

# Where There's Smoke, There's Fire

## Reflection Section Answer Guide

### Introduction

In your own words, and in the form of a question, state the question that the scientists were trying to answer with this research.

*Students may formulate unique ways to phrase the research questions. Some examples may include: How is climate linked to very large wildland fires in the Western United States? What does weather data tell us about the relationship between climate and very large wildland fires? Are very large wildland fires connected to particular weather and climate in the Western United States?*

How did the scientists come up with their research question? What is another way that scientists can create a research question? (Watch the *Natural Inquirer* Scientist Video series to see how scientists create a research question. To learn more, visit: <http://www.naturalinquirer.org/Science-Fair-Connections-v-146.html>)

*Students will have individual answers to these questions. Students should understand from the "Introduction" that the scientists used a literature review to find a research question. The scientists made an observation about wildland fires, and didn't see any other research regarding this topic, so there was a gap in knowledge. Scientists may also create research questions by talking to other scientists or by hearing about problems that are experienced by their community or society.*

### Methods

Review the weather data and biophysical observations used to represent climate in this research. What similarities or differences do you see among these data and observations?

*The students may have individual responses to these questions. However, the students should realize that many of the weather data and biophysical observations used in this research*

*are related to air temperature and moisture. Moisture indicates dryness or drought, and can indicate weather or climate that could easily facilitate wildland fires.*

Why do you think the scientists decided to look at weather data and biophysical observations from before, during, and after wildland fires? *The scientists were unsure which, and if any, weather data or biophysical observations were related to very large wildland fires. Therefore, the scientists needed to look at these data and observations over the whole wildland fire event. Completing this analysis for multiple fires and for multiple locations enabled the scientists to observe patterns.*

### Findings

The scientists found some patterns in the data for many biophysical observations. The patterns were seen before, during, and after very large wildland fires. These patterns often occurred in multiple study regions. Look at figure 10, and examine the results. What is the pattern you see occurring for very large wildland fires in each study region? Which study regions are experiencing this pattern? How is that pattern different from large wildland fires?

*After observing figure 10, the students will notice that in many study regions, the data for "DMC" showed an increase in drought conditions before, during, and after the fire. In most cases, the drought conditions began to decrease 4 weeks after a fire. This pattern was visible across all 8 study regions. In most study regions, increased drought conditions were more common in very large wildland fires than in large wildland fires.*

Review figures 10 and 11. These figures illustrate the results of biophysical observations that are climate variables. Using the information you

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learned about biophysical observations (see table 1), why do you think these variables are connected to very large wildland fires?

*Students should notice that both DMC and PDSI, shown in figures 10 and 11, are related to moisture in the environment. PDSI is focused on soil, while DMC is focused on moisture on the forest floor. In both cases, moisture is important and can indicate the dryness of the environment. The drier an environment is, the greater chance that wildland fire can spread and grow larger.*

### **Discussion**

The scientists noted that this research supports what they already believed about very large wildland fires. Why is it important for scientists to research questions even if they feel that they already know the answer?

*Students will have individual answers to this question. However, students should understand that it is important to use scientific evidence to support ideas, even if those ideas are logical. Research also enables scientists to improve their understanding. For instance, in this research, the scientists were able to identify a clear difference between how certain types of ecosystems (many plants versus few plants) that they may not have noticed had they not completed the research.*

Imagine you were given the opportunity to study this topic. What other factors would you test to see if they are connected to very large wildland fires? Why?

*Students will have individual answers to this question. Some potential additional variables that could be tested include wind speeds, topography, and relative humidity.*

# Time Warp

## Where There's Smoke, There's Fire

### Reflect and Connect Answer Guide

#### Introduction

What are the similarities and differences between the job of a fire guard and the “Where There’s Smoke There’s Fire” scientists?

*Students will have individual responses to this question. Some potential similarities between the two include: the study of wildland fire, study focus on the Western United States, the use weather in studying wildland fires, and the goal of spotting, identifying, or predicting wildland fires. Differences may include: the technology used to spot, identify, or predict wildland fires, the workplace environment, or the final goal of their work.*

#### Discussion

Over time, some wildland fire research has changed from being completed with humans to being completed with computer technology. These changes can be seen in the wildland fire research covered in this monograph. What are the pros and cons of relying on computer technology for wildland fire research?

*Students will have individual answers to these questions. Computer technology may be used more often in current wildland fire research because scientists save money and time by not spending long periods of time outdoors conducting research. Additionally, computer technology may enable scientists to study questions that are unanswerable by people. For instance, computer technology can store and analyze large datasets, and computer technology enables scientists to study broader questions. Some negative consequences of these changes in research include the costs of new technology and the lack of firsthand experience to draw conclusions about research.*