

HOW DO POPULATIONS GO EXTINCT?

NREM450

LEARNING OBJECTIVES

- Describe the process a wildlife manager must go through to manage wildlife of concern. While describing the process, demonstrate comfortable mastery of knowledge from previous lectures and course materials.
- Describe when *ex situ* management may be necessary, and identify best practices
- State and describe the advantages and disadvantages of community conservation areas, compared with national parks and preserves
- Identify advantages and disadvantages of national parks and preserves
- State cases where legislation may assist in managing wildlife
- Identify locations and taxa which are currently managed ONLY through conservation international efforts
- State and describe the five categories used by the IUCN red data books
- Identify the importance and usefulness of CITES
- State and describe the causes of extinctions
- Describe how contraction and modification of habitat may contribute to extinction
- Identify situations where harvesting by humans may be sustainable or unsustainable, and potential solutions
- Describe how introduction of a novel species may result in population decline of native populations. (i.e. introduced primary vs. secondary consumer, differing effects on predators or prey, based on predator-prey theory)
- State and describe other potential causes of decline
- Demonstrate the process a wildlife manager must go through to prevent extinction of a population. Demonstrate comfortable mastery of knowledge from previous lectures and course materials.

Process

1. Recognize a decline
2. Determine causes

Next steps...

- ▣ Legislative change?
- ▣ Active management?
 - Examples

How populations go extinct

- Stochastic extinctions

1. Demographic malfunction (small populations)
2. Genetic malfunction (loss of heterozygosity)

- Driven extinctions

3 most common causes of driven extinctions:

1. Contraction & modification of habitat
2. Unsustainable harvesting by humans
3. Introduction of a novel pathogen, predator, or competitor into the environment

1. Contraction & Modification of Habitat

- Generalists vs. **Specialists**
- **Habitat**: food, protective cover from predators, denning sites, shelter from inclement weather, access to mates
- **Patchiness** of habitat
- Extinction: negative function of patch size
- **Colonization rates**: low when patches are widely spaced
- Data: local extinction and recolonization events across a **matrix** of possible sites

1. Habitat Fragmentation

□ Edges:

- ▣ Some species require interior forest habitats
- ▣ More edge = more incursion of predators from outside the patch, increasing predators on interior forest species

□ Connectivity:

- ▣ some species need to disperse through intact habitat

2. Unsustainable harvesting by humans

- Game species:
- **Sustainable:** species with high fecundity, rapid turnover, broad geographical distribution, ability to tolerate interference by hunting humans
- **Unsustainable:** Hunting for male ornaments (horn, tusks, antlers, etc.)
 - ▣ Black rhinos, elephants, big cats
- **Value** increases with age of male (w/ later decline in deer)
- Ex: lions
 - ▣ Simple harvesting strategy, reliable clue to age

3. Introduction of a novel species

- Modification of trophic relationships
- Ex: Endemic species on islands
- 1. Predator-prey theory
 - A. Efficient predator
 - High rates of capture even at low prey densities
 - High efficiency of conversion of prey into offspring
 - Results in small prey population → stochastic demographic/environment dynamics increase probability of extinction
 - Ex: brown tree snake

3. Introduction of a novel species

B. Hyperpredation

- ▣ Exotic prey with higher reproduction subsidizes native predator, increasing predation on native prey
- ▣ Asymmetric apparent competition induced via subsidies to a common predator population

May lead to:

- ▣ Extinction of endemic prey, perpetuation of exotics and predators
- ▣ Extinction of exotics but perpetuation of endemic prey and predators
- ▣ Extinction of predators but perpetuation of both prey
- ▣ Coexistence of all three species
- ▣ Ex: Channel Island fox, feral pig, golden eagles

3. Introduction of a novel species

- C. Indirect reduction of prey
 - Loss of prey results in reduction in native predators
 - Ex: tigers, leopards, ungulates
- D. Introduction of predators

Other causes of decline

- Side effects of pest control
 - ▣ Ex: black-footed ferret
- Poorly regulated commercial hunting
 - ▣ Ex: commercial whaling
- Unregulated recreational hunting
 - ▣ Ex: Arabian oryx
- Competition with introduced species
- Environmental contaminants
 - ▣ Ex: raptors
- Introduced diseases
 - ▣ Ex: Hawaiian birds

How to prevent extinction

- Identify the problem
- Is the cause of decline a single factor or a combination of factors?
- Are those factors still operating?
- If so, can they be nullified?
- Hypothesis-driven testing
- Rescue and recovery
- Places of conservation