

# Student Lab: Troubled Tree Frogs (4-8)

## Program Summary

In this laboratory activity, students will perform an investigation that illustrates how surface area -- and a suite of external conditions -- may affect the rate of evaporation from an object, using a model frog made from sponge. They will learn about the environmental factors that affect tree frog survival in the rainforest, especially as pertains to their characteristically permeable skin, and familiarize themselves with the species found in our Rainforests of the World exhibit. Throughout the program, students will apply scientific process skills by making a hypothesis, following experimental procedure, controlling variables, recording data, and analyzing graphs.

The program begins by having the students set up their experiments in a controlled manner. After they

practice using a precise electronic scale, students 1) weigh sponges which represent tree frogs, 2) use a dropper to add an established amount of water to the "frog", and 3) reweigh their study subject. After all data is record, the "frogs" are set aside until later, undergoing passive evaporation throughout the lab session.

In the meantime, students are led in a discussion of how frogs might use water: from drinking to swimming, from escaping predation to laying eggs for reproduction. Often less obvious to students is that frogs actually need water to breathe. The instructor outlines the different modes of frog respiration, which vary over the animal's lifetime as it changes from a tadpole (gills) to an adult (lungs, skin). Of particular importance is the fact that most frogs actually rely on their moist skin for collecting oxygen from the air, which compensates for the inefficiency of their simple sac-like lungs.

Students are then asked to consider their sponges, comparing and contrasting their study subject with other frogs in the class. By sharing similarities between the sponges (same color, material, shape, etc.), the class highlights the controlled variables in the experiment. By noticing that there are two sizes of sponges in the class, the students discover the one variable under investigation. In partners, they discuss how the size of the sponge may affect the rate at which it dries out, and record a hypothesis as to which sponges -- the population of small frogs, or the population of larger frogs -- will dry out more during the course of the class, being sure to include the reasoning behind their decision.

Next, the students learn about the environmental conditions that may benefit or threaten tree frog survival. Working in groups, they sort cards noting various conditions (high wind, fresh water, etc.) into "good" and "bad" piles, from the perspective of an amphibian with sensitive skin. These decisions are discussed by the class until consensus is reached, leading into a discussion of how bromeliads often serve as a perfect home for tree frogs in the rainforest.

To compile results from their experiment, the students reweigh their sponges, using the structure of the data table to calculate the precise amount of water evaporated from each frog. Each group reports their values to the instructor, who compiles the data in a table projected for all to see. The data are converted automatically into a bar graph, such that students may practice analyzing data in multiple formats. As a class, the students discuss why the data may support or contradict their hypotheses, and propose ways in which one could improve the experiment for a future trial.



## Grade 4

**SCIENCE** LS 3b; I&E 6a, 6b, 6c, 6d, 6e  
**MATH** M&G 1.1, 1.4; SD&A 1.3; MR 2.6

### Life Sciences

3b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

### Investigation and Experimentation

- 6a. Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
- 6b. Measure and estimate the weight, length, or volume of objects.
- 6c. Formulate and justify predictions based on cause-and-effect relationships.
- 6d. Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
- 6e. Construct and interpret graphs from measurements.

### Measurement & Geometry

- 1.1 Measure the area of rectangular shapes by using appropriate units, such as square centimeter (cm<sup>2</sup>).
- 1.4 Understand and use formulas to solve problems involving perimeters and areas of rectangles and squares. Use those formulas to find the areas of more complex figures by dividing the figures into basic shapes.

### Statistics, Data Analysis, & Probability

- 1.3 Interpret one-and two-variable data graphs to answer questions about a situation.

### Mathematical Reasoning

- 2.6 Make precise calculations and check the validity of the results from the context of the problem.

## Grade 5

**SCIENCE** LS 2a; ES 3b; I&E 6e, 6f, 6g, 6h  
**MATH** MR 2.6

### Life Sciences

2a. Students know many multicellular organisms have specialized structures to support the transport of materials.

### Earth Sciences

3b. Students know when liquid water evaporates, it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water.

### Investigation and Experimentation

- 6e. Identify a single independent variable in a scientific investigation and explain how this variable can be used to collect information to answer a question about the results of the experiment.
- 6f. Select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.
- 6g. Record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams) and make inferences based on those data.
- 6h. Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.

### Mathematical Reasoning

- 2.6 Make precise calculations and check the validity of the results from the context of the problem.

## Grade 6

**SCIENCE** I&E 7a, 7b, 7c, 7e  
**MATH** SDA 2.1, 2.4; MR 2.7

### Investigation and Experimentation

- 7a. Develop a hypothesis.
- 7b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- 7c. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
- 7e. Recognize whether evidence is consistent with a proposed explanation.

### Statistics, Data Analysis, & Probability

- 2.1 Compare different samples of a population with the data from the entire population and identify a situation in which it makes sense to use a sample.
- 2.4 Identify data that represent sampling errors and explain why the sample (and the display) might be biased.

### Mathematical Reasoning

- 2.7 Make precise calculations and check the validity of the results from the context of the problem.



## Grade 7

**SCIENCE** LS 5b; I&E 7a, 7c  
**MATH** SD&A 2.1, 2.4; MR 2.7

### Life Sciences

- 5b. Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.

### Investigation and Experimentation

- 7a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- 7c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.

### Mathematical Reasoning

- 2.7 Make precise calculations and check the validity of the results from the context of the problem.

## Grade 8

**SCIENCE** I&E 9b, 9c, 9e

### Investigation and Experimentation

- 9b. Evaluate the accuracy and reproducibility of data.
- 9c. Distinguish between variable and controlled parameters in a test.
- 9e. Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.

