

Question 2: Analyze an Environmental Problem and Propose a Solution

10 points

A	Based on the information in Figure 1, identify the type of plate boundary that runs beneath Serengeti National Park. Acceptable identification point: • Divergent (boundary)	Point 01
B	Based on the information provided, identify the dominant biome within the Serengeti. Examples of acceptable responses may include the following: • Savanna • Tropical grassland	Point 02
C	Wildebeest give birth to their young when new grasses are growing. Based on the information in Figure 2, identify the location in the Serengeti where wildebeest are most likely to give birth. Examples of acceptable responses may include the following: • Grumeti Game Reserve • The west/northwestern side/edge (of Serengeti National Park)	Point 03
D	Explain why resource partitioning allows for the coexistence of the wildebeest and the gazelle in the Serengeti. Examples of acceptable responses may include the following: • (Resource partitioning) reduces the (negative) impact of competition for (limited) resources. • (Resource partitioning) allows species to use (limited) resources in different ways/places/at different times.	Point 04
E	Describe one way the proposed highway shown in Figure 2 could negatively affect the wildebeest population in the Serengeti. Examples of acceptable responses may include the following: • Building the highway would fragment/destroy habitat/food/resources. • The highway could prevent/reduce/disturb migration. • Wildebeest could be hit/killed by vehicles. • Noise pollution could cause stress/change migratory routes.	Point 05

F **Propose** a solution to the negative effect created by the planned highway described in part E. **Point 06**

Examples of acceptable responses may include the following:

Problem in part E	Realistic Potential Solution
Building the highway would fragment/destroy habitat/food/resources.	- Construct a habitat corridor over/under the highway - Construct the highway over/above the habitat - Relocate the highway north/outside of the migratory path - Expand the national park/create additional protected habitat
The highway could prevent/reduce/disturb migration. Wildebeest could be hit/killed by vehicles.	- Relocate the highway north/outside of the migratory path - Construct a habitat corridor over/under the highway
Noise pollution could cause stress/change migratory routes.	- Install a sound barrier to mitigate noise pollution - Relocate the highway north/outside of the migratory path

G **Describe** a characteristic of an invasive species, such as the spotted knapweed, that allows them to outcompete native species. **Point 07**

Examples of acceptable responses may include the following:

- They have many offspring/reproduce quickly/mature early/invest minimal energy in each offspring (tend to be r-selected).
- They can feed on/use many different types of resources.
- They can survive in conditions outside their normal habitat/have a wide range of tolerance (tend to be generalists).

H **Justify** the use of crop rotation as an environmental solution by providing an additional advantage, other than controlling pest populations. **Point 08**

Examples of acceptable responses may include the following:

- Improved soil fertility/soil structure/soil quality
- Increased nutrient cycling/reduction in fertilizer use
- Reduced soil erosion
- Increased food security/crop yield
- Increased biological activity (in the soil)

I	Describe an environmental problem associated with controlling pest populations with large amounts of pesticide. Examples of acceptable responses may include the following: • Pesticides can harm/kill nontarget species. • Pests can develop resistance to the pesticide.	Point 09
J	Propose a solution to controlling pests, other than pesticides or crop rotation. Examples of acceptable responses may include the following: • Use biocontrol/intercropping/natural predators • Trap insects/use mechanical controls to eliminate the pests • Use genetically modified crops that are pest resistant	Point 10

Question 3: Analyze an Environmental Problem and Propose a Solution**Doing Calculations****10 points**

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- (a) **Describe** a characteristic of a specialist species that would make the specialist species more likely to be negatively affected by habitat fragmentation than a generalist species. **1 point**

Accept one of the following:

- Specialists have narrow ecological niches compared to broad niches of generalist species, which are reduced even further by habitat fragmentation.
- Specialists with specialized adaptations are unable to adapt quickly, making them more vulnerable to habitat fragmentation than generalists that adapt quickly.
- Specialists tend to have small populations with less genetic variation than generalist species with larger populations and more genetic variation, making specialists more vulnerable to habitat fragmentation.

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- (b) **Identify** the symbiotic relationship between the wood thrush and the cowbird. **1 point**

Accept one of the following:

- Parasitism
- Brood Parasitism
- The cowbird uses the wood thrush (as the surrogate parent) to raise their hatchling, which negatively affects the wood thrush and benefits the cowbird.

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- (c) **Describe** one ecological advantage of leaving areas of undeveloped forest in the development plan as compared to clear-cutting the property. **1 point**

Accept one of the following:

- Since the habitat isn't being clear-cut, it does preserve some biodiversity by allowing some of the species to survive in the fragmented areas of the forest.
 - Habitat fragmentation can benefit some generalist species or species which thrive in edge habitat, leading to population increases for those species.
 - If planned with buffer zones around targeted conservation areas, edge disturbances for specialist species can be reduced.
 - The remaining forest/trees will reduce soil erosion.
 - The remaining forest will help with climate/cooling resulting from transpiration/shade from trees.
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- (d) **Propose** a solution that will minimize the effect of development on the resident population of wood thrush while still meeting the municipality's need for a housing development. **1 point**

Accept one of the following:

- Leave areas for wildlife corridors/crossings to prevent isolating populations.
- Include conservation easements in the plan that will preserve species and also provide tax breaks for the residents.
- Create buffer zones near the development to separate it from wildlife habitat.
- Create a mitigation plan that preserves land elsewhere of similar quality.
- Cluster housing or vertical development to limit the development footprint.
- Incorporate common green spaces that promote wood thrush populations.

- (e) A male wood thrush needs a minimum of 800 m² of territory for reproduction. The municipal development committee has set a biodiversity preservation target of 275 male wood thrush territories. **Calculate** the area that must be set aside to support the goal of 275 male thrush territories. **Show** your work. **1 point**

One point for the correct setup to calculate the area:

- $275 \text{ territories} \times \frac{800 \text{ m}^2}{1 \text{ territory}}$

One point for the correct calculation of the area: **1 point**

- 220,000 m²

Total for part (e) 2 points

- (f) A real estate developer wants to build houses on the property. The plan will support 1,000 lots with a lot size of 1,100 m². The developer has proposed setting aside land equal to 10% of the size of each lot it sells. **Calculate** the maximum number of male wood thrush territories that could be created under this proposal. **Show** your work. **1 point**

One point for the correct setup to calculate the number of male wood thrush territories:

- $1,000 \text{ lots} \times \frac{1,100 \text{ m}^2}{1 \text{ lot}} \times 0.10 \div 800 \text{ m}^2 \text{ per territory}$

One point for the correct calculation of the number of male wood thrush territories, accept one of the following: **1 point**

- 137.5 male wood thrush territories
- 137 male wood thrush territories
- 138 male wood thrush territories

Total for part (f) 2 points

- (g) **Calculate** the percentage of each of the 1,000 lots that would need to be set aside in order to support the goal of 275 male wood thrush territories. **Show** your work. **1 point**

One point for the correct setup to calculate the percentage of each lot to be set aside:

- $\frac{220,000 \text{ m}^2}{1,100,000 \text{ m}^2} \times 100$
- $275 \text{ territories} \times \frac{110,000 \text{ m}^2}{137.5 \text{ territories}} \div 1,100,000 \text{ m}^2 \times 100$
- $\frac{275 \text{ territories} \times 10\%}{137.5 \text{ territories}} \times 100$

One point for the correct calculation of the percentage of each lot to be set aside: **1 point**

- 20% of each lot

Total for part (g) 2 points

Total for question 3 10 points