NELSON EDUCATION | Canada's Learning Advantage

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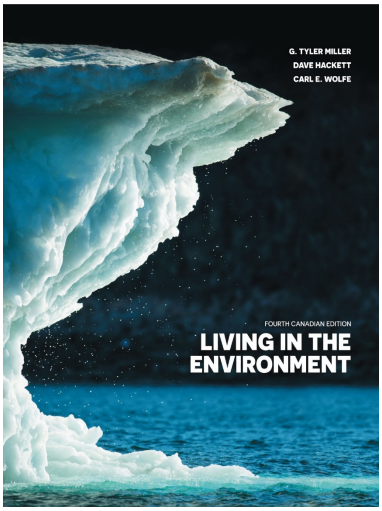

prepared by

Ian Dawe

Chapter 12

Sustaining Biodiversity: The Species Approach

Key Concepts

Why should we preserve wild species?

Types of species extinction

Factors contributing to extinction

- Habitat loss and degradation
- Deliberately introduced species
- Illegal removal or poaching
- Predator control

Key Concepts

Risk categories

- Extirpated, endangered, threatened, special concern

Protection of endangered species

- Treaties, refuges, sanctuaries

Reconciliation ecology

Species Extinction

Local Extinction
– No longer found in a specific area
– Can still be found elsewhere

Ecological Extinction
– Too few individuals left to fulfill its role in the ecosystem

Biological Extinction
– No longer found anywhere on Earth

Extinct Canadian Species

Fifteen species have become extinct in Canada, including:

Case Study
The Passenger Pigeon: Gone Forever

From numerous to extinct in 100 years

Uncontrolled hunting

Habitat loss

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Characteristics of Extinction-Prone Species

Characteristics of Species Prone to Ecological and Biological Extinction

Characteristic	Examples
Low reproductive rate	Blue whale, giant panda, rhinoceros
Specialized niche	Blue whale, giant panda, Everglades kite
Narrow distribution	Elephant seal, desert pupfish
Feeds at high trophic level	Bengal tiger, bald eagle, grizzly bear
Fixed migratory patterns	Blue whale, whooping crane, sea turtle
Rare	African violet, some orchids
Commercially valuable	Snow leopard, tiger, elephant, rhinoceros, rare plants and birds
Large territories	California condor, grizzly bear, Florida panther

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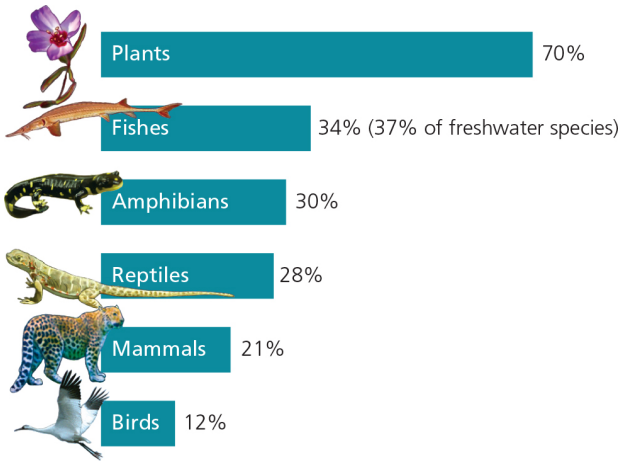
Species Threatened with Extinction



Source: Based on data from International Union for Conservation of Nature, Conservation 2009.

The Human Effect

- Current rate of extinction 1000 to 10 000 times what it was before the rise of humanity
- Annual extinction rate is between 0.1% and 1%.
- This would lead to 20% of animal and plant species gone by 2030.
- But it may be worse—these are conservative estimates.

How Do Biologists Estimate Extinction Rates?

Use of measurements and models

– **Species-area relationships**

Challenges

– Difficult to document over long time periods
– Many species not yet identified
– Little known about most identified species

Why Should We Preserve Wild Species?

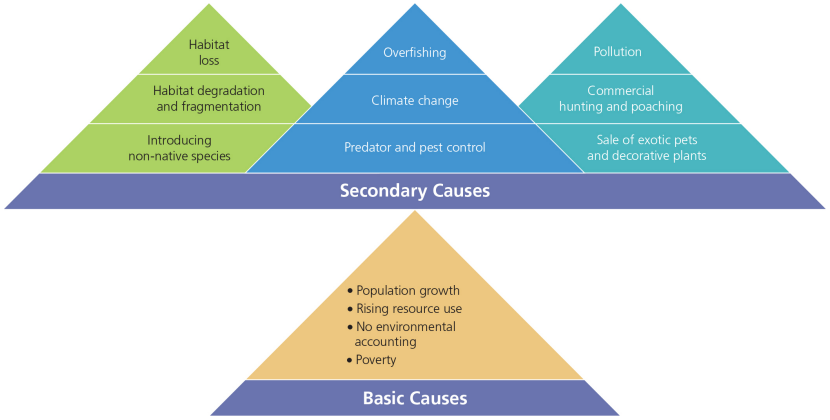
It would take 5 million years to rebuild destroyed biodiversity.

Intrinsic value

Economic and ecological services of species

– Genetic information
– Recreational pleasure
– Ecotourism

Basic and Secondary Causes of Depletion and Extinction



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Causes of Depletion of Wild Species

Habitat destruction

Invasive species

Population (humans) growth

Pollution

Overharvesting

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Causes of Depletion of Wild Species

Direct Causes

- Habitat loss
- Habitat degradation and fragmentation
- Introduction of non-native species
- Pollution
- Climate change
- Overfishing
- Commercial hunting and poaching
- Sale of exotic pets and decorative plants
- Predator and pest control

Habitat Loss and Degradation

Single greatest threat to species survival

– Deforestation
– Wetlands destruction
– Plowing of grasslands

Habitat fragmentation

- Isolation and scattering makes species more vulnerable

Threats from Non-Native Species

Deliberately introduced species

– For food, medicine, shelter, aesthetics

No natural predators in new environment

Can overrun native species

Characteristics of Successful Invader Species

- High reproductive rate, short generation time (*r*-selected species)
- Pioneer species
- Long-lived
- High dispersal rate
- Release growth-inhibiting chemicals into soil
- Generalists
- High genetic variability

Characteristics of Ecosystems Vulnerable to Invader Species

- Similar climate to habitat of invader
- Absence of predators of invading species
- Early successional systems
- Low diversity of native species
- Absence of fire
- Disturbed by human activities

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How Can We Reduce Threats from Non-Native Species?

Prevention

– Identify characteristics of successful invaders and screen for these

– Inspect imported goods likely to transport species

– Ban the transfer of harmful invader species

Awareness and Control

– Be aware of how invader species arrive

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Other Extinction Threats

Hunting and poaching

Predator control

Market for exotic pets and plants

Climate change and pollution

Legislation Protecting Wild Species

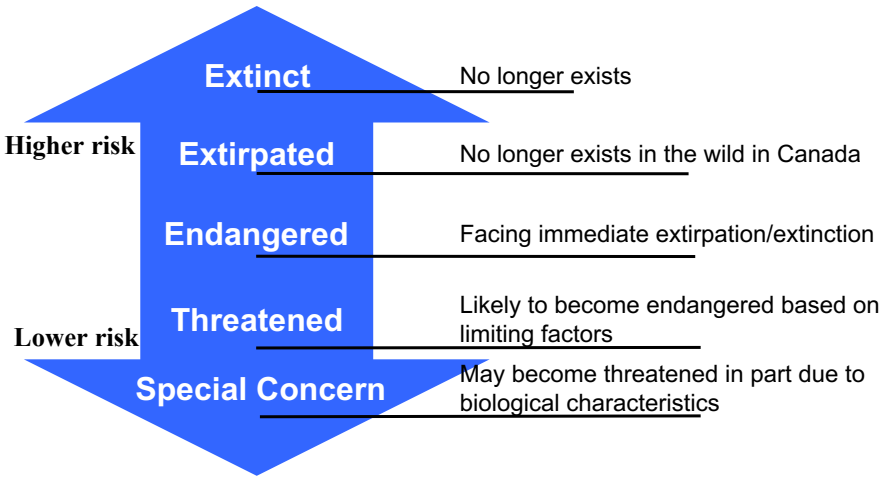
International treaties

- Convention on International Trade in Endangered Species (**CITES**)
- Convention on Biological Diversity (**CBD**)
- Enforcement is limited and difficult.

National legislation

- Committee on the Status of Endangered Wildlife in Canada (**COSEWIC**)
- Species at Risk Act (**SARA**)

COSEWIC Risk Categories



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COSEWIC Risk Categories: Canadian Examples

Extirpated
- Greater prairie chicken
- Black-footed ferrets

Endangered
- Swift fox
- Vancouver Island marmot

Threatened
- Woodland caribou
- Fowler's toad

Special Concern
- Polar bear
- Mountain beaver

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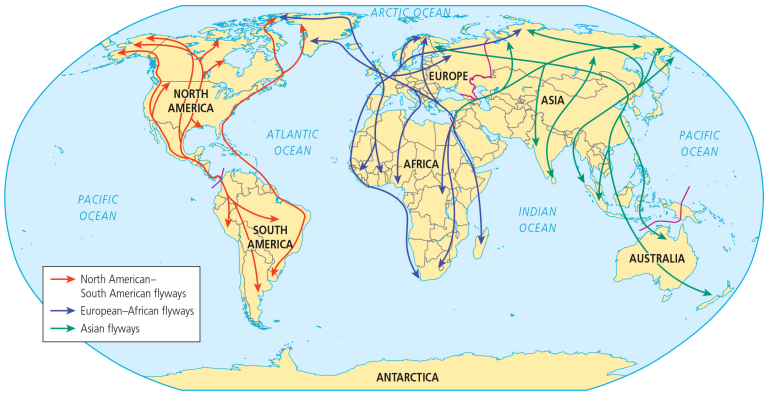
Woodland Caribou Distribution

Source: Based on
http://www.gov.mb.ca/conservation/wildlife/sar/fs/wlcaribou.html;
http://www.gis.unbc.ca/courses/geog413/projects/2010/willame/index.htm;
http://en.wikipedia.org/wiki/File:Rangifer_tarandus_Map_NA.svg

Major Flyways of Migratory Birds

International treaties exist to protect these flyways.



Protecting Wild Species: The Sanctuary Approach

Wildlife refuges and protected areas

Gene banks, botanical gardens, and farms

Zoos and aquariums

Challenges

- Species often concentrated near human development
- Limited size
- Funding requirements
- Reintroduction from seed banks or zoos

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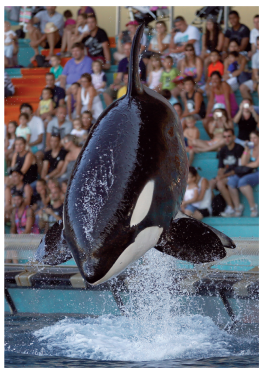
Zoos and Aquariums

Good: They entertain and educate

Not so good: Their efforts to introduce species-at-risk back into the wild have not been effective.

Ethical concerns



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Reconciliation Ecology

Reserves can only protect 5% of nature.

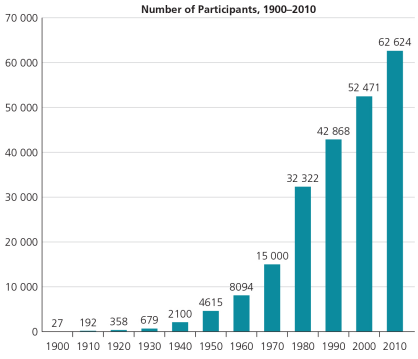
Reserves are also expensive to maintain.

Instead, maintain cooperative lifestyle

– New habitats for species conservation in proximity to human populace

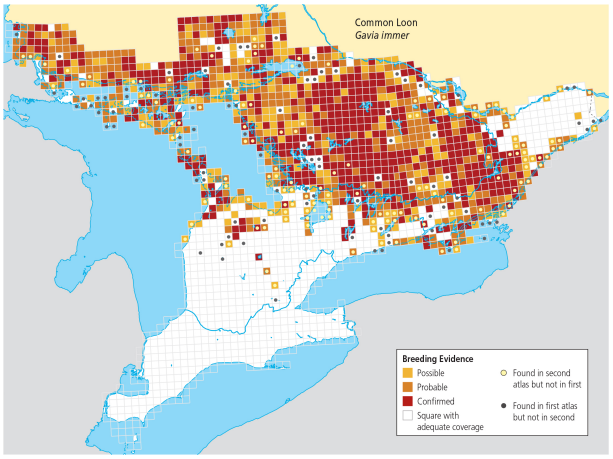
Voluntary Conservation Efforts

Initiatives whose success depends on citizen participation



Source: Data from http://www.audubon.org

Voluntary Conservation Efforts (Loons)



Source: Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007. *Atlas of the Breeding Birds of Ontario, 2001–2005*. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto xxii + 706 pp. Map provided by Andrew Couturier, Bird Studies Canada, and used with permission from the *Atlas of the Breeding Birds of Ontario, 2001–2005* (Cadman et al., 2007).

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Conclusion

Background extinction and mass extinction

Human activity driving up extinction rate

Protect species through:

- International treaties
- Prevent habitat loss and invasive species
- Create sanctuaries
- Practise reconciliation ecology

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