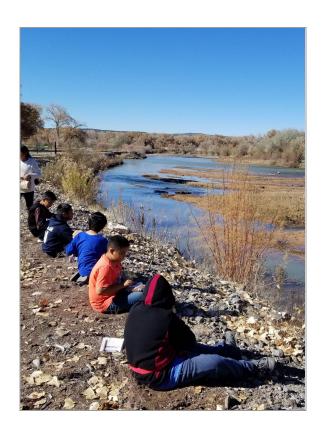**BEMP**
Bosque Ecosystem Monitoring Program

Educational Offerings – FALL 2023

Hello, and welcome!

In the following pages, you will see our present curriculum, beginning with an all-inclusive flow chart of our offerings for Fall 2023.

We hope you find an opportunity of interest and look forward to BEMPing with you!

Preparation

Please note that:

- Every BEMP lesson begins with your choice of one introductory lesson (yellow on page 2 diagram). You can build upon this introduction through your choice of a core lesson (orange) and/or field experience (red). Culminate your learning experience with an optional student leadership and presentation component (gray).

- Depending on your time availability, please choose from the following three options:
    1) Field Experience Focus;
    2) Classroom & Field Experience; or
    3) Classroom Experience Focus (see diagram page 2).

- All lessons offered have asynchronous AND/OR in-person <u>outdoor</u> options.

	FIELD EXPERIENCE FOCUS			CLASSROOM & FIELD EXPERIENCE (Remote and/or In-person Outdoor)	CLASSROOM EXPERIENCE FOCUS (Remote and/or In-person Outdoor)	7th GRADE
Introductory lessons	**BEMP Basics:** - Asynchronous lesson **OR** **River of Change:** - Asynchronous video series and, - 2-3 in-person, outdoor	**BEMP Basics:** - Asynchronous video and activity	**Stormwater Science:** - Asynchronous video series and/or, - One, synchronous, in-person lesson	**River of Change:** - Asynchronous video series and/or, - 3 in-person, outdoor lessons	**River of Change:** - Asynchronous video series and/or, - 3 in-person, outdoor lessons	**Bosque Mystery:** - In-person classroom lesson
Core lessons				**Exploring the Outdoors:** - Two in-person, outdoor lessons, *Lesson can stand alone or be added to Data Jam* **OR** **Data Jam:** - Four, synchronous remote lessons OR, - Four, synchronous, in-person lessons *Lesson can stand alone or be added to Exploring the Outdoors* **OR** **Stormwater Science:** - Asynchronous video series and/or, - One, synchronous, in-person lesson **OR** **Dabbling in Data:** - Asynchronous video and activity OR, - One in-person lesson	**Exploring the Outdoors:** - Two in-person, outdoor lessons, *Lesson can stand alone or be added to Data Jam* **OR** **Data Jam:** - Four, synchronous remote lessons OR, - Four, synchronous, in-person lessons *Lesson can stand alone or be added to Exploring the Outdoors* **OR** **Stormwater Science:** - Asynchronous video series and/or, - One, synchronous, in-person lesson **OR** **Dabbling in Data:** - Asynchronous video and activity OR, - One in-person lesson	**Bosque Data Analysis:** - In-person, classroom lesson
Field Experiences	**Monthly Monitoring:** - **in the bosque,** in-person, outdoor data collection (for 9 months) OR, - **On Campus,** three sessions on/near your school campus, in-person, outdoor data collection	**Phenology Study Trip:** - **One, three to five-hour,** in-person outdoor experience	**Stormwater Science Study Trip:** - **One, three to five-hour,** in-person outdoor experience	**Monthly Monitoring:** - **Monthly in the bosque,** in-person, outdoor data collection (for 9 months) OR, - **Three, one-hour sessions on/near your school campus,** in-person, outdoor data collection **OR** **Phenology Study Trip:** - **One, three to five-hour,** in-person outdoor experience **OR** **Stormwater Science Study Trip:** - **One, three to five-hour,** in-person outdoor experience		**Bosque Data Collection** - **In the bosque,** in-person, outdoor.
Presentation Component				- Spanish language **Luquillo-Sevilleta** Virtual Symposium **AND/OR** - **Crawford** Symposium (NOT optional for students participating in Data Jam)	- Spanish language **Luquillo-Sevilleta** Virtual Symposium **AND/OR** - **Crawford** Symposium (NOT optional for students participating in Data Jam)	

INTRODUCTORY LESSONS

Choose ONE:

BEMP Basics:
Asynchronous lesson *(for Monthly Monitoring)*:

Description: Students will learn what BEMP is and what we do. They will also learn the different instruments and methods we use to collect our data and why it is important.

- *Grade target:* All grades
- *Time commitment:* 40-min lesson
- *NGSS:* 5-ESS3-1

Or, **BEMP Basics:**
Asynchronous video and activity *(for Phenology Study Trip)*:

Description: Students will learn what BEMP is and what we do. This lesson also highlights components of an ecosystem, food webs and student's relationship with the bosque.

- *Grade target:* ES & MS
- *Time commitment:* 40-min lesson
- *NGSS:* 5-LS2-1; 5-ESS3-1; MS-LS2-3; & HS-LS2-4

River of Change:
Four-part asynchronous video series OR three-part synchronous in-person outdoor lessons:

Description: Adapted from the Bosque Education Guide, students will learn what the Rio Grande and its bosque looked like 2000 years ago (Rio Bravo), what caused it to look the way it does today (Rio Manso), and what it could look like in the future (Rio Nuevo). They will also explore what BEMP is doing to monitor the Rio Grande and its bosque, while discovering ways to improve the health of that ecosystem.

- *Grade target:* 3rd grade through HS
- *Time commitment:*
    - Asynchronous: Four 30-minute videos = 2 hours total
    - Synchronous: Three to four 1-hour sessions
- *NGSS:* 2-ESS2-1; 3-ESS3-1; 3-LS4-4; 4-ESS3-2; & MS-ESS3-3

Stormwater Science:
Five-part asynchronous video series OR one in-person lesson:

Description: Students learn that the health of the Rio Grande is directly tied to the health of its surrounding watershed and arroyos. Students investigate how a storm impacts river health by looking at a watershed model with different sized communities and the pollution each one produces. This lesson encourages students to learn about stormwater drainages in Albuquerque, how that affects our Rio Grande, and what they can do to help limit pollution in the river.

- *Grade target:* MS & HS
- *Time commitment:*
    - Asynchronous: Five 30-minute videos = 2.5 hours total
    - Synchronous: One 1-hour session
- *NGSS:* MS-ESS3-2; MS-ESS3-3; MS-ETS1-1; MS-ETS1-2; HS-LS2-2; HS-LS2-7; HS-ESS3-4; HS-ETS1-2

CORE LESSONS

Choose ONE:

Exploring the Outdoors:
Three-part in-person, outdoor lessons:

Description: A two-part lesson where students will learn how to start their own nature journal, how to collect data in their neighborhood or open space, and an introduction to analyzing their data. These lessons will allow students to step away from their computers and observe what is around them, whether that is trees in a park, birds sitting on a line, or a plant outside their home.

- *Grade target:* ES & MS
- *Time commitment:* 3 lessons (1.5 hours each = 4.5 hours total)
- *NGSS:* K-LS1-1; K-ESS2-1, 2-LS4-1 & 3-ESS2-1

Data Jam:
Four-part in-person lessons:

Description: A four-part lesson where students will practice the scientific method by collecting their own data regularly over the semester, forming their own scientific questions/hypotheses, analyzing the data collected, finding trends, and graphing the results. At the end of this process, the goal is for students to come up with a creative piece to represent the results of their scientific project. Once finalized, these student projects and creative pieces are suggested to be presented at one or all of our annual

events (see below).

- *Grade target:* All grades; best for MS & HS
- *Time commitment:* 4 lessons (1-hour each + 1 presentation session = 5 hours total)
- *NGSS:* MS-ESS3-2; MS-ESS3-3; MS-ETS1-1; HS-LS2-2 & HS-LS2-7

Stormwater Science*:
Five-part asynchronous video series OR one in-person lesson:

Description: Students learn that the health of the Rio Grande is directly tied to the health of its surrounding watershed and arroyos. Students investigate how a storm impacts river health by looking at a watershed model with different sized communities and the pollution each one produces. This lesson encourages students to learn about stormwater drainages in Albuquerque, how that affects our Rio Grande, and what they can do to help limit pollution in the river.

- *Grade target:* MS & HS
- *Time commitment:*
  - Asynchronous: Five 30-minute videos = 2.5 hours total
  - Synchronous: One (?) 1-hour session
- *NGSS:* MS-ESS3-2; MS-ESS3-3; MS-ETS1-1; MS-ETS1-2; HS-LS2-2; HS-LS2-7; HS-ESS3-4; HS-ETS1-2

Note: This lesson is the same as the one presented in the *Introductory Lessons* section and should be paired with the *Stormwater Science Study Trip* field experience.

Dabbling in Data:
One asynchronous video OR one to two in-person lesson:

Description: During this lesson, students will learn about BEMP's groundwater dataset: what it is, how we measure it, and why it's important. They will also consider how the water cycle moves through the Rio Grande Valley using an aquifer model. Afterwards, students will graph groundwater and streamflow data for different BEMP sites. Students will look at several years of data to discern the relationship between the river and groundwater, and how pollution might impact that connection. Once finalized, students will propose several actions they can adopt to encourage community stewardship of the bosque ecosystem. Afterwards, students are encouraged to create research projects and creative pieces to be presented at one or all of our annual events (see below).

- *Grade target:* Upper MS & HS
- *Time commitment:* 1-hour lesson or two 1-hour lessons.
- *NGSS:* MS-ESS2-4; MS-ESS3-3 & HS-ESS2-2 & HS-ESS3-6

Please factor in your own travel time to accommodate for the following experiences.

Choose ONE:

Monthly Monitoring in the Bosque:
Monthly in the bosque, in-person, outdoor:

Description: BEMP monthly monitoring groups are a part of our core scientific data collection and environmental education program. Each month, during the week of the third Tuesday, students and teachers join BEMP staff (when available) in the bosque at one of our 33 research sites to collect: depth to groundwater, precipitation, and litterfall data. These data are analyzed at the University of New Mexico and shared with local, state, tribal, and federal agencies throughout the Middle Rio Grande Valley to help with decisions on how to manage the bosque.

- *Grade Target: All grades*
- *Time Commitment:* 1 lesson per month (1.5 hours each for 9 months = 13.5 hours total)
- *NGSS:* K-LS1-1; K-ESS2-1; K-ESS3-3; 2-LS4-1; 3-ESS2-1; 5-PS3-1; 5-LS2-1; MS-LS2-2; MS-ESS3-3; HS-LS2-2; HS-LS2-7 & HS-ESS3-5

Monthly Monitoring on Campus:
Three one-hour sessions on/near your school campus, in-person, outdoor:

Description: A modified version of BEMP monthly monitoring, this experience engages students in similar precipitation, litterfall, and arthropod data collection but with a BEMP educator on or near your own school campus. Students will learn the how-to's of setting up a monitoring site, learn why monitoring is a valuable tool, and observe the importance of phenological (seasonal) changes while collecting, interpreting, and engaging with their collections.

- *Grade Target: All grades*
- *Time Commitment:* 3 lessons (1.5 hours each = 4.5 hours total)
- *NGSS:* K-LS1-1; 2-LS2-1; 2-LS4-1; 2-ESS2-2; 2-ESS2-3

Phenology Study Trip:
One, three to five-hour, in-person outdoor experience:

Description: BEMP Study Trips are a core part of our environmental education program. When a group joins us for a Study Trip, they will be embarking on an exciting academic foray into the *bosque*, or riparian forest around the Rio Grande. Students will learn about the phenology of plants and animals in the bosque by playing camouflage as an introduction to seasonal changes, collecting community science observational data about phenology through the National Phenology Network , exploring native vs. exotic

plants, and discussing phenological changes of our keystone species, the Rio Grande cottonwoods. It is BEMP's priority to provide high-quality education and an opportunity for students to collect vital, usable scientific data. This Study Trip focuses primarily on the bosque ecosystem and the plants and animals that live in it with a particular interest in Phenology monitoring (tracking seasonal changes in cottonwood trees).

- *Grade Target: All grades*
- *Time Commitment:* 1 lesson - approximately 3 - 5 hours
- *NGSS:* K-ESS3-1; K-ESS3-3; 2-LS4-1; 3-ESS2-1; 5-PS3-1 & 5-LS2-1

Stormwater Science Study Trip*:
One, three to five-hour, in-person outdoor experience:

Description: BEMP Study Trips are a core part of our environmental education program. When a group joins us for a Study Trip, they will be embarking on an exciting academic foray into the *bosque*, or riparian forest around the Rio Grande. It is BEMP's priority to provide high-quality education and an opportunity for students to collect vital, usable scientific data. This Study Trip focuses primarily on Stormwater Science related concepts and includes exposure to accessible water channels and structures, surveying for litter and pollution sources, and testing water quality samples.

- *Grade Target:* MS & HS
- *Time Commitment:* 1 lesson - approximately 3-5 hours
- *NGSS:* MS-ESS3-3; MS-ESS2-4; MS-ETS1-1; MS-ETS1-2; HS-ESS3-4; HS-ETS1-2 & HS-ETS1-3

**Note:* This lesson should be paired with the *Stormwater Science* classroom lesson.

PRESENTATION COMPONENT

Optional *(unless participating in the Data Jam and/or Dabbling in Data lessons)*:

Luquillo-Sevilleta Virtual Symposium

Description: In partnership with the Luquillo Long Term Ecological Research Network, BEMP annually hosts a formal student webinar for students to share their own, original research delivered in Spanish AND English. Students of all ages from Albuquerque and Puerto Rico gather (virtually) to share their long term scientific research from their respective forests and rivers. Ultimately, this event intends to celebrate the diversity in cultures and backgrounds that these two locations foster.

Prior to the event, students are supported throughout their learning in the process of gathering data and preparing a presentation. Their experience concludes with the creative presentation of their findings in a virtual format.

Crawford Symposium

Description: The Crawford Symposium is BEMP's annual event where we celebrate our year's successes in memory of Cliff Crawford, BEMP's co-founder. Throughout his life, Dr. Crawford inspired students of all ages and catalyzed a growing body of research in the bosque. Moreover, he also radiated the work of students, fellow scientists, and professionals back into the community. Thus, each year we gather to celebrate community science and environmental research along the Middle Rio Grande in his honor. This allows us to showcase the research of the students and professionals who have been engaged with our organization.

Prior to the event, students are supported throughout their learning in the process of gathering data and preparing a presentation. Their experience concludes with the creative presentation of their findings in a well attended, in-person event (virtual presentations will be offered should COVID restrictions necessitate it).

7th GRADE PROGRAM

BEMP is expanding its programming to reach every 7th grader in the Middle Rio Grande valley! Through the following three part series, 7th grade students connect with their local ecosystems by developing hypotheses, constructing arguments, collecting data during hands-on fieldwork, and analyzing their findings to uncover indicators of bosque ecosystem health.

Lesson 1 - Bosque Mystery:
In-person classroom lesson:

Description: During this lesson, students analyze qualitative and quantitative evidence to construct an argument about how changes to the ecosystem affect native populations and keystone plant species through an inquiry based exploration session. Students are provided introduction to Rio Grande history and ecology concepts and BEMP data.

- *Grade Target:* 7th grade
- *Time Commitment:* 1-hour lesson
- *NGSS: MS-LS2-4*

Lesson 2 - Bosque Data Collection:
In the bosque, in-person, outdoor:

Description: This lesson encompasses experiential, place-based, student collection of field data whereby students create, discuss and explore hypotheses developed in

lesson 1 to gather more information on the state of the bosque, utilizing observations to encourage deeper evidence collection.

- *Grade Target:* 7th grade
- *Time Commitment:* 1.5+-hour lesson
- *NGSS:* MS-LS2-2 & MS-ESS3-3

Lesson 3 - Bosque Data Analysis:
In-person classroom lesson:

Description: In this lesson, students review all qualitative and quantitative data collected and/or introduced from lessons 1 and 2 to learn about BEMP's groundwater dataset: what it is, how we measure it, and why it's important. Students graph data to discuss the relationship between ecosystem components, how pollution might impact that connection, and discuss stewardship initiatives.

- *Grade target:* 7th grade
- *Time commitment:* 1-hour lesson
- *NGSS:* MS-ESS2-4; MS-ESS3-3 & HS-ESS2-2 & HS-ESS3-6