OVERVIEW

This worksheet complements the [Niche Partitioning and DNA Metabarcoding](#) Click & Learn.

PROCEDURE

In the Click & Learn, you will collect and analyze data to test the hypothesis that herbivore species can coexist in the same habitat because they partition their niches in some way. Follow the instructions in the worksheet to guide you through the Click & Learn and answer the questions below as you progress through different sections.

INTRODUCTION: STUDYING NICHE PARTITIONING

1. Based on previous knowledge, how would you define biodiversity?

2. Why should people be interested in maintaining biodiversity?

Watch Dr. Rob Pringle's video at the beginning of the Click & Learn. Using the arrows to the right of the screen, continue through the background information about Mpala Research Center.

3. How does niche partitioning relate to biodiversity?

4. Why does the presence of 22 large herbivore species at Mpala seem to contradict the competitive exclusion principle Dr. Pringle described in his introduction?

5. Examine the four species of herbivores you will be observing in this Click & Learn. List some similarities and differences between them.

6. All of these species are herbivores and share the same habitat. Coexistence, however, can occur when animals partition their niches in one or more important ways. When it comes to foraging for food, name three ways in which these herbivores may partition their niches.

MODULE 1: Collecting Evidence for Herbivore Niche Partitioning

Proceed through Module 1, including the review questions at the end. After completing Module 1, answer the questions below.

7. Did you find evidence to support the hypothesis that the four herbivore species partition their niches?

8. What is the most likely niche partitioning mechanism for the four Mpala herbivores? Support your claim with evidence.

9. The data for time and vegetation was presented in two formats, tally marks and percentages.

Dik-dik	卌 卌		卌 II	III
Grevy's zebra	卌 II		卌 卌 I	II
Impala	卌 III		卌 II	III
Buffalo	IIII		III	卌 III

Dik-dik	50%	(10)	35%	(7)	15%	(3)
Grevy's zebra	35%	(7)	55%	(11)	10%	(2)
Impala	44%	(8)	39%	(7)	17%	(3)
Buffalo	27%	(4)	20%	(3)	53%	(8)

Which format provided a more useful representation of the data from which to make a claim? Explain your reasoning.
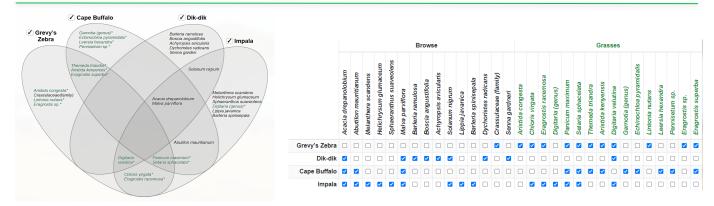
MODULE 2: A More Detailed Look into Dietary Partitioning

In science, research typically leads to more questions, and more research. Sometimes, the new questions can only be answered once new methods and technologies for collecting and analyzing data become available.

10. What technology did you use to make your observations in Module 1? What were two limitations of the technology?

Start working through Module 2, where you will collect dung, identify plant species using DNA barcoding, and analyze the results in several ways.

11. In your own words, describe how DNA metabarcoding works.

12. The data for the herbivores' diets were presented in two different formats, a data table and a Venn diagram.

	Browse															Grasses															
	Acacia drepanolobium	*Abutilon mauritianum*	*Melanthera scandens*	*Helichrysum glumaceum*	*Sphaeranthus suaveolens*	*Malva parviflora*	*Barleria ramulosa*	*Boscia angustifolia*	*Achyropsis avicularis*	*Solanum nigrum*	*Lippia javanica*	*Barleria spinisepala*	*Dychoristes radicans*	*Crassulaceae (family)*	*Senna gardneri*	*Aristida congesta*	*Chloris virgata*	*Eragrostis racemosa*	*Digitaria (genus)*	*Panicum maximum*	*Setaria sphacelata*	*Themeda triandra*	*Aristida kenyensis*	*Digitaria velutina*	*Garnotia (genus)*	*Echinochloa pyramidalis*	*Lintonia nutans*	*Leersia hexandra*	*Pennisetum sp.*	*Eragrostis sp.*	*Eragrostis superba*
Grevy's Zebra	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☑	☑	☐	☑	☑	☑	☑	☑	☐	☑	☑	☐	☐	☑	☑
Dik-dik	☑	☐	☐	☐	☑	☑	☑	☑	☑	☐	☑	☑	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
Cape Buffalo	☑	☑	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☑	☑	☐	☑	☑	☐	☑
Impala	☑	☑	☑	☑	☑	☑	☐	☐	☐	☑	☑	☑	☐	☐	☐	☑	☑	☑	☑	☑	☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

Which representation of the data was most helpful in providing evidence to support your claim? Explain your answer.

Once you have determined the diet profiles of the four herbivores, you will use the formula below to calculate the Sorenson's Index and quantify how similar the different diets are.

$$\frac{2 \times \text{number (no.) of shared plant species}}{2 \times \text{no. shared species} + (\text{no. species for animal 1 only} + \text{no. species for animal 2 only})}$$

13. What does it mean if the Sorenson's Index value is closer to 1?

Finish all the calculations and the review questions.

14. Did the Sorenson's Index calculations provide additional evidence to support your claim for dietary partitioning among the herbivores in Mpala? Explain your answer.

Conclusion: Applying What You Learned

Dr. Pringle's research concluded "that even among herbivores that eat grasses, each herbivore species consumes some plant species that are not eaten by others." Park managers work to restore or maintain the populations of as many different native species as possible.

15. Park managers at a national park in Africa are planning to relocate three grazing herbivores—buffalo, zebra, and wildebeest—that disappeared during a civil war. Make a plan for how they would use the tools and methods in this Click & Learn to determine when and where each species should be relocated to the park.

16. A conservation group in Kenya would like to increase the numbers of Grevy's zebra and other endangered antelopes, such as hartebeests. On the other hand, local cattle herdsmen worry that these native herbivores will compete for food with their cattle. **Explain** how you could investigate their concerns using the tools in the table below and what information you could provide to the herdsmen based on the data collected.

Data collection or analysis tool	Information to communicate to herdsmen
Observation of grazer/browser food selections	
DNA metabarcoding with herbivore (including cattle) dung	
Venn Diagram	
Sorenson's Index	

17. Mpala (shown on the left) has a large diversity of plant species, with around 800 plant species growing in the park. This plant diversity helps support the high number of large herbivore species. Although superficially very similar, the oak savannas of Texas (shown on the right) feature around 250 plant species. Would you expect that the savannas in Texas support more or fewer herbivore species? Explain your answer.