



## Scientific Inquiry and Data Analysis Using WildCam Gorongosa

### OVERVIEW

This activity complements WildCam Gorongosa (<http://www.wildcamgorongosa.org>), an online citizen science platform for identifying animals photographed by motion-detecting trail cameras in Gorongosa National Park. The WildCam Lab is a part of WildCam Gorongosa, where students can view trail camera data on a map, filter, and download the data to investigate scientific questions. In this activity, students will be guided through making observations from trail camera data, the development and investigation of a scientifically testable research question using trail camera data that they download from the WildCam Lab, and analysis of their results.

### KEY CONCEPTS

- The process of scientific inquiry begins by making detailed observations of the natural world and formulating questions.
- The process of scientific inquiry is typically iterative and nonlinear.
- Testable scientific questions are questions that can be answered by experimentation or collecting data through observations.
- Questions lead to hypotheses and/or predictions that can be tested with further observations or carefully designed experiments.
- The location and abundance of animals are determined by the availability of resources and community interactions, such as competition, predation, and human influences.
- Data can be analyzed to investigate scientific questions and to communicate findings.

### STUDENT LEARNING TARGETS

- Develop testable ecological questions based on an available data set.
- Formulate hypotheses and predictions about the questions that they posed.
- Select and analyze data to investigate their questions.
- Analyze data and describe trends to investigate their questions.
- Communicate the results of their inquiry and generate new questions based on their findings.

### CURRICULUM CONNECTIONS

Standards	Curriculum Connection
NGSS (2013)	HS-LS2-1, HS-LS2-2, HS-LS2-8
AP Bio (2015)	2.D.1, 4.A.5, SP3, SP5
IB Bio (2016)	4.1, C.1, C.2
AP Env Sci (2012)	II.A
IB Env Systems and Societies (2017)	2.1, 2.2
Common Core (2010)	ELA.RST.9-12.7, WHST.9-12.7 Math.S-IC.3, N-Q.A.3, MP.2, MP.4
Vision and Change (2009)	CC5, DP1

### KEY TERMS

abundance, biodiversity, ecosystem, grassland, Gorongosa, habitat, hypothesis, limestone gorge, observation, prediction, savanna, scientific inquiry, testable question, vegetation type, woodland

### TIME REQUIREMENTS

- One to two 50-min classroom periods. Part of Part 1 may be assigned as homework (see Teaching Tips).
- The extension will require an additional 50 min.
- Time requirements may differ depending on computer/internet access.

## SUGGESTED AUDIENCE

- High School: Biology (all levels), Environmental Science (all levels)
- College: Introductory Biology or Ecology

## PRIOR KNOWLEDGE

Students should

- have experience with making observations and analyzing data.
- be introduced to the WildCam Gorongosa website and perform some animal identifications prior to conducting this activity, as a way to engage and provide context.

## TEACHING TIPS

- Students can watch the Scientists at Work film “Tracking Lion Recovery in Gorongosa National Park” (<http://www.hhmi.org/biointeractive/tracking-lion-recovery-gorongosa-national-park>) to gain an appreciation of how the trail camera data are collected and the kinds of studies being conducted using these data.
- The Glossary and Help tabs on the right-hand menu on the Gorongosa Interactive Map can provide guidance and information for you and your students.
- The Help and Ecology tabs on the WildCam Lab website (<https://lab.wildcamgorongosa.org/students/ecology>) provide additional background information on the geography and climate, water, vegetation, wildlife, and humans in Gorongosa.
- To help anticipate student questions during the activity, prior to implementing it would be helpful for you to practice using the WildCam Lab, review the spreadsheet download, and complete the spreadsheet tutorial.
- To gain more familiarity with the information available about Gorongosa and how to filter data, students can complete Part 1: A, B, and C as homework or on their own prior to the class working through the activity. If this option is selected, students would start working on question 1 in Part 1 together in class.
- Ideally, students should work through the class activity in pairs or small groups.
- Each pair or group of students should have access to a computer/device with spreadsheet software.
- Depending on how you facilitate students working through the activity, you may want to project WildCam Lab to demonstrate how to view, filter, and download data. You can also project the spreadsheet in the tutorial for Part 3 to guide students through creating pivot tables and graphs.

## ACCESSING DATA SETS ON WILDCAM GORONGOSA

To show your students how to access the data sets for this activity, they will first need to set up a Zooniverse account. Optionally, you can also set up a “Classroom” for your students, which will allow you to monitor which students join the site.

- If you do not yet have an account on Zooniverse, you will need to create one first via this website: [https://panoptes.zooniverse.org/users/sign\\_up](https://panoptes.zooniverse.org/users/sign_up)
- Launch the WildCam Lab website (<http://lab.wildcamgorongosa.org>) and enter as an educator.
- Create a “New Classroom.”
- This will generate a unique url. Send this url to your students to invite them to join the classroom. Instruct your students that they must create a Zooniverse account first, then click the url to join your classroom.
- If you choose not to create a Classroom, you can simply have your students set up a Zooniverse account and enter the WildCam Lab website as an “Explorer.”

## MATERIALS

- Internet access, computers/tablets with spreadsheet software (Excel or Google Sheets)
- Student handouts

## PROCEDURE

Several online/supplemental resources are used in this activity:

- Gorongosa Interactive Map
- WildCam Lab for data sets
- Tutorial for analyzing data

## ANSWER KEY

### PART 1: Making Observations and Asking Questions

[Sections A, B, and C can be completed by the students individually. In groups, students should compare their observations recorded in the table and Venn diagram in section C before proceeding in the activity.]

1. Brainstorm possible research studies or investigations that could be developed using the information (variables) that can be gathered from the trail cameras.

*Answers will vary.*

2. Before coming up with your own testable research question using trail camera data, determine whether the following question is testable using trail camera data:

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

Explain your answer and include what information (variables) you would need to study this question and whether you could obtain the information from trail camera data alone.

*Question is testable; you would need to include the data about the limestone gorge habitat. Variables that would be included in the analysis are the season and numbers of animals.*

3. A sample spreadsheet from trail camera data below shows the parameters which are collected from the WildCam database for a set of images. Which research ideas, identified in question 1 above, are potentially testable using this data? Star or circle each idea that you think you could answer.

*Answers will vary.*

Modify your ideas into questions which could be answered with trail camera data, and write your testable research questions below, underlining the variables you can use from the spreadsheet.

*Answers will vary, but the underlined variables of study should correspond to the parameters in the database.*

### PART 2: Hypothesis and Prediction (Expected Results)

4. Based on your observations in Part 1, what might be a hypothesis that would explain the relationships between the variables you are going to explore with your research question?

*Answers will vary.*

5. Based on the information you've learned and gathered so far, what are your expected results? Explain the source(s) of your information you used to make your prediction.

*Answers will vary.*

6. Identify the variables for your testable question.

*Answers will vary.*

### PART 3: Actual Results and Interpreting Data

Use the *Tutorial on Scientific Inquiry Using WildCam Gorongosa* to guide students in downloading the data (Part A of the tutorial) from WildCam Lab (<https://lab.wildcamgorongosa.org/>). Then guide them through making a pivot table and bar graph using the downloaded spreadsheet (Parts B, C, and D of the tutorial).

Students will repeat this process to collect and analyze data for their selected testable research question. Students should submit their graph in a format of your choosing, such as a copy of the Excel file, copy/paste into a separate document, screenshot, etc.

#### PART 4: Analysis and Feedback

Answer the following questions based on the pivot table and graphs you made for your research question:

7. Do you notice any trends in your graph? Explain. *Answers will vary.*
8. Did the data support or disprove your hypothesis? Explain. *Answers will vary.*
9. Were your predictions accurate? Explain. *Answers will vary.*
10. How would you revise or write a different/new hypothesis based on your analysis of the data?  
*Answers will vary.*
11. What are the limitations in using trail camera data in answering your research question?
  - *Trail cameras only take photos of animals that are large enough to be captured by the camera sensors. This technique omits smaller animals.*
  - *More photos are taken of animals that spend a lot of time in front of a camera as opposed to animals that pass by quickly.*
  - *Some individual animals visit the same area repeatedly, so individuals are counted multiple times.*
  - *When comparing across habitats, there may be a bias if some habitats have more cameras in them than others.*
  - *Cameras in open habitats may detect animals in a larger area than those in habitats with dense vegetation.*
12. Research is often a nonlinear, or iterative, process. Input of additional information, revisions to the investigation and peer review happen throughout the research. Explain how you might approach the study of this subject differently were you to conduct similar research again.  
*Answers will vary.*
13. Did the data inspire revised assumptions about Gorongosa and/or the specific animals/places you were exploring? What new questions or ideas do you have?  
*Answers will vary.*

**Optional Extension:** Using the techniques you learned and practiced in this activity, choose another area of study to research (*suggestions: choose different parameters, e.g., day/night, time of year/season*); select a new question or idea from question 13 above or identified at the end of Part 1).

**NOTE:** This revised activity is a collation and synthesis of the following resources:

- Scientific Inquiry Using WildCam Gorongosa
- Gorongosa: Making Observations Activity
- Gorongosa: Scientific Inquiry and Data Analysis

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