Across the Highway

Model how a barrier may change genetic variation

ES.10 "Use mathematics and graphic models to communicate how human activity may affect genetic variation in organism populations, including threatened and endangered species."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the human-made change, circle the before-and-after counts for one gene variant, and number the possible cause-and-effect steps from fewer crossings to variant loss.

A Road Between Foxes

1. A new highway splits the habitat of a fictional endangered marsh fox population. Forty foxes live on one side. Before construction, foxes sometimes crossed open land and bred with foxes beyond it. After construction, fewer cross safely. This limits gene flow, the movement of gene variants between groups through breeding.

2. Researchers build a simplified model of one gene with variants A, B, and C. Each fox carries two copies, so 40 foxes have 80 copies altogether. The table counts every copy in this model before the highway and several generations later. Variant C still occurs among foxes across the highway.

GENE COPIES IN 40 LOCAL FOXES

Gene variant	Before highway	Several generations later
A	40	60
B	24	20
C	16	0

3. Locally, C falls from 20% of copies to zero, while A rises. Fewer safe crossings can reduce breeding between groups. In a small group, a variant may then disappear by chance over generations. This model shows a possible effect on genetic variation, not proof that a real highway caused these changes.

2 ANSWER WITH EVIDENCE

Use the passage

1. What percentage of local gene copies are A at each time? Use the change to describe what happened to A.

2. How many different variants are present locally at each time? Use the counts to explain what this change shows about genetic variation.

3. Write an arrow chain showing how the highway could lead to the loss of C in the local group. Include where chance plays a role.

4. Does the rise in A from 40 to 60 copies prove that the highway favored A? Explain using the model.

3 YOUR TURN

Your own words

Design a possible count model for these 40 local foxes after a wildlife crossing reconnects them to foxes carrying C. Give counts for A, B, and C that total 80, calculate C's percentage, and explain in one or two sentences why your model is possible but not guaranteed.

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PART 1 · READ AND MARK

Underline the human-made change, circle the before-and-after counts for one gene variant, and number the possible cause-and-effect steps from fewer crossings to variant loss. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What percentage of local gene copies are A at each time? Use the change to describe what happened to A.	**A rises from 40/80, or 50%, to 60/80, or 75%, an increase of 25 percentage points.**
2	How many different variants are present locally at each time? Use the counts to explain what this change shows about genetic variation.	**Three variants are present before the highway and two later. C falls from 16 copies to zero, so this gene has fewer variants in the local group.**
3	Write an arrow chain showing how the highway could lead to the loss of C in the local group. Include where chance plays a role.	**Highway → fewer safe crossings → less breeding between groups → C may disappear by chance in the small local group.**
4	Does the rise in A from 40 to 60 copies prove that the highway favored A? Explain using the model.	**No. The model shows a change in counts and a possible effect of reduced gene flow, but it does not prove the highway caused A to increase. Chance could affect which variants remain.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A: 52, B: 20, C: 8, for 80 copies total. C makes up 8/80 = 10% of the copies. The crossing could let foxes carrying C breed in the local group, but chance and breeding patterns could produce different counts.

Accept any nonnegative whole-number counts totaling 80 with C above zero and a correct C percentage. The explanation should describe a possible effect of renewed breeding without claiming the crossing guarantees the predicted counts.