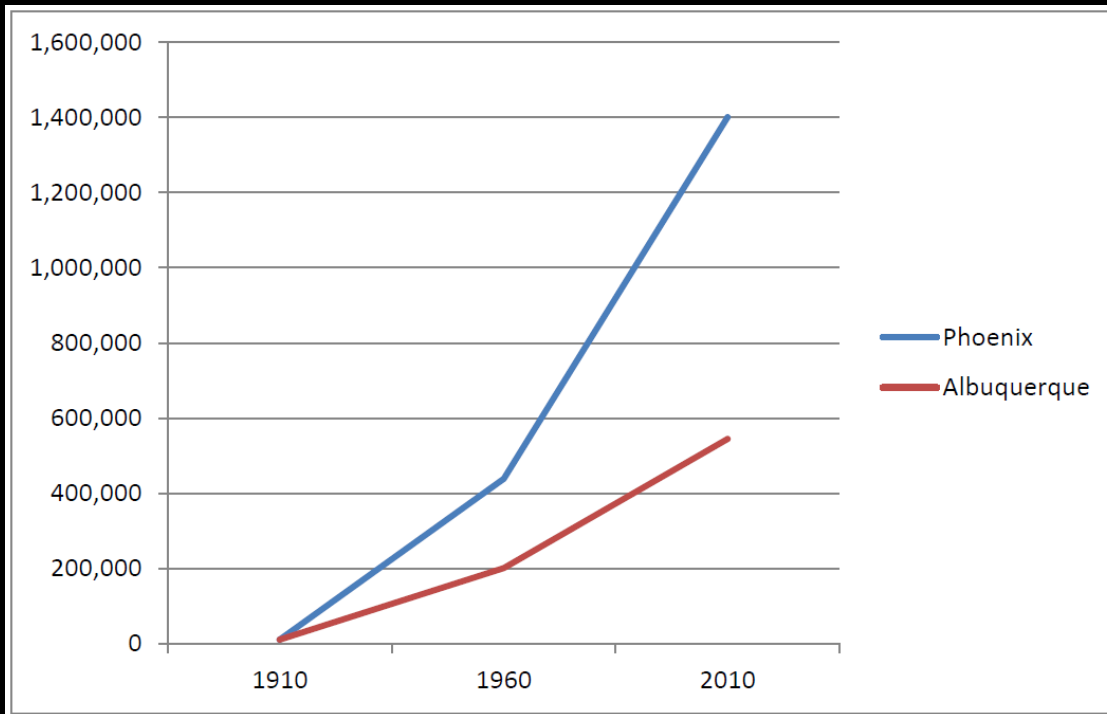
Bosque Ecosystem Monitoring Program - www.bosqueschool.org/bemp.htm

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Phoenix and Albuquerque Human Populations



Metro Area
Populations
Phoenix 3.3M
Albuquerque 0.9M

In 1910 both cities: 11,000 people



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Of Course, a million here or there is
nothing compared to...



7 Billion +

as depicted by the manifesto-waving: <http://www.workerspower.co.uk>



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Hope, Joy, and Citizen Science



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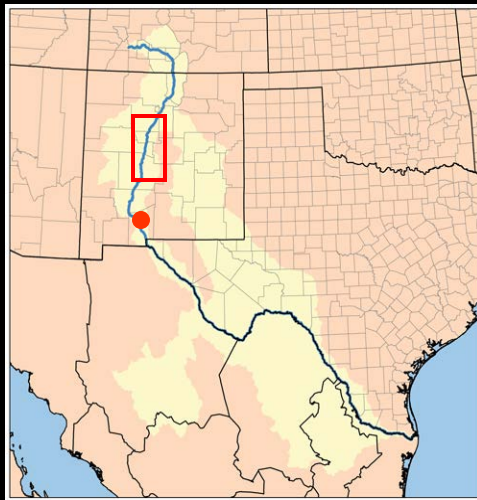
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Bosque Ecosystem Monitoring Program ~ Science, Education & Stewardship ~

BEMP's mission is collaborative long-term ecological monitoring of key abiotic and biotic processes and characteristics to promote continued education, understanding, and stewardship of the riparian ecosystem to scientists, teachers, students, policy makers and the public.



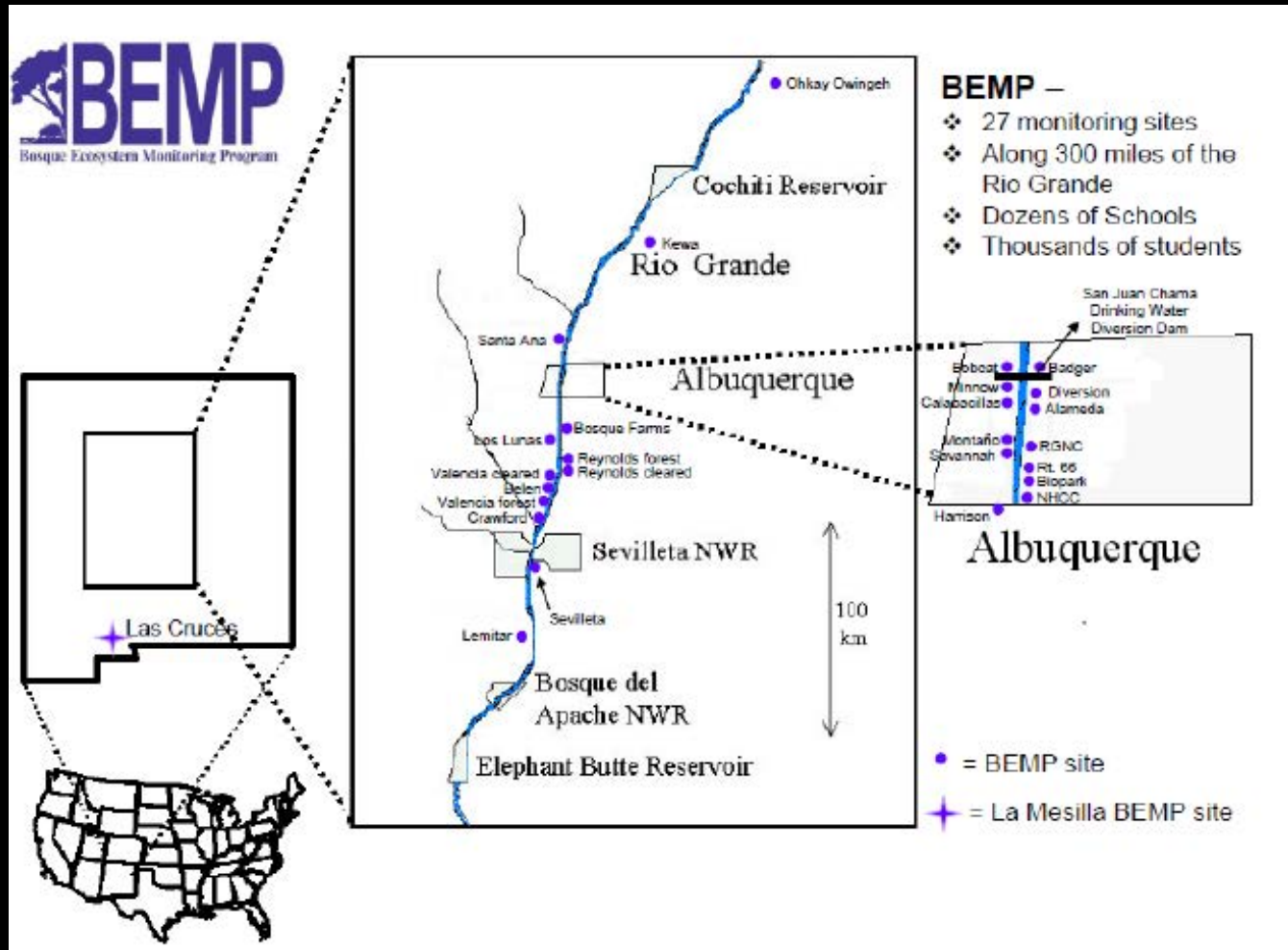
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BEMP a Network of 27 Sites



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Across 300 Miles From Ohkay Owingeh Pueblo to La Mesilla Valley



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I've never seen a bosque, quite like this one...

~ Dr. Cliff Crawford



Alameda



Belen



Hispanic Cultural Center



Lemitar



Savannah



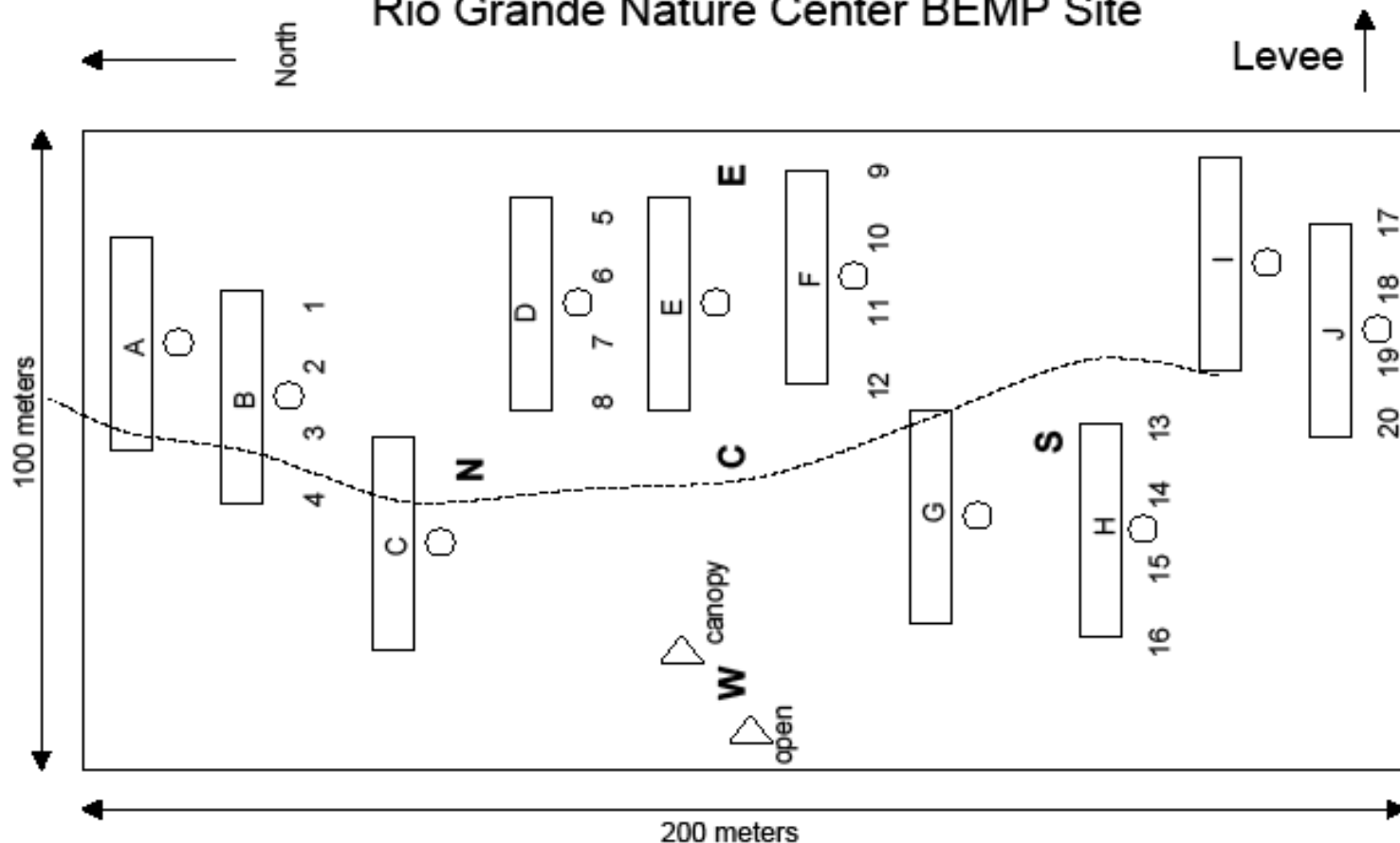
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Rio Grande Nature Center BEMP Site




 Vegetation plot

1, 2, etc. Pitfall traps

----- Trail

N, E, C, S, W Groundwater well

 Litterfall tub

 Rain gauge

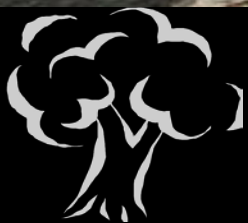
Rio Grande ↓

BEMP Site Locations

Rural
Urban
Public
Pueblo
Federal
State Park



Community
Buy-in!



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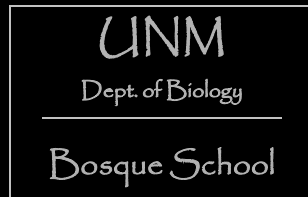
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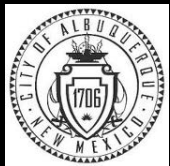
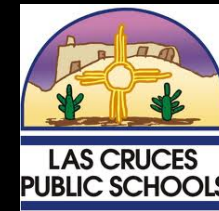
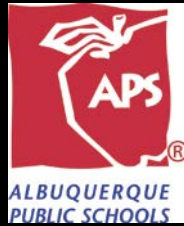
A Statewide Partnership



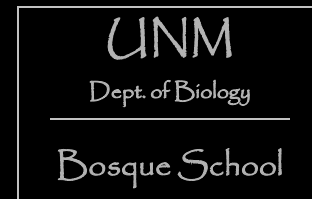
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Some of BEMP's Partners



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Yearly Involving:
7,000 K-12 Students and Others in BEMP
1,500 Students Doing Extended Field Research



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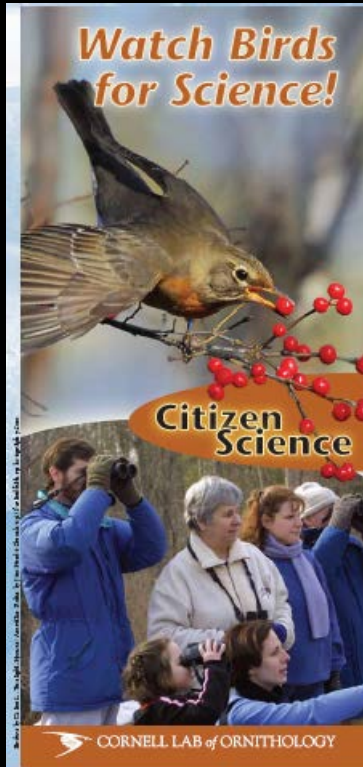
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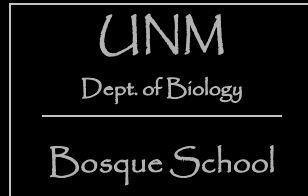
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Citizen Science

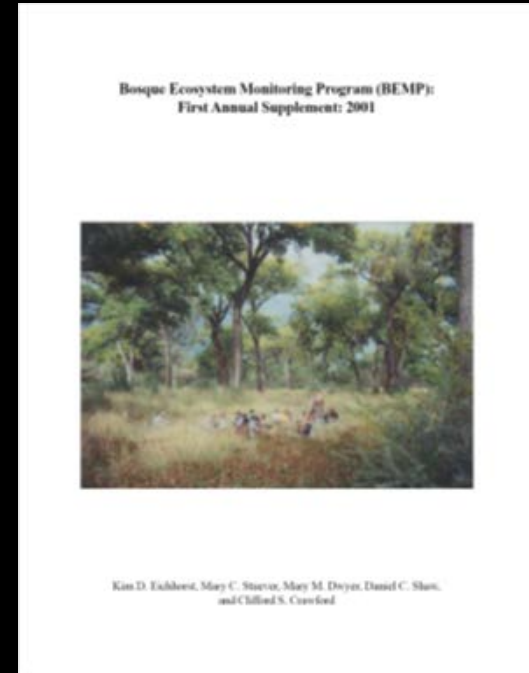
~ People without extensive science training contributing to scientific research ~



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From Kids in the Field to Publication



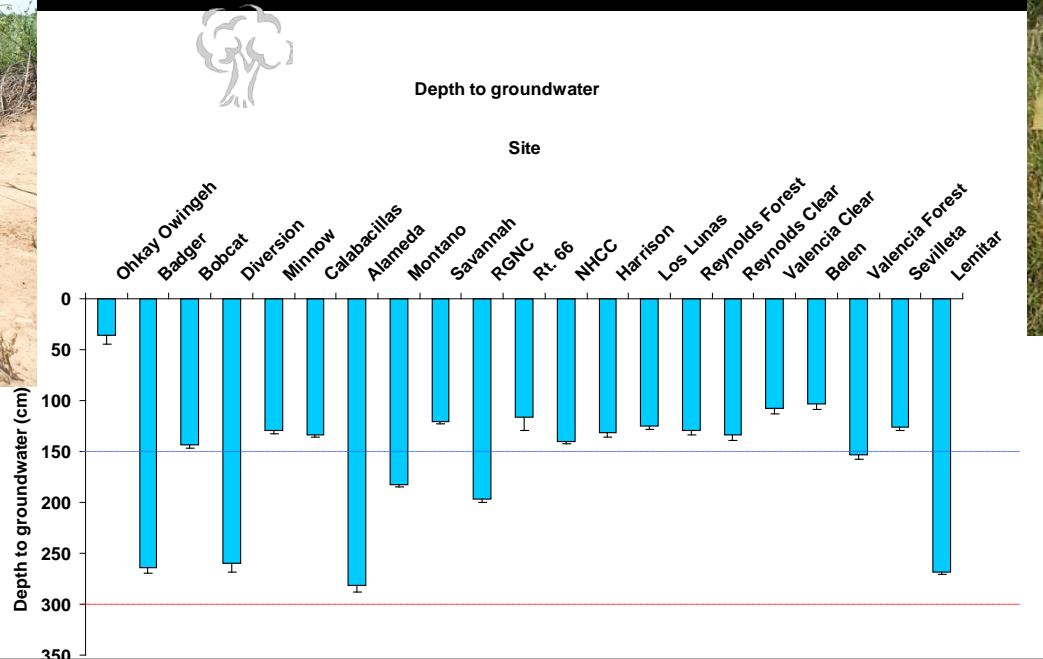
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Since 1996 – Monitoring the Bosque Now Collecting over a Million Data Points a Year



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BEMP: Studying the Ecological Drivers of Flood, Fire, Climate, & Human Alteration



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Variations in Flooding and Seeping



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River flows & Groundwater Quantity & Quality Interaction Across Time



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Climate & Habitat Change Research



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Woody Debris/Fuel Load Assessing Fire Risk



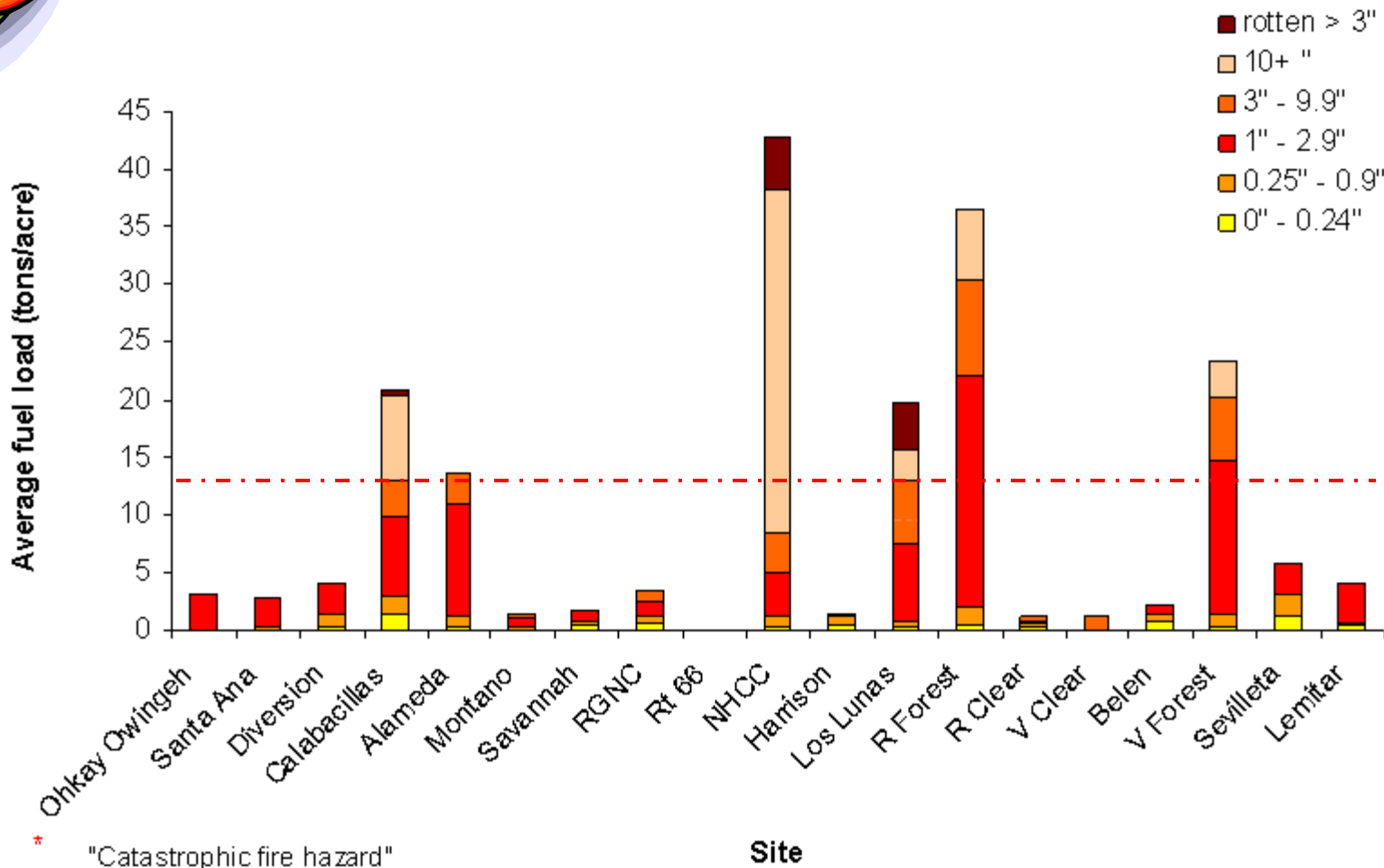
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Fuel Load Data



13 tons/acre



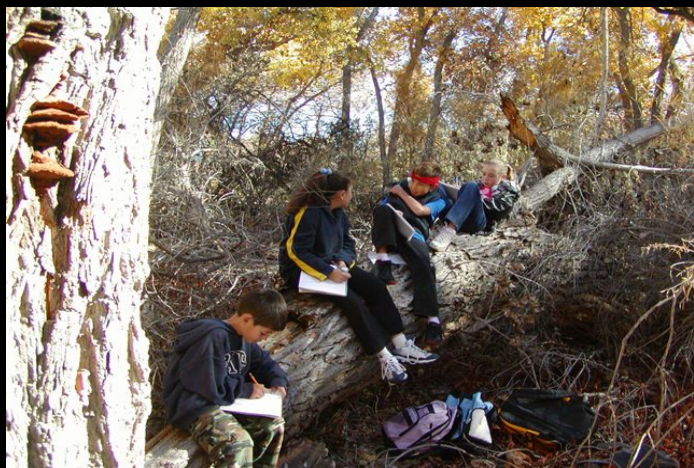
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Burn Recovery Sites: Such as Reynolds Forest



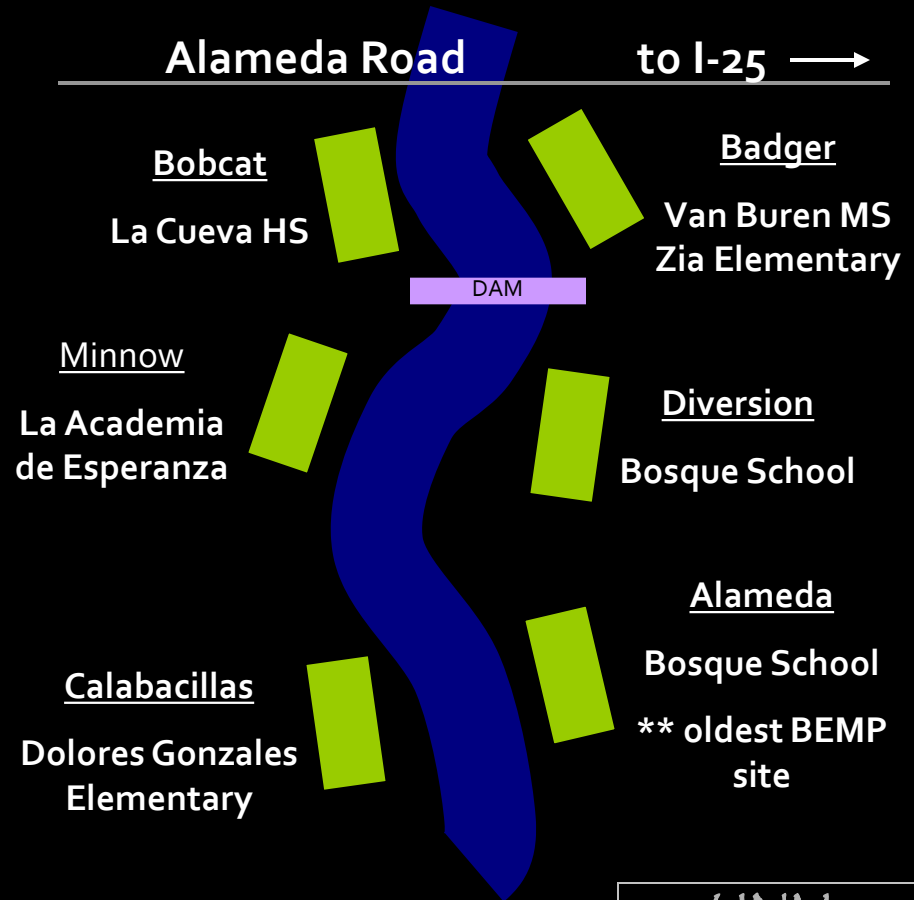
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6 sites bracket Albuquerque's Drinking Water Diversion Dam



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BEMP Work is Matched to Participant Abilities and Talents



K-12 Students

Grades 9-12 and College Students



Professional Scientists



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Monthly Monitoring -K-12 Student Focused



Groundwater Wells
Leaf Litter Bins
Precipitation Gauges



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Groundwater Wells

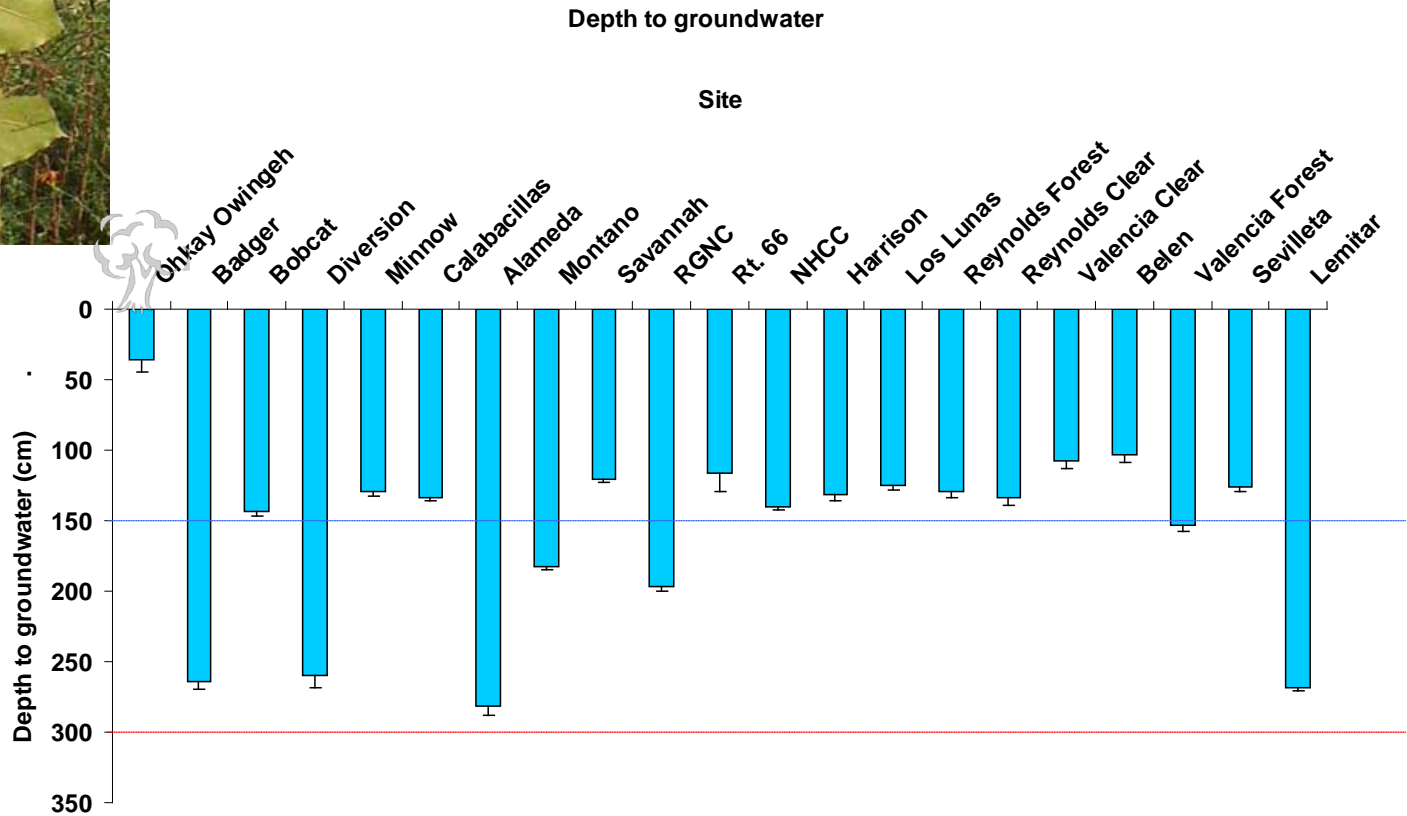
~ 5 wells at each site: N, S, E, W & C ~



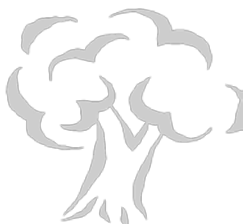
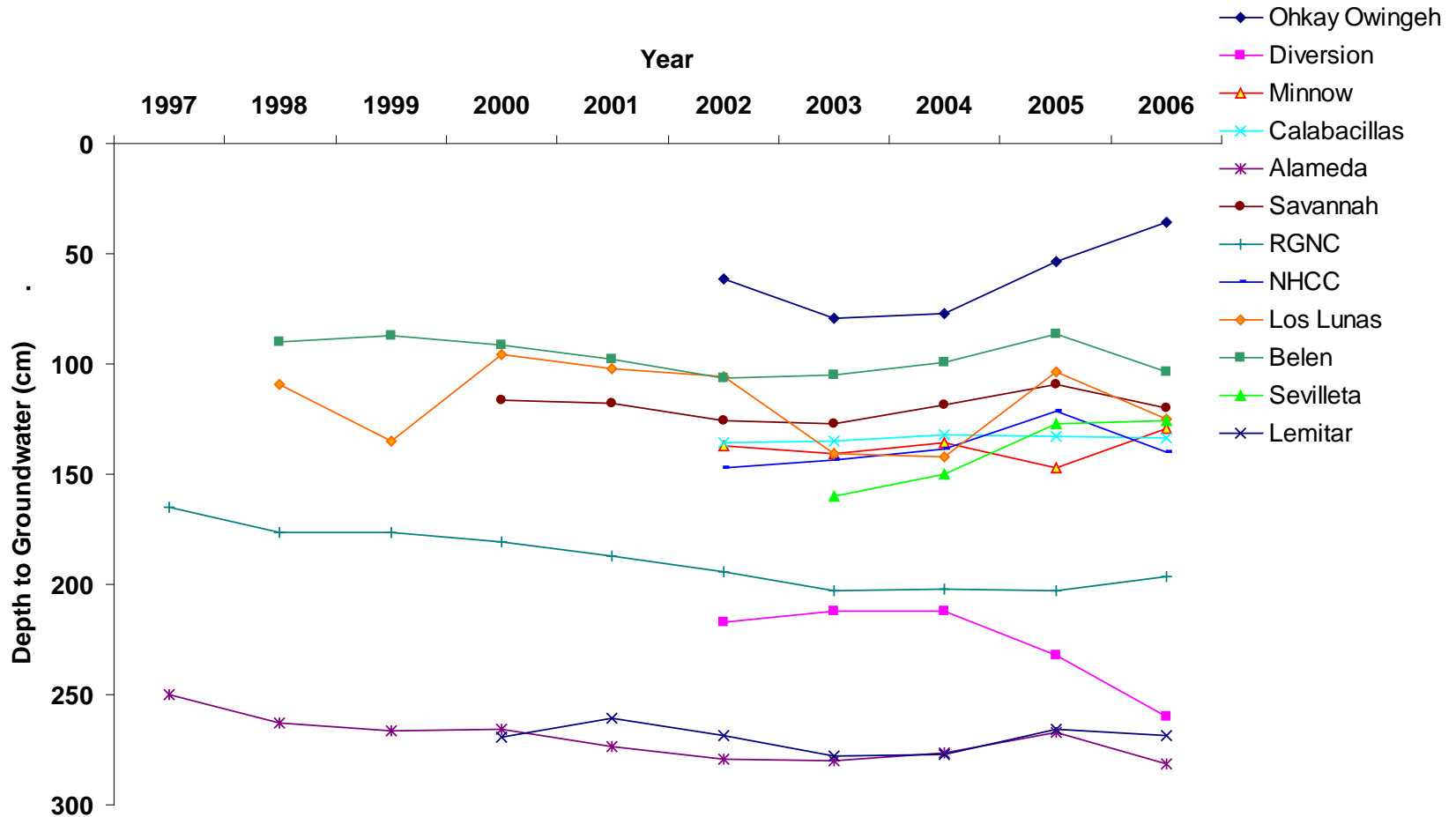
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Example of Groundwater Depths

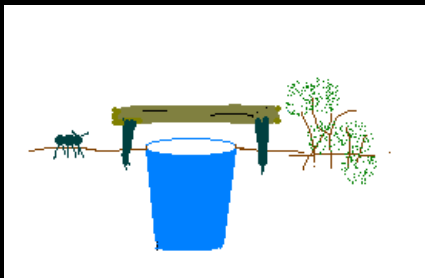


Example of Groundwater Trends



Surface Active Arthropod Traps

~ i.e. pitfall traps, 20 at each site ~



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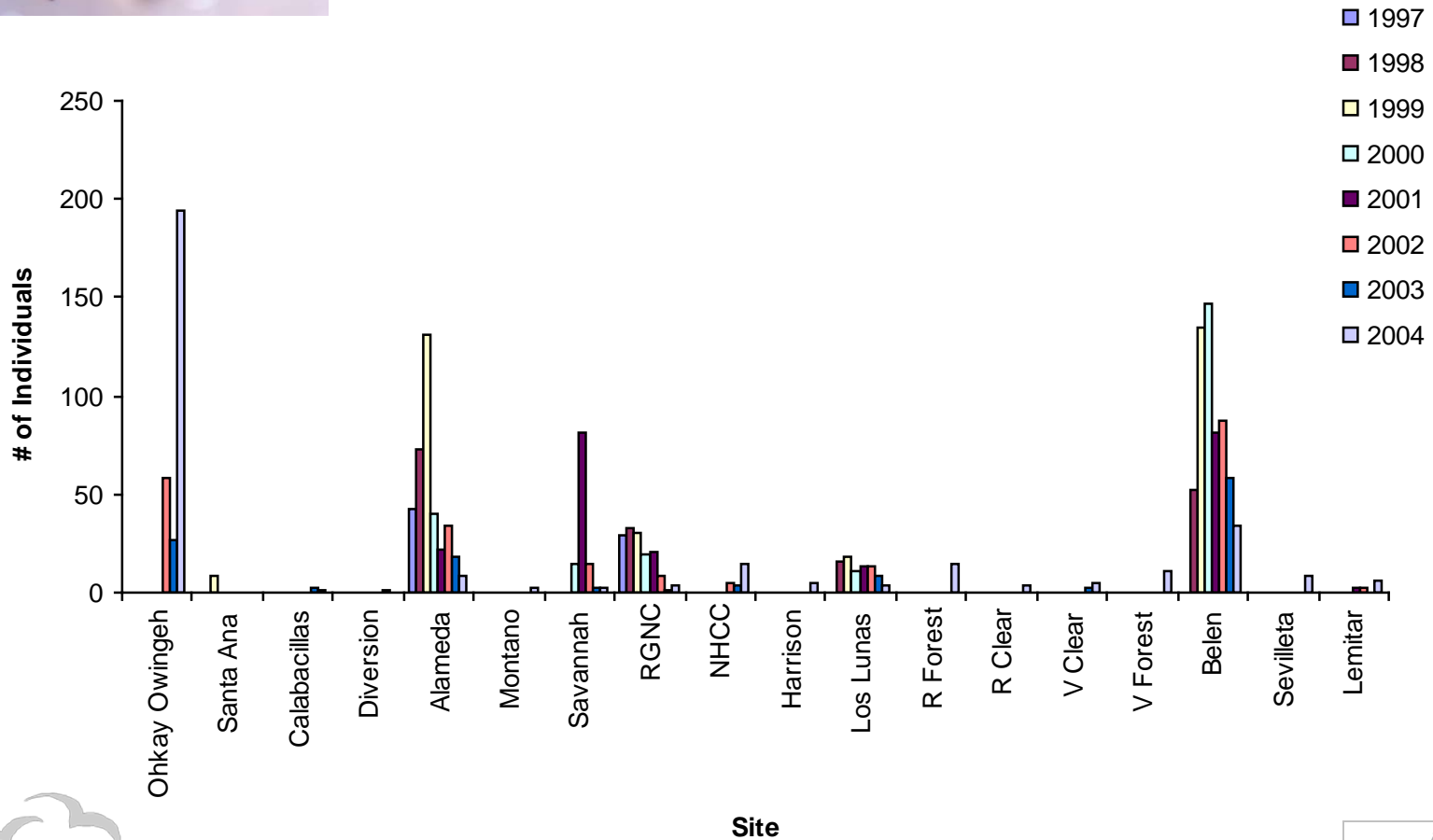
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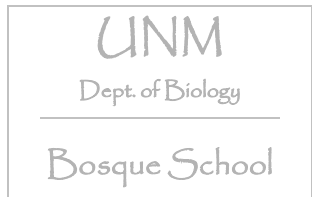


Carabid Beetles

~ indicators of moisture ~



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Salt Cedar Beetle



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From Field to Classroom



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The environment is right here
Our backyard is habitat



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UNM Bosque Internship class

~ BIO 408 / 508 ~

UNM BEMP Interns Providing:

- Mentoring to younger students
- Quality control
- Transfer of data to UNM



The University of New Mexico



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Additional Monitoring By Older Students & Professional Scientists

- Water Chemistry
- Cottonwood Monitoring
- Vegetation Transects
- Fuel Load Studies
- Air & Ground Temperature
- Small Mammal Trapping**
- Beaver Studies**
- Jackrabbit Surveys**
- Porcupine Research**



** in cooperation with the Black Institute at Bosque School



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Money on Diesel Fuel and Labor. Did it Work?



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Sustainable Bosque Resilient Restoration

Monitor first: baseline
data tells you what is
possible

Continue monitoring
after treatment = gauge
of success or signal to
change



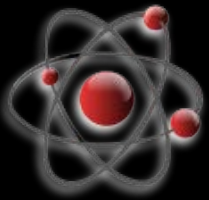
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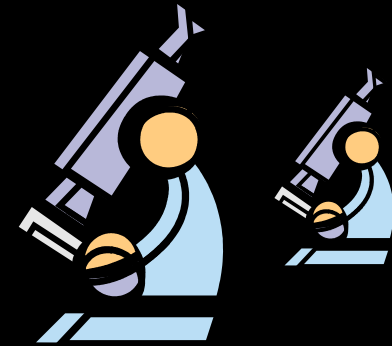
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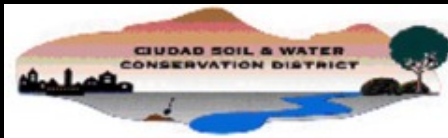
Data Users Include



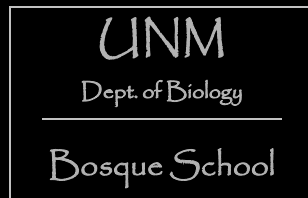
- Upper Rio Grande Water Operations Model (URGWOM)
 - water chemistry of ditch, river and groundwater
- native plant restoration organizations
- silvery minnow habitat management
- fuel removal /mechanical clearing
- bosque precipitation data for closures
- Albuquerque's Drinking Water Project



- US Army Corps of Engineers
- Paramatrix Contracting
- US Fish & Wildlife Service
- Soil & Water Conservation Districts
- Interstate Stream Commission
- Middle Rio Grande Conservancy District (MRGCD)
- City of Albuquerque Open Space
- Urban Flood Demonstration Project
- Conservation & Restoration Biology (CRB)



Bosque Ecosystem Monitoring Program – www.bosqueschool.org/bemp.htm



Technical Reports Issued by UNM

**Bosque Ecosystem Monitoring Program (BEMP):
Comprehensive Report: 1997-2009**



Kim D. Eichhorst, Daniel C. Shaw, Jennifer F. Schuetz, Kimi Scheerer,
Melanie Keithley, and Clifford S. Crawford



Bosque Ecosystem Monitoring Program – www.bosqueschool.org/bemp.htm

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Delivering Research and Findings to Decision Makers



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Once Upon a Time there was No BEMP Only a Receding Ice Age



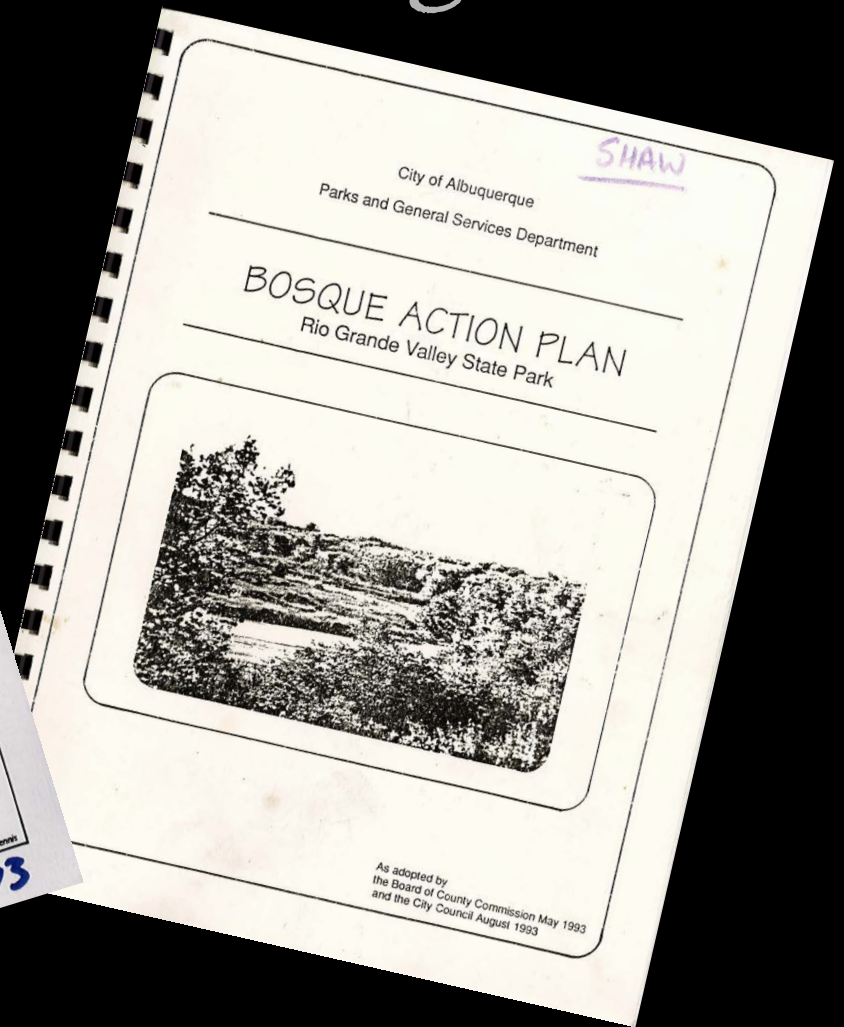
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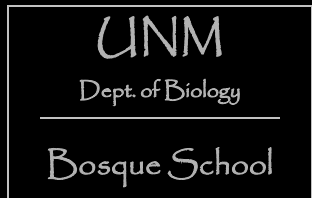
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The Environmental Monitoring Need



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The Environmental Education Need



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Science Education Reform



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Chasing Dollars



1996-1997 Started with:
\$20K National Science Foundation

Current Budget
\$400K

Funding Sources
1/3 Federal Govt.
1/3 Local and Regional Govt.
1/3 Private Foundations

FTE – 3; Part-time – 4 to 10
Bus transportation
Lab fees



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BEMP - On the Front lines of No Child Left Inside



"This book is an absolute must-read for parents." —The Boston Globe

Last Child in the Woods

Saving Our Children
from Nature-Deficit
Disorder



Richard Louv



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Agencies and Researchers Should Know About their Citizen Science Partners:

- Why they participate
- What they want out of the experience
- What training they need
- What support they need in terms of:
 - Supplies
 - Equipment
 - Transportation



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Why Teachers Choose to Have their Students Participate In Citizen Science

1. Opportunity for Hands On Learning
2. Participation in “Real Science”
3. Studying and Learning about the Local Environment



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Obstacles for Continued Participation In Citizen Science

1. None
2. Logistical – Particularly Travel Support
3. Conflict with Meeting Standards



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BEMP ~ Making a Green Trail With the Next Generation



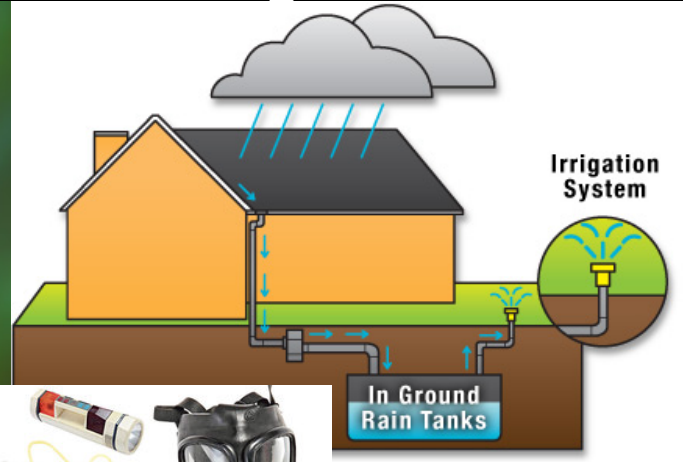
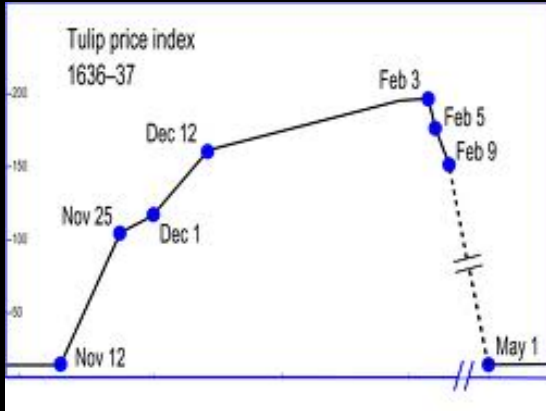
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Essential Tools, Skills, and Knowledge for the 21st Century?

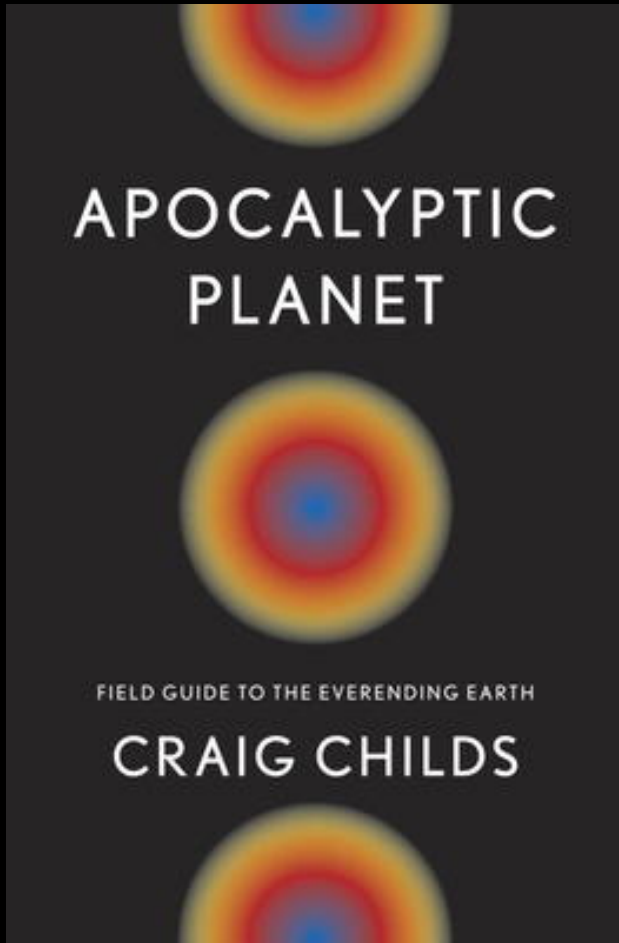


Clockwise from upper left: aks-blog.com 360degrez.blogspot.com <http://www.eco-generation.org>
www.blogspan.org <http://www.nytimes.com/2013/01/27/> www.extravaganzi.com

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Preparing Students to live on this Planet



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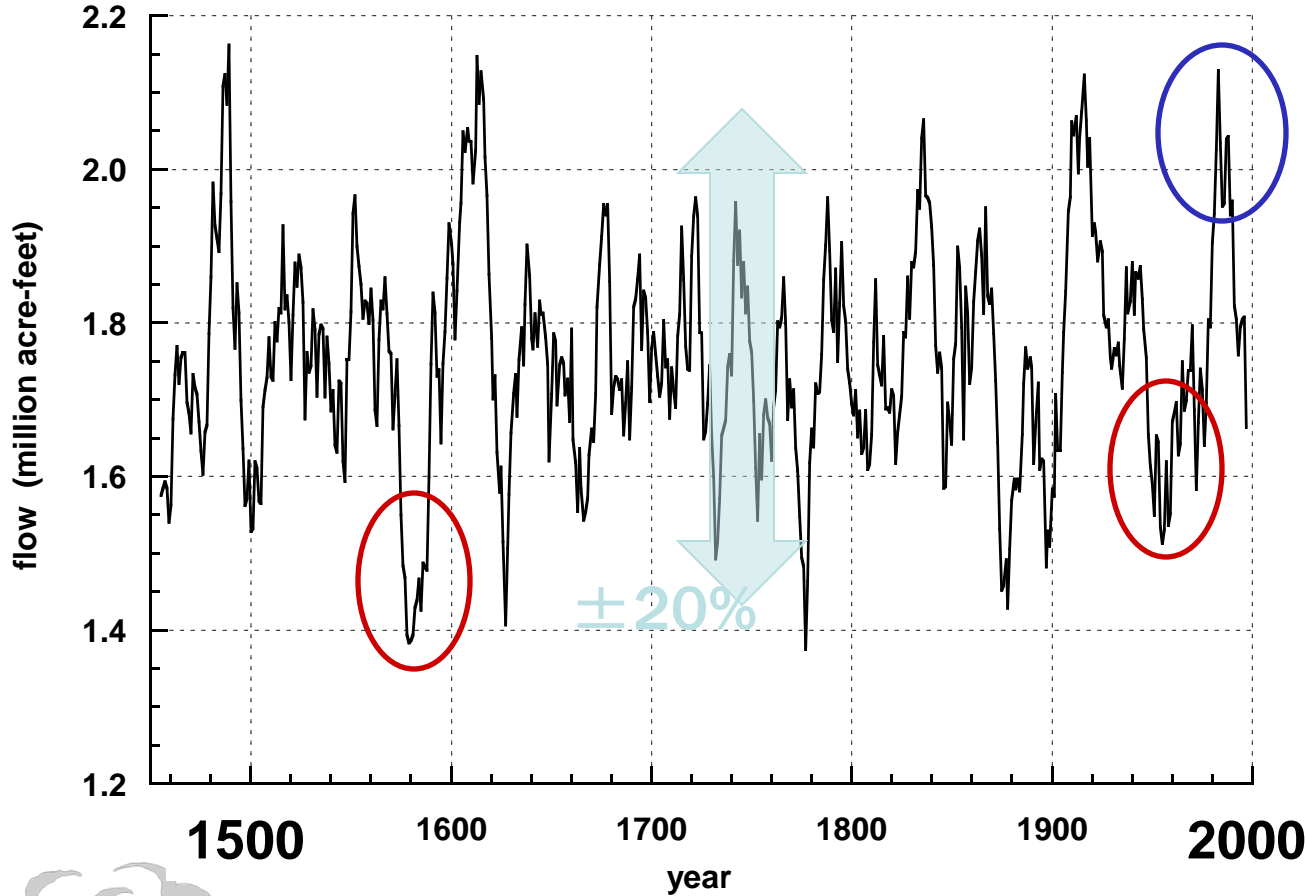
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Proxy Rio Grande streamflow: Otowi gauge

Reconstructed Rio Grande Streamflow at Otowi
11-year running average



based on
tree ring data

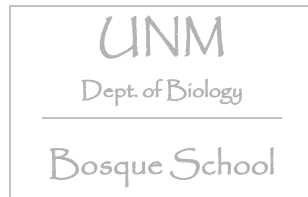


Otowi gauge

treeflow.org
Gutzler (2012)



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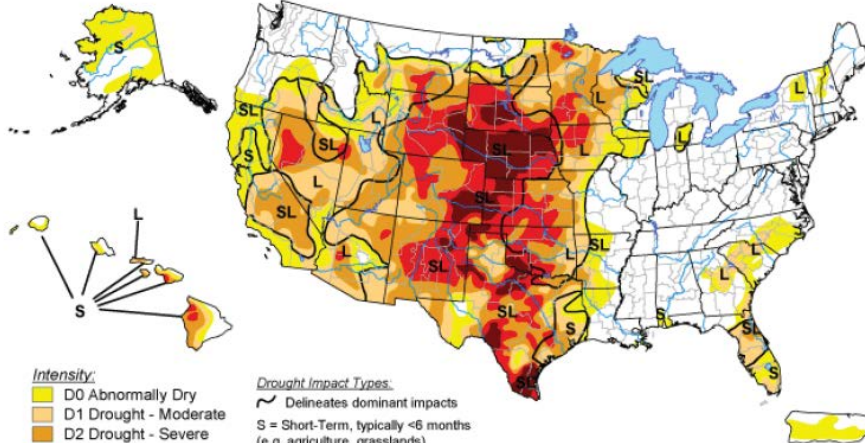


We're in a drought now ...

US Drought Monitor
last week

U.S. Drought Monitor

March 26, 2013
Valid 7 a.m. EDT



Intensity:
 D0 Abnormally Dry
 D1 Drought - Moderate
 D2 Drought - Severe
 D3 Drought - Extreme
 D4 Drought - Exceptional

Drought Impact Types:
 ~ Delineates dominant impacts
 S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
 L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu/>

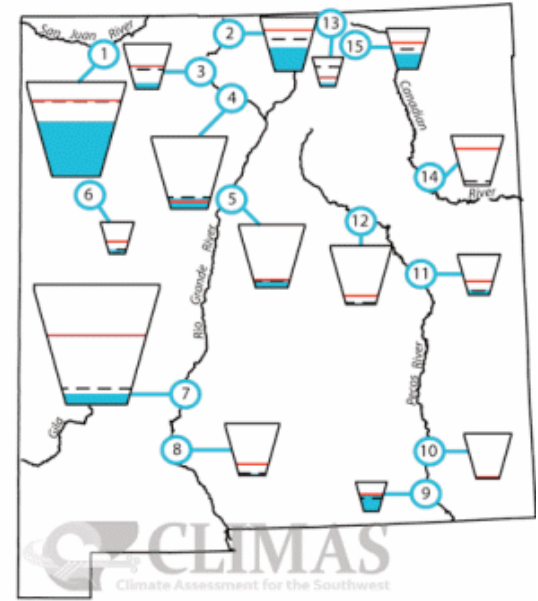


Released Thursday, March 28, 2013
 Author: Anthony Artusa, NOAA/NWS/NCEP/CPC

Figure 7. New Mexico reservoir volumes for December as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.



size of cups is representational of reservoir size, but not to scale

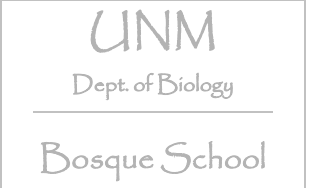


NM Reservoirs December 2012



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Slide Design
 Dave Gutzler, UNM



Our biological nature dictates that we have an absolute need for clean air, clean water, clean soil, clean energy and the biodiversity to deliver those elements to us.

David Suzuki



David
Suzuki
Foundation



Action, Resilience, Community



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THE PEACE OF WILD THINGS

When despair for the world grows in me
and I wake in the night at the least sound
in fear of what my life and my children's lives may be,
I go and lie down where the wood drake
rests in his beauty on the water, and the great heron feeds.

I come into the peace of wild things
who do not tax their lives with forethought
of grief. I come into the presence of still water.

And I feel above me the day-blind stars
waiting with their light. For a time
I rest in the grace of the world, and am free.

Wendell Berry, 1968, "Openings" Harcourt Brace Jovanovich, Inc.

Making a Difference One Student at a Time



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And with Deep Gratitude to BEMP's Co-Founder

Dr. Cliff Crawford
30 July 1932 – 4 September 2010



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- Bernalillo and Sandoval Counties
- City of Albuquerque Open Space
- Middle Rio Grande Conservancy District
- National Hispanic Cultural Center
- National Science Foundation – LTER Schoolyard Program
- Pueblos of Santa Ana, Ohkay Owingeh & Tewa
- Rio Grande Nature Center & NM State Parks
- Rio Grande Stream Team
- Sevilleta Long Term Ecological Research Schoolyard Program
- University of New Mexico, Biology Department & Sevilleta LTER
- U.S. Fish and Wildlife Service – Middle Rio Grande Bosque Initiative
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- Valencia and Ciudad Soil and Water Conservation Districts
- All schools, site representatives, and students that BEMP it up!
- ROCKin' BEMP Staff:



• **Dr. Kim Eichhorst**

• **Dan Shaw**

• **Christian LeJeune**

• **Jen Schuetz**

• **Kimi Scheerer**

• **Colleen Seager**

• **Rebecca Belletto**

• **Melanie Keithley**

• **Kristen Weil**

• **Kimberly Fike**

• **Danny Ortwerth**



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Questions?



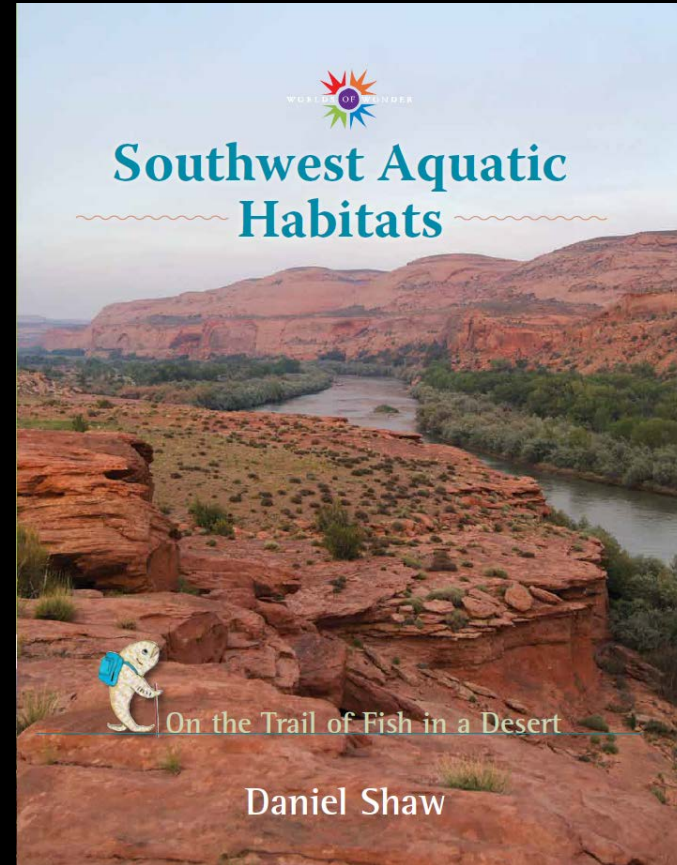
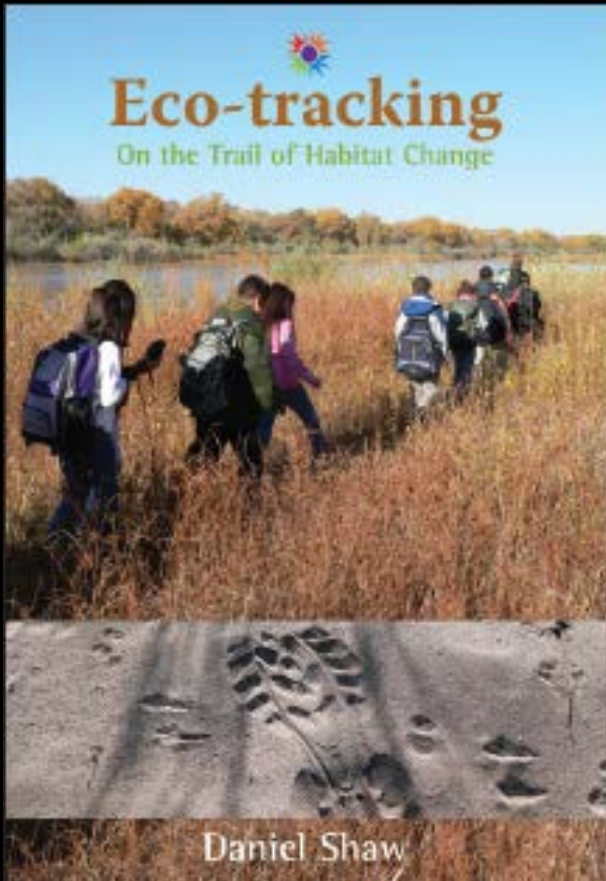
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Shameless Commerce



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