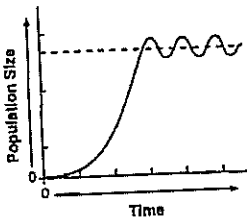
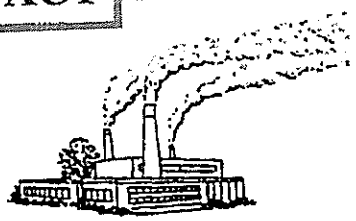
ECOLOGY AND HUMAN IMPACT





Overview:

Ecology is the scientific study of the relationships and interactions that living organisms have with respect to each other and their natural environment. Ecology involves an understanding of the components of nature and how these different components interact to create our environment. The study of ecology reveals many different ecosystems, each maintained by a delicate balance. In these different but connected ecosystems, individual species play a small but significant role in the working of the whole. Throughout the history of the Earth, the delicate balances found within ecosystems have been disrupted by natural and man-made influences. Given enough time, many ecosystems can adjust and regain their natural balance. Human actions, however, like creating air and water pollution, destroying habitats and depleting natural resources, etc., are seriously stressing many ecosystems and sending them out of balance. The saying "we are all connected" is so true. Our present and future actions will determine whether we leave a better planet for future generations.

Essential Information:

Ecological Relationships – The study of life on Earth is organized into levels that define living things and the environment in which they live. The *biosphere* includes all life on Earth. It is subdivided into various *ecosystems* that depend on climate and location. Within each ecosystem, there are *communities* made up of many different *populations* of living organisms that interact with their environment. There are both *abiotic* (non-living) and *biotic* (living) factors that influence life. Abiotic factors include sunlight, temperature, water, air, and soil, whereas, biotic factors include plants, animals, fungi, and bacteria. Within an ecosystem, organisms live in specific habitats – their surroundings. Within a habitat, each organism has a niche it fills or role that it fulfills within that habitat. Different species of organisms may appear to occupy the same habitat, but each has a different niche allowing it to survive in that habitat. Stable ecosystems have *producers*, known as *autotrophs*, that convert light energy from the Sun into chemical energy for use both for itself and other organisms. *Primary consumers*, also known as *heterotrophs*, feed on producers and transfer that energy as they too are consumed. This transfer of energy can be modeled in a *food web* or an *energy pyramid* (see page 3). Energy is passed up each level from producer to primary consumer to secondary consumer. At each level, some energy is lost as heat. Consumers that feed on plants are called *herbivores*, and those that feed on animals are known as *carnivores*. Also necessary in a stable ecosystem are *decomposers*, such as bacteria and fungi, which breakdown and recycle organic matter, dead or decaying organisms, into a usable form.

Ecosystems are constantly changing as energy moves through the system. Change occurs naturally to plant life in an ecosystem over time, and this is known as *succession*. In succession, as the composition and nutrient levels of the soil change, a progression of different plants will be established and replace others until the ecosystem reaches what is known as a *climax stage* – usually a mature forest. The ecosystem will remain stable at this stage until there is a major disruption, either natural (e.g. forest fire) or man-made (e.g. deforestation).

Populations within ecosystems are regulated or kept in check by various factors. Organisms are limited by the amount of *available resources* in an area. The population size that can be supported with resources in an area is known as the *carrying capacity*. When carrying capacity is reached, population growth will slow and level off. *Limiting resources*, such as necessary minerals or nutrients, can affect population growth. Without proper amounts of these nutrients, organisms will not survive. Disease and parasite activity regulate population numbers by keeping those numbers in check. In predator–prey relationships, biological interactions between two different species (like wolves and elk), have a direct effect on population numbers. For example, if the population number of one animal increases, it will impact the numbers of the other population. When conditions become crowded, diseases and parasites are spread more readily. Individuals already weakened by lack of resources may not survive, and therefore population numbers will decrease.

Human Impact – The increase in the world's human population has brought about many situations that have had *negative impacts* on ecosystems. Simply said, more people more problems. As the world population increases, there is a greater demand for resources and living space. Available resources can be either *renewable* (able to be replaced), like water, or *nonrenewable* (unable to be replaced), such as *fossil fuels*. Humans, needing space and housing, tend to destroy *habitats* such as forests and wetlands. More people require more food, so farm production must increase, requiring more chemicals to produce higher yields. Increased use of pesticides and chemicals in agriculture can increase soil and water pollution, ruining habitats and recreational areas.

Increased energy use has led to an increased burning of fossil fuels, creating air pollution, which leads to the formation of *acid rain*. This type of precipitation, having an acidic (low) pH, has adverse impacts on habitats, especially those that are located in the eastern parts of the United States. Burning fossil fuels produces *carbon dioxide*, a *greenhouse gas*, which, when released into the atmosphere, adds to *global warming*. Chemicals, such as *CFCs* from refrigerants, as well as other airborne chemicals, can also lead to the depletion of the *ozone layer*, allowing more harmful UV radiation to reach the Earth's surface, which increases the chance of skin cancer and cell mutations.

Humans have also introduced *non-native* species to ecosystems, either by accident or purposefully. These *invasive species* have no natural predators or population controls and outcompete native species, possibly leading to the extinction of those native species and, in some cases, the total disruption of an ecosystem.

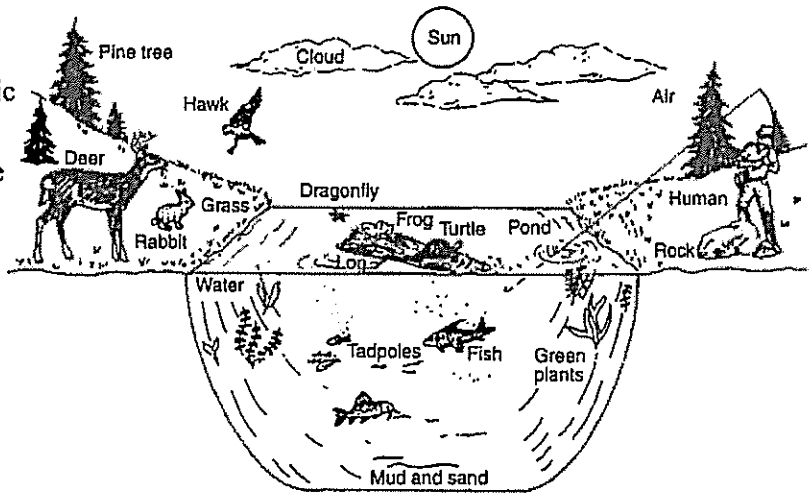
Ecosystems are interconnected, and human action can alter the ecosystem's equilibrium. The result of this can cause an imbalance within the ecosystems. Loss of habitats has reduced populations of certain organisms resulting in loss of *biodiversity* or even extinction of many species. Unstable ecosystems could prevent the discovery of new medicine from plants. Through legislation, public awareness, educational programs, and conservation practices, humans can correct and reduce their negative impact on Earth.

Additional Information:

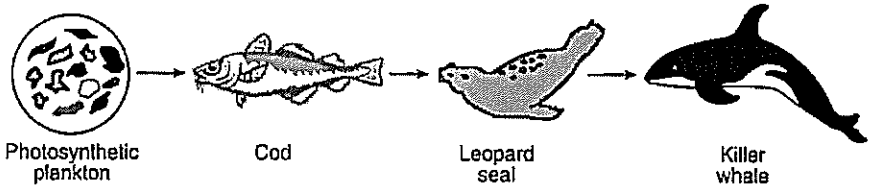
- Several invasive species introduced into New York State that have impacted ecosystems include: emerald ash borer, asian long horned beetle, and zebra mussels found in waterways, as well as purple loosestrife, which is a wetland plant, and hydrilla found in freshwater habitats.
- There are specific types of ecosystems found on Earth, each being defined by climate. The term, biome, is used to describe these large ecosystems types. Each biome has specific plants and animals that inhabit the area. Examples include: Tropical Rain Forests, Deserts, Temperate Deciduous Forests (NYS), and Arctic.

Diagrams:

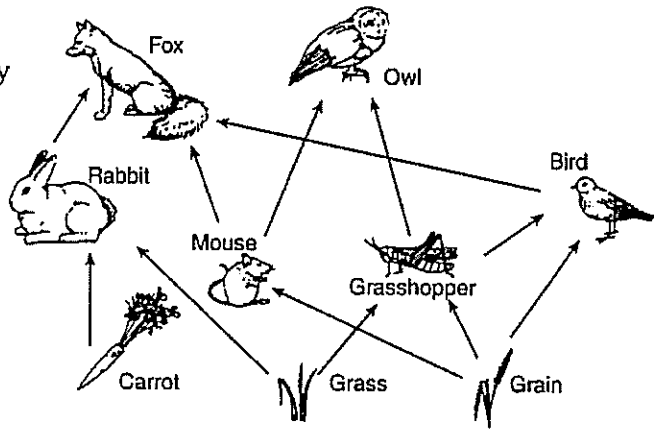
1. **Ecosystem** – Shown here is a pond ecosystem illustrating how the biotic members of the ecosystem interact with one another as well as with the abiotic (non-living) environment. Within all ecosystems are specific habitats that support a number of niches. Each niche is filled by the activity of single species.



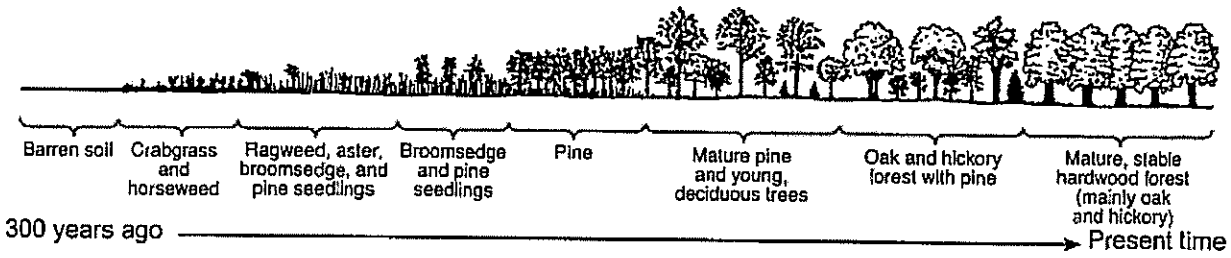
2. **Food Chain** – A food chain shows how living organisms get their food. It starts with a producer and ends with the largest consumer.



3. **Food Web** – A food web shows the flow of energy between organisms and the community as a whole. Energy, made by the producers, flows upward through the consumers, represented by the arrows. Food webs are much more stable than just simple food chains and have many more energy connections. Removal of an organism from a food web can impact those organisms above and below it within that web.

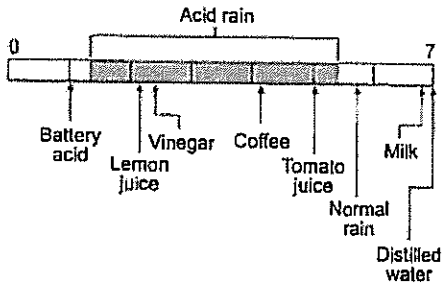


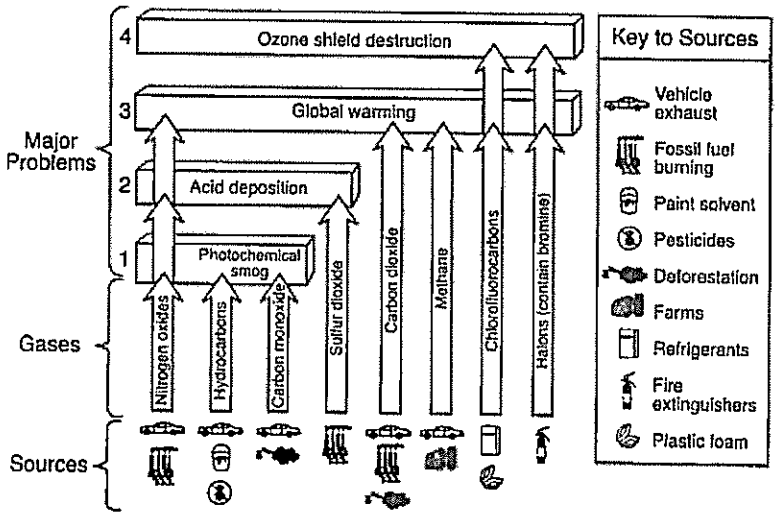
4. **Energy Pyramid** – In an energy pyramid, plants (producers) contain the most energy and are located at the bottom of the pyramid. Producers gain their energy from the Sun by photosynthesis. In the energy pyramid, organisms receive their energy from the level directly below them. As energy moves up it decreases, being lost to the environment as heat.



5. **Ecological Succession** – This naturally occurring process takes place when vegetation changes as the environmental conditions evolve over time in an area. The beginning stages of this process involve the emergence of organisms that break down rocks that, when combined with organic material, form soil. Over time, the soil depth increases as larger grasses, shrubs and different trees take over the area. Eventually the area reaches a climax stage that is stable (hardwood forest) and remains until there is a disruption to that ecosystem.

6. **Acid Rain** – The full pH scale goes from 0 to 14, where 7 is neutral. Any pH value less than 7 is acidic. Rain is normally slightly acidic, having a pH around 5.5. When airborne pollutants, especially sulfuric or nitric compounds, are chemically joined with atmospheric moisture, acid rain results, lowering the pH of the precipitation. Acid rain is harmful to young aquatic life and their habitats.





7. **Air Pollution Sources** – A large amount of air pollution is caused by the combustion of fossil fuels which releases large amounts of carbon dioxide, a greenhouse gas. Greenhouse gases have the ability to absorb much infrared radiation, resulting in an increase of atmospheric temperature. Chlorofluorocarbons or CFCs destroy ozone (O_3) molecules, causing the thinning of the ozone layer. The ozone layer traps much harmful ultraviolet (UV) radiation. UV radiation is linked to skin cancer, eye damage, and cell mutations. The reduction of the use of CFCs has had a positive impact on restoring the ozone within the upper atmosphere.

Vocabulary Refresher

Group A *Directions* - Match the correct definition for the following terms:

1. _____Biosphere
2. _____Ecosystem
3. _____Community
4. _____Population
5. _____Abiotic
6. _____Biotic
7. _____Biodiversity
8. _____Energy pyramid
9. _____Autotrophs
10. _____Heterotrophs
11. _____Food web
12. _____Niche
13. _____Herbivores
14. _____Carnivores
15. _____ Nonrenewable resources
16. _____ Climax stage

A. A measure of the richness, with regard to species, that is found within an area. The more varied an ecosystem is, the more stable the ecosystem.

B. Organisms, known as producers, that synthesize their own food source (glucose) by using the process of photosynthesis.

C. All of the living populations that are found and interact within an ecosystem.

D. Complex interconnections that show the feeding relationships of organisms within an ecosystem. The more connections, the more stable the ecosystem.

E. The non-living factors that influence living organisms such as water, temperature, soil, and atmosphere.

F. An organism that feeds exclusively on plant material, example – a deer.

G. The living organisms found within an ecosystem.

H. The realized role that an organism fills within an ecosystem. It defines where it fits within a food web or energy pyramid.

I. All living organisms that encompass the Earth.

J. Organisms that must take in preformed nutrients (organic compounds). These consumers may ingest, absorb, or engulf their nutrients.

K. All living organisms of one species that live and interact within an ecosystem.

L. A model that shows the flow of energy in an ecosystem from producers to consumers. As energy flows up this model, it decreases being lost as heat.

M. The most biodiverse and stable stage of ecological succession.

N. Those resources that are unable to be replaced and, once used up, are gone. Fossil fuels are examples of this type of resource.

O. Organisms that feed exclusively on other animals, example – a fox.

P. The interactions of living organisms and non-living factors within a defined area.

Vocabulary Refresher

Group B *Directions* - Match the correct definition for the following terms:

1. _____ Succession
2. _____ Carrying capacity
3. _____ Predator-prey
4. _____ Invasive species
5. _____ Limiting resources
6. _____ Available resources
7. _____ Renewable resources
8. _____ Decomposers
9. _____ Fossil fuel
10. _____ Acid rain
11. _____ Greenhouse gases
12. _____ Global warming
13. _____ CFCs
14. _____ Ozone depletion

A. Atmospheric gases that absorb (trap) heat energy, increasing the temperature of the atmosphere. Carbon dioxide is an example of such a gas.

B. A predictable series of changes that occur to an area with respect to vegetation over time. In a forest ecosystem, once bare ground slowly develops into a forest setting.

C. A relationship between two animals where the population of one will feed on and influence the population of the other. For example – a fox population and a mouse population.

D. Those resources that can be replaced, recycled, or renewed, such as water, air, or trees.

E. The population that can be supported by the available nutrients and space within an ecosystem. This concept is usually shown by a graph.

F. The release of nitrogen, sulfur, and carbon compounds into the atmosphere that react with moisture producing precipitation with a pH of less than 7. This harmful precipitation can destroy habitats, especially in areas east of the release of the pollutants.

G. Organisms that break down and recycle organic material from decaying or dead organisms, examples: bacteria and fungi (mushrooms).

H. Those nutrients that support the growth of a population. When present, they allow the population to grow and maintain itself. When absent, they can limit the growth of the population.

I. Energy sources such as gas, coal, and oil that were formed from the decayed remains of ancient living organisms such as plants.

J. Chloroflourocarbons were once used in refrigerants like air conditioners and aerosol cans. They can lead to ozone depletion.

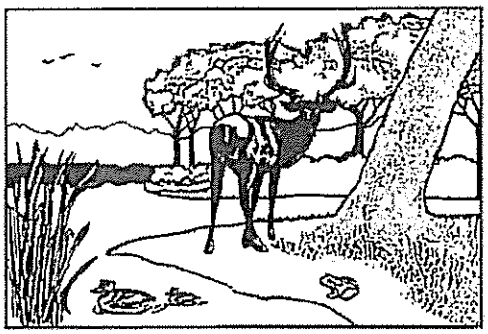
K. Non-native species that have been introduced into a new area. These species have no natural population checks so they outcompete and take over habitats of native species. An example is the plant Purple Loosestrife, found in NYS.

L. The break down of the ozone layer in the atmosphere by man-made chemicals such as CFCs, allowing harmful UV radiation to reach the Earth's surface.

M. Multiple complex conditions, such as increasing greenhouse gases and ozone depletion, that cause the Earth's atmosphere to heat up. This increased atmospheric temperature can lead to habitat destruction and eventually to extinction of certain species.

N. Items that an organism requires in order to survive including water, air, and nutrients.

1. Which ecological term includes everything represented in the illustration below?



(1) ecosystem (3) population
(2) community (4) species 1 _____

2. In an ecosystem, the presence of many different species is critical for the survival of some forms of life when

(1) ecosystems remain stable over long periods of time
(2) significant changes occur in the ecosystem
(3) natural selection does not occur
(4) the finite resources of Earth increase

2 _____

3. Decomposers are important in the environment because they

(1) convert large molecules into simpler molecules that can then be recycled
(2) release heat from large molecules so that the heat can be recycled through the ecosystem
(3) can take in carbon dioxide and convert it into oxygen
(4) convert molecules of dead organisms into permanent biotic parts of an ecosystem 3 _____

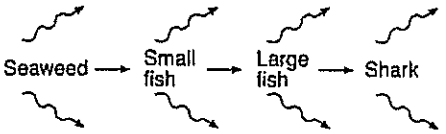
4. Which statement best describes a situation where competition occurs in an ecosystem?

(1) A deer outruns an attacking wolf.
(2) A deer, during the winter, consumes tree bark.
(3) A deer and a rabbit consume grass in a field.
(4) A deer and a rabbit are both startled by a hawk flying overhead. 4 _____

5. In some areas, foresters plant one tree for every tree they cut. This activity is an example of

(1) lack of management of nonrenewable natural resources
(2) a good conservation practice for renewable natural resources
(3) a good conservation practice for nonrenewable natural resources
(4) lack of concern for renewable natural resources 5 _____

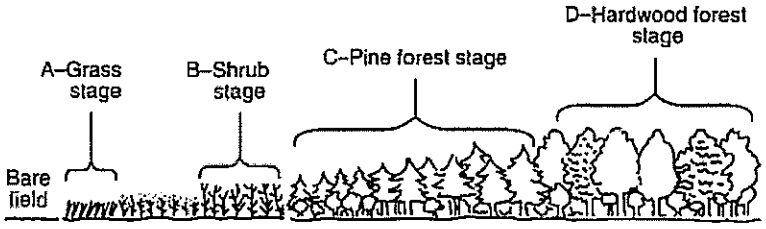
6. A food chain is illustrated below.



The ~~→ arrows represented most likely indicate

(1) energy released into the environment as heat
(2) oxygen produced by respiration
(3) the absorption of energy that has been synthesized
(4) the transport of glucose away from the organism 6 _____

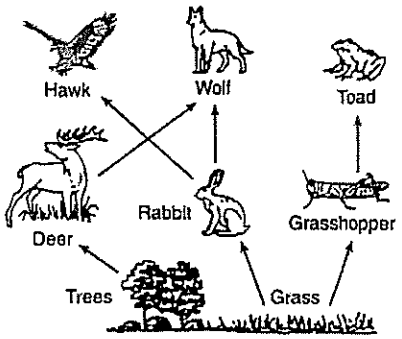
19. Stage *D* in the diagram below is located on land that was once a bare field.

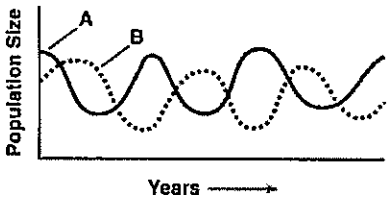


The sequence of stages leading from bare field to stage *D* best illustrates the process known as

(1) replication (2) recycling (3) feedback (4) succession 19_____

Base your answer to question 20 on the food web and graph below. The graph represents the interaction of two different populations, *A* and *B*, in the food web.





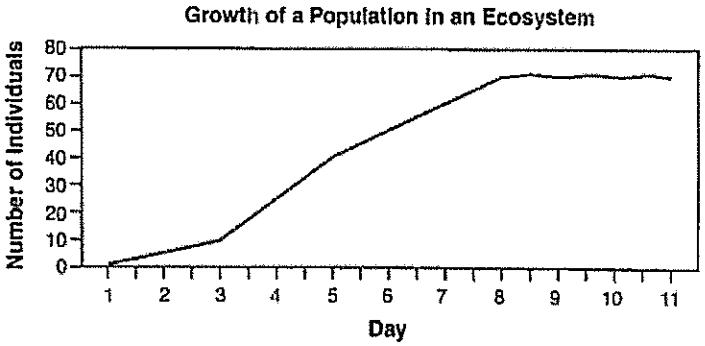
20. *a*) Population *A* is made up of living animals. The members of population *B* feed on these living animals. The members of population *B* are most likely

(1) scavengers (2) autotrophs (3) predators (4) parasites a_____

b) Which organism carries out autotrophic nutrition?

(1) hawk (2) grasshopper (3) grass (4) deer b_____

21. On which day did the population represented in the graph reach the carrying capacity of the ecosystem?



(1) day 11 (2) day 8 (3) day 3 (4) day 5 21_____

22. Human activities continue to place strains on the environment. One of these strains on the environment is the loss of biodiversity. Explain what this problem is and describe some ways humans are involved in both the problem and the possible solutions. In your answer be sure to:

a) state the meaning of the term biodiversity _____

_____

b) state one negative effect on humans if biodiversity continues to be lost

_____

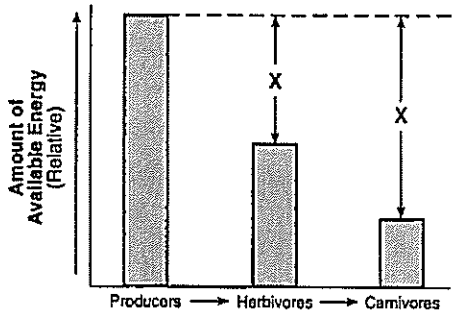
c) suggest one practice that could be used to preserve biodiversity in New York State

_____

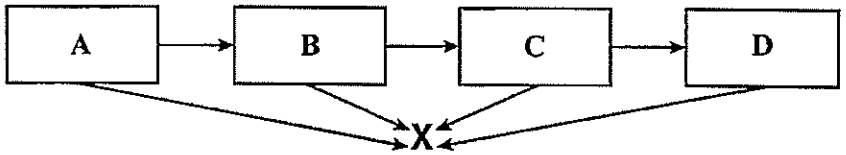
23. The graph represents the amount of available energy at successive nutrition levels in a particular food web.

The *X*s in the diagram represents the amount of what?

_____



24. The diagram below represents some energy transfers in an ecosystem.

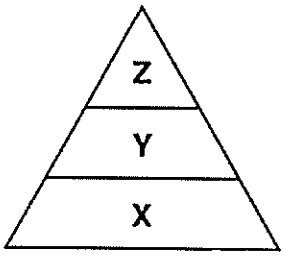


a) Which type of organism is most likely represented by letter *X*? _____

b) What happens to energy as it moves from *A* to *D*? _____

25. In the accompanying energy pyramid, identify one organism that would be found at level *X*.

_____



Base your answers to question 26 on the information below.

A student uses a covered aquarium to study the interactions of biotic and abiotic factors in an ecosystem. The aquarium contains sand, various water plants, algae, small fish, snails, and decomposers. The water contains dissolved oxygen and carbon dioxide, as well as tiny amounts of minerals and salts.

26. *a*) Describe one specific way the fish population changes the amount of one specific abiotic factor in this ecosystem.

_____

b) Identify one source of food for the decomposers in this ecosystem. _____

c) Describe one specific way the use of this food by the decomposers benefits the other organisms in the aquarium.

_____

d) Identify the primary source of energy for this aquarium ecosystem. _____

27. *a*) A food web is represented to the right. Give a statement that best describes energy in this food web.

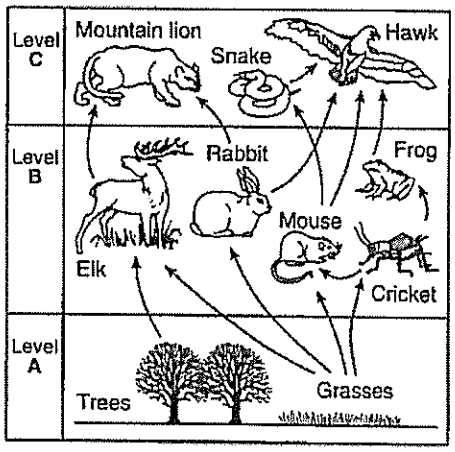
_____

_____

b) If the mountain lion was removed, how would this impact other populations?

_____

_____



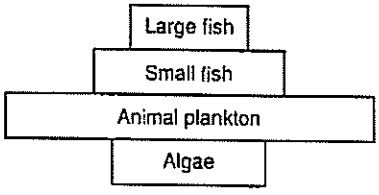
c) Name a herbivore shown in this food web. _____

28. Explain why damage to the ozone shield is considered a threat to many organisms.

_____

29. The diagram represents an energy pyramid constructed from data collected from an aquatic ecosystem.

Why is the ecosystem most likely unstable?



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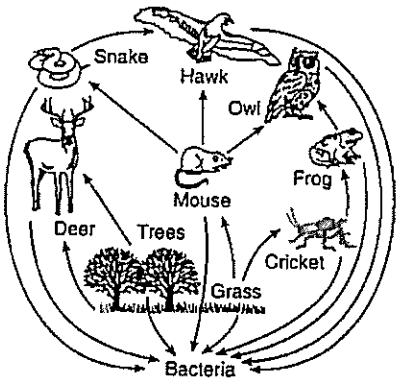
Base your answers to question 30 on the accompanying diagram.



30. *a*) Which organism carries out autotrophic nutrition?

_____

b) State what would most likely happen to the cricket population if all of the grasses were removed.

_____

c) What is the role of bacteria within a food web? _____

31. State one reason why the amount of carbon dioxide in the atmosphere has increased in the last 100 years.

_____

Base your answers to question 32 on the passage below and on your knowledge of biology.

On April 20, 2010, an explosion occurred at an oil well in the Gulf of Mexico, causing millions of gallons of oil to escape into the water over the next few months. Large areas of the Gulf were covered by oil. As the oil washed ashore, many areas along the coastline that were breeding grounds for various bird species were contaminated. By November 2010, researchers along the coast and in the Gulf had collected 6104 dead birds, 609 dead turtles, and 100 dead mammals. Although the oil well had provided oil for energy for a large number of people, the oil spill had a great effect on the ecosystems in and around the Gulf of Mexico.

32. *a*) Explain how the original decision to drill for oil in the Gulf of Mexico could be considered a trade-off.

_____

b) State one benefit of drilling for oil in the Gulf of Mexico. _____

c) State one possible reason why it will most likely take the bird populations more time to recover from this oil spill than it will mammal populations.

_____

33. Explain why an ecosystem requires a constant input of energy.

_____

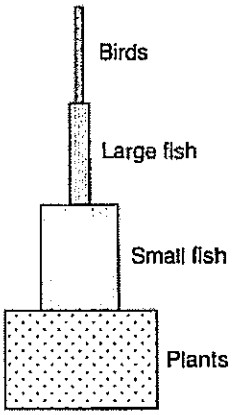
34. What is meant by the carrying capacity of a particular population in an ecosystem?

_____

1. A food web is more stable than a food chain because a food web

   (1) transfers all of the producer energy to herbivores
   (2) reduces the number of niches in the ecosystem
   (3) includes alternative pathways for energy flow
   (4) includes more consumers than producers 1_____

2. The diagram below represents a model of a food pyramid.



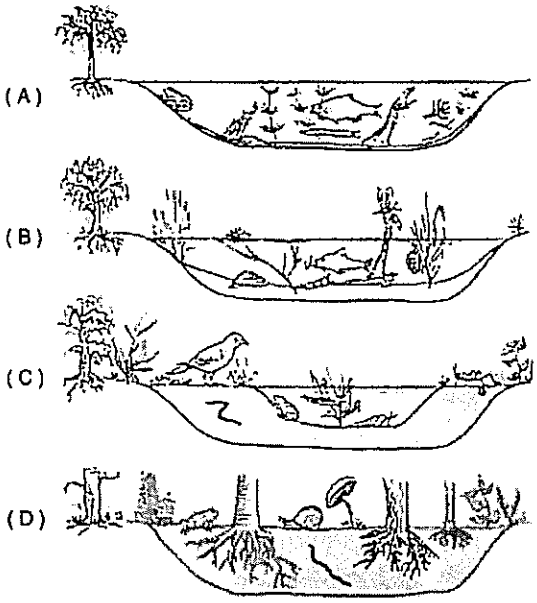
   Which statement best describes what happens in this food pyramid?

   (1) More organisms die at higher levels than at lower levels, resulting in less mass at higher levels.
   (2) Energy is lost to the environment at each level, so less mass can be supported at each higher level.
   (3) When organisms die at higher levels, their remains sink to lower levels, increasing the mass of lower levels.
   (4) Organisms decay at each level, and thus less mass can be supported at succeedingly higher levels. 2_____

3. Which ecosystem has a better chance of surviving when environmental conditions change over a long period of time?

   (1) one with a great deal of genetic diversity
   (2) one with plants and animals but no bacteria
   (3) one with animals and bacteria but no plants
   (4) one with little or no genetic diversity 3_____

4. The diagrams below show some changes in an environment over time.



   Which phrase best describes this sequence of diagrams?

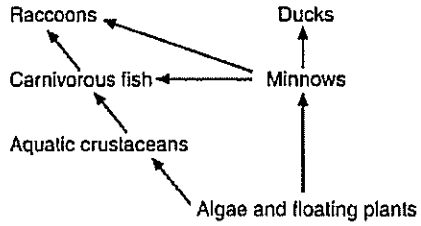
   (1) the path of energy through a food web in a natural community
   (2) the altering of an ecosystem by a natural disaster
   (3) natural communities replacing each other in an orderly sequence
   (4) similarities between an aquatic ecosystem and a terrestrial ecosystem 4_____

5. By causing atmospheric changes through activities such as polluting and careless harvesting, humans have

(1) caused the destruction of habitats
(2) affected global stability in a positive way
(3) established equilibrium in ecosystems
(4) replaced nonrenewable resources

5_____

6. The diagram below illustrates the relationships between organisms in an ecosystem.



Which change would most likely reduce the population size of the carnivorous fish?

(1) an increase in the autotroph populations
(2) a decrease in the duck population
(3) an increase in the raccoon population
(4) a decrease in pathogens of carnivorous fish

6_____

7. In a stable, long-existing community, the establishment of a single species per niche is most directly the result of

(1) parasitism
(2) interbreeding
(3) competition
(4) overproduction

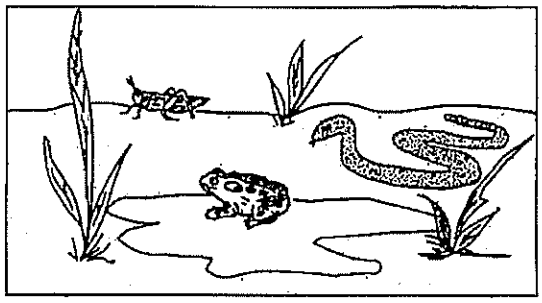
7_____

8. A stable pond ecosystem would not contain

(1) materials being cycled
(2) biotic factors
(3) decomposers
(4) more consumers than producers

8_____

Base your answers to question 9 on the diagram below.



9. *a*) Which organism carries out autotrophic nutrition?

(1) frog (3) plant
(2) snake (4) grasshopper a_____

b) The base of an energy pyramid for this ecosystem would include a

(1) frog (3) plant
(2) snake (4) grasshopper b_____

10. In an ecosystem, which component is not recycled?

(1) water (3) oxygen
(2) energy (4) carbon 10_____

11. Vultures, which are classified as scavengers, are an important part of an ecosystem because they

(1) hunt herbivores, limiting their populations in an ecosystem
(2) feed on dead animals, which aids in the recycling of environmental materials
(3) cause the decay of dead organisms, which releases usable energy to herbivores and carnivores
(4) are the first level in food webs and make energy available to all the other organisms in the web

11_____

12. "Natural ecosystems provide an array of basic processes that affect humans."

Which statement does not support this quotation?

(1) Bacteria of decay help recycle materials.
(2) Trees add to the amount of atmospheric oxygen.
(3) Treated sewage is less damaging to the environment than untreated sewage.
(4) Lichens and mosses living on rocks help to break the rocks down, forming soil.

12_____

13. The carrying capacity of a given environment is least dependent upon

(1) recycling of materials
(2) the available energy
(3) the availability of food and water
(4) daily temperature fluctuations

13_____

14. Increased efforts to conserve areas such as rain forests are necessary in order to

(1) protect biodiversity
(2) promote extinction of species
(3) exploit finite resources
(4) increase industrialization 14_____

15. Changes in the chemical composition of the atmosphere that may produce acid rain are most closely associated with

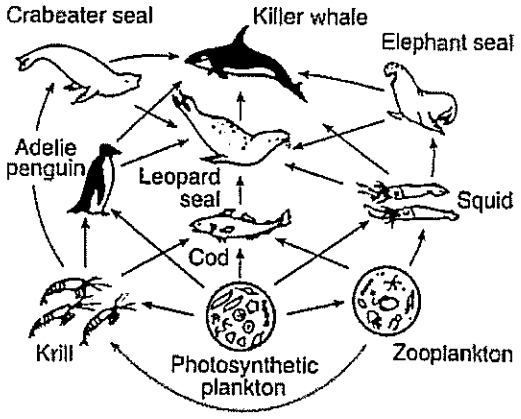
(1) insects that excrete acids
(2) runoff from acidic soils
(3) industrial smoke stack emissions
(4) flocks of migrating birds 15_____

16. Which practice would most likely deplete a nonrenewable natural resource?

(1) harvesting trees on a tree farm
(2) burning coal to generate electricity in a power plant
(3) restricting water usage during a period of water shortage
(4) building a dam and a power plant to use water to generate electricity

16_____

17. Which statement concerning the producers in the ocean ecosystem shown below is correct?

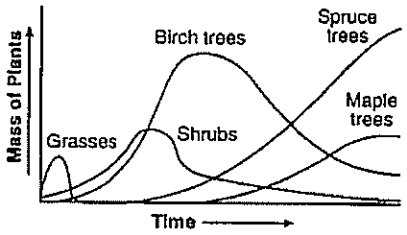


(1) An increase in the types of producers will most likely decrease the available energy for the squid.
(2) A producer in this ecosystem is the zooplankton.
(3) If all the producers in this ecosystem are destroyed, the number of heterotrophs will increase, but the ecosystem will reach a new equilibrium.
(4) Since there is only one group of producers, their numbers must be large enough to supply the energy for the rest of the food web. 17_____

18. In December 2004, a tsunami (giant wave) destroyed many of the marine organisms along the coast of the Indian Ocean. What can be expected to happen to the ecosystem that was most severely hit by the tsunami?

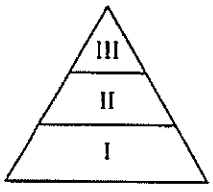
(1) The ecosystem will change until a new stable community is established.
(2) Succession will continue in the ecosystem until one species of marine organism is established.
(3) Ecological succession will no longer occur in this marine ecosystem.
(4) The organisms in the ecosystem will become extinct. 18_____

19. Which concept is represented in the graph below?



(1) ecological succession in a community
(2) cycling of carbon and nitrogen in a forest
(3) energy flow in a food chain over time
(4) negative human impact on the environment 19_____

20. An energy pyramid containing autotrophs and other organisms from a food chain is represented.



Carnivores would most likely be located in

(1) level I, only
(2) level I and level II
(3) level III, only
(4) level II and level III 20_____

21. Four environmental factors are listed below.

A. energy C. oxygen
B. water D. minerals

Which factors limit environmental carrying capacity in a land ecosystem?

(1) A, only
(2) A, C, and D, only
(3) B, C, and D, only
(4) A, B, C, and D 21_____

22. The relationship that exists when athlete's foot fungus grows on a human is an example of

(1) predator/prey
(2) producer/consumer
(3) parasite/host
(4) decomposer/autotroph 22_____

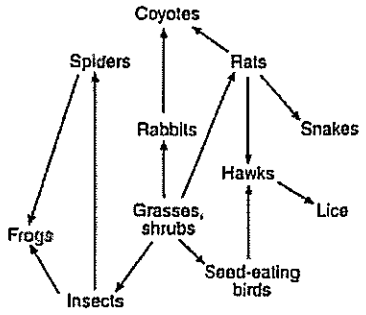
23. Which change is a cause of the other three?

(1) increased fossil fuel consumption
(2) destruction of the ozone shield
(3) increased industrialization
(4) destruction of natural habitats 23_____

24. The release of products of combustion into the air often causes the formation of ozone near the surface of Earth. This ground-level ozone damages plants and affects their ability to absorb carbon dioxide. The doubling of ground-level ozone since 1850 is most likely due to

(1) the chemical composition of the upper atmosphere
(2) emissions from vehicles and industrial processes
(3) the extinction of certain animal species
(4) a greater use of nuclear fuel 24_____

42. The accompanying diagram represents a food web.



The arrows only point away from "Grasses, shrubs" and not toward them. State one biological reason that this is so.

_____

_____

Base your answers to question 43 on the information below.

The ice fields off Canada's Hudson Bay are melting an average of three weeks earlier than 25 years ago. The polar bears are therefore unable to feed on the seals on these ice fields during the last three weeks in spring. Polar bears have lost an average of 10% of their weight and have 10% fewer cubs when compared to a similar population studied just 20 years ago. Scientists have associated the early melting of the ice fields with the fact that the average world temperature is about 0.6°C higher than it was a century ago and this trend is expected to continue.

43. *a*) What ecological problem most likely caused the earlier melting of the ice fields in the Hudson Bay area of Canada? _____

_____

b) State one specific long-term action that humans could take that might slow down or reduce the melting of the ice fields. _____

_____

c) Which prey of the polar bears would increase in numbers as a result of the situation described in the reading? _____

44. Currently, Americans rely heavily on the burning of fossil fuels as sources of energy. As a result of increased demand for energy sources, there is a continuing effort to find alternatives to burning fossil fuels. Discuss fossil fuels and alternative energy sources. In your answer be sure to:

a) state one disadvantage of burning fossil fuels for energy

_____

b) identify one energy source that is an alternative to using fossil fuels _____

c) state one advantage of using this alternative energy source

_____

d) state one disadvantage of using this alternative energy source

_____

Base your answers to question 45 on the information and table below.

The variety of organisms known as plankton contributes to the unique nutritional relationships in an ocean ecosystem. Phytoplankton include algae and other floating organisms that perform photosynthesis. Plankton that cannot produce food are known as zooplankton. Some nutritional relationships involving these organisms and several others are shown in the table below.

Nutritional Relationships in a North Atlantic Ocean Community

	Food Eaten by Animals in Community				
Animals in Community	**Codfish**	**Phytoplankton**	**Small Fish**	**Squid**	**Zooplankton**
codfish			X		
sharks	X			X	
small fish		X			X
squid	X		X		
zooplankton		X			

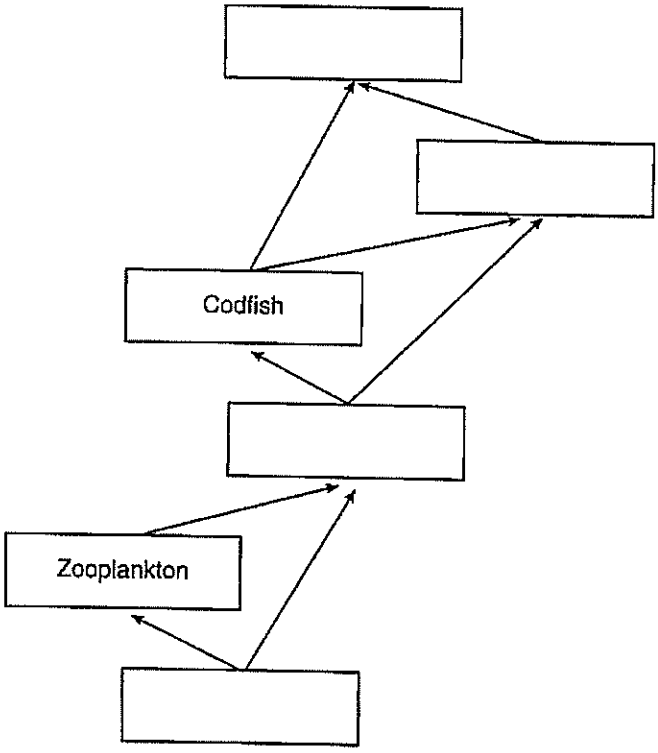
45. *a*) Humans are currently overfishing codfish in the North Atlantic. Explain why this could endanger both the shark population and the squid population in this community.

_____

b) According to the table, which organism can be classified as both an herbivore and a carnivore?

_____

c) Complete the accompanying food web using the information from the above table.



d) If phytoplankton were removed, what would happen to this ocean ecosystem?

_____

_____

e) Identify an organism not shown that is needed to maintain a stable community?

_____

f) State what the arrows in the food chain represent.

_____

Base your answers to question 46 on the article below which was written in response to an article entitled "Let all predators become extinct."

Predators Contribute to a Stable Ecosystem

In nature, energy flows in only one direction. Transfer of energy must occur in an ecosystem because all life needs energy to live, and only certain organisms can change solar energy into chemical energy.

Producers are eaten by consumers that are, in turn, eaten by other consumers. Stable ecosystems must contain predators to help control the populations of consumers.

Since ecosystems contain many predators, exterminating predators would require a massive effort that would wipe out predatory species from barnacles to blue whales. Without the population control provided by predators, some organisms would soon over populate.

46. *a*) Draw an energy pyramid in the given space that illustrates the information underlined in the second paragraph. Include *three* different, specific organisms in the energy pyramid.

b) Explain the phrase "only certain organisms can change solar energy into chemical energy," in the underlined portion of the first paragraph. In your answer be sure to identify the type of nutrition carried out by these organisms

_____

c) Explain why an ecosystem with a variety of predator species might be more stable over a long period of time than an ecosystem with only one predator species.

_____

d) Beside predators, identify one other type of population control.

_____

e) Name an organism what would drastically increase if all predators within a large lake were removed. _____

47. State one specific environmental problem that can result from burning coal to generate electricity.

_____

48. Explain why using a food chain is more limiting than using a food web to show relationships between organisms in an ecosystem.

_____

Ecology and Human Impact

Set 1 – Answers

1. 1 The picture shows both the living (biotic) and non-living (abiotic) components of the environment, which make up an ecosystem. All other choices are only parts of an ecosystem.

2. 2 The presence of many different species within an ecosystem (biodiversity) allows for variation. This variation provides multiple food sources for consumers within a food web. If environmental changes were to remove one food source, others would still be available, allowing the consumer to survive.

3. 1 Decomposers, acting on living matter, convert larger molecules into simpler molecules, often through a digestive process. These simpler molecules can then be recycled through the ecosystem, primarily as nutrients within the food chain.

4. 3 Competition occurs when two organisms are utilizing the same resource. In the case of deer and rabbit, they are both eating the same food, grass, and there would be competition for that resource.

5. 2 Trees are a renewable resource, and for every tree that is cut down, at least one tree seedling should be planted. This good conservation practice is implemented by almost all industries that harvest trees, such as paper companies.

6. 1 In all food chains and webs, as one moves up the chain(s), energy is released as heat. This release of heat energy is a result of metabolic activity within that organism as it uses that food source.

7. 2 Carrying capacity can be defined as the population number that can be supported by all the resources within an ecosystem. Once the carrying capacity is reached, population growth will level off due to competition for available nutrients, energy sources, space, etc.

8. 4 Choice 4 would cause the least disruption to the ecosystem because the fish are already native to that area. The other choices will affect non-target species by harming or destroying habitats or killing species other than mosquitoes.

9. 1 In the decision to build this garbage-to-steam energy plant, the community must be informed of the positive and negative aspects of the project. This plant will provide useful energy in the form of steam, but the trade-offs will involve air pollution and an increase in truck traffic, along with other possible negative consequences.

10. 1 Since the slug and the shelf fungus live in or on the decaying tree, they share the same habitat. They use different types of nutrients and, therefore, occupy different niches within the ecosystem. The slug is an herbivore, feeding on algae (on the tree), whereas the shelf fungus is a decomposer, obtaining its nutrients from materials absorbed from the decaying tree.

26. *a*) Answer: fish release CO_2 *or* fish release nitrogenous waste products *or* removes oxygen

Explanation: An abiotic factor is a nonliving component of an ecosystem. Within this ecosystem, the abiotic factors are water, sand, gases, minerals, and salts. Fish have the ability to directly affect several of these factors. Through respiration, fish add CO_2 to water, while removing O_2. Through excretion, fish can release nitrogenous wastes, such as ammonia into the water.

b) Acceptable answers include but are not limited to: dead animals *or* dead plants *or* organism waste

See explanation for *c*).

c) Acceptable answers include but are not limited to: Decomposers return basic materials such as nitrates and CO_2 to the ecosystem for reuse by other organisms. *or* Decomposers recycle nutrients.

Explanation: Decomposers act as recyclers of organic materials within an ecosystem. They generally break down complex materials into simpler nutrient forms. In order to be a stable ecosystem, decomposers must be present to break down materials, otherwise the system would have a buildup of organic material and become toxic.

d) Answer: sunlight

Explanation: Producers take in energy from the Sun and convert that light energy into the chemical energy of glucose or sugar.

27. *a*) Acceptable answers include but are not limited to:
The energy, which is being lost as heat, decreases as it moves up through the different levels.
or The energy content of each level is transferred to a higher level.

Explanation: In a food web, organisms at Level *A* are autotrophs and receive their energy in the form of sunlight (an abiotic source). Energy moves up a food web from Level *A* to *B* to *C*. The greatest amount of energy is found at *A*, and energy decreases as one moves up through the levels.

b) Answer: The number of elks and rabbits would increase. *or* There would be no predators to control elk or rabbit populations. *or* Grass and tree populations would decrease.

Explanation: Elimination of mountain lions would lead to an overpopulation of elks and rabbits that were sources of food for mountain lions. This would result in overgrazing by these herbivores.

c) Answer: Any animal found in Level *B* except for the frog.

Explanation: A herbivore is any animal that feeds exclusively on plant material.

28. Answer: expose organisms to UV rays *or* increase the chance of mutations in cells
or increase skin cancer *or* cause eye damage

Explanation: Ozone, located in the upper atmosphere, absorbs much of the harmful ultraviolet rays given off by the Sun. CFCs and other airborne chemicals can thin out this protected ozone layer causing more UV rays to reach the Earth's surface. When this occurs, these high-energy rays can do harm to living cells.

29. Acceptable answers include but are not limited to: There are not enough producers.
or The number of producers is not sufficient to support the number of consumers.

Explanation: This ecosystem is unstable because the number of producers (algae) is far less than the number of primary consumers (plankton). With fewer algae or producers present, less energy is available to be transferred up the energy pyramid, making this ecosystem unstable.

30. *a*) Answer: trees *or* grass

Explanation: Trees and grasses are producers that carry out photosynthesis or autotrophic nutrition.

b) Answer: The cricket population would decrease.

Explanation: Crickets feed on grass. If grass was removed, crickets would lose their food source and their population numbers would decrease.

c) Answer: to break down dead matter *or* recycle nutrients into the environment
or They are decomposers.

Explanation: Decomposers, like bacteria or fungi, break down organic material. This action recycles nutrients back into the environment.

31. Answer: burning fossil fuels

Explanation: The burning of fossil fuels releases carbon dioxide, which is a greenhouse gas. Greenhouse gases trap (absorb) heat energy within the atmosphere, resulting in global warming.

32. *a*) Acceptable responses include, but are not limited to:
People could get oil to be used for energy, but they might damage the environment while doing it.
or Oil companies provide many jobs for people, but there could be a negative effect on the environment.

Explanation: A trade-off involves both the positive and negative effects of an action being explored before a decision is made. The trade-off occurs when a decision is made with the hope that the positives or benefits outweigh the negative effects. In some cases, the negatives may be too dangerous to proceed.

b) Acceptable responses include, but are not limited to: create jobs *or* increased revenue for the state *or* increased supply of U.S. oil *or* decreased reliance on foreign oil

Explanation: Oil production brings jobs and money to the drilling region.

c) Answer: More birds were killed. *or* The breeding grounds were contaminated.

Explanation: Researchers collected 6,104 dead birds, while 100 mammals died. This large number of dead birds would severely affect the recovery time for this species. Some of the oil will stay in the birds' environment for years contaminating their breeding grounds.

33. Acceptable responses include, but are not limited to:
Energy is always lost as it is transferred through the ecosystem.
or Energy is continuously needed for metabolic processes.
or It is needed so that autotrophs can make food.

Explanation: Without energy, abiotic organisms would die. Energy is lost as it is transferred up through the food web or energy pyramid. This loss of energy, in the form of heat, needs to be constantly replenished.

34. Answer: See answer 7, page 25.