Name_____

DATA Nugget

What grows when the forest goes?

Featured scientists: Joe LaManna (he/him) from Marquette University and Matt Retterath (he/him) from Fridley Public Schools.

Research Background:

The H.J. Andrews Experimental Forest, or Andrews for short, is a long-term ecological research site in the Cascade Mountains of Oregon. The forest is a temperate old-growth rainforest. It is known for its lush and green understory of flowering plants, ferns, mosses and a towering canopy of Douglas fir, Western hemlock, Red cedar, and other trees. Scientists have spent decades studying how plants, animals, land use, and climate are all connected in this ecosystem.

Matt is a biology teacher who has spent two summers in the field working with scientists at the Andrews. These experiences have been valuable ways to bring real data and research back to his students! Matt works closely with Joe, a scientist who studies the impact of disturbances on plants, such as fires.

Area of the H.J. Andrews Experimental Forest in Oregon, a few years after a fire.

Historically, large, severe fires have been a part of the ecology of forests in Oregon. They typically occur every 200-500 years. Many of the plants at the Andrews Forest are those that can deal with fire. Fires clear out dead plants, return nutrients to the soil, and promote new growth of understory and canopy plants. With climate change impacting temperature and rainfall across the globe, forests in Oregon are increasingly experiencing longer periods of dry and hot weather. These changes are causing an increase in the frequency and severity of wildfires.

On Matt's last day at the Andrews in 2023, a lightning strike started a wildfire in a far corner of the forest. With hundreds of firefighters on the ground and several helicopters in the air, the "Lookout Fire" burned for several months, consuming about 70% of the Andrews forest!

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When Matt returned in the summer of 2024, it looked nothing like the forest he had left. The fire completely changed the course of his research experience. When he saw the scorched forest, he began to wonder how it would recover. He also observed that the fire had not burned at the same intensity throughout the forest. Some areas of Andrews were burned more, and in some spots, the fire had been less intense.

Matt thought that some plants may do better after a severe burn, while other species might do worse. Specifically, Matt wanted to see whether native and invasive plants would show differences after a fire. Plants that have historically grown in an area without human interference are called **native plants**. These plants have a long history of adapting to the specific conditions in an area. When a plant species is moved by humans to a new area and grows outside of its natural range, it is called an **invasive plant**. Invasives often grow large and fast, taking over habitats, and pushing out native species. Invasive plants tend to be the ones that can grow fast and handle disturbances, so the team expected that invasive species would recover more quickly than native plants after high severity fires.

Plots in 2023 being surveyed for native and invasive plants to calculate the proportion that are invasive after a burn.

It was still too early to re-enter the areas burned by the Lookout Fire, so Matt and Joe chose another recent fire. They used data collected from a section of the forest that had burned in 2020. In 2021, a year after the fire, scientists put out 80 plots that were $1m^2$ in size to collect data on the understory plants.

Each section was given a **burn severity** value based on the amount the canopy trees had burned directly over the plot. Scientists would look up at the tree canopy and see how much was missing, and the more that was gone, they knew the burn severity had been higher. Scientists then identified every species of plant in the plots and counted the number of individual plants of each species. This was repeated every year after 2021 to observe changes over time. Matt and Joe decided to analyze data from 2023, which Matt helped collect when he visited. To answer their question, they calculated the proportion of invasive plants in each plot.

Scientific Question: How does burn severity affect the proportion of invasive plant species after a fire?

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.

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Scientific Data:

Use the data below to answer the scientific question:

Burn Severity Range	Number of plots (*n*)	Burn Severity Median	Average Proportion of Invasive Plants	Standard Error (SE)
0-10%	26	0.05	0.029	0.013
10-30%	26	0.2	0.137	0.057
30% and up	23	0.5	0.222	0.055

**Standard deviation (SD) tells us about the amount of variation in the data. A large SD means there is a lot of variation around the mean, while a small SD means the data points all fall very close to the mean. Standard error (SE) tells us how confident we are in our estimate of the mean, and depends on the number of replicates in an experiment (n) and the SD. A large SE means we are not very confident, while a small SE means we are more confident.*

What data will you graph to answer the question?

Independent variable: _____

_____

Dependent variable: _____

_____

Name_____

Draw your graph below: Identify any changes, trends, or differences that 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, how does burn severity affect the proportion of native and invasive plant species after a fire?

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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 the role of fire as a disturbance in the Andrews Forest ecosystem.

Did the data support Matt and Joe's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

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Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Matt and Joe's research? How do your questions build on the research that has already been done?

HJ Andrews Experimental Forest
LONG-TERM ECOLOGICAL RESEARCH