Bosque Ecosystem Monitoring Program

Bio 408/508L – Bosque Internship
Science, Education & Stewardship

BEMP’s mission is science, education, and stewardship of the Rio Grande and its watershed through long-term, hands-on student research of ecosystem response and function to inform public policy

Goals
1. Monitoring the bosque.
2. Outreach & Education.
Citizen Science

What is it?

Examples....
Rio Grande
- flows through 3 US states...Colorado, New Mexico & Texas
- flows through 4 Mexican states: Chihuahua, Coahuila, Nuevo Leon, & Tamaulipas
- length ~ 2000 miles /3220 km
- elevation: from 12,800 ft. to sea level
How we came about...

- published in October 1993
- joint effort of authors representing:
  - UNM
  - U.S. Fish & Wildlife Service
  - U.S. Bureau of Reclamation
  - U.S. Army Corps of Engineers
  - NM State University
- covered: climate, geology, historical conditions, existing conditions & recommendations (to enhance biological quality and ecosystem integrity)
- recommendation #18: develop a coordinated program to monitor biological quality and ecosystem integrity of the Middle Rio Grande ecosystem (monitoring & research)
Who Uses the Data?

- Upper Rio Grande Water Operations Model (URGWOM)
  - water chemistry of ditch, river and groundwater
- native plant restoration organizations
- silvery minnow habitat development
- fuel removal /mechanical clearing
- bosque precipitation data for closures
- Albuquerque’s Drinking Water Project
- US Bureau of Reclamation
- Bernalillo County Open Space
- New Mexico State Parks
- 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
- SWCA Environmental Consultants
Bosque Ecosystem Monitoring Program (BEMP)

- 19 years of data
- 11 core datasets
- Data users (federal, state & local agencies, consulting agencies)
- ~9000 students from 45 schools involved in monitoring bosque sites each year
32 Long-term Ecological Monitoring Sites in the Middle Rio Grande Valley, New Mexico
I’ve never seen a bosque quite like this one...

~ Dr. Cliff Crawford

Alameda

Los Lunas

Belen

Hispanic Cultural Center

Lemitar

Valencia Forest

Diversion

Savannah
Ethical Responsibilities

• Meticulous notes
• Double-check while in the field
• Zero vs. no data / missing data
• Never make up data; never guess
• Mistakes in data recording
• Scientific integrity
Typical Site Layout

- 2 Precipitation gauges
- 3 Data loggers

Legend:
- □ = PITFALL TRAP
- □ = LITTERFALL TUB
- □ = GROUNDWATER WELL
- □ = VEGETATION PLOT
## Monthly Monitoring
~ occurs the week of the 3rd Tuesday of each month ~

### Bosque Ecosystem Monitoring Program: Monthly Monitoring

<table>
<thead>
<tr>
<th>Site Name:</th>
<th>Collection Date:</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Data Collected by:</th>
<th></th>
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<tbody>
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</table>

<table>
<thead>
<tr>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

### Groundwater Monitoring

<table>
<thead>
<tr>
<th>Well</th>
<th>Depth from top of well to water table</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td></td>
<td></td>
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<tr>
<td>Center</td>
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<tr>
<td>South</td>
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<tr>
<td>West</td>
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</tr>
</tbody>
</table>

**Nearby Ditch**

### Precipitation Monitoring

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Net amount of precipitation (less oil) (mm)</th>
<th>Amount of oil added</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canopy</td>
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<tr>
<td>Open</td>
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</tbody>
</table>

### Litterfall Collection

<table>
<thead>
<tr>
<th>Tub</th>
<th>Collected?</th>
<th>Comments (note if tubs were moved, turned over, etc.)</th>
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</thead>
<tbody>
<tr>
<td>A</td>
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<td>B</td>
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<td>J</td>
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</tbody>
</table>

[Data entry file: ]

White copy (original) to be mailed to: Kim Echols, UNM, Department of Biology, Albuquerque, NM 87131
Yellow copy to be mailed to Site Representative
Pink copy to be retained in collector’s files

Groundwater Wells - 5  
Leaf Litter Bins - 10  
Precipitation Gauges – 2  
Ditch - 1
Groundwater Wells

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

Ground Surface

Well Cap

Bentonite

Slip Coupler: Well Casing; PVC
Diameter = 5.1 cm

Slotted 0.25 mm Screen: PVC Diameter = 5.1 cm

Gravel Pack: 10-20 mesh silica sand

Borehole Diameter: 10 cm

Drive Point: PVC

Bottom of Auger Hole: approximately 1.0 m below water table

Soil moisture

Water Table

Unsaturated

Saturated

All pore spaces filled
2014 Mean Annual Depth to Groundwater

Depth to groundwater (cm)
Precipitation Monitoring

~ 2 gauges at each site: canopy & open ~
Monthly Precipitation For All Sites

Precipitation (mm)

- August
- April
- August, Sept.
- August
- July

Year: 1997 to 2015
# Litterfall Collection

~ 10 Litterfall tubs at each site ~

** Look in Student Handbook to see form!

---

## Site Name: __________________________

Field Collection by: ____________________

Collection Date: ________________________

Labwork by: ____________________________

## Species

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<th></th>
<th>A</th>
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<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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<tbody>
<tr>
<td>Cottonwood</td>
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<td>Willow spp.</td>
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<td>Indigo bush</td>
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## Total Weight

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**Bosque Ecosystem Monitoring Program: Leaf Litter Lab**

**Lab Directions:**

- Throw out all non-vegetation materials (i.e. hair, scat, dirt, insects) BEFORE beginning.
- Record measurements in grams (g). Species that have a scale reading of 0.0g should be recorded as < 0.1g.
- TARE your scale EVERY time.
- The difference between the sum of weights and total weight should be 0.3g or less. If it is more, reweigh everything.

Data entry: File: ______________________ Entry by: ______________________ Date: __________
Surface Active Arthropod Traps

~ ie. pitfall traps, 20 at each site ~

<table>
<thead>
<tr>
<th>Opened</th>
<th>Comments</th>
<th>Trap</th>
<th>Closed</th>
<th>Comments</th>
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<tbody>
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<td>B1</td>
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<td>J19</td>
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<tr>
<td>J20</td>
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</tbody>
</table>

** When you open pitfall traps, make sure the cups are level with the ground! **
** When traps are collected, place all invertibrates from each cup in its own labeled bag! **

Data entry by: ________________ Date: ________________
Water Chemistry

Turbidity, Dissolved Oxygen, Total Dissolved Solids, GW Temp., Conductivity, pH and Lab Work: chloride, bromide, nitrate, phosphate, sulfate & ammonium

E. coli Geometric Mean
Woody Debris/Fuel Load
~ according to US Forest Service protocol ~
~ done on the north line of our vegetation plots ~
Spring Cottonwood Monitoring

Determining sex

Tree diameter at breast height (DBH)
Fall Vegetation Transects
~ done on the south line of our vegetation plots ~

30 m transects.

Identifying plant species.
Tamarisk Leaf Beetle Monitoring

Genus: Diorhabda
Small Mammal Trapping

Why trap small mammals?

BEMP is able to use the data to gain a better understanding of the quality of habitat AND how it is changing ...
Porcupine Telemetry

*Erethrezon dorsatum*

A local vet supervises as students administer a sedative & insert a microchip.
Connecting kids to their local landscape!
Course Instructors:

Kim Eichhorst, PhD (BEMP Co-Director)
Kim Fike, MS (BEMP Science Coordinator)
Audrey Kruse, MS (BEMP Education Coordinator)
<table>
<thead>
<tr>
<th>Overview and Syllabus</th>
<th>UNM Course Readings</th>
<th>Directions to BEMP Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Education Resources</td>
<td>Field Notes for Intern Notebooks</td>
<td>How to Graph in Excel</td>
</tr>
<tr>
<td>Find and Fix (common mistakes in papers)</td>
<td>Scientific Question Formulation Techniques</td>
<td>How to Cite References and Avoid Plagiarism</td>
</tr>
<tr>
<td>Nature's Notebook Link</td>
<td>Data Nuggets Link</td>
<td>USGS River Flow Data</td>
</tr>
</tbody>
</table>

**SELECTED DOCUMENTS (FROM OUR LIST OF READINGS):**

- The Bosque Education Guide: The Middle Rio Grande Bosque Overview
- The Middle Rio Grande Bosque: An Endangered Ecosystem
- Eco-Tracking – On The Trail of Habitat Change
- Water in the Middle Rio Grande: One Observer’s View
# Find and fix

## Common mistakes in RAs and papers

<table>
<thead>
<tr>
<th>What to fix</th>
<th>Change to</th>
<th>Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affect vs. effect</td>
<td>The effect; was affected by</td>
<td>Use “affect” as a verb and “effect” as a noun</td>
</tr>
<tr>
<td>the BEMP Program</td>
<td>BEMP</td>
<td>The P stands for program, so the BEMP program is redundant</td>
</tr>
<tr>
<td>Bosque Environmental Management Project (for example)</td>
<td>Bosque Ecosystem Monitoring Program</td>
<td>Always look up the proper name of the program, for any program. Acronyms are specific.</td>
</tr>
<tr>
<td>Bosque</td>
<td>bosque</td>
<td>“bosque” = “forest” and is not capitalized unless part of the proper name “Middle Rio Grande Bosque”</td>
</tr>
<tr>
<td>Citations – lacking</td>
<td>Proper citations</td>
<td>EACH sentence with borrowed information HAS to be cited</td>
</tr>
<tr>
<td>Citations – indirect</td>
<td></td>
<td>Cite the paper you read, not the paper that was cited in the source you read. Also, read the paper, not just the abstract</td>
</tr>
<tr>
<td>Cochiti Damn, damns</td>
<td>Cochiti Dam, dams</td>
<td>“damn” is the swearword; “dam” is the structure</td>
</tr>
<tr>
<td>Cottonwood, Russian Olive (for example)</td>
<td>cottonwood, Russian olive</td>
<td>Do not capitalize common names of plants, or any animals except birds</td>
</tr>
<tr>
<td>cotton wood</td>
<td>cottonwood</td>
<td>One word</td>
</tr>
<tr>
<td>data is (This data is...)</td>
<td>These data are/were/show</td>
<td>The word “data” is plural. “Datum” is singular.</td>
</tr>
</tbody>
</table>
Scientific Citation & Plagiarism

Citation = to quote by way of example, authority or proof

Plagiarism = to steal and pass off (the ideas of words of another) as one’s own; to use (another’s production) without crediting the source; to present as new and original an idea or product derived from an existing source

In scientific writing, references are useful AND relevant. Scientists do not use the common referencing practice of footnotes, but instead use citations that include inserting the author's last name and the year of publication right into the text.
For example, after reading the following passage from the Bosque Education Guide (BEG – Bosque Background, page 40).

From: **A Dynamic System**

Because of the dynamic nature of the river, the Middle Rio Grande Valley would have continuously supported a patchwork of plant communities. Clearly all such communities, including the cottonwood forest, depend on the stream movement for their existence. Sandbars formed by the shifting river provide the conditions needed for cottonwood establishment. Seedlings that germinate on a newly scoured sandbar produce a cohort of plants of the same age, and if these survive future periods of high water, they will grow into a stand of young trees of about the same size. New seedlings cannot grow in a forest with a closed canopy...

You can choose several ways to cite the utilization of that idea.

1. **Paraphrase** - Research shows that the Middle Rio Grande Valley supports a mosaic of plant communities. These mosaics are based on shifting river patterns, sandbar creation/destruction and germination activities (Ellis, 2003).

2. **Paraphrase** - According to Ellis (2003), the different plant communities found in the Middle Rio Grande Valley depend on the changes in river flows and creation of new sandbars.

   OR

3. **Direct Quote** - Ellis (2003) states “clearly all [plant] communities... depend on the stream movement for their existence”.
BEMP Datasets

Bosque Ecosystem Monitoring Program
Science, Education, and Stewardship

SCIENTIFIC DATA SETS

32 monitoring sites spanning 350 miles from Pueblo of Ohkay Owingeh pueblo to Mesilla Valley in Las Cruces; 16 sites are within Albuquerque – see map on following page

- Groundwater depths and water levels of adjacent ditches (monthly)
- Open and canopy precipitation (monthly)
- Air and sub-surface temperature at select sites (hourly, downloaded annually)
- Cottonwood, willow, saltwillow, NM olive, indigo bush, saltcedar, Russian olive, elm, mulberry and other plant leaf litter (monthly)
- Wood as litterfall (monthly)
- Cottonwood, willow, Russian olive, saltcedar and other plant reproductive parts as litterfall (monthly)
- Surface-active arthropods via pitfall trapping (early May, mid-June, and late Sept)
- Vegetation cover and species (annually)
- Fuel load/woody debris (annually)
- Groundwater, ditch and river chemistry (spring, summer and winter)
  - Conductivity, temperature, pH, turbidity, dissolved oxygen; chloride, bromide, nitrate, phosphate, sulfate
  - Pharmaceuticals and personal care products, PCB's and pesticides (funding dependent)
  - E. coli and associated river chemistry at select sites
- Pressure transducers logging every 30 minutes around the drinking water diversion dam in Albuquerque at Badger, Bobcat, Minnow and Diversion sites and in Belen at Valencia Forest, Crawford and Belen sites
- Woody stem reemergence after fire or exotic species removal
- Tamarisk leaf beetle distribution and abundance (summer 2013, 2014, 2015)
- Jackrabbit surveys at Sevilleta National Wildlife Refuge (quarterly at full moon)
- Small mammal trapping* using Sherman traps at select sites (fall, spring and summer)
- Porcupine radio telemetry* with local veterinary assistance in winter (annually)

*Program managed by the Black Institute at Bosque School
Forming Testable Hypotheses

• Scientific Question
• Hypothesis
• Predictions

• Question? Answer (hypothesis).
• If, then (prediction) ... because (hypothesis).