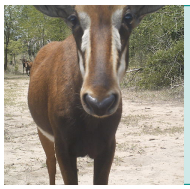


INTRODUCTION

Gorongosa National Park is a 1,570-square-mile protected area in Mozambique. Lion researcher Paola Bouley and her team use motion-detecting trail cameras to learn more about Gorongosa's lions. Lions are not the only animal captured by these cameras. The photos provide valuable information on a variety of different animals, including numbers to help estimate populations, behaviors, and interactions with other animals. The public has identified animals and collected data from the photos on a citizen science website called WildCam Gorongosa (www.wildcamgorongosa.org). The WildCam Lab is a part of WildCam Gorongosa where you can view trail camera data on a map, filter, and download the data to investigate scientific questions.

The process of science is iterative and adaptable. The first step in scientific inquiry typically consists of **making observations** about the natural world. Observations can inspire questions about phenomena, to gain understanding about how nature works. For scientists to answer a question, it must be testable, meaning that it could be answered by designing an experiment and/or collecting data. After identifying a **testable question**, the scientist may form a **hypothesis**, which is an explanation for the observed phenomenon, based on observations and/or prior scientific knowledge. Before collecting data, the scientist may also **predict** the expected results of the investigation if the hypothesis is supported. The scientist can **test the hypothesis** through experimentation or further observation, followed by an analysis of the data collected.

In this activity, you will learn firsthand what it is like to be an ecologist studying Gorongosa's wildlife. You will use actual trail camera data to generate a testable question, form a hypothesis and prediction, and choose and analyze the appropriate data to answer your question from the WildCam Lab. The results of your investigation may contribute to the conservation effort in Gorongosa National Park.

PROCEDURES AND QUESTIONS

Part 1: Making Observations and Asking Questions

1. Visit WildCam Gorongosa (www.wildcamgorongosa.org) and create an account or sign in with your existing account. Click the "Get Started" button and read through the tutorial.
2. With a partner, spend 10 minutes observing and identifying animals. Record your observations and questions in the table on the following page. As you work, consider the following questions and make notes in the two boxes below:

    - What do you notice? What do you wonder?
    - Which animals have you identified in the pictures? How many?
    - What are they doing? What environment are they in?
    - If there are pictures with no animals, what other observations can you make? What questions do you have?

Observations
Questions

Part 2: Testable Questions

A good research question is one that can be answered by performing an experiment, collecting data, or analyzing existing data. In order to determine which questions you can answer, you need to know which kinds of data can be gathered from the trail camera photos.

3. With your partner, brainstorm which kinds of data you can gather from the trail camera photos. Write your list in the space below:

4. Assess whether the following question is testable given the types of data you could collect from the trail camera images, based on the list you generated above.

   During which season is the highest abundance of animals present in the limestone gorge vegetation type?

Is this question testable using the data from the trail camera images? If so, what information would you include in your analysis from the images? If not, what additional data would you need to test this question?

5. The spreadsheet below shows a sample of the types of data that can be collected from the WildCam database for a set of images. Which of the research questions you wrote for question two above are potentially testable using this data? Star each question that you think you could answer. Spend five minutes with your partner modifying your questions or writing more questions in the space below that could be answered with data from WildCam pictures.

image_id	camera	longitude	latitude	date	month	year	season	time_period	veg_type	human_structure	distance_human_m
681504	C15	34.5406	-18.9522	11/17/13	Nov	2013	DryWet Oct-Dec	Day 0623-1709	Floodplain Grassland	Road	4
687882	C08	34.3215	-18.9672	8/10/13	Aug	2013	Dry Jul-Sep	Day 0623-1709	Mixed Savanna and Woodland	Road	3
688612	C21	34.676	-19.0319	9/24/13	Sep	2013	Dry Jul-Sep	Day 0623-1709	Limestone Gorge	Ranger Outpost	6466

water_type	distance_water_m	species	species_count	percentage_resting	percentage_standing	percentage_moving	percentage_eating	percentage_interacting	young_present	horns
River	222	Warthog	1	0	0.2	0.2	0	0	FALSE	
River	3677	Warthog	1	0	0.1	0.1	0	0	FALSE	
River	16	Baboon	1	0.047619048	0.047619048	0.047619048	0.047619048	0	FALSE	

Questions

Part 3: Hypothesis and Prediction

Now that you know the types of data that are available, it is time to select your research question and formulate a hypothesis and prediction. Then, you will make a plan for collecting data that will allow you to test that hypothesis.

Before you explore your own question, we will walk you through the process of making a hypothesis and a prediction using the following example question:

During which season is the highest abundance of animals present in the limestone gorge vegetation type?

You may be able to generate some possible answers to this question just by exploring the Gorongosa National Park Interactive Map (http://www.hhmi.org/biointeractive/gorongosa-national-park-interactive-map). Visit the map, click on the limestone gorge and vegetation type layers, and read about the various vegetation types. You might discover that the limestone gorge vegetation type has streams that flow year-round and lush, green vegetation, even during the dry season. Vegetation typically dries out and dies in the other vegetation types during the dry season. A possible hypothesis would be:

Hypothesis: *In the limestone gorge vegetation type, animals are most abundant in the dry season because they are attracted to the water and green vegetation that is scarce in other areas.*

Before analyzing data, scientists will typically predict the results or observations that would be generated if the hypothesis were supported. In our example, a prediction might be:

Prediction: *I will find more animals in photos during the dry season than during any other season in the limestone gorge vegetation type.*

6. Choose one of the testable questions you generated in questions 2 and 5 above which you are the most interested in studying and write it below:

7. Based on background research and the WildCam images you have seen so far, what is your hypothesis and prediction?

   Hypothesis:

   Prediction:

An independent variable is the variable you are studying the effect of, and the dependent variable is the variable that is affected by (or depends on) the independent variable. For example, for the question “During which season is the highest abundance of animals present in the limestone gorge vegetation type?” the independent variable would be the season and the

dependent variable would be the number of animals found in the limestone gorge in each of those seasons.

8. Which variables from the spreadsheet will you need to include in your analysis to test your hypothesis stated above (see the data column headings in question 5 for the possible variables)?

   Independent variable(s):

   _____

   Dependent variable(s):

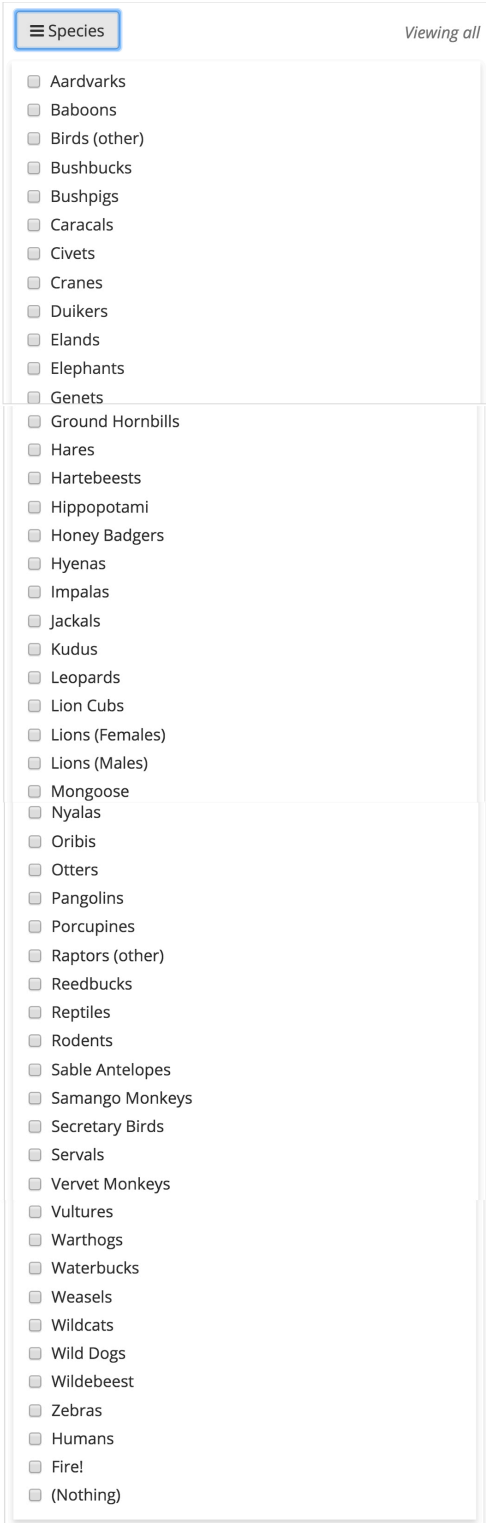
   _____

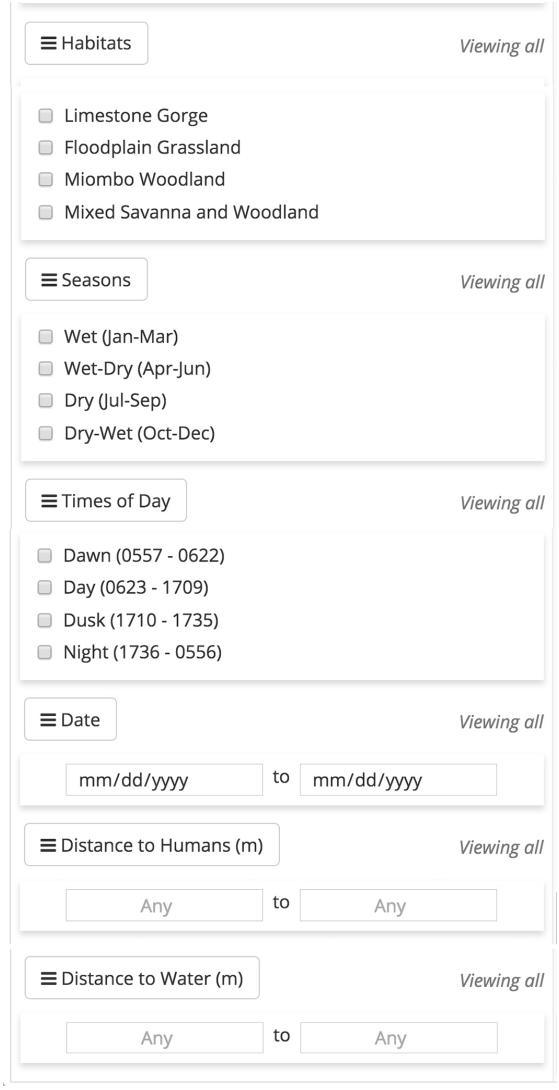
Part 4: Data Collection Plan

You will now gather the data for your research question using the WildCam Lab.

9. Take notes in the space below as your teacher discusses how to use the WildCam Lab, focusing on the questions below:
   - How do you use the filters on WildCam?
   - What do you do with filters you do not need (for example, the "Season" filter if your question is not looking at seasons)?

On the image below of the WildCam Lab, circle or write in the options you would select for each relevant filter to get the data needed to answer your question.





10. Use the WildCam Lab (lab.wildcamgorongosa.org) to filter the data and download a spreadsheet that will help you answer your research question. If you discovered as you worked through the filter options that you might not be able to filter the appropriate data to address your question, you may return to question 5 and either edit your question or pick a new one. Refining or changing your question based on the available data is a regular part of the iterative process of science.

Part 5: Data analysis

You will now analyze your data and create a graph to represent your findings.

11. Use the spreadsheet tutorial provided to organize your data and create a graph.

12. Were you able to answer your question using the data you collected? If not, what additional data would you need to answer this question?

Part 6: Communicating Your Findings

13. Describe the trends that you see in your graph.

14. Based on this graph, are your hypothesis and prediction supported? Explain your answer using evidence from the graph.

15. What are the potential limitations of trail camera data? Identify at least two potential biases of trail camera data or with the way the trail camera survey was designed.

16. In this activity, the scientific process followed a linear sequence: observation, question, hypothesis, prediction, data collection/analysis, and findings. However, the process is typically iterative. Explain how new information might lead a researcher to go back and repeat certain steps in the scientific process, including asking different questions. At what stages in your process could you have obtained additional information from the scientific literature or other sources to inform or revise your process?

17. Based on the results of this investigation, what are some additional research questions that could be further investigated to gain a deeper understanding about the animals in Gorongosa National Park?