

# Reflection Section Answer Guide

## The Golden Egg

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### Introduction

- **In your own words and in the form of a question, state the problem the scientists were trying to solve.** *How can managers maximize the amount of hiking while also ensuring the protection of the golden eagle and their nesting sites?*
- **Why do you think scientists were trying to maximize hiking and protection of the golden eagle nests?** *The Organic Act, which created the National Park Service, mandates that managers of national parks need to protect the environment, plants, and animals while ensuring that people have an opportunity to enjoy their experiences at the park. Also, eagles are protected by laws.*

### Methods

- **Why do you think the scientists chose to study only 25 territories instead of all 93 territories?** *The scientists limited their study to 25 territories because they thought the 25 territories would be the ones most affected by hikers.*
- **Why do you think scientists used three different models in their study?** *Three models present a wider range of possible effects of hiking restrictions than just one model.*

### Findings

- **Why do you think that when snowshoe hare abundance is low, more hiking areas need to be closed?** *Because snowshoe hares are a main part of the golden eagle diet. When the number of snowshoe hares is low, the*

*golden eagles are under more stress. Limiting hiker access during this time may serve to reduce some stress on the golden eagles.*

- **Based on the findings you read, do you think hiking has any effect on golden eagle nesting? Why or why not?** *Students will have individual answers to this question. They should, however, note that under model 2, hiking had at least a small effect on golden eagle nesting. In Model 3, hiking had a larger negative effect on eagle nesting.*

### Discussion

- **Do you think that making management decisions based on the models in the paper is better than waiting until more data are available? Why or why not?** *Students will have individual answers to this question. Students need to use reasoning and facts from the article to back up their assertions.*
- **Do you think scientists and managers need to take this much effort to protect golden eagles? Why or why not? (Hint: Review figure 3.)** *Students will have individual answers to this question. Based on figure 3, however, they should realize that golden eagles have special legal protection and, therefore, efforts to protect golden eagles are appropriate.*

## At Your Service

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### Introduction

- **What was the problem the scientists were trying to solve? How can managers best identify management priorities as they manage a changing natural environment?**

- **Identify one area of your life in which you have to set priorities.** *Students will have individual answers to this question. Some possible answers include: How should they spend their time; Which school activities are most important; Which values are most important, and so on?*
- **What is one similarity between your need to set priorities and the managers' need to set priorities?** *Students will have individual answers to this question. Some possible answers are not having enough time and money to do everything, and one's desire to reach a goal or objective.*

## Methods

- **Look at figures 3 and 4. Pick one of these figures and explain it in your own words.** *Students will have various ways to describe these figures. Figure 3 is easier than figure 4 to explain. In figure 4, the models show that as high use continues, disturbance will lead to degradation of the ecosystem at some point. As a result of degradation, fewer ecosystem services will be provided by the ecosystem.*
- **Look at figure 7. Do you think these variables completely described southeastern Alaska's ecosystems? Why or why not?** *Students will have individual answers to this question. They should, after careful consideration, come to the conclusion that this list of variables does not completely describe ecosystem services, use, and disturbance in southeastern Alaska. Many other variables could have been included. To give students a hint, have them read the partial list of ecosystem services in the Introduction and ask them if all of those services have been measured by the variables in figure 7.*

## Findings

- **Which illustration in figure 4 describes the situation in which the scientists were most interested?** *The one in the upper right (B), showing high provision, use, and disturbance. **Based on this model, what is likely to happen to an ecosystem described by illustration B?** Students should look at illustrations C and D and realize that, over time, provision will decrease, leading to a decrease in use. Disturbance will remain high, at least for a while.*
- **How will the identification of high provision, high use, and high disturbance areas help managers make better natural resource decisions?** *If the scientists' model is correct, the managers will be able to predict what might happen to the ecosystems in the future. If managers can predict what might happen in the future, they can make decisions that will lessen ecosystem disturbance.*

## Discussion

- **If you were a scientist doing this study, would you recommend that managers base their natural resource management decisions on the map in figure 9? Why or why not? (Hint: Reread the first paragraph in the "Discussion" section.) What is one advantage and one disadvantage of basing management decisions on the map in figure 9?** *Students should realize that the map in figure 9 was made without sufficient information to base real decisions. This would be the primary disadvantage. An advantage of using the map is that having some information upon which to base decisions is better than having no information.*

- **Explain in your own words how models and mathematical equations can help natural resource managers make better decisions about changing ecosystems.** *Students will have individual answers to this question. They should realize that after the models and equations are developed, new data can be used in the equations as they become available. In that way, managers can change their management decisions if need be, as new information becomes available. Students may also realize that as better variables are identified and measured, models will become more accurate predictors of future conditions.*

## Tying the Knot

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### Introduction

- **In your own words and in the form of a question, state what the scientists wanted to know.** *How will different management decisions about the harvest of horseshoe crabs affect the red knot population?*
- **Do you think it is important for managers to define objectives for their management decisions? Why or why not?** *Students will have individual answers to this question, but they should back up their answers with logic and reasoning.*

### Methods

- **Why do you think scientists wanted a population model for horseshoe crabs that looked at both male and female horseshoe crabs?** *Scientists thought that a difference might exist between the effect of male and female horseshoe crab harvesting on red knot populations.*

- **Why did the scientists consider different possible management actions?** *Students will have individual answers to this question. They should realize, however, that the use of models to explore what would happen in the models under different levels of harvesting horseshoe crabs was a way to predict how the size of the red knot population is related to the number of horseshoe crabs harvested.*
- **Why did the scientists group the red knots into two weight categories?** *Students may need help with this question. The heavy red knots were assumed to have eaten a lot of horseshoe crab eggs. The light red knots were assumed to have eaten fewer horseshoe crab eggs. If the scientists found no difference between the two weight categories, they would conclude that the consumption of eggs and, therefore, the numbers of horseshoe crabs had little to do with the declining red knot population.*

### Findings

- **Why do you think harvesting only male horseshoe crabs had little effect on red knot abundance?** *Red knots gain their weight from horseshoe crab eggs. The males do not lay eggs so the males' absence did not have a great effect on red knot abundance.*
- **If you were the scientist, would you recommend that horseshoe crab harvests be limited in the future? Why or why not?** *Students will have individual answers to this question. They should realize, however, that if the red knot population is to survive into the future, the horseshoe crab harvest will need to be limited.*

## Discussion

- **Do you think this model will be useful to land managers and natural resource professionals? Why or why not?** *Students will have individual answers, but should use logic and examples from the text to back up their assertions.*
- **Should the scientists continue to estimate the populations of horseshoe crabs and red knots next year? Why or why not?** *Students will have individual answers to this question, but they should realize that continual monitoring of populations will be necessary to understand what is happening, what should be done to conserve the populations, and that new decisions will be made after evaluating each cycle of monitoring data.*

## Cedar Waxing or Waning?

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### Introduction

- **What change did the scientists observe in the north Pacific coastal rainforest?** *They observed that yellow-cedar trees were dying. Students may also note on their own, from hints given in the “Introduction,” that the climate was changing.*
- **Name two reasons why yellow-cedar is important to Alaskans.** *You must read “What Is Yellow-Cedar” on page 53 before you answer this question. Students will have different answers to this question. They should name the Alaska Native cultural uses of yellow-cedar, such as for totem poles, baskets, shelter, canoe paddles, and clothing. Students may also mention the importance of selling yellow-cedar for disease-resistant and decay-resistant wood products.*

- **What might be lost if yellow-cedar trees continue to die in the north Pacific coastal rainforest?** *You must read “What Is Yellow-Cedar” on page 53 before you answer this question. This question is a logical extension of the previous reflection question. The Alaska Native cultural values of yellow-cedar will be diminished or lost, and less money would be made from the sale of yellow-cedar for wood products.*

### Methods

- **Examine figure 5 and reread the final two paragraphs of the previous section. What do you think the scientists discovered about the cold tolerance of yellow-cedars?** *Because the onset of yellow-cedar tree death begins with fine root death, it appears that yellow-cedar’s fine roots may not be as tolerant of cold weather as western-hemlock roots. If the roots are less cold-tolerant, then cold temperatures near the ground may be the cause of yellow-cedar death.*
- **How might climate change be involved in the death of yellow-cedar fine roots?** *Students will have individual answers to this question. Help students think through why, after thousands of years of survival, a warming climate may cause cold temperatures near the ground to freeze the fine roots of yellow-cedar trees. The clue is in the final paragraph of the “Methods” section.*

### Findings

- **A paradox is a seeming contradiction. What is the paradox of this study’s findings?** *Students will have individual answers to this question. They should, however, realize the seeming contradiction that a warming climate is leading to colder soil temperatures and resulting in the freezing of fine roots that are near the soil surface.*



- **Reread “Thinking About the Environment.” What do you think the scientists recommended to help keep yellow-cedar trees alive in Alaska?**

*Students will have individual answers to this question. The clue provided in “Thinking About the Environment” should lead them to guess the scientists recommended that yellow-cedar trees be planted in more suitable environments with adequate spring snow cover. These would most likely be found at higher elevations. The finding that yellow-cedar trees were dying in wet soils with shallow roots should be another clue. The scientists recommended that yellow-cedar trees be planted in areas with deeper, well-drained soils.*

## **Discussion**

- **Adaptive management is a way to manage natural resources so the best decisions can be made under changing conditions. Explain how the scientists’ recommendation about yellow-cedar can be used in adaptive management.**

*Students will have individual answers to this question. Students should realize, however, that adaptive management could include planting yellow-cedar trees experimentally in areas to see where they can survive best as the climate continues to change. Urge students to include monitoring as a part of adaptive management.*

- **Why would yellow-cedar trees need managers’ help to move into a more suitable environment? See “Thinking About the Environment” for a clue.**  
*Students will have individual answers to this question. They should realize, however, that slow-growing yellow-cedar trees may not be able to germinate and grow fast enough in new habitats to keep up with the changing climate.*
- **How could the model in figure 8 be used in adaptive management?** *Students will have individual answers to this question. They should, however, recognize that the model in figure 8 can be used to guide a management plan for planting yellow-cedar in colder environments and to aid in the development of a plan for monitoring the success of yellow-cedar plantings.*