

# Wild Living Resources: Plentiful & Endangered



## Biodiversity

Biological Diversity involves 3 main concepts

1. genetic diversity
2. habitat diversity
3. species diversity

•Human activities have had a large impact on all 3 of these. We'll concentrate here on species diversity.

### Species Diversity is a measure of

**species richness**- the total number of a species in area.

**species evenness**- relative abundance of members of each species.

**species dominance**- which species is the most abundant.

### Other terms related to species diversity

**Exotic species**- introduced species

**Endemic species**- native species

**Cosmopolitan species**- species with world wide distribution.

**Ubiquitous species**- species found worldwide in many ecosystems.

### Number of Species on Earth

•Exact number of species on earth at present is unknown.

•There are just over 1million described species (most are plants and insects).

•Most numerous are the **beetles** with ≈100,000 described species.



•Estimates range from 10 million to 100 million total species. (about 15,000 new species are described annually)

### The truth is:

•For endangered species, it is better to have an ecosystem in **GOOD CONDITION** and a small population, than an ecosystem in **BAD CONDITION** and a large population.

**When we say we want to “save” an endangered species, what is it that we really want to save ?  
There are 4 main possibilities:**

1. We want to save a wild creature in a wild habitat as a symbol of what the wilderness means to us.



2. We want to save the wild creature in a managed habitat with little interference by us so we can see what they behave like in their natural habitat.
3. We want to preserve the creature in a zoo, so that the genetic characteristics are maintained in live individuals.
4. We want to preserve only the genetic material from the creature in the form of frozen cells containing DNA from the organism, for future scientific research.

### **Categories of Threatened Species**

•The International Union for the Conservation of Nature (IUCN), headquartered in Switzerland, provides scientists around the world with data on threatened and endangered species.

•They publish their Red List of Threatened species each year. They break the species down into 9 evaluated categories and a “Not Evaluated” categories.

The nine evaluated categories are:

#### **Extinct Categories**

1. Extinct
2. Extinct in the Wild

#### **Threatened Categories**

3. Critically Endangered
4. Endangered
5. Vulnerable

#### **Lower Risk Categories**

6. Conservation Dependent
7. Near Threatened
8. Least Concern

#### **Data Deficient Category**

9. Data Deficient

### **Category Definitions:**

**Extinct (EX):** A taxon is considered extinct when there is no reasonable doubt that the last individual had died.

**Extinction in the Wild (EW):** A taxon is Extinct in the Wild when it is known to survive in cultivation, in captivity or as a naturalized population well outside the past range. A species is presumed extinct in the wild when exhaustive surveys in known or expected habitat at appropriate times throughout its historic range have failed to record any individuals of this species.

**Critically Endangered (CR):** A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria:

- A. An observed, estimated, inferred, or suspected reduction of at least 80% over the last 10 years or three generations, whichever is longer.
- B. Extent of occurrence estimated to be less than 100 km<sup>2</sup> or area of occupancy less than 10 km<sup>2</sup>.
- C. Population estimated to number less than 250 mature individuals and a population is expected to decline at a rate of at least 25% over the next three years.
- D. Population estimated to number less than 50 individuals currently.
- E. Analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is longer.

**Endangered (EN):** A taxon is endangered when it is not Critically Endangered, but is facing a very high risk of extinction in the wild in the near future, as defined by any of the following criteria (A to E).

- A.** Population reduction in the form of either of the following:
1. A reduction of at least 50% over the last 10 years.
  2. A reduction of at least 50% predicted within the next 10 years.

- B.** Extent of occurrence estimated to be less than 5000 km<sup>2</sup> or area of occupancy estimated to be less than 500 km<sup>2</sup>, and estimates indicating any two of the following:

1. Severely fragmented or known to exist at no more than 5 locations.
2. Continuing decline, inferred, observed, or projected, in any of the following:
  - a. extent of occurrence
  - b. area of occupancy
  - c. area, extent and/or quality of habitat
  - d. number of locations or subpopulations
  - e. number of mature individuals

3. Extreme fluctuations in any of the following:
  - a. extent of occurrence
  - b. area of occupancy
  - c. number of locations or subpopulations
  - d. number of mature individuals

- C.** Population estimated to number less than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years.
2. A continuing decline, observed, or projected, in numbers of mature individuals in the form of
  - a. severely fragmented (no subpopulations contain more than 250 individuals)
  - b. all individuals are in a single population

- D.** Population estimated to number less than 250 mature individuals

- E.** Analysis showing the probability of extinction in the wild is at least 20% within 20 years.

**Vulnerable (VU):** A taxon is considered vulnerable with it is not Critically Endangered, or Endangered but is facing a high risk of extinction in the medium-term future.

**Lower Risk (LR):** A taxon it considered to be Lower Risk when it has been evaluated and does not satisfy the criteria for any of the High Risk categories (Extinct, Extinct in the Wild, Critically Endangered, Endangered, or Vulnerable). Taxa included in the Lower Risk category can be separated into three sub-categories:

1. **Conservation Dependent (cd):** Taxa which are the focus of a continuing taxon-specific or habitat specific conservation program, targeted toward the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.

**2. Near Threatened (nt):** Taxa which do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable.

**3. Least Concern (lc):** Taxa, which do not qualify for Conservation Dependent or Near Threatened.

**Data Deficient (DD):** A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution, and/or population status.

**Not Evaluated (NE):** A taxon is Not Evaluated when it has not yet been assessed against the criteria.

**Based on current data the following trends have been shown:**

- 25% of mammal species, 11% of birds, 20% of reptiles, 25% of amphibians, and 34% of fish (primarily fresh water) are at risk of extinction.
- 12.5% (33,798) of the world's vascular plants are under threat of extinction. (Includes 9% of the world's trees)

#### **Justifications for Saving Endangered Species**

**Utilitarian Justification:** Many wild species might be useful to us, and it would be imprudent of us to destroy them before we have had a chance to test their usefulness.

1. Genetic Characteristics
2. Chemical and Medical Uses
3. New Crops and Products
4. Indigenous Peoples (decrease in biodiversity would mean an increase in poverty)
5. Pollution Control
6. Ecotourism (in many countries tourism is the biggest industry)
7. Medical Research

Rosy Periwinkle



Pacific Yew (TAXOL)



**Ecological Justification:** We reason that organisms are necessary to maintain the functions of ecosystems, and the biosphere. Individual species, entire ecosystems, and the biosphere provide public service functions essential or important to the persistence of life, and as such they are necessary for our survival.

1. Conservation of Forests
2. Global Perspective

**Aesthetic & Cultural Justification:** An aesthetic justification asserts that biological diversity adds to the quality of life, providing some of the most beautiful and appealing aspects of our existence. Today we continue to imbue certain animals with cultural significance, for instance, in the US; the bald eagle (which is endangered) is especially valued because it was adopted as the symbol of the new nation when the country was founded.

**Moral Justification:** This is based on a belief that a taxon has a moral right to exist, independent of our need for them. The right for all species to exist is stated in the U.N. General Assembly World Charter for Nature of 1982, and the U.S. Endangered Species Act also includes statements concerning the rights of organisms to exist. Thus a moral justification for the conservation of endangered species is part of the INTENT OF THE LAW.

Moral justification has deep roots. People will not put their money where their hearts are, and have boycotted purchasing tuna that has been caught by methods that are harmful to porpoises, or furs that have been made from pelts of animals that are not ranch raised, etc.

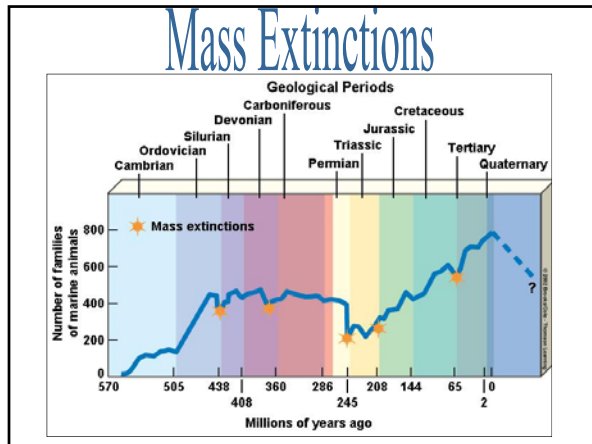
#### **What is the DEEP ECOLOGY MOVEMENT?**

- The deep ecology movement argues that the biosphere ranks more importantly than humans, because the persistence of all life depends on the biosphere. Therefore from a moral perspective, choices should be made for the biosphere, rather than for the people.

#### **Extinction**

- Extinction is the rule of nature.
- Local Extinction: A taxon goes extinct from part of its range, but exists elsewhere.
- Global Extinction: A taxon goes extinct everywhere.
- Extinction is the ultimate fate of all species
- For most of earth's history, the extinction rate has averaged about 1 species per year. The average longevity of a species has been about 10 million years.

- There have been periods of "**mass extinctions**" where many species have gone extinct due to natural disasters or other catastrophes, and there have been periods of rapid evolution of new species. Because of this give and take of biodiversity, some have dubbed it a "punctuated equilibrium" (punctuated extinctions).



•Often these natural extinctions follow logically, as one better prepared species out-competes another for resources, etc. Sometimes though, these extinctions don't follow so naturally.

### Wisconsin Glaciations:

- 10,000 years ago
- 33 genera of large mammals (only 13 genera extinct over the previous 1-2 million years)

### Causes of Extinction

Generally grouped into 5 risk categories

1. **Population Risk:** random variations in population rates in a species of low abundance (over hunting blue whale)
2. **Environmental Risk:** population size can diminish through variations in the physical or biological environment. (Late snow and freeze kept buds closed too long and killed the butterfly)
3. **Natural Catastrophe:** a "sudden" change in the environment, not due to human actions (earthquakes).

4. **Genetic Risk:** Detrimental change in genetic characteristics not caused by external environmental changes. (Genetic drift)

5. **Human Actions:** This lately has been mostly in the form of pollution, but in the past has also been associated with hunting.

### Common Traits of Endangered Species

Easily endangered species (esp. vertebrates) tend to:

1. Be large
2. Have slow reproductive rates (recover the population slowly)
3. Be long-lived  
i.e.-. California Condors raise one offspring every few years.
4. Require large territories
5. Require lots of food per individual  
(Carnivores and large herbivores are particularly susceptible to extinction)
6. BE HIGHLY SPECIALIZED

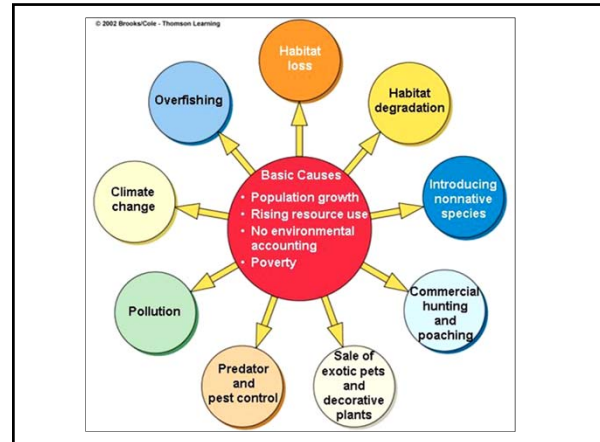
### How People Cause Extinction and Affect Biological Diversity

Human actions cause extinction of species through:

1. Intentional Hunting or Harvesting (generally for commercial purposes) mostly in 1800's
2. Disruptions or Elimination of Habitats
3. Introduction of New Species (parasites, predators, or competitors of a species)
4. Pollution of the Environment

People have been causing extinction of species for a LONG time.

- The IUCN estimates that 75% of the extinctions of birds and mammals since 1600 were caused by humans
- Hunting is estimated to have caused 42% of bird, and 33% of mammal extinctions worldwide
- In the US of 47 species that went extinct between 1700 and 1970, 25 were lost between 1920 and 1970.
- Current estimate is that 50,000 species go extinct yearly (world wide)



• Among the lessons learned is that decline of any particular species rarely has a single cause. Typically multiple forces entrained by human activity reinforce one another and either simultaneously or in sequence force the species down. These factors are summarized by conservation biologists under the acronym **HIPPO**:

**Habitat destruction.** Hawaii's forests, for example, have been three-fourths cleared, with unavoidable decline and extinction of many species

**Invasive species.** Ants, pigs, and other aliens displace the native Hawaiian species.

**Pollution.** Fresh water, marine coastal water, and the soil of the islands are contaminated, weakening and erasing more species.

**Population.** More people means more of all the other HIPPO effects.

**Overharvesting.** Some species, especially birds, were hunted to rarity and extinction during the early Polynesian occupation.

### Introduction of Exotic Species

• As humans began to explore their world, plants and animals followed them (intentionally and unintentionally)

*i.e.*- Asian Water Buffalo in Australia



• Introduced to Australia in 1883 as a beast of burden

• Northern plains had no natural grazers and no natural predators

• Also only 11 of the Asian Water Buffalo's 77 major parasites came with it

• As you can imagine, the AWB's underwent a major population explosion

• The population quickly out grew the carrying capacity, and there were several major die-offs due to SLOW STARVATION.

• The slowly starving AWB's kept eating everything they could, and in the dry season there was bare ground, instead of dry grasses (more erosion)

• An unstable population of the AWB's exists in Australia today, but it fluxgates greatly.

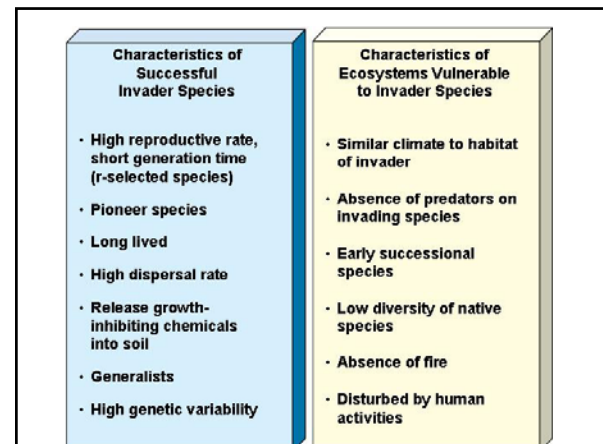
•As people colonized new areas, they brought their favorite foods with them. (In Great Britain, the only native foods that would have been found would have been **nuts, berries, and wild game**, all other foods grown in Great Britain have been imported)

•Oranges originated in southern China, but are now grown in Mediterranean climates around the world.

•Wheat originated in the Middle East and Northern Africa

•Corn originated in Mexico and South America

•Now both are grown on all continents (except Antarctica) and in all temperate climates were people live.



### Inadvertent Introductions

•Small pox and Chicken pox came with the European settlers in America, and caused fatal epidemics among the Native American Peoples.

•Mice, Rats, and Weeds (as seeds) have come along for the ride on many expeditions of discovery.

### Intentional Introductions

•These often turn disastrous as they are turned out to, or escape to the wild.

•Commercial Trade in Endangered Species

### WILDLIFE MANAGEMENT

- Traditionally, wildlife management plans focused on large, terrestrial mammals and birds that were hunted for food, used commercially or for sport.

Goals were stated in terms of :

1. **Maximum Sustainable Yield (MSY)**: maximum production per unit of time that could be sustained indefinitely without decreasing the capacity to sustain production.
2. **Optimum Sustainable Yield (OSY)**: maximum production maintained without detriment to the population or it's ecosystem

### The Logistic Growth Curve

•S shaped growth curve

•**Logistic Carrying capacity** has been an important concept in wildlife management, but it is flawed in that populations fluctuate around the carrying capacity, which is not necessarily a good thing.

•Carrying Capacity (without the logistic qualifier) is used more broadly to define the ability of a population to thrive without massive die-offs, etc.



**How Can We Better Manage Wildlife**

Since the logistic curve is not a good basis for wildlife management, a group of organizations have proposed 4 principles to base management strategies on:

- 1. A Realistic Population Size...** a safety factor in terms of population to allow for limitations of knowledge and the imperfections of procedures.
- 2. A Concern for Community...** a concern for the entire community of organisms and all the renewable resources, so that policies developed for one species are not wasteful of other resources.

- 3. Maintenance of the Ecosystem...** minimize the risk of irreversible change and long-term adverse effects as a result of use.

- 4. Continual Monitoring, Analysis, and Assessment...** use science, knowledge and interest in the wildlife and ecosystem for evaluation of maintenance.

**It is also suggested that wildlife managers look at:**

- age structure of the population
- wildlife management techniques
- knowledge of area specific problems
- special look at management and conservation of migratory species

**What is Being Done to Help Conserve Biological Diversity and Endangered Species**

1. Taking emergency actions for seriously endangered species
2. Determining the minimum viable population size for a species and assist species to achieve this size.
3. Restoring damaged habitat, and ecosystems or creating a new appropriate habitat.
4. Taking an ecosystem approach to conservation
5. Understanding and applying the concept of an Ecological Island.
6. Monitoring of populations, habitats and ecosystems
7. Developing better ways to project future population numbers
8. Enact new and better protective laws (like the endangered species act) internationally.