Timber! Trees Need Water!

Wood Litterfall in the Middle Rio Grande Bosque **Sandy Pham**

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Research Background

Precipitation comes in the form of rain, ice, and snow into the Middle Rio Grande Bosque. It has a major impact on shaping the landscape of the bosque. Depending on the amount of precipitation that the bosque receives, there could be an increase in river water which would lead to an increase in the amount of groundwater, as well as vegetation (Jackson et al. 2001). However, when severe weather changes occur it could affect the landscape of the bosque. When there are droughts, the species that live in the bosque could start to decline. One of the signs that indicate that the Middle Rio Grande isn't in a healthy condition is an increase in wood litterfall. Healthy trees and plants don't drop their limbs if they are healthy (Boa 2003). One of the oldest species living in the bosque is cottonwoods. Cottonwood trees need enough water in order to stay healthy. When surface flow and water levels decrease in the bosque, cottonwoods are able to survive by using their roots. Cottonwoods can use their roots to reach deeper into the ground to access groundwater (Crawford et al. 1993). Cottonwood productivity and abundance decreases as groundwater levels decrease (Stromberg et al. 2012).

Here in New Mexico, the Middle Rio Grande Valley extends throughout Sandoval, Bernalillo, Valencia, and Socorro counties. Humans and climate change here have made extensive modifications to the bosque, and in ways it has both harmed and benefitted the

bosque. Over the years, there has been removal of plants, changes on cyclic drought/ wet-year patterns, and introduction of exotic species to the bosque (Ellis et al. 2003). All of these changes have to be monitored so that we can study and understand the positive and negative impacts. The Bosque Ecosystem Monitoring Program (BEMP) has been monitoring the bosque ecosystem since 1996 (bemp.org). BEMP works with students all over New Mexico to educate them about the bosque and to also teach them about scientific research. BEMP allows students to connect with nature by allowing them to interact and touch nature themselves. The students that work with BEMP collect data in order to help with conservation and restoration of the Middle Rio Grande Bosque (bemp.org).

Precipitation is prominent in the landscaping of the bosque and it could have an effect on the wood litterfall. When there are low amounts of precipitation in the bosque, there will be more wood fall, due to trees needing resources to hold onto their limbs and branches. All of the BEMP sites have two rain gauges. One of the rain gauges is in the open, meaning that there aren't any trees over the rain gauge (bemp.org). The other rain gauge is under a canopy, in which trees are shading the rain gauge. Oil is used in the rain gauges to prevent evaporation of the water that falls in the gauges. Water levels are read below the oil in the rain gauge (bemp.org). Precipitation amounts are recorded in millimeters. The wood litterfall is collected from ten litterfall tubs at each of the BEMP sites (bemp.org). It is collected along with other types of litterfall and is placed in a properly labeled brown paper bag. If there is wood that was hanging outside of the tub, BEMP students should mark the place where the wood was hanging out of the tub so that it can be cut off at that point and only the portion of the wood that was in the tub will be collected (bemp.org). All of the litterfall materials are brought back to the lab to be sorted, weighed, and recorded (bemp.org).

Scientific Question:

What is the relationship between changes in precipitation and cottonwood health?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Scientific Data:

Use the data below to answer the scientific question:

BEMP Site Alameda Rain Gauges		
	Precipitation Average (mm)	Wood Litterfall Average (g/m^2)
2000	14.5	11.2
2001	8.8	13.9
2002	9.4	11.4
2003	9.6	11.3
2004	24.1	14.7
2005	14.1	3.9
2006	22.6	24.3
2007	19.2	21.5
2008	12.9	11.4
2009	15.5	25.8
2010	17.2	30.9
2011	9.6	9.8
2012	7.1	9.0
2013	19.2	13.6
2014	10.1	10.9

BEMP Site Rio Grande Nature Center Rain Gauges		
	Precipitation Average (mm)	Wood Litterfall Average (g/m^2)
2000	16.5	4.6
2001	8.5	6.7
2002	14.0	8.9
2003	9.8	3.0
2004	24.1	11.3
2005	18.8	1.4
2006	19.1	3.4
2007	14.3	2.4
2008	12.9	7.2
2009	9.1	1.6
2010	15.3	2.5
2011	11.9	15.0
2012	7.0	1.9
2013	13.9	5.8
2014	11.3	2.9

What data will you graph to answer the question?

Independent variable: _____

Dependent variable: _____

Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.

Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about.

<u>Your next steps as a scientist</u>:

Science is an ongoing process. Did this study fully answer the scientific question?

What new question do you think should be investigated?

What hypothesis would you like to test? A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

What data will you graph to answer the question?

Independent variable(s): _____

Dependent variable(s): _____

For each variable, explain why you included it and how it could be measured.

References

BEMP, 2017. Bosque Ecosystem Monitoring Program. Website. http://bemp.org/history/.

Boa, E. R. *An Illustrated Guide To The State Of Health Of Trees*. Rome: Food and Agriculture Organization of the United Nations, 2003. Print.

Crawford, C.S., A.C. Cully, R. Leutheuser, M.S. Sifuentes, L.H. White and J.P. Wilber. 1993. Middle Rio Grande Ecosystem: Bosque Biological Management Plan. Middle Rio Grande Biological Interagency Team. U.S. Fish and Wildlife Service, Albuquerque, NM. vii-xvi.

Ellis, L. 2003. The Middle Rio Grande Bosque. In Morris, L., M. Steuver, L. Ellis and R. Tydings. Bosque Education Guide, 2nd edition. Friends of the Rio Grande Nature Center, 2901 Candelaria Road NW, Albuquerque, NM. 35-54.

Jackson, R.B., S.R. Carpenter, C.N. Dahm, D.M. McKnight, R.J. Naiman, S.L. Postel and S.W. Running. 2001. Water in a Changing World. Ecological Applications 11(4): 1027-1045.

Stromberg, J., K. McCluney, M. Dixon and T. Meixner. 2012. Dryland Riparian Ecosystems in the American Southwest: Sensitivity and Resilience to Climatic Extremes. Ecosystems 16: 411-415.