

**Question 1: Design an Investigation****10 points**

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| <b>A</b> | <p><b>Describe</b> one reproductive strategy used by a K-selected species such as the chickadee. <b>Point 01</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• (K-selected species) provide considerable parental care for offspring.</li> <li>• (K-selected species) have few offspring.</li> <li>• (The parents) expend significant energy for each offspring.</li> <li>• (Individuals) reproduce more than once in their lifetime.</li> <li>• (K-selected species) have a long gestation period/reach reproductive maturity later.</li> </ul>                             |
| <b>B</b> | <p>Based on the information provided, <b>explain</b> how a decrease in spider populations could affect a lower trophic level. <b>Point 02</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• Insects/insect populations would increase because the insects are not being preyed on/eaten as much.</li> <li>• Plants/plant populations would decrease because the number of insects that eat plants will increase.</li> </ul>                                                                                                                                                  |
| <b>C</b> | <p>Based on the data in Figure 1, <b>identify</b> the number of spiders per sample at 25% nonnative plants. <b>Point 03</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• 2.0</li> <li>• 2</li> </ul>                                                                                                                                                                                                                                                                                                                                                                        |
| <b>D</b> | <p>Based on the data in Figure 1, <b>describe</b> the trend in the number of insects per sample in relation to the percentage of nonnative plants. <b>Point 04</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• As nonnative plant percentage/percent increases, the number of insects decreases.</li> <li>• As nonnative plant percentage/percent decreases, the number of insects increases.</li> <li>• They have an inverse/indirect/negative relationship.</li> </ul>                                                                                                   |
| <b>E</b> | <p>Scientists hypothesized that the population of chickadees would be stable or growing with fewer than 25% nonnative plants. <b>Describe</b> one way that the data in Figure 2 support this hypothesis. <b>Point 05</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• Below this level/With fewer than 25%, the growth rate is at/above replacement level.</li> <li>• Below this level/With fewer than 25%, enough reproduction is occurring to replace the population.</li> <li>• Below this level/With fewer than 25%, the population growth rate is positive.</li> </ul> |

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| <b>F</b> | <p><b>(i) Identify</b> a likely scientific question for the students' investigation of ant diversity. <b>Point 06</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• Does the number of species/species richness/biodiversity differ between an urban park and a grassland?</li> <li>• Does mowing affect the number of species/species richness/biodiversity?</li> </ul>                                                                                                                                                                                                                                                                             |
|          | <p><b>(ii) Identify</b> the dependent variable in the students' investigation. <b>Point 07</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• Number of ant species</li> <li>• Ant species richness</li> <li>• Presence/absence of different ant species</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>G</b> | <p><b>(i) Explain</b> why the ant community of the unmowed grassland would be more likely to recover from a disturbance, such as a flood or fire, than the ant community in the mowed urban park would. <b>Point 08</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• With a larger number of species, the grassland is more likely to have some species/individuals with adaptations that allow them to survive.</li> <li>• The grassland is more diverse, so the loss of one species is less likely to cause a collapse (of the whole ecosystem).</li> </ul>                                                                                       |
|          | <p><b>(ii) Explain</b> how the results of the investigation could have been altered if students had measured ant biodiversity at a paved playground rather than in the grassland. <b>Point 09</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• (The playground) would have fewer species (than the grassland/urban park) because the paved area is not suitable habitat for many ant species.</li> <li>• (The playground) would have fewer species (than the grassland/urban park) because humans could trample the ants/ant habitat.</li> </ul>                                                                                                    |
| <b>H</b> | <p><b>Describe</b> one effect a paved road in a forest can have on animal species such as deer or bears. <b>Point 10</b></p> <p>Examples of acceptable responses may include the following:</p> <ul style="list-style-type: none"> <li>• Animals can get hit by cars when trying to cross the road/hunt/migrate.</li> <li>• Fragmentation can lead to isolation of individuals/loss of genetic diversity.</li> <li>• Noise pollution can damage hearing/cause stress/mask the sounds used to communicate/hunt.</li> <li>• The road/noise pollution can cause changes in migratory routes/prevent movement of animals (to access resources).</li> <li>• Species that thrive in edge habitats might increase.</li> </ul> |

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

- (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.

- (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.

- (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.

- (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 m<sup>2</sup> 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:

$$220,000 \text{ m}^2$$

**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 m<sup>2</sup>. 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:

- 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**