INTRODUCTION
Due to habitat loss and hunting, African elephants and many other animals are in danger of dying out. Determining where these animals live and how large their populations are can help us decide where to focus conservation efforts.

Using an interactive tool, you will simulate methods that scientists have used to determine elephant population sizes. The tool will store the data you collect in several tables. You’ll use these tables to make sense of the data and help explain why these methods are important — not just for elephants but for other populations too.

PROCEDURE
Follow the instructions and complete the questions as you work through this worksheet.

First, open the Elephant Census interactive tool. You’ll use this tool to simulate some of the methods that scientists used for the Great Elephant Census: a large-scale survey that counted elephants across Africa.

Before engaging with the tool, review all of the content in the “Introduction” section, which includes:
- an 8-minute video on the Great Elephant Census
- a “Measure Area” section overview and instructions
- a “Count Elephants” section overview and instructions

Return to this section whenever you need clarification for how to engage with the sections of the tool.

PART 1: The Great Elephant Census
After watching the video in the “Introduction” section, answer the following questions. Be prepared to share your ideas.

1. Why do you think it was important for scientists to do the Great Elephant Census?

2. In the following table, list the advantages and disadvantages of using a sample count vs. a total count to determine the size of a population.

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample count</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total count</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Consider the following questions based on your ideas in the table. You don’t have to answer these questions now, but you will revisit them at the end of this worksheet.

- Why do scientists use sample counts instead of a total count of all elephants in Africa?
- If scientists did a total count of all elephants in Africa, what could happen in the time between starting and finishing that would impact elephant population sizes?

**PART 2: Measure Area**

Navigate to the “Measure Area” section of the interactive tool, which will open a map showing a model of the transects and strips in the video. Observe the map and familiarize yourself with the parts of this model.
- **Transects** are the lines that the airplane flies along. There are two transects of different lengths, labeled Transect A and Transect B.
- **strips** are the areas around a transect that are sampled — that, the areas in which elephants are counted by people flying along the transect. Each transect has two strips with the same dimensions, labeled Strip 1 and Strip 2.

Now you’ll measure the dimensions (length and width) of a strip for each transect, then the entire map. To make the measurements, follow the prompts in the dialogue box in the middle of the map. Additional instructions are provided in the “Introduction” section and are also copied below:

- Make a measurement by placing a start and end point using your mouse/finger or keyboard arrow keys.
  - Place a point by clicking/tapping directly on the map. Or, tab to or click on the crosshair target icon and use the arrow keys to move it into place. Press the Enter key to place a point.
  - After placing the second point, a line will be drawn.
- If you make a mistake placing your points, you can use the “Undo Last” button.
- When you are happy with your measurement, lock it in by selecting the “Submit” button to add it to the sidebar table.
- To reset individual measurements, select the X icon, then select “Reset Cell” in the sidebar table’s cell you wish to reset. You will be prompted to measure again.
- When you have completed all measurements and the sidebar table is populated, the “Send to Data Tables” button will become active.
- Switch to the “Data Tables” section to view data and other calculations.
- To reset the entire “Measure Area” tool, select the “Reset” link at the top of the tool’s sidebar. Note: Resetting the sidebar table will clear the “Data Tables” values associated with this tool.

Note that since Strip 1 has the same dimensions as Strip 2 for each transect, the table will automatically use your Strip 1 measurements for Strip 2. The table will also show a “Total” for each transect that combines the widths of Strips 1 and 2. This represents the total area around the transect that was sampled.

Answer the following questions to help make sense of the data.

3. Data Table 1 shows the total **transect area**, which is the area sampled around Transect A added to the area sampled around Transect B (in other words, the areas of all the strips added together). What is the purpose of adding these areas together?

4. The total transect area covers what percentage of the total map area?
5. How could you use the number of elephants in the transect areas to estimate the number of elephants in the total map area?

6. How might knowing the number of elephants over a large area help us better protect elephant populations?

PART 3: Count Elephants

Navigate to the “Count Elephants” section of the interactive tool. This will show the same map as in the “Measure Area” section, but now with icons representing two types of elephants, tusked and tuskless, as shown in Figure 1:

- **Tusked** elephants are those with tusks (long front teeth that grow outside their mouths). These elephants can use their tusks to fight, gather food, and dig holes for water. However, they may be killed by poachers (illegal hunters) who want to take their tusks for ivory.
- **Tuskless** elephants are those without tusks. Being tuskless is a natural, but usually rare, trait that some African elephants are born with.

![Figure 1. Icons representing a tusked elephant (left) and a tuskless elephant (right).](image)

Now you’ll count the numbers of each type of elephant around each transect, then across the entire map. To complete the counts, follow the prompts in the dialogue box in the middle of the map. Additional instructions are provided in the “Introduction” section and are also copied below.

- Hover, long press, or tab to the elephants to get info about them (e.g., Not Counted, Tusked Elephant, Inside Transect A).
- To count the tusked and tuskless elephants within a transect, click, tap, or tab/enter to select the elephants to add them to the “Current Count.” Repeat the action to deselect the elephant, or use the “Undo Last” button.
  - Tip: Use the keyboard shortcut Alt + A for “All Elephants.”
  - Remember to count elephants in both strips for each transect.
- When you are happy with your current counts, select the “Submit” button to add them to the sidebar table.
- To reset individual group counts, select the X icon, then select “Reset Cell” in the sidebar table’s cell you wish to reset. You will be prompted to count the group again.
- You will then be prompted to count the next group. When you have completed counting all four groups and the entire population, the “Send to Data Tables” button will become active.
- Switch to the “Data Tables” section to view data and other calculations.
- To reset the entire “Count Elephants” tool, select the “Reset” link at the top of the tool’s sidebar. Note: Resetting the sidebar table will clear the “Data Tables” values associated with this tool.

Answer the following questions to help make sense of the data.
7. What did you notice about the elephants and how they were distributed across the map? List your observations here.

8. What might cause the size of the elephant population to change?

9. What might counting the elephants only in the transect areas tell us about the total elephant population?

10. Consider the information on tuskless elephants in your Data Table 2.
   a. What percentage of elephants in the transect areas were tuskless?
   b. What might studying this percentage over time tell us about the elephant population?

11. What might the size of the elephant population tell us about potential resources in their environment?

**PART 4: Data Tables for Elephant Population Densities**

Return to the “Data Tables” section for the Elephant Census tool. Go to Data Table 3, which uses the data you collected in Data Tables 1 and 2 to make some additional calculations.

Answer the following questions to help make sense of these numbers and why they are important. You can select the “i” icons in the table to learn more about certain parts.

12. Based on Data Table 2:
   a. What was the elephant population density (elephants/km²) for Transect A?
   b. What was the elephant population density (elephants/km²) for Transect B?

13. How could you use the values in Question 12 to calculate the “Average density of elephants for transects” in Data Table 3?

14. In one or two sentences, explain what “density” means in the context of populations.
15. Construct an explanation for how the elephant density in the transect areas can help us better understand the total elephant population.

PART 5: Using Sampling to Estimate Population Sizes

Now let’s consider how sample data can be used to estimate total population sizes.

16. How can you use the average density of elephants in the transect (sample) areas to estimate the total number of elephants in the population?

17. Why is estimating numbers often useful for investigating populations of living organisms?

18. Answer the following questions (which previously appeared at the end of Part 1) based on what you’ve learned by doing this worksheet.
   a. Why do scientists use sample counts instead of a total count of all elephants in Africa?
   b. If scientists did a total count of all elephants in Africa, what could happen in the time between starting and finishing that would impact elephant population sizes?

19. Explain why using sample counts to estimate total population sizes could also be helpful for studying other organisms (including other animals, bacteria, plants, etc.).