Name_____

DATA Nugget

Changing climates in the Rocky Mountains

Featured scientist: Daniel Laughlin from The University of Wyoming.
Written by: Matt Bisk

Research Background:

Each type of plant needs specific conditions to grow and thrive. If conditions change, such as temperature or the amount of precipitation, plant communities may change as well. For example, as the climate warms, plant species might start to shift to higher latitudes to follow the conditions where they grow best. But what if a species does well in cold climates found at the tops of mountains? Because they have nowhere to go, warming puts that plant species at risk.

To figure out if species are moving, we need to know where they've lived in the past, and if climates are changing. One way that we can study both things is to use the **Global Vegetation Project**. The goal of this project is to curate a global database of plant photos that can be used by educators and students around the world. Any individual can upload photos and identify plant species. The project then connects each photo to information on the location's biome, ecoregion, and climate, including data tracking precipitation and temperature over time. The platform can also be used to explore how the climates of different regions are changing and use that information to predict how plant communities may change.

Daniel is a scientist who is interested in sharing the Global Vegetation Project data with students. Daniel became interested in plants and vegetation when he learned in college that you can simply walk through the woods and prairie, collect wild seeds, germinate the plants, and grow them to restore degraded landscapes. Plants set the backdrop for virtually every landscape that we see. He thinks plants deserve our undivided attention.

Daniel and his team wanted to create a resource where students can look deeper into plant communities and their climates. Much of the inspiration for the Global Vegetation Project came from the limitations to undergraduate field research during the COVID-19 pandemic. Students in ecology and botany classes, who would normally observe and study plants in the field, were prevented from having these opportunities. By building an online database with photos of plants, students can explore local plants without having to go into the field and can even see plants from faraway places.

Daniel's lab is based in the Rocky Mountains in Wyoming, where the plants are a showcase in both biodiversity and beauty. These communities deal with harsh

conditions: cold, windy and snowy winters, hot and dry summers, and unpredictable weather during spring and fall. The plants rely on winter snow slowly melting over spring and into summer, providing moisture that can help them survive the dry summers.

The Rocky Mountains are currently facing many changes due to climate change, including drought, increased summer temperatures, wildfires, and more. This creates additional challenges for the plants of the Rockies. Drought reduces the amount of precipitation, decreasing the amount of water available to plants. In addition, warmer temperatures in winter and spring shift more precipitation to rain instead of snow and melts snow more quickly. Rain and melted snow rapidly move through the landscape, becoming less available to plants in need. On top of all this, hotter, drier summers further decrease the amount of water available, stressing plants in an already harsh environment. If these trends continue, there could be significant impact on the types of plants that are able to grow in the Rocky Mountains. These changes will have an impact on the landscape, organisms that rely on plants, and humans as well.

Lower elevation site, temperate conifer forest, Wyoming. Photo Credit: Alice Stears.

Higher elevation site, montane conifer forest, Wyoming. Photo Credit: Rhiannon Jakopak.

Daniel and his colleagues pulled climate data from a **Historic period (1961-2009)** and **Current period (2010-2018)**. They selected two locations in Wyoming to focus on: a lower elevation montane forest and a higher elevation site. To study climate, they focused on temperature and precipitation because they are important for plants. They wanted to study how temperature and precipitation patterns changed overall and how they changed in different seasons. They predicated temperatures would be higher in the Current period compared to the Historic period in both locations. For precipitation, they predicted there would be drier summers and wetter springs.

Scientific Question: How has precipitation and temperature changed in the Rocky Mountains over the last 60 years?

Name_____

Scientific Data:

Use the data below to answer the scientific question:

	Lower Elevation Site				Higher Elevation Site			
	Historic Data (1961-2009)		**Recent Data (2010 - 2018)**		**Historic Data (1961-2009)**		**Recent Data (2010 - 2018)**	
Month	Temperature (°C)	Precipitation (mm)	Temperature (°C)	Precipitation (mm)	Temperature (°C)	Precipitation (mm)	Temperature (°C)	Precipitation (mm)
January	-6	20	-5	21	-8	30	-8	30
February	-5	18	-6	25	-7	27	-9	29
March	-1	30	-1	35	-5	24	-3	20
April	3	60	3	55	-2	32	-1	32
May	7	63	5	85	4	37	3	42
June	11	68	12	55	8	42	9	23
July	15	27	17	18	13	25	16	18
August	14	27	16	28	12	29	15	22
September	12	48	14	43	9	31	12	32
October	7	36	9	32	6	23	8	21
November	0	20	1	23	-5	29	-2	29
December	-6	20	-4	27	-9	30	-8	42

Note: Temperature and precipitation have been averaged across the time period presented. For example, -6 C was the average temperature in January at lower elevations from 1961-2009.

What data will you graph to answer the question?

Independent variable(s): _____

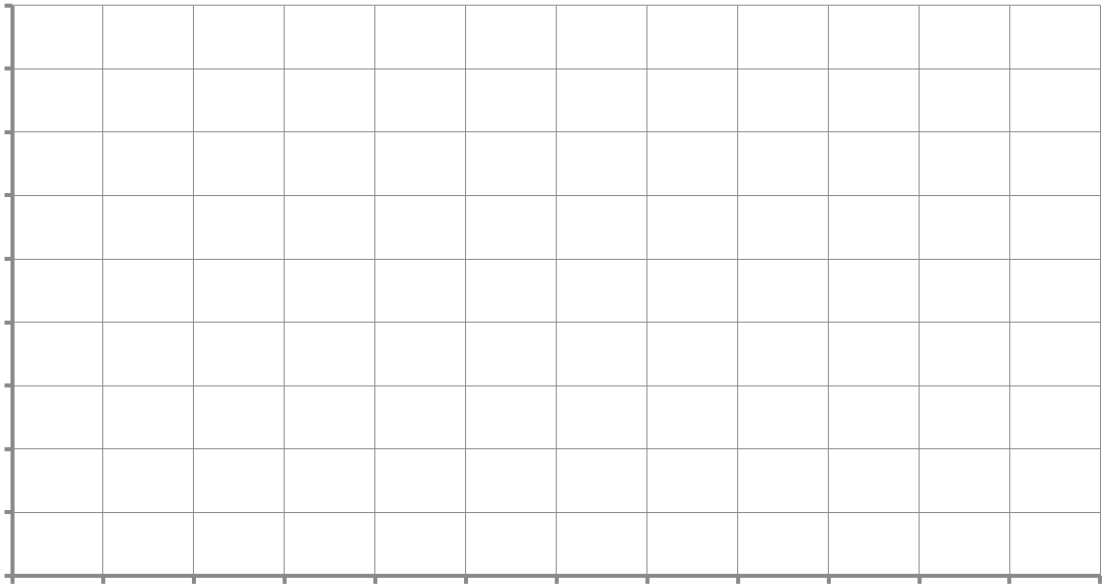
_____

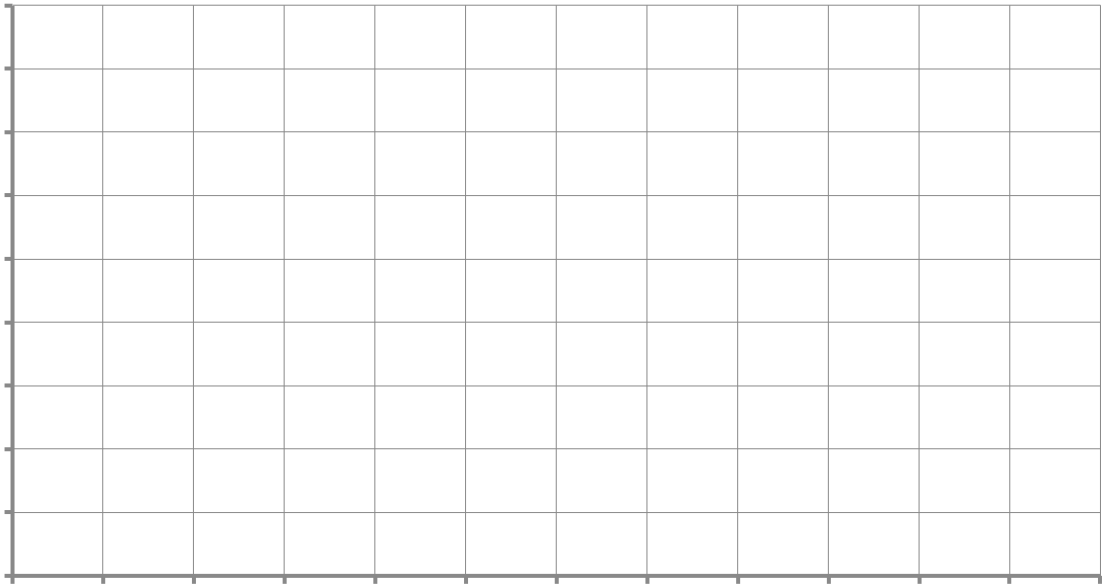
Dependent variable(s): _____

_____

Name_____

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





Name_____

Interpret the data:

Make a claim that answers the scientific question, how has precipitation and temperature changed in the Rocky Mountains over the last 60 years?

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

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how climate change might affect plant species growing in the Rocky Mountains.

Name_____

Your next steps as a scientist:

Science is an ongoing process. What new question(s) should be investigated to build on Daniel's research? How do your questions build on the research that has already been done?

What future data should be collected to answer your question?

Independent variable(s): _____

_____

Dependent variable(s): _____

_____

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

What hypothesis are you testing in your experiment? A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.