

# SCIENCE·3D

## TIGER REALM

In this packet, sample student answers are provided in **red** and notes to teachers are in **blue**.

In this **STEM Project**, students will use what they have learned to design a study using camera traps to monitor populations of cats with different body sizes and behaviors. Then, they will use the engineering design process to develop solutions to minimize human-tiger conflict.

This activity is designed to help students improve their problem-solving and design skills. You might have students complete all of the activities or pick and choose ones that best fit the learning goals. This project can be done individually, in groups, in class or as homework.

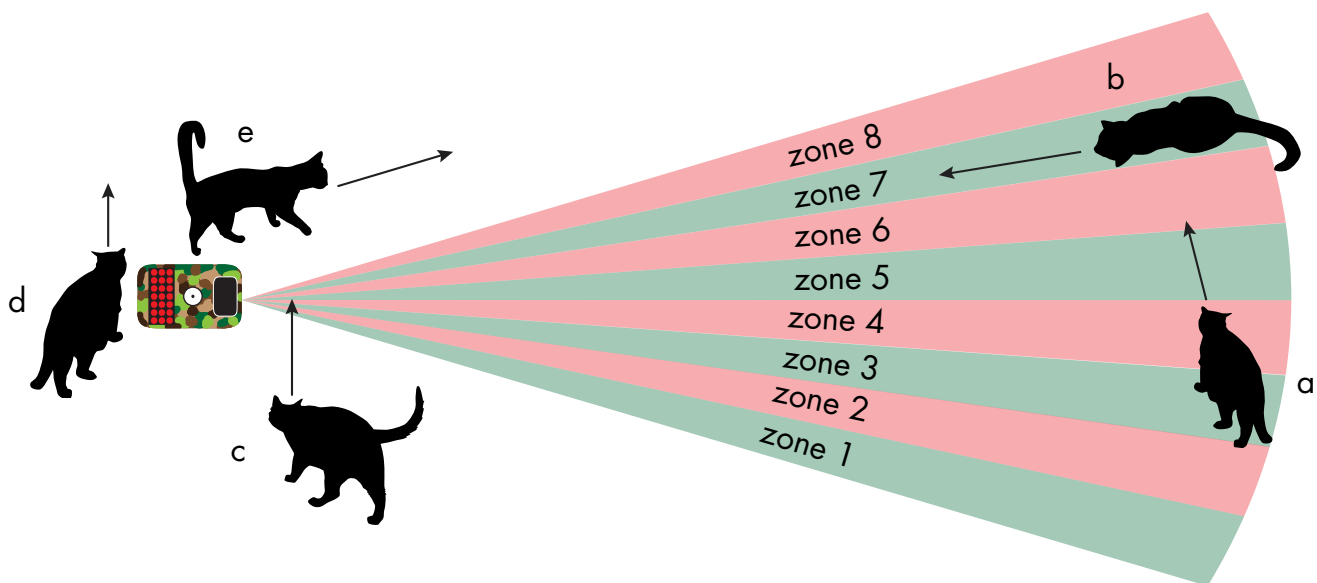
When students complete these activities, consider having them present their ideas to the class. Then, have them update their designs based on feedback. Alternatively, have them work in groups or as a class to develop ideas together.



## ACTIVITY 1: UNDERSTANDING CHALLENGES OF CAMERA TRAPS

Advances in engineering have been really important for studying tigers and other cat species. Camera traps have been used to help count populations of animals on land (like tigers) and in the oceans. Some challenges for camera traps include limited battery life and the memory capacity needed to save and store huge amounts of image and video data. To help with these, camera traps have special sensors to detect movement. When they do, they snap a picture or start the video camera recording for a set amount of time.

Here's how the trigger works. The camera has sensors that create different zones. It detects movement when an object moves from one zone to another. So, depending on how an animal moves it may be detected quickly, or it may not trigger the camera at all.



**Figure 1. An above-angle view of the detection zones from a camera trap and possible movements of animals near it (the image recording area stretches from zone 1 to 8)**

1. **Describe** whether animal "a" or "b" in Figure 1 will trigger the camera first.

Animal "a" will trigger it first because it will move across multiple zones first. Animal "b" is moving within a single zone.

2. **Describe** if animal "c" in Figure 1 will trigger the camera.

Yes, the animal will trigger the camera because it will quickly cross multiple zones.

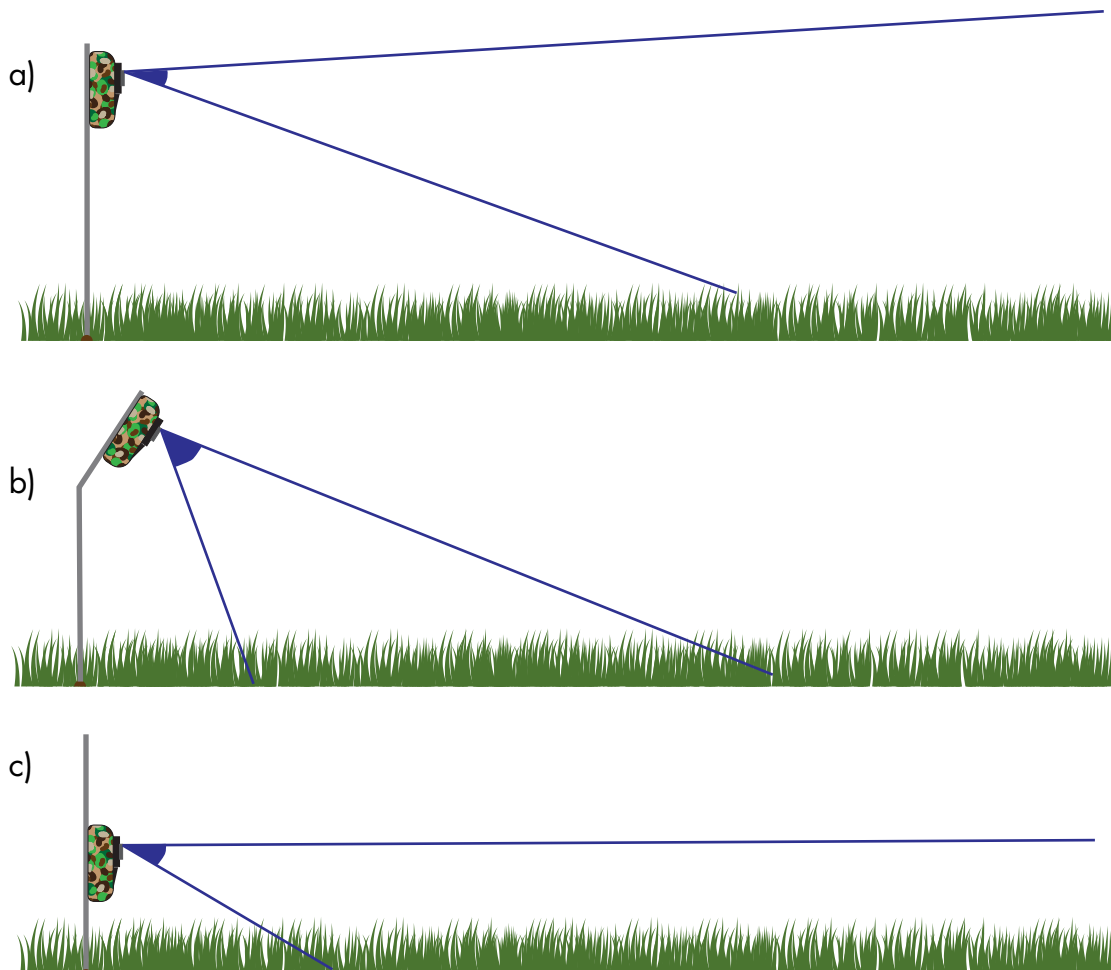
3. **Describe** whether you think it will be a challenge to obtain a good image of animal "c" in Figure 1.

I think there could be a problem of taking a picture of the whole body of animal "c" because it is so close to the camera.

4. **Describe** whether you think it will be a challenge to obtain images of animals "d" and "e" in Figure 1.

I don't think these animals will be recorded at all because they are not going to pass into any trigger detection zones or even in front of the camera.

Figure 2 shows the side view of the area where animals will be within view of the camera and motion detector.



**Figure 2. Detection areas for camera traps placed at different heights and angles as viewed from the side**

5. Using Figure 2, **describe** some of the challenges of positioning a camera appropriately if you are studying species of very different sizes. Hint: What would happen if an elephant walked in front of camera "c"? What would happen if a mouse walked close to camera "a"? What would happen if a tiger walked in front of camera "b" but was far away from the camera?

If a camera trap is positioned too low, it won't get a picture of the whole body of a large animal. It would only record its legs! If a camera trap is positioned too high, small animals may not trigger the camera if they are close to it. If a camera is angled downward, it won't detect animals that are far away.

## ACTIVITY 2: DESIGNING A BETTER CAMERA TRAP

Now it's your turn to think about how to improve the design of the camera traps! Tigers and their prey aren't the only species that we want to collect information on. In fact, there are other cat species in the Nilgiri Biosphere Reserve. Leopards are another large predatory cat that share the forests with tigers. The jungle cat is smaller, only growing to 60 centimeters long and weighing 9 kilograms. The rusty-spotted cat is the smallest cat in the world! It only grows to 35 centimeters long and weighs 1.5 kilograms. Compare that to a tiger that is 250 centimeters long and over 150 kilograms. Another important difference in these species is that tigers often follow set pathways. That makes placing camera traps to detect them easier (just look for tiger tracks). The smaller cats might not follow the same trails that tigers do. Will the same camera traps being used for taking tiger pictures detect and record the other cat species too?





## ACTIVITY 3: REDUCING HUMAN-TIGER CONFLICT

Within protected areas of India, tiger populations have grown quickly. However, to ensure the survival of tigers, populations need to continue to grow. But, as tiger numbers inside the park get larger, there isn't enough space for young tigers to set up their own territories. Finding prey may become harder because of competition with other tigers or other predators like leopards. Some tigers are starting to leave protected habitats to look for new territories or prey. That means they can come into conflict with people. Hungry tigers will eat livestock and are dangerous to people.

1. Your assignment is to develop some methods to reduce conflict between people and tigers without reducing the number of tigers. **Create** a poster or presentation that highlights your solutions. These solutions could involve designing structures or changing how landscapes are managed. They could involve changing how people are allowed to use areas or suggestions on how people should behave or raise livestock. It could involve moving tigers. **List** the *criteria* and *constraints* that you identified for your design. **List** the *benefits* and *drawbacks* of your solution(s).

There are many directions students could go with this assignment. What is important is that they are proposing a feasible solution that considers the benefits and drawbacks. Once students have finished their projects, encourage them to share their ideas with the class. Then have the class discuss the pros and cons of each solution and decide collectively which might be the most effective.

If students find this assignment challenging, have them do online research to see some of the ways India is trying to reduce conflict between people and tigers. They could also investigate lion-human conflict in Africa. A couple news stories on the topic include:

<https://www.bbc.com/news/world-asia-india-49148174>

<https://pulitzercenter.org/reporting/india-moving-people-make-space-tigers>

<https://www.hindustantimes.com/india-news/10-pilibhit-tigers-living-in-fields-may-be-relocated/story-IrBGZroN1NcgcfGNV7AhVJ.html>

<https://www.newindianexpress.com/cities/bengaluru/2019/jun/25/nagarhole-tiger-reserve-in-kodagu-to-get-bigger-1994902.html>