

CHAPTER 31 CONSERVATION BIOLOGY

TIPS FOR MASTERING KEY CONCEPTS

Around the world, species are going extinct at an accelerating rate, primarily due to the activities of humans, and at great cost ecologically and economically. In the new discipline of conservation biology, scientists are studying which species are most vulnerable and why, and are designing conservation and recovery plans in an effort to stem the losses. There have been, and will continue to be, both successes and failures in these complex, imperative efforts.

31.1 The new science of conservation biology is focused on conserving biodiversity.

- Extinction of species is a natural process, but humans have greatly increased the rate of this loss of biodiversity.
- There are pockets of high biodiversity (hot spots) that still remain scattered around the world.
- With loss of biodiversity, we are losing species that contribute (in the form of food, shelter, clothing, medicine, fuel, and aesthetics) to our quality of life and financial well being, as well as contribute to ecosystem stability.

31.2 Vulnerable species are more likely to become extinct.

- Species are more in danger of going extinct if they have a limited geographic distribution, a small and/or declining population size, low genetic diversity, or are used by humans in some way.
- Because of the ecological interdependence of organisms, the loss or decline of one species can have a cascading impact throughout an ecosystem and endanger other species.

31.3 Causes of endangerment usually reflect human activities.

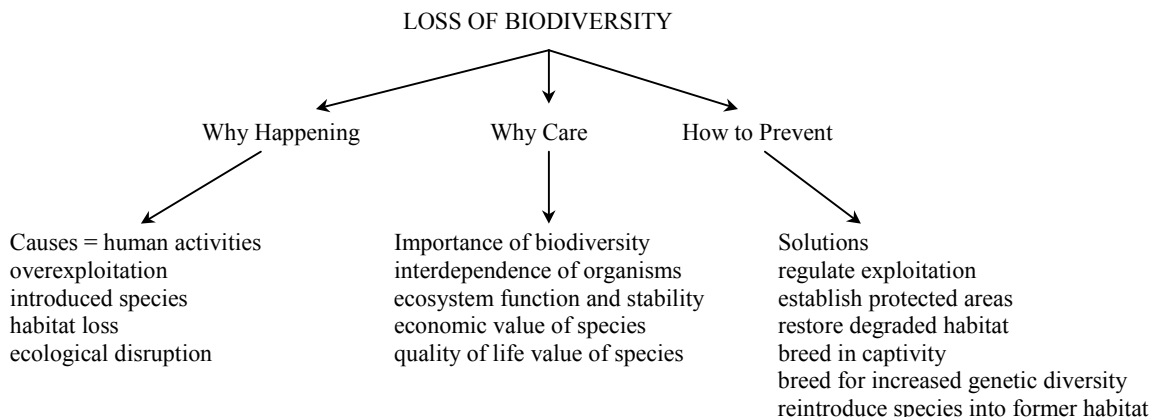
- As humans alter the environment around them, especially on a large scale and short time frame, it has a negative impact on other species.
- The degradation, fragmentation and outright loss of habitat caused by humans is the single biggest factor contributing to species extinction today.
- Other significant factors include overexploitation of species and natural resources by humans, species introduced into an area by humans that compete with or eat the native species, human disruption of ecological relationships in an ecosystem, and loss of genetic diversity.

31.4 Successful recovery plans will need to be multidimensional.

- The first step in trying to save a species from extinction or restore an ecosystem is to understand why they are threatened - which also requires knowing their basic biology.
- There are many possible options for helping promote species and ecosystem conservation and recovery: restoring habitat, regulating exploitation, removing introduced species, maintaining or increasing genetic diversity, captive breeding and reintroduction of species into their former habitats.
- Since all organisms need a suitable place in which to live and are dependent on other organisms, it is more effective to focus on preserving and restoring whole ecosystems rather than individual species.
- The larger the protected area, the greater the chances of species survival, but cost and human needs will play important roles in determining sizes of reserve.

MAP OF UNDERSTANDING

The maps given below show the relationship of the concepts to each other. They should help you organize the information.



KEY TERMS

31.1

megafauna
endemic
hot spots
gene prospecting
endangered

31.2

minimum viable
population
population viability
analysis
demographic stochasticity

genetic stochasticity
metapopulations

31.3

edge effects

31.4

community importance
megareserves

LEARNING BY EXPERIENCE

1. Consider the following scenario: you are the leader of a tropical country that is very poor, has a rapidly growing human population, and is rapidly losing its forests for three main reasons – harvesting to sell the lumber to other countries, clearing land to graze cattle to export beef, and clearing by subsistence-level farmers (which are the majority of your citizens). You are under pressure from international conservation organizations to stop or at least decrease the loss of the tropical forests and all their resident species. What do you do? What do you think your Minister of the Environment, Minister of Economics, and Minister of Human Welfare will advise you to do? *[Write out your answer, or stage a discussion/debate with some of your classmates – each could play a different role and represent a different viewpoint. Remember, these are complex issues and there are no easy answers.]*
2. While restoring a severely degraded ecosystem to pristine conditions is an admirable goal, it is virtually impossible to do. List the reasons why this is so.
3. Draw a design for a megareserve, labeling the different use zones and explaining why you chose the design you did.

EXERCISING YOUR KNOWLEDGE

Briefly answer each of the following questions in the space below.

1. Major extinction events have occurred in the past and species diversity has recovered each time. Why are many scientists worried that diversity may not be able to come back this time?
 2. Species have both direct and indirect economic value to us. What is the primary difference between these two value categories?
 3. What characteristics make a species vulnerable to extinction?
 4. Why are introduced species potentially so harmful?
 5. Why does the loss of genetic diversity make a species more vulnerable to extinction?
 6. What terms apply to solutions to the biodiversity crisis?
 7. Why are megareserves effective?
 8. Using the plight of the black rhinoceros as an example, explain how recovery plans for endangered species often involve compromises.
 9. Why is it important to protect the keystone species in an ecosystem?
 10. What are the biggest problems facing conservation biologists as they try to formulate species recovery plans?
- Circle the letter of the one best answer in each of the following questions.
11. Over the last several centuries, the rate of species extinction has been
 - a. increasing
 - b. decreasing
 - c. holding steady
 - d. fluctuating wildly
 - e. no one knows
 12. The majority of extinctions in recent times have occurred
 - a. in Africa
 - b. in South America
 - c. on the northern continents
 - d. on islands
 - e. in the oceans
 13. Which state has the greatest number of endemic species?
 - a. Florida
 - b. Texas
 - c. Alaska
 - d. New York
 - e. California
 14. When talking about biodiversity, the term “hot spots” refers to areas that have a lot of
 - a. pollution
 - b. global warming
 - c. poaching
 - d. endemic species
 - e. endangered species
 15. Approximately what percentage of the prescription and non-prescription drugs on the market today contain active ingredients extracted from plants and animals?
 - a. 20%
 - b. 40%
 - c. 60%
 - d. 75%
 - e. 80%

16. The estimated number or density of individuals necessary for a population to maintain or increase its numbers is called the
- minimum viable population (MVP)
 - population viability analysis (PVA)
 - community importance factor (CIF)
 - metapopulation
 - carrying capacity
17. Use the following scenario to answer Questions 17–19. Tropical forests in South America are being clear cut, but patches of the original forest are being left in various sizes, surrounded by clear cut areas. Scientists are monitoring three such patches: A is 10,000 acres in size, B is 1,000 acres and C is 100 acres. In which of the patches would you expect to see the greatest decrease in both the size of populations (number of individuals) and the number of species present?
- A
 - B
 - C
 - there should be equal losses in all three
 - there should be no losses in any of them
18. Species living in patch B are likely to be impacted in a negative way by
- habitat fragmentation
 - the edge effect
 - increased exposure to parasites and predators
 - all of the above
 - none of the above
19. Which patch is likely to experience the greatest edge effect?
- A
 - B
 - C
 - they should all experience an equal edge effect
 - none of them should experience an edge effect
20. The single greatest factor threatening species today and causing their extinction is
- loss of genetic variability
 - loss of habitat
 - introduced species
 - overexploitation
 - ecodisruption
21. What is the single biggest cause of habitat loss today?
- cutting of forests
 - pollution
 - draining of wetlands
 - buildings and pavement
 - rising sea levels
22. Which type of habitat tends to be the most vulnerable to pollution?
- mountains
 - forests
 - prairies
 - deserts
 - aquatic
23. Which of the following is an example of a species that was threatened with extinction because of overexploitation of it by humans?
- black-footed ferret
 - peregrine falcon
 - Lake Victoria cichlids
 - right whales
 - all of the above
24. Eutrophication is linked to the death and extinction of
- song birds
 - passenger pigeons
 - humpback whales
 - prairie chickens
 - Lake Victoria cichlids
25. In what year did the International Whaling Commission institute a worldwide moratorium on the commercial killing of whales?
- 1935
 - 1946
 - 1952
 - 1974
 - 1986
26. All of the following endangered species have been bred successfully in captivity for reintroduction into the wild EXCEPT for the
- passenger pigeon
 - California condor
 - black-footed ferret
 - peregrine falcon

27. Which of the following would NOT be a good recovery plan for an endangered species?
- move all the remaining individuals into a totally different but protected natural area
 - try to maintain and increase the genetic diversity
 - try to preserve or restore the organism's habitat
 - pass legislation to protect the species
 - begin a captive breeding program
28. By definition, megareserves are
- small
 - large
 - tropical
 - temperate
 - aquatic
29. Which is a more serious problem for Asian rhinoceros, being killed for their horns or habitat loss?
- being killed for their horns
 - habitat loss
 - they are equally serious
 - neither is a problem for the Asian rhino; they are not endangered
30. More and more conservation efforts today are focusing on saving
- microscopic organisms
 - charismatic megafauna
 - plants
 - intact ecosystems

ASSESSING YOUR KNOWLEDGE

Testing Your Knowledge - Answers

Answers to the questions in this section test your ability to synthesize information gained from the entire chapter and to solve challenging problems on an exam or in everyday life.

1. no single right or wrong answer, and no easy answers; have to consider multiple factors (e.g., habitat protection, economic development, quality of life for people, cost of plans); should try to obtain sustainable use of forests that will generate revenue, training/education for farmers, international financial support to help.
2. can never get back to the exact same environmental conditions and the exact same species assemblages; ecosystems are too complex; the restoration will have a different starting point and there will be different influences and interactions over time than would have occurred in the original ecosystem.
3. no single right drawing; a megareserve should have a buffer zone with multiple uses surrounding the protected areas.

Assessing Your Knowledge -Answers

As you check your answers, put a mark in the Review (Rvw.) column for the answers you missed. If you didn't miss any, congratulations – you have mastered the chapter! If you missed some, review the Section (Sect.) in the text where this concept is discussed. In order to develop an efficient review strategy it is important that you understand what types of questions you missed. The questions with asterisks test more for understanding of the **concepts**, whereas the others test more for **detail**. *See the Preface for details about learning strategies for concepts and for detail.*

	Sect.	Rvw.
*1. species recovery in the past has taken millions of years, it is not quick; also, humans are overexploiting resources and destroying habitats so there will not be much available for new species	31.1	
*2. with direct economic value the benefit is obtained by directly using or consuming the species; with indirect, the benefit is obtained because of what the species do in their normal functioning rather than by us consuming them	31.1	
*3. small population size, a single population instead of many, low genetic variability, hunted or harvested by humans, very specialized niche requirements	31.2	

*4. introduced species may not have any predators or parasites to help limit their population size in the new habitat; they have to eat, and native species will not have had the opportunity to evolve any defenses against these particular herbivores or predators; they may be able to outcompete the native species for limited resources	31.3	
*5. loss of genetic diversity decreases the likelihood that at least some individuals will be adapted to future changes in the environment that come along	31.3	
*6. solutions to the biodiversity crisis are complex, expensive and must be multidimensional	31.4	
*7. megareserves are effective because they recognize human and economic needs and provide limited-use buffer zones around the protected core areas	31.4	
*8. black rhinos illustrate that in trying to increase genetic diversity, unique adaptations of local subspecies may be lost	31.4	
*9. keystone species must be protected because they are crucial to the structure and functioning of the whole ecosystem and all of its species	31.4	
*10. lack of data, time and financial resources	31.4	
11. a	31.1	
12. c	31.1	
13. e	31.1	
14. d	31.1	
15. b	31.1	
16. a	31.2	
*17. c	31.3	
*18. d	31.3	
*19. c	31.3	
20. b	31.3	
21. a	31.3	
22. e	31.3	
23. d	31.3	
24. e	31.3	
25. e	31.3	
26. a	31.4	
*27. a	31.4	
28. b	31.4	
29. b	31.4	
*30. d	31.4	