**Chapter 16**

**Biological Resources**

**Lecture Outline:**

1. Biological Diversity
   1. A species is a group of organisms that are capable of interbreeding with one another to produce fertile offspring; to date, 1.8 million species have been scientifically named and described
      1. Variation among organisms is referred to as *biological diversity (biodiversity*)
      2. Biodiversity takes into account *genetic diversity* and *ecosystem diversity*; it is much more than *species richness*
   2. Why we need organisms
      1. Ecosystem services and species richness
         1. The activities of all organisms are interrelated
         2. Species richness within an ecosystem provides the ecosystem with resilience
      2. Genetic reserves
         1. The maintenance of a broad genetic base is critical for each species’ long-term health and survival
         2. Genetic uniformity results in increased susceptibility to pests and disease
      3. Scientific importance of genetic diversity
         1. *Genetic engineering* makes it possible to use the genetic resources of organisms on a wide scale
         2. It has taken hundreds of millions of years for *evolution* to produce the genetic diversity found in organisms today
      4. Medicinal, agricultural, and industrial importance of organisms
      5. Aesthetic, ethical, and spiritual value of organisms
2. Endangered and Extinct Species
   1. *Extinction* is the elimination of a species from Earth; it is an irreversible loss
      1. *Background extinction* has occurred continuously during the time in which organisms have occupied the Earth
      2. *Mass extinctions* have only occurred maybe five or six times
      3. It is greatly accelerated by human activities; Earth’s biological diversity is disappearing at an unprecedented rate
   2. Endangered and threatened species
      1. A species that faces threats that may cause it to become extinct within a short period is considered an *endangered species*
      2. A *threatened species* is a species whose population has declined to the point that it may be at risk of extinction
      3. Characteristics of endangered species
         1. Small (localized) ranges
         2. Requiring a large territory
         3. Living on islands (*endemic* species)
         4. *Habitat fragmentation*
         5. Low reproductive success
         6. Needing specialized breeding areas
         7. Having specialized feeding habits
   3. Where is declining biological diversity the greatest problem?
      1. In the U.S., Hawaii and California have the highest levels of declining biological diversity
      2. Tropical rain forests in South and Central America, central Africa, and Southeast Asia also face serious levels of declining biological diversity
      3. Earth’s biodiversity hotspots
         1. As many as 44% of all species of vascular plants, 29% of bird species, 27% of endemic mammal species, 38% of endemic reptile species, and 53% of endemic amphibian species live within *biodiversity hotspots*
         2. There are 25 biological hotspots around the world
   4. Human causes of species endangerment
      1. In 2001, the Millennium Ecosystem Assessment gathered scientific information about ecosystem changes and the effects these changes have on human well-being; it found that biological diversity is declining due to several direct and indirect factors
      2. Land use change - most species facing extinction today are endangered because of the destruction, fragmentation, or degradation of habitats by human activities
      3. Invasive species
         1. *Biotic pollution* often upsets the balance among the organisms living in a particular area and interferes with the ecosystem’s normal functioning
         2. Foreign species whose introduction causes economic or environmental harm are called *invasive species*
      4. Overexploitation
         1. Species can become endangered or extinct as a result of deliberate efforts to eradicate or control their numbers
         2. Illegal commercial hunting, or poaching, endangers many larger animals
         3. Many unique animals and plants are threatened by *commercial harvesting*
      5. Pollution can degrade wilderness habitats that are “totally” natural and undisturbed
3. Conservation Biology
   1. *Conservation biology* is the scientific study of how humans impact organisms and of the development of ways to protect biological diversity
      1. Conservation biologists believe it is more effective and, ultimately, more economical to preserve intact ecosystems in which many species liven than to work on preserving individual species one at a time
      2. Conservation biologists use two problem-solving techniques to save organisms from extinction
         1. In situ conservation (on site conservation)
         2. Ex situ conservation (off site conservation)
   2. Protecting habitats
      1. Protecting habitats is the single best way to preserve biological diversity
      2. Currently more than 3,000 national parks, sanctuaries, refuges, forests, and other protected areas exist worldwide
         1. Protected areas are not always effective in preserving biological diversity
         2. Ecosystems in which biological diversity is greatest often receive little protection
   3. Restoring damaged or destroyed habitats
      1. In *restoration ecology*, the principles of ecology are used to help return a degraded environment to a more functional and sustainable one
   4. Zoos, aquaria, botanical gardens, and seed banks
      1. All play a critical role in saving individual species on the brink of extinction
      2. *Artificial insemination* and *embryo transfer* are two techniques used in various zoos and aquaria to increase the numbers of rare species
      3. Reintroducing endangered species to nature
         1. The ultimate goal of captive-breeding programs is to produce offspring in captivity and then release them into nature so that wild populations are restored
         2. Only one of every ten reintroductions is successful
      4. Seed banks
         1. More than 100 *seed banks* (gene banks) exist around the world and hold more than three million samples
         2. Many types of plants cannot be stored as seeds, seeds do not remain alive indefinitely, cryopreservation is expensive, and stored plants remain stagnant in an evolutionary sense
   5. Conservation organizations
      1. Essential in the effort to maintain biological diversity
      2. These groups help educate policymakers and the public
4. Conservation Policies and Laws
   1. The Endangered Species Act (1973) protects endangered and threatened species in the U.S. and abroad
      1. Currently more than 1,300 species in the U. S. are listed
      2. It is illegal to sell or buy any product made from an endangered or threatened species
      3. The ESA is one of the most controversial pieces of environmental legislation
   2. *Habitat conservation plans (HCPs)*
      1. Allow a landowner to “take” a rare species if the “taking” doesn’t threaten the survival or recovery of the threatened or endangered species on the property
      2. HCPs do not provide any promise of recovery of rare species
   3. International conservation policies and laws
      1. The World Conservation Strategy (1980) is a plan designed to conserve biological diversity worldwide
      2. The Convention on Biological Diversity (1992) was produced to decrease the rate of extinction of the world’s endangered species; it requires each signatory nation to inventory its own biodiversity and develop a *national conservation strategy*
      3. CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) helps control the exploitation of endangered species
         1. Established in 1975
         2. It bans hunting, capturing, and selling of endangered or threatened species and regulates the trade of organisms listed as potentially threatened
5. Wildlife Management
   1. *Wildlife management* is an applied field of conservation biology that focuses on the continued productivity of plants and animals
      1. Most attention is focused on common organisms
      2. It includes the regulation of hunting and fishing and the management of food, water, and habitat
      3. Wildlife managers manipulate the plant cover, food, and water supplies of a specific animal’s habitat
   2. Management of migratory animals are usually established by international agreements
   3. Management of aquatic organisms
      1. Traditionally, the ocean’s resources have been considered common property, available to the first people to exploit them
      2. Under such management, whales were harvested to the point of *commercial extinction*