

**LIVING PLANET
UNIT SIX**

SUMMARY OF UNIT SIX MATERIAL

The videotapes to watch for this unit are:

Video Episode 11 – The Open Ocean
Video Episode 12 - New Worlds

For each video episode in this unit:

read the **CONCEPTS** section in the study guide
answer the **Concepts Study Questions**
watch the Video Episode
answer the **Video Study Questions**

OVERVIEW OF UNIT 6 LEARNING OBJECTIVES

Chapter/Video 11

To become acquainted with:

1. ocean zones
2. food chains of the open ocean
3. variations of the Pacific Ocean floor
4. ecology of shallow oceans near coasts: location, characteristics, life forms, and adaptations
5. plankton and their importance to ocean inhabitants
6. bony fish as compared to cartilaginous fish
7. ecology of coral reefs
8. ecology of open ocean communities
9. ecology of kelp beds
10. ecology of deep water communities (deep-sea)
11. relationship between currents and nutrients
12. the Sargasso Sea
13. the Grand Banks of Newfoundland

Video Episode 12

To become acquainted with:

1. the problems of overpopulation and resource use
2. changes caused by humans: domestication, cultivation, cities
3. changes made in plants, animals and habitats as a result of human intervention
4. the concept of monocultures
5. ecology of urban life: location, characteristics, life forms and adaptations
6. the spread of Oxford ragwort
7. the interdependence of organisms found in the Chincha and San Gallan Islands and the effects of humans on this community
8. pollution
9. deforestation and cultivation of rain forests
10. advantages and disadvantages of dams
11. three principles of the World Conservation Strategy

CONCEPTS FOR EPISODE 11 - THE OPEN OCEAN

OCEAN ZONES

In this episode, you will see a few of the communities that are found in the ocean. The oceans are divided into a number of zones, some of which Attenborough visits.

Let's talk about the ocean bottom first. Imagine you are in your own personal submarine as you voyage across the bottom of the ocean. The bottom slopes gradually as you leave the shore and head toward open water. This gradual slope is called the **continental shelf** and is actually part of the continent. As you proceed further into the open ocean, you reach the edge of the continental shelf. Here, there is a sudden increase in the steepness of the slope; you are now on the **continental slope**. When your descent levels out again, you have reached the **abyssal plain**. Continue cruising away from shore. When you reach the middle of the ocean, you encounter a vast mountain range, with taller, steeper mountains than any on land. This is the **midoceanic ridge**. If you are exploring the Pacific Ocean, you may encounter deep canyons, called **trenches**, as well, especially around the edges of the ocean.

During your voyage along the ocean floor, you have been traveling just above the **benthic zone**. Near the shore, light is able to reach the benthic zone, and in these regions, seaweeds and seagrasses may be found. Away from the shore, as the water gets deeper, the light can no longer reach the bottom. Thus, most of the benthic zone is in perpetual darkness, and, except in special circumstances (hydrothermal vents--see episode 1), all the organisms there either get their food from dead organic matter that falls down out of the lit regions above or prey on each other.

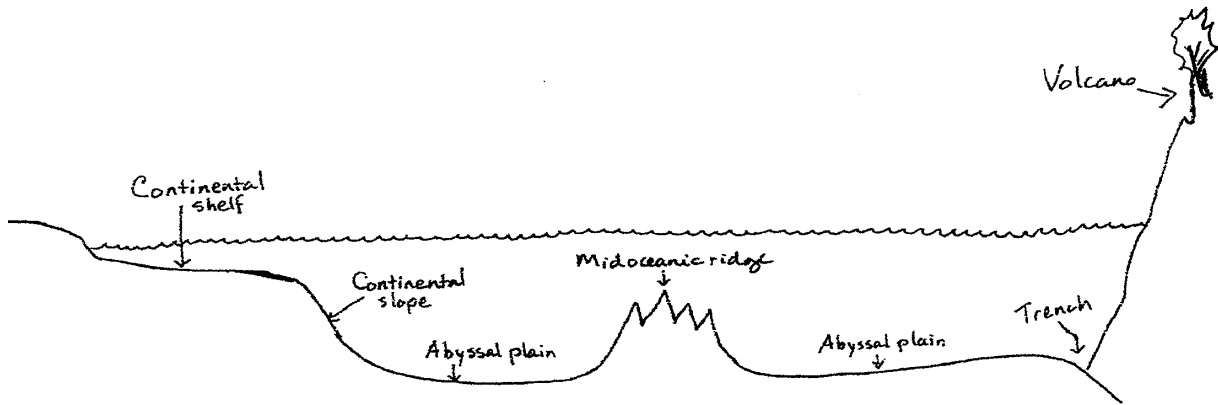
The open waters above the ocean floor are called the **pelagic zone**. The pelagic zone is divided into two regions: the **neritic zone** and the **oceanic zone**. The neritic zone encompasses the water above the continental shelf. The oceanic zone includes the water above the continental slope, abyssal plains and midoceanic ridges.

The **neritic zone** is richer than the oceanic zone. Because it lies above the continental shelf, the water is more shallow, and more of the bottom is reached by light. More light means more photosynthesis, and more animals that feed on the photosynthesizers. Also, the neritic zone receives large amounts of nutrients from the rivers that empty into the ocean in the coastal regions. This means that all those photosynthesizers have plenty of nutrients to grow, so more animals can be supported. The richness of the neritic zone supports the world's most productive commercial fisheries. Or did, until technologically advanced human beings managed to efficiently deplete many fish populations. You'll see this in episodes 11 and 12.

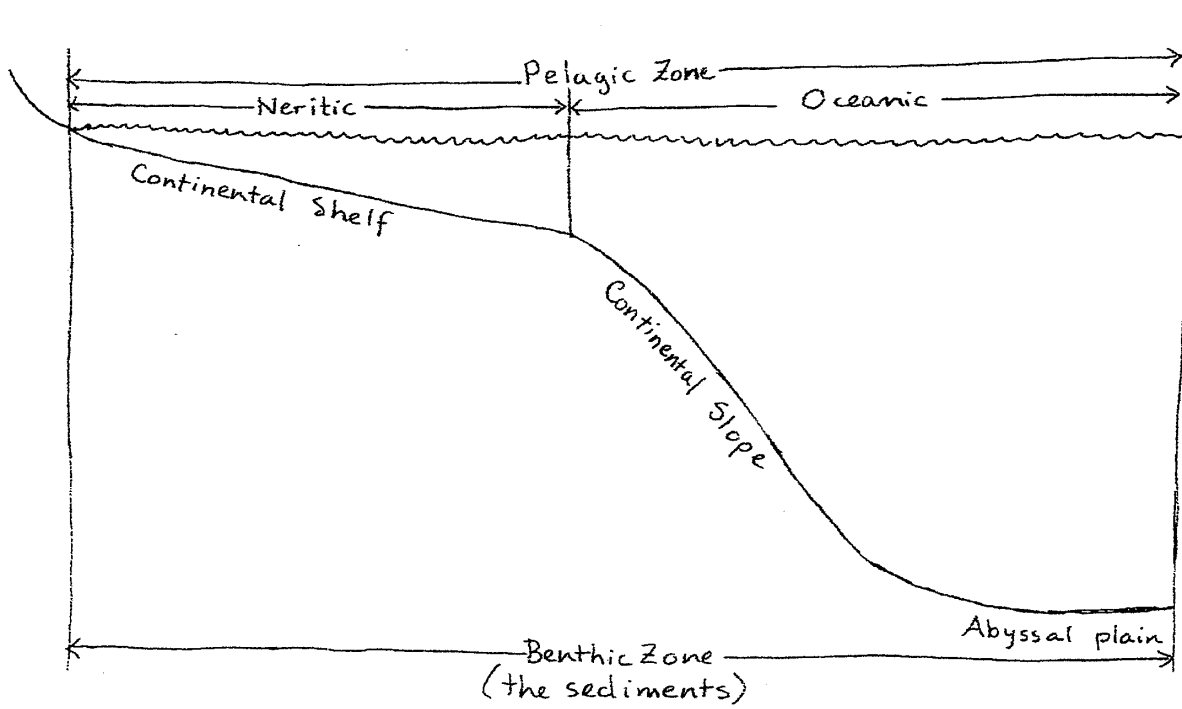
Many of the communities that Attenborough visits in this episode are found in the neritic zone. Look for the coral reefs, kelp beds, and the Grand Banks in the videotape.

The **oceanic zone** is the desert of the sea. This may seem like a contradiction in terms, but let us explain. Even in the parts near the surface that receive light, the distance of these areas from land means that plant nutrients are low and that the microscopic algae that supply the food for all the animals cannot grow very rapidly. Thus, communities in the oceanic zone grow slowly because of low levels of plant nutrients, just as desert communities on land grow slowly because of low rainfall. Look for the Sargasso Sea in the videotape as an example of a special oceanic zone community.

Regions of the Ocean Bottom



Life Zones of the Ocean



Diagrams modified from Thurman (1988).

OPEN OCEAN FOOD CHAINS

In the open water of the oceans, all the organisms must either float or swim. The **plankton** are small organisms that are designed to float or are such weak swimmers that they cannot escape the ocean currents. Plankton is a general category for floaters. Floaters come in two specific subtypes: the phytoplankton (producers) and the zooplankton (consumers).

In the oceans, most of the **phytoplankton** consists of tiny algae. They may be small, but they are present in enormous numbers, especially in the neritic zone, and together they produce enough organic matter to support all the rest of the organisms of the open ocean.

The **zooplankton** of the oceans consists mostly of tiny animals, but some may be quite large, such as the jellyfishes. Many zooplankton feed on the phytoplankton, and others feed on other members of the zooplankton. Many of these animals are permanent members of the zooplankton, spending their entire lives feeding on phytoplankton or on each other. Other animals live as zooplankton for only part of their lives, such as larval crabs and fishes.

Another important group of animals in the open waters of the ocean is the **nekton**. Examples of animals which belong to the oceanic nekton that you will see in the video include the squid, adult fishes (from the relatively small capelin to those very large and voracious predators, the tuna) and the whales. Keep in mind that all the animals, both zooplankton and nekton, no matter how large or small, are all supported by the enormous numbers of microscopic phytoplankton.

Here's a simple food chain for the open ocean:

Phytoplankton ⇒ Zooplankton ⇒ Nekton

KEYSTONE SPECIES

The coral reefs are a good ecosystem to look at keystone species again. The corals themselves are the keystone species in this ecosystem. With the corals, this ecosystem is highly diverse. Without the corals, most of the organisms that live there would not be able to survive and the ecosystem would be radically different.

References:

Grzimek, Bernhard. 1984. *Grzimek's Animal Life Encyclopedia. Vol. 5: Fishes II and Amphibians*. Van Nostrand Reinhold, New York.

Thurman, Harold V. 1988. *Introductory Oceanography*, 5th ed. Merrill, Columbus, OH.

Watson, Lyall. 1981. *Sea Guide to Whales of the World*. Dutton, NY.

CONCEPTS STUDY QUESTIONS FOR EPISODE 11 – The Open Ocean

1. Describe variation in the topography of the ocean bottom including the continental shelf, continental slope, abyssal plain, midoceanic ridge, and trenches.

2. Describe the typical open ocean food chain based on phytoplankton,

11. How large is the whale shark? What type of animal is it? What does it eat? What other fish are found around the whale shark and what do they eat?

12. Describe the gray reef shark. How is it adapted to living in the water? (Note: Attenborough uses the term “gristle” to mean “cartilage”. Sharks are cartilaginous fishes.)

13. Describe the bony fish. How do they differ from the sharks?

14. How fast can a tuna swim while hunting?

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ADDITIONAL INFO. Tunas are one of the big, streamlined fish predators found in the open oceans. Even though they are ectotherms, they are able to raise their temperatures as much as 12 degrees Celsius above the water temperature (about 22 degrees Fahrenheit). (pgs 282-284)

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15. When did the toothed whales evolve? What are they descended from? [Also see the additional information that follows question 16.]

16. Describe the narwhal. What is the function of its long tusk?

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ADDITIONAL INFO: Whales come in two varieties: toothed and baleen. The toothed whales all have teeth (obviously). This group includes the dolphins, killer whale, narwhals, belugas and some very large whales such as the sperm whale. These whales are all predators, and their spiky teeth are excellent weapons for catching fish and other slippery animals. Toothed whales evolved from terrestrial carnivores about 50 million years ago.

Baleen whales evolved from a common whale ancestor; scientists do not agree about when they evolved. Instead of teeth, the baleen whales have large plates hanging down from their upper jaws like fringe. They use the plates, or baleen, to filter their food from the water. They take large quantities of water into their mouths and force the water through the baleen, catching small fishes and other animals such as krill (a planktonic crustacean) on the plates. The humpback whale is a baleen whale; look for it eating capelins in the video.

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Locator: Canadian Arctic

17. Describe the beluga. How do they communicate? Why do they congregate in large numbers?

18. Describe the walrus. What are they descended from? How are they adapted to life in the seas?

19. Describe a coral reef. What do corals need in order to grow?

20. What are the features of a lagoon? [Coral reefs were also covered in Episode 10.]

21. Briefly describe the different varieties of coral.

22. How do the coral organisms grow?

23. What terrestrial ecosystem is considered to be an equivalent to the coral reefs? Why?

24. Be able to describe the coral.

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CLARIFICATION: In the video, Attenborough says that corals are "tiny anemone-like creatures" and refers to algae that live within their tissues. **Coral polyps** (the name for individual coral organisms) often contain algae, living in a symbiotic relationship. The algae photosynthesize during the day, providing the partners with food. At night, the coral polyp feeds by filtering small particles out of the water, thus providing the partners with food. Corals belong to the same group of animals as sea anemones.
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25. Describe the angler fish and the decoy fish. How do they catch prey?

26. Why do crabs frequently place sea anemones or sponges on their shells? How do the anemones and sponges benefit?

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ADDITIONAL INFO: The interactions between these crabs and sponges and/or sea anemones are just a few examples of the many symbiotic interactions found within the seas. Here is one of our favorite examples. The cleaner wrasse is a fish that we call the "dentist-of-the-sea". It specializes in picking the parasites out of the mouths and off the gills of other fishes. It finds a prominent coral head which it uses as its cleaning station (dentist's office), then advertises by swimming in a particular pattern and by its striped appearance (you may now picture your dentist in a clown suit doing a hula dance outside her office). The wrasse's sometimes dangerous clients, such as barracuda and immense groupers, seem to be kept in line by the little guy's dance. They hover in one spot and open their mouths and gill covers so the wrasse can clean them. Once the cleaning station is "open", several fishes will queue up, patiently waiting their turn. (Just imagine how comfortable you would feel, knowing a predator is in line behind you.) So, where are the mutual benefits? The wrasse gets dinner; the fish gets its mouth and gills clean, which are hard to reach for a fish!

Another symbiotic relationship between shrimp, sea anemones and algae is discussed in *National Geographic* (May 1997). The shrimp gets food and possibly protection; the sea anemone has symbiotic algae living inside its tissues which provides the sea anemone with food; the algae get nitrogen from the ammonia wastes excreted by the shrimp. (Remember the nitrogen cycle. In tropical waters, nitrogen is rare.)

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Locator: Norway

27. Describe the kelp beds. What are the conditions of the kelp beds?

28. Why are kelp beds considered to be equivalent to evergreen forests?

29. Describe the eider. What do they eat? How are they adapted to this community?

30. How does the lumpsucker deal with the problem of currents?

31. Where do kelp beds grow?

Locator: Australia

species mentioned in this section: sea urchin, goatfish, giant amphipod, hagfish, deep sea stars

32. Describe the leafy sea dragon. What does it eat?

33. Describe the "deserts" of the sea. What organisms live here?

34. Describe the garden eels. What do they eat?

35. How does the blade fish elude predators?

36. Why does the cuttlefish burrow into the sand? What does it eat?

37. How far does light penetrate in the ocean waters?

38. What types of animals are found in deep, dark waters? [Note: This is the deep sea community. There is no true land equivalent to this community.]

39. Where does the food for this deep sea community come from?

40. Describe the flashlight fish and their adaptation to living in the dark, deep waters.

41. What are the conditions on the floor of the deep ocean that animals have to cope with?

42. What does the tripod fish look like?

43. Water that is picked up by the waves of the ocean tend to circulate in the same place while the waves move on. What function does this circulation have?

44. How are deep currents formed?

45. Describe the deep currents of the Pacific.

46. Describe the deep currents of the Atlantic.

47. Describe the Sargasso Sea. Where is it located? Why is this area largely barren? What life forms live here?

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ADDITIONAL INFO: The center of the Sargasso Sea is 2000 miles west of the Canary Islands. It is an irregular oval-shaped area bounded within the 20-40 degrees North parallels (latitude) and the 35-75 degrees West meridians (longitude). (Reference: *World Book Encyclopedia*.) We have roughly sketched it on the map below.

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Locator: Grand Banks of Newfoundland

species mentioned in this section: shearwaters, gannets, seals, mackerel

48. Why are the coasts off Newfoundland fertile and productive?

49. What conditions promote the large numbers of phytoplankton (what Attenborough calls plants) in these waters?

50. Describe the breeding methods of the capelin.

51. What animals eat the capelin?

52. How are capelin gathered by the humpback whale? What is this technique called?

53. What does the presence of the dead squid bodies signify? What happens to the great harvest of squid?

54. What does a squid do when it is hooked? [Note: this is the squid's escape mechanism that it uses to elude predators.]

55. What other fish comes in great numbers to the Grand Banks? Why?

56. What has been the impact of fishing on the animal populations of the Grand Banks?

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ADDITIONAL INFORMATION: By the early 1990s, the cod and flounder fisheries on the Grand Banks had collapsed. The limits of turbot, ocean perch and other fish species were severely restricted, with drastic economic effects. Check out these web sites for information that is more current than the video: <http://www.gov.nf.ca/exec/premier/gbanks.htm> or <http://www.greenpeace.org/international/news/no-cod-blame-the-seals>

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CONCEPTS FOR EPISODE 12 - NEW WORLDS

THE PROBLEMS ASSOCIATED WITH HUMAN POPULATIONS

The world's population is much larger today than it was when the videotape was made (Attenborough used the number 4 billion and the tapes were made in the early 1980s). As of 11:26 EST on August 7, 2007, there were 6,609,930,520 humans on the earth.

Thus, in less than 30 years, more than 2 billion people have been added to the world's population. According to the estimates of the U.S. Census Bureau, the world's population will reach 7 billion by 2013, 8 billion by 2026 and 9 billion by 2042. Just imagine: nine billion people jammed on the surface of the planet. [Reference: <http://www.census.gov>]

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AUTHORS' NOTE: To really comprehend the problem, most of us have to look at shorter time scales. The population of the world increased by 76,715,602 people in one year from 2006 to 2007. This does **NOT** mean that almost 77 million babies were born. This means that almost 77 million babies were born **IN EXCESS OF** the number of babies born that replaced the people who died in this time period. Or, as depicted below:

$$76,715,602 = \# \text{ born} - \# \text{ died}$$

With rounding, this is roughly equivalent to:

Per Day:	210,180 more people born than died
Per Hour:	8,757 more people born than died
Per Minute:	146 more people born than died

This means that 292 more people were added to the population of this planet if you took two minutes to read and comprehend this note.

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Most of these people will be born in developing countries, places where the people today have a low standard of living. These countries will be hard pressed to feed and house any additional people, and it will be almost impossible to increase their standard of living.

Growth in the human population puts stress on the environment. With more people to feed, more land must be cleared for the production of crops. More fishermen will go to sea, resulting in increased harvesting of commercial fishes. Where there is a natural resource that can generate money to buy food and other items, such as timber or minerals, it will be exploited more fully. All of these activities are carried out to the detriment of natural ecosystems.

Thus, human **overpopulation** leads to environmental degradation. But in case you think that overpopulation in developing countries is the only cause of environmental problems, let's take a look at another kind of overpopulation that is found in the United States: **resource overpopulation**. Resource overpopulation is due to consumption of resources by each person. The effect one human being has on the environment depends on the amount of resources he or she uses. In the United States, on average, each person uses many times the resources of a person in a developing country like Rwanda or Afghanistan. For example, the U.S. population makes up 4.7% of the world's population, but we use 25% of the world's energy and produce 33% of the world's solid wastes. And all these resources we use are ultimately extracted from or have effects upon natural ecosystems. [These numbers are taken from Miller; see below for the reference.]

A simplified schematic of the problem is:

Overpopulation ⇒ Resource Depletion ⇒ Environmental Degradation

CARRYING CAPACITY

Biologists studying natural communities have introduced the concept of carrying capacity. The **carrying capacity** of an ecosystem is the number of individuals it can support without sustaining damage. The question we face today is: Have humans outstripped the carrying capacity of the planet? How many humans can be supported without endangering the ecosystems on which all life depends? We have seen throughout this series, both in the videos and the study guide, the types of effects humans have on ecosystems: Global Warming, Ozone Depletion, Overfishing, Deforestation, Species Extinctions. Do you think that humans have yet to reach their carrying capacity? Or have we already surpassed it?

Please note: carrying capacity does NOT just apply to humans. There is a maximum number of deer that the Hill Country can support without sustaining damage. There is a maximum number of squirrels that can be supported in a forest. There is a maximum number of blue catfish that can live in Town Lake.

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Or, to use the words of a student: The carrying capacity of a community is a reflection of how many organisms can live in that community based on the resources available to support it. Example: you cannot have 10,000 squirrels in an isolated pecan grove of 20 trees.

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SOLUTIONS?

So, how do we solve these problems? Let's look first at the problem of human population growth. A population grows if the number of births per year exceeds the number of deaths. Thus, there are two ways to stop the population from growing: (1) decrease the number of births, or (2) increase the number of deaths. Option two is not a reasonable option for most people. After all, are you willing to kill off yourself and everyone you know just to control our population size? However, nature may use this option to solve the problem for us, whether we like it or not. Consider the Ebola virus or AIDS. These, or a new disease that we haven't heard of yet, could be the plague of the 21st century.

For most of us, option one has to be the one we use if we are serious about controlling the problem. That option itself leads to serious questions. How will the number of births be decreased? Voluntarily? Involuntarily? Who gets to decide how many children you get to have?

The People's Republic of China was until recently one of the countries of the world with a very high growth rate. The Chinese government has been successful at controlling population growth through their One Child Policy. Each couple is allowed to have only one child. Any additional children result in substantial financial and social penalties. The policy has been most successful in urban areas. In rural areas, it has been less successful, in part because rural families rely on the children to help with farming. Without access to the technology used by

Western farmers, farming is a labor-intensive business. Families with few children are unable to successfully farm their land. The Chinese government has recognized this problem, and has relaxed the One Child Policy in rural areas.

Another problem that has emerged since the One Child Policy was begun is female infanticide. If a couple can only have one child, most couples prefer that the child be a son. Some couples, when their only child turns out to be a girl, neglect the girl so that she grows sick and dies. Then the couple can try again for a son. With the use of amniocentesis, a technique that allows some genetic defects and the sex of a fetus to be determined before birth, a couple can choose to abort female fetuses.

So think about an imaginary scenario. You now have the power to enforce population growth. What is your policy going to be?

Now let's look at **resource overpopulation**. There is only one way to solve this problem: use less. These are some of the areas that Americans overuse resources, compared to other nations. We burn more fuel. We generate more wastes. We eat more food. We use more water. We buy more gadgets. We are a nation known for conspicuous consumption. Let's face it - that's why many of us are happy to be Americans.

One campaign promoted in the United States recently to encourage us to reduce resource consumption is based on the slogan: **Reduce, Reuse, Recycle**. This means:

- (1) **Reduce** the amount of stuff you use by cutting down on purchases. Proponents suggest that you buy what you need, not what you want.
- (2) **Reuse** the things you own instead of throwing them out when you're done. For example, instead of throwing out magazines you have read, you could take them to the library for others to read.
- (3) **Recycle** materials such as aluminum cans, office paper, newspapers, plastic bottles, glass. These materials can be transformed into new products. For example, Polartec fleece is made using recycled plastic soda bottles.

So, what are you willing to give up? What are you willing to do? If you were in control, what would your solution be?

These are some of the tough decisions that need to be made NOW. Ignoring them is like being an ostrich with its head stuck in the sand as the lions creep up from behind. As citizens, you are in the position to make a difference.

Attenborough discusses these issues in this final episode. As you watch the videotape, watch for issues that deal with:

- (1) Human population growth,
- (2) Preserving biodiversity,
- (3) Land use problems, and
- (4) Pollution.

Reference:

Miller, G. Tyler, Jr. 1994. *Living in the Environment: Principles, Connections, and Solutions*, 8th ed. Wadsworth, Belmont, CA.

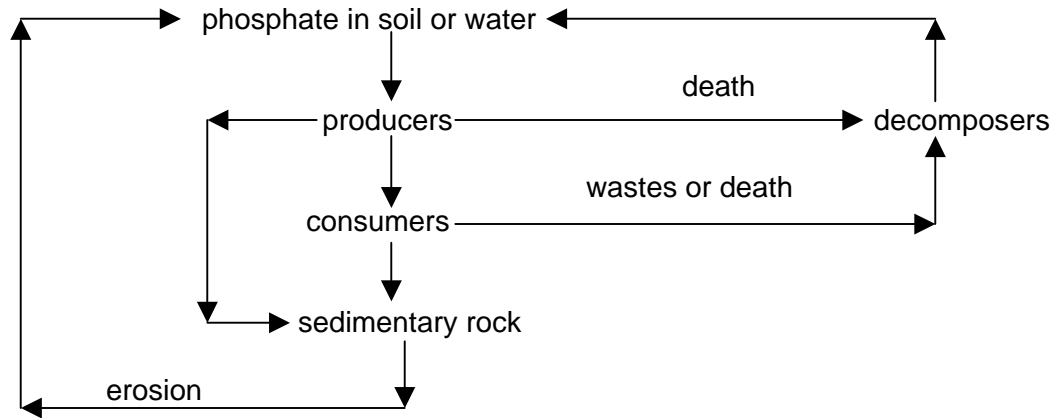
PHOSPHORUS CYCLE

The last nutrient cycle that we are going to discuss is the phosphorus cycle. Phosphorus is used by organisms to make nucleic acids (like DNA). It is also used to make phospholipids, which are a major component of the cell membrane of cells. The phosphorus cycle is different from either the nitrogen cycle or the carbon cycle because it does not have an atmospheric stage. The main form of phosphorus found in the environment is phosphate (PO₄).

Phosphates are found in soil, water and in sedimentary rocks. Remember that the growth of producers is limited by the availability of nitrogen **and** phosphorus. In nature, phosphorus is in short supply. Look at a bag of fertilizer. The ingredients list on the label will tell you how much nitrogen and phosphate is in the fertilizer.

So, if you are a farmer and you want good crops, you use lots of fertilizer. Some of the fertilizer is taken up by the plants; some stays in the soil; some runs off when it rains and ends up in the water. The aquatic algae and plants now have LOTS of available nutrients and they grow and grow and grow. [Remember the **algal bloom** from Episode 8.] As their numbers increase, they use more and more oxygen at night. At some point, they use more oxygen than they produce. Then, the ecosystem collapses. Everything that needs oxygen dies. And so, the results are: no more algae, no more producers, no more snails, no more fish.

Here is a quick overview of the phosphorus cycle:



Reference: Smith, Robert Leo. 1992. *Elements of Ecology*, 3rd ed. HarperCollins, NY.

In the video, Attenborough talks about **guano** which is a waste product produced (in this case) by guanay cormorants. Guano is also produced by bats. Large colonies of seabirds or bats produce large quantities of guano. Humans have used guano for fertilizers for thousands of years. In recent decades, however, the phosphate in fertilizer is made synthetically from phosphorus-containing rocks. Humans mine the rock, extract the phosphate, mix with nitrates and other nutrients and bag it up. As a result, the naturally slow cycling of phosphorus has been drastically accelerated.

CONCEPTS STUDY QUESTIONS FOR EPISODE12 - New Worlds:

1. State the approximate world population in 2003
2. State predicted world populations in:
 - a. 2013
 - b. 2026
 - c. 2042
3. Describe the kinds of environmental degradation caused by increased human populations.

4. Define resource overpopulation.

5. Explain how energy consumption and solid waste production in the United States compares to our percent of the total world population.

6. Define carrying capacity. Explain how you would know when the carrying capacity of a population had been exceeded.

7. Describe the two types of solutions for human overpopulation. Compare benefits and drawbacks of each solution.

VIDEO STUDY QUESTIONS FOR EPISODE 12 - New Worlds

1. What forces have changed the surface of the earth?

2. Why are the poles cold?

3. What causes forests to be replaced by grasslands? What causes grasslands to be replaced by deserts?

4. How have animals adapted to hot conditions? to cold conditions?

5. How have the following humans managed to live in the various habitats without adapting:
 - a. Eskimos

 - b. Indians in equatorial jungles

 - c. Bushman of South Africa

Locator: Middle East

6. What major change in human society occurred in the Middle East about 9,000 years ago?

7. Describe the early village remains that are found in the valley of Beda in Jordan.

8. What type of plant was cultivated?
9. What meat was eaten by these people?
10. Where are caribou found? Where are reindeer found?
11. Describe the Lapp people of Scandinavia. How is the lifestyle of the Lapps related to the lifestyle of the reindeer?

Website on the Sami people: <http://boreale.konto.itv.se/samieng.htm>

12. What have been the effects of the Lapps on the reindeer?

Locator: Britain (White Cliffs of Dover)

13. When did European herdsmen with domesticated stock move into Britain?
14. Describe the changes that man and his domesticated animals brought about in England.

25. Describe the changes that have occurred in turkeys as a result of selective breeding. Where did turkeys originate?

26. Describe the changes that have occurred in chickens as a result of selective breeding. Where did chickens originate?

27. Where did the following common domesticated plants develop?
 - a. potatoes

 - b. peas

 - c. beans

 - d. rhubarb

 - e. beet roots

 - f. carrot

28. Which plant family has been the single most important food plant for man?

29. When was rice domesticated? Where?

30. When was wheat domesticated? Where?

31. How much of the arable land today is devoted to growing rice? How many people depend on rice?

- 32. Which grass species is favored by the Western World?

- 33. How has selective breeding changed wheat?

- 34. What has been the impact of man's preferred monocultures on the communities that once lived on cultivated farmland?

- 35. What other great monoculture is a product of man?

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CLARIFICATION: Even though Attenborough uses the urban environment as another example of a monoculture, this is really a **misuse** of the term.

A monoculture is an agricultural or forestry term used for a plot of land planted with only one **variety** of a crop or a tree. The following are better examples of monocultures than a city: a corn field, a wheat field, your lawn, a golf course planted with one type of grass which is carefully weeded and fertilized, a pecan orchard, a tree farm or a pine plantation.

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- 36. What changes have occurred in dogs and cats, as a result of domestication?

Locator: Mt. Etna, Sicily

- 37. Where was the Oxford ragwort first found? How did it get to Britain? Describe the spread of the Oxford ragwort.

38. How have these animals been affected by human activities?

- a. sea otters
- b. prairie dogs
- c. acorn woodpeckers
- d. osprey
- e. kestrels
- f. kittiwakes
- g. swallows
- h. insects

39. Describe the brown rat. Where did it originate? What problems do they cause for man?

Locator: New York City

40. Describe the impact of these human pollutants on the earth:

- a. rubbish (solid waste)
- b. soap suds

c. oil

d. fumes from engines and factories

Locator: Lakes of Scandinavia

41. What has happened to the lakes of Norway and Scandinavia as a result of pollution? to the forests of Germany?

Locator: Chincha and San Gallan Islands of Peru

42. What is guano?

43. Describe the chain of events that happened when the anchovies were overfished in the 1950s.

44. What is the relationship between anchovies, guanay cormorants and plankton?

