

## Miller Notes Supplement (PJ Shlachtman) - Sustaining Wild Species

### *Why Preserve Wild Species?*

- All species have economic, medical, scientific, ecological, aesthetic, and recreational values
  - Economic and Medical Importance of Wild Species
    - 90% of today's crops were domesticated from wild tropical plants
    - Wild species are needed to derive crop strains
    - Pollination by birds and insects essential to food crops
    - 80% of the world's population uses plant extracts for medicine
    - Used for anticancer drugs and popular antibiotics
  - Scientific and Ecological Importance
    - Each species helps scientists understand evolution
    - Sustain biodiversity and ecological integrity
    - Recycle nutrients, generate and maintain soil
    - Absorb pollution and moderate climate
    - Make up a vast gene pool for future evolution
  - Aesthetic and Recreational Importance
    - Ecotourism is a quickly growing segment of global travel industry
    - Ecotourism is often destructive to the natural habitats because of construction of large hotels
  - Ethical Importance
    - Some believe each species has intrinsic value, or an inherent right to exist
    - We have an ethical obligation to protect species from becoming prematurely extinct
    - Some people distinguish between killing different animal species (cockroach vs. deer)
    - Some emphasize that each individual organism, not just species, has the right to survive

### *The Rise and Fall of Species*

#### **Background Extinction vs. Mass Extinction**

- Background
  - Natural rate of extinction, a small number of species become extinct each year
  - Average rate is 3 species for every 10 million
- Mass
  - Abrupt rise in extinction rates, catastrophic and widespread
  - Usually a result of global climate changes
- Five great mass extinctions have occurred in the past 500 million years
- Mass extinctions are followed by adaptive radiations- increase in diversity

#### **The New Mass Extinction Crisis**

- We are rapidly losing biodiversity
- We have little understanding of the earth's 1.75 million identified and 100 million unidentified species
- Precautionary principle- should be used to prevent premature extinction
- Biologists estimate 18,000-73,000 species become extinct each year, rate is accelerating
- Differences between current mass extinction and mass extinctions of the past
  1. Current extinction crisis is caused by a single species, humans
  2. Current mass wildlife extinction is taking place in a few decades rather than thousands of years
  3. We are not only killing off species, but also eliminating biologically diverse environments, including areas such as tropical rainforests, coral reefs, and wetlands that have served as centers for recovery of biodiversity after mass extinctions

## Is there really an Extinction Crisis?

- Critics point out:
  1. We don't really know how many species there are
  2. We cannot observe extinction for species we know little or nothing about

## Endangered and Threatened Species

- 3 Levels of extinction
  1. **Local extinction** - species is no longer found in an area it once inhabited but is still found elsewhere
  2. **Ecological extinction** - there are so few members of a species left it cannot play its ecological roles
  3. **Biological extinction** - species is no longer found anywhere on the earth
- **Endangered species** - so few individuals are left that it could soon become extinct (e.g., California condor, giant panda)
- **Threatened species** - still abundant in its natural range but is declining and will likely become endangered (e.g., Ex- grizzly bear, American alligator)
- Factors that make a species more vulnerable to premature extinction:
  - Low reproductive rate
  - Specialized feeding habits
  - Feed at high trophic levels
  - Large size
  - Specialized nesting area
  - Found in only one region
  - Fixed migratory pattern
  - Preys on livestock or people
- Each species has a critical population density and a minimum viable population size

## Status of Wild Species and Ecosystems in the United States

- 32% of plant and animal species are vulnerable to premature extinction
- Ecosystems are particularly threatened in California, Hawaii, Texas, and the Southeast

### *Causes of Depletion and Premature Extinction of Wild Species*

## Main Causes of Wildlife Depletion and Extinction

- Underlying Causes
  1. Human population growth
  2. Economic systems that fail to value the environment
  3. Greater per capita resource use
- Direct Causes
  1. Habitat loss and degradation
  2. Habitat fragmentation
  3. Commercial hunting and poaching
  4. Overfishing
  5. Predator and pest control
  6. Sale of exotic pets and decorative plants
  7. Climate change and pollution
  8. Introduction of nonnative species into ecosystems

## Protecting Wild Species from Depletion and Extinction

- Three basic approaches to protecting biodiversity

1. **Ecosystem approach:** tries to preserve balanced populations of species in their native habitats and eliminate nonnative species
  2. **Species approach:** based on protecting individual endangered species by identifying them and propagating them in captivity and reintroducing them into their habitats
  3. **Wildlife management approach:** manages game species by using laws that regulate hunting
- **Bioinformatics** - the applied science of managing, analyzing, and communicating biological information. Involves:
    1. Building computer databases to store information
    2. Providing computer tools to find, visualize, and analyze the information
    3. Providing means for communicating the information

### International treaties

- **Convention on International Trade in Endangered Species (CITES)** - 1975, lists 700 species that cannot be traded commercially because they are endangered or threatened

### United States Laws

- **Lacey Act of 1900** - prohibits transporting live or dead wild animals across state borders without a federal permit
- **US Endangered Species Act of 1973** - illegal for Americans to import or trade products made from endangered or threatened species unless it is to enhance the survival of the species
  - Attempts to weaken this act by:
    - Making the protection of endangered species on private land voluntary
    - Having government pay landowners if they must stop using part of their land to protect an endangered species
    - Making it harder to list new species by requiring hearings and peer-review panels
    - Giving the secretary of the interior the power to permit a species to become extinct without attempting to save it
    - Allowing the secretary of the interior to give anyone exemption from the law
    - Allowing landowners habitat conservation plans that exempt the owners from obligations for 100 years or more
    - Prohibiting the public from bringing lawsuits on changes in habitat conservation plans for endangered species
  - Funds for protecting endangered species should be concentrated on species that:
    1. Have a good chance for survival
    2. Have the most ecological value
    3. Are potentially useful for agriculture, medicine, or industry

### Refuges and Protected Areas

- US National Wildlife Refuge System has 508 refuges, 85% are in Alaska
- ¾ of refuges are for protection of migratory waterfowl
- World Conservation Union has helped other countries set up marine protected areas

### Gene Banks and Botanical Gardens

- Seeds of endangered plant species are stored in refrigerated, low-humidity environments
- Maintaining these banks is very expensive
- Existing sanctuaries are too small to preserve most of the world's threatened plants

### Zoos

- Are increasingly being used to preserve endangered species
- Egg pulling- collecting wild eggs laid by endangered species and hatching them in zoos

- Captive breeding- individuals are captured for breeding in captivity with the aim of reintroduction in the wild
- Other techniques:
  - Artificial insemination
  - Surgical implantation of eggs into a surrogate mother of another species
  - Incubators
  - Cross-fostering

### ***Wildlife Management***

- Wildlife management: entails manipulating wildlife populations and their habitats for their welfare and for human benefit
- Manipulation of Vegetation and Water Supplies
- Four types of wildlife species: early successional, mid-successional, late successional, and wilderness
- Habitat management can be used to attract a desired species and encourage growth

### **Sport Hunting for Wildlife Management**

- Licensed hunters can hunt only in certain parts of the year to protect animals in mating season
- Limits set on size, number, and sex of animals killed
- Animals such as deer, raccoons, geese, and beavers are pests in suburban areas and on farms and some people support the killing of these animals
- Defenders argue that they are preserving biological diversity by preventing depletion of other plants and animals
- Opponents argue that hunting causes wild animals to suffer and few that are killed supply food that is needed for human survival

### **Management of Migratory Waterfowl**

- Birds migrate to find conditions suitable for reproduction
- **Flyways** - north-south routes the birds take
- Some countries along flyways have made agreements to protect habitats needed by the birds
- Wildlife officials regulate hunting, protect existing habitats, and develop new habitats for the birds

### ***Fishery Management and Protecting Marine Biodiversity***

#### **Sustaining Freshwater Fisheries**

- Techniques:
  1. Increase certain commercial and sport species and reduce less desirable species by regulating fishing seasons
  2. Build reservoirs and farm ponds stocked with fish
  3. Fertilize nutrient-poor lakes
  4. Protect spawning sites
  5. Control predators, parasites, and diseases

#### **Managing Marine Fisheries**

- Exclusive economic zones- a country's offshore fishing zone that extends 370 kilometers from shore, foreign fishing vessels can fish only with the government's permission
- High seas- ocean area beyond the legal jurisdiction of any country, limitations are set by international maritime law
- Ways to reduce overfishing in US waters:
  1. Gradually phase out government subsidies of the fishing industry
  2. Impose fees for harvesting fish and shellfish from publicly owned and managed offshore waters

### **Why it is difficult to maintain marine biodiversity?**

- Shore-hugging species are adversely affected by coastal development and sediment and wastes from land
- Damage is not visible to most people
- Seas are viewed as an inexhaustible resource
- Most of the ocean area lies outside the legal jurisdiction of any country and is an open-access resource

### ***Case Study: The Whaling Industry***

- Whales are divided into two groups:
  - **Toothed whales** - porpoise, sperm whale, killer whale - bite and chew food
  - **Baleen whales** - blue, gray, humpback- filter feeders - filter plankton and krill
- Whales are easy to kill because of size and invention of harpoon guns and inflation lances
- Harvesting is mostly in international waters
- 8 of 11 major species have been driven to commercial extinction in the past 75 years

### **The Blue Whale**

- World's largest animal
- Have been hunted to near biological extinction for oil, meat, and bone
- Reproductive rate is very slow, making it difficult to recover from low populations
- Have been classified as endangered since 1975
- Some biologists believe that too few blue whales remain to avoid extinction
- The International Whaling Commission (IWC) regulates the whaling industry, has been unable to stop the decline of most whale species
- Whaling is a traditional part of some cultures and economies (e.g., Japan, Norway, and Iceland) some argue the ban on whaling should be lifted for this reason
- In 1994 a permanent whale sanctuary was established in the Antarctic Ocean