# CH 38: Conservation biology

李承叡
生態學與演化生物學研究所
生命科學館 1129

Figure 38.0-1

The pika's high body temperature is well-suited to the chilly climate of its mountain habitat.

https://www.youtube.com/watch?v=gJ0WkEeAjuQ

Figure 38.0-2

# Chapter 38: Big Ideas

The Loss of Biodiversity

Conservation Biology and Restoration Ecology

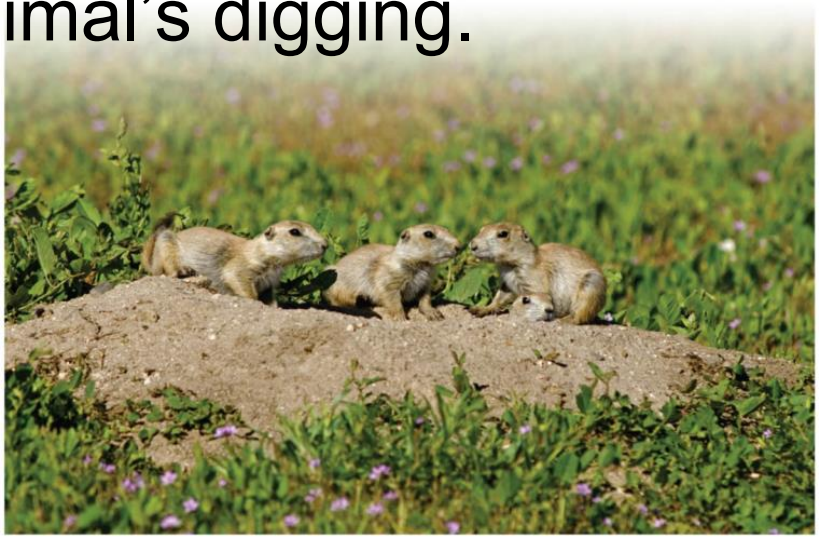
# The Loss of Biodiversity

# 38.1 Loss of biodiversity includes the loss of ecosystems, species, and genes

- Biodiversity encompasses three levels:
  1. ecosystem diversity,
  2. species diversity, and
  3. genetic diversity.

# 38.1 Loss of biodiversity includes the loss of ecosystems, species, and genes

- Because of the network of community interactions among species, the loss of one species negatively affect the species richness of an ecosystem.
- In prairie ecosystems, plant and arthropod diversity is greatest near prairie dog burrows, where the soil has been altered by the animal's digging.



# 38.1 Loss of biodiversity includes the loss of ecosystems, species, and genes

- The enormous genetic diversity of all the organisms on Earth has great potential benefit for people, too.
  - Breeding programs have narrowed the genetic diversity of crop plants.
  - Resistance genes found in the wild relatives of wheat may hold the key to the world's future food supply.

Figure 38.2a

# 38.2 CONNECTION: Habitat loss, invasive species, overharvesting, pollution, and climate change are major threats to biodiversity

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- Invasive species
  - compete with native species,
  - prey on native species, and
  - parasitize native species.
- The Pacific island of Guam was home to 13 species of forest birds when brown tree snakes arrived as stowaways on a cargo plane.

# 38.2 CONNECTION: Habitat loss, invasive species, overharvesting, pollution, and climate change are major threats to biodiversity

- Overexploitation is the third major threat to biodiversity.
  - threatened rare trees,
  - reduced populations of tigers, Galápagos tortoises, whales, and rhinoceroses, and
  - depleted wild populations of game fish.
- In parts of Africa, Asia, and South America, wild animals are heavily hunted for food.
  - Land animal: Why is Taiwan not in the list?
  - 台灣漁業: 過度捕撈 + 海洋污染

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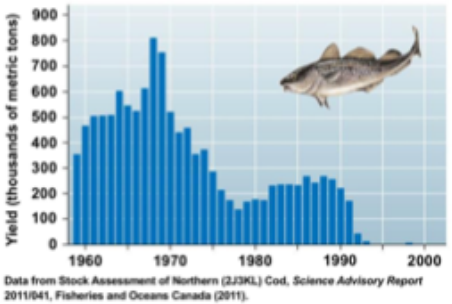


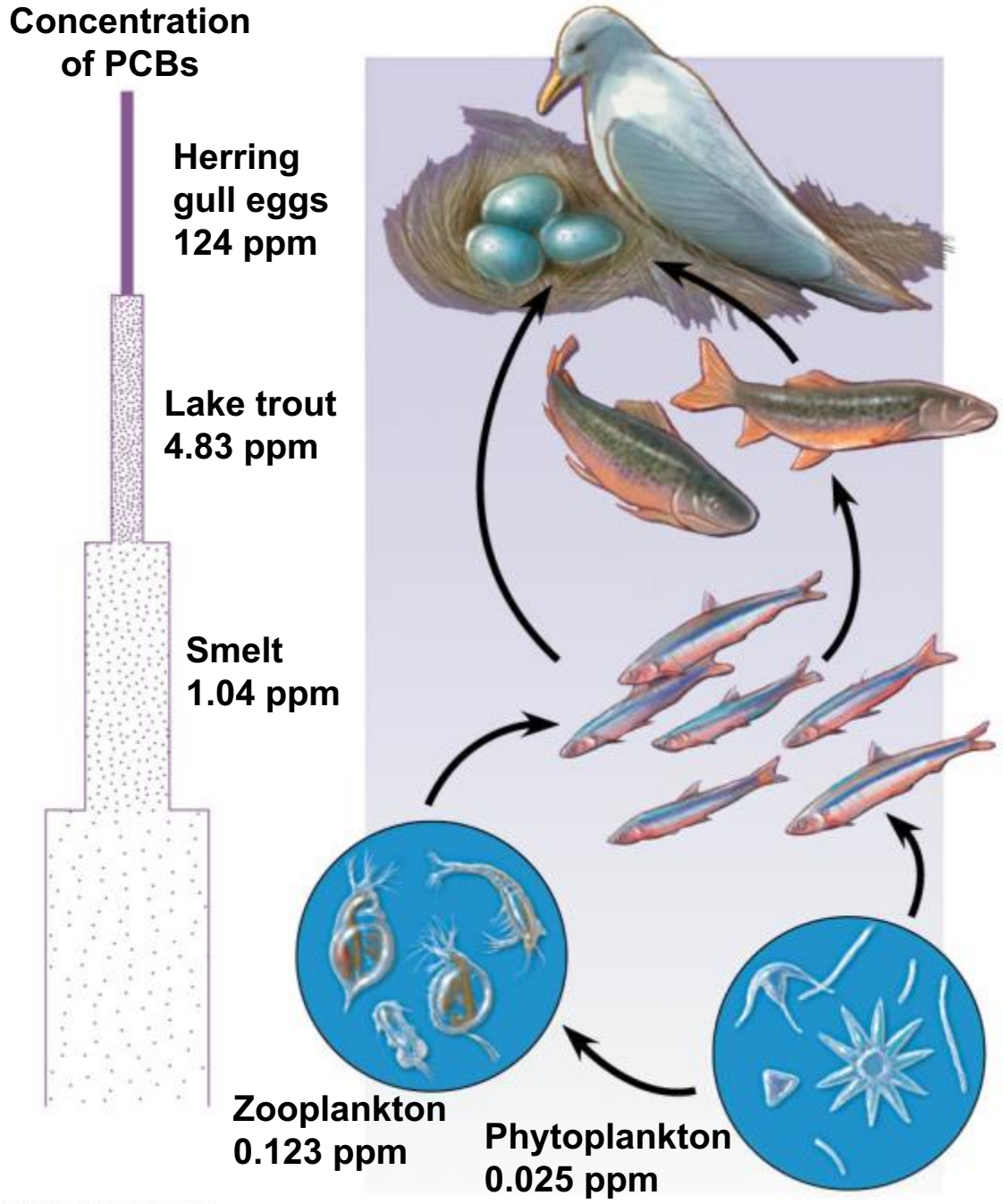
Data from Stock Assessment of Northern (2J3KL) Cod, *Science Advisory Report* 2011/041, Fisheries and Oceans Canada (2011).

- What about North America and Europe?
- Atlantic cod
- Bison
- https://zh.wikipedia.org/wiki/%E7%BE%8E%E6%B4%B2%E9%87%8E%E7%89%9B
- https://en.wikipedia.org/wiki/Bison_hunting
- Passenger pigeon
- https://zh.wikipedia.org/wiki/%E6%97%85%E9%B4%BF

# 38.2 CONNECTION: Habitat loss, invasive species, overharvesting, pollution, and climate change are major threats to biodiversity

- **Biological magnification** concentrates industrial wastes and pesticides as they pass through the food chain.
- Thus, top-level predators are usually the organisms most severely damaged by toxic compounds in the environment.

Figure 38.2d



# 38.2 CONNECTION: Habitat loss, invasive species, overharvesting, **pollution**, and climate change are major threats to biodiversity

- Recently, scientists have recognized a new type of aquatic pollutant, plastic particles that are small enough to be eaten by zooplankton.
  - Many body washes and facial cleansers include plastic "microbeads" to boost scrubbing power.
  - Too small to be captured by wastewater treatment plants, these microparticles enter the watershed and eventually wash out to sea.
  - Larger particles used in making plastic products are also common marine pollutants.

# 38.3 CONNECTION: Rapid warming is changing the global climate

- Average global temperature has risen 0.8°C (1.5°F) in the last 100 years:
  - 0.6°C of that increase occurred in the last three decades and
  - 2 to 6°C (3.6–10.8°F) increases are likely by the end of the 21st century, depending on the rate of future greenhouse gas emissions.

Figure 38.3a

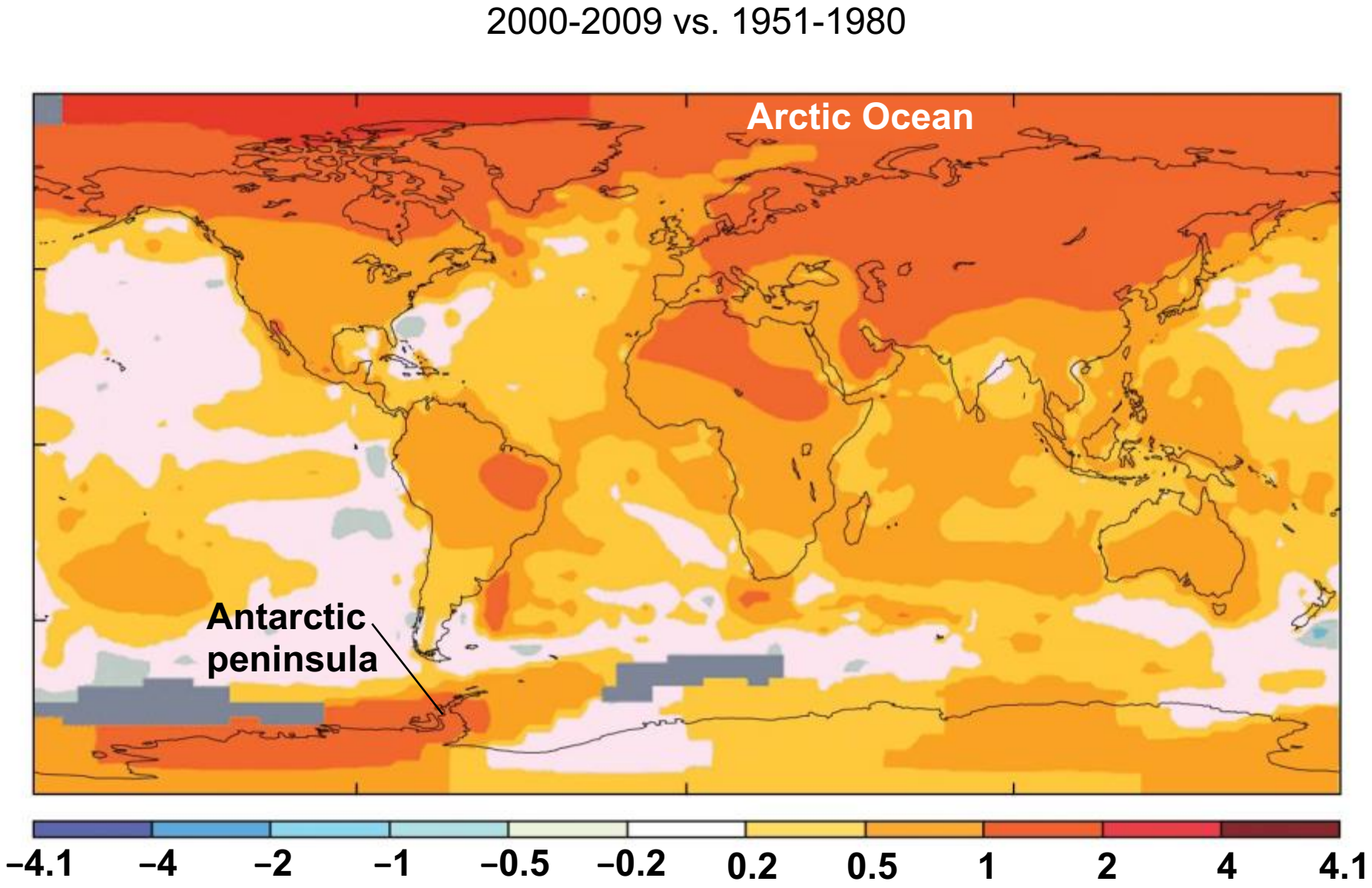
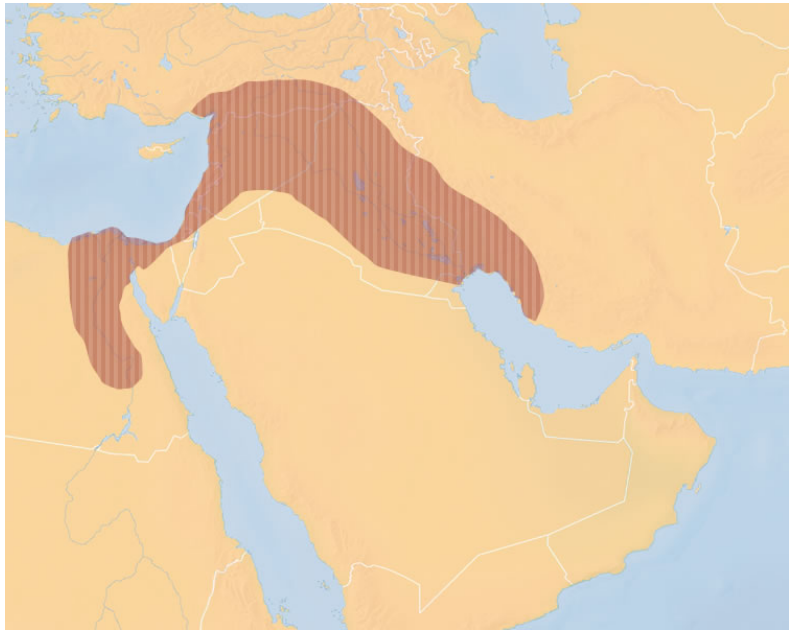


Figure 38.3b-0

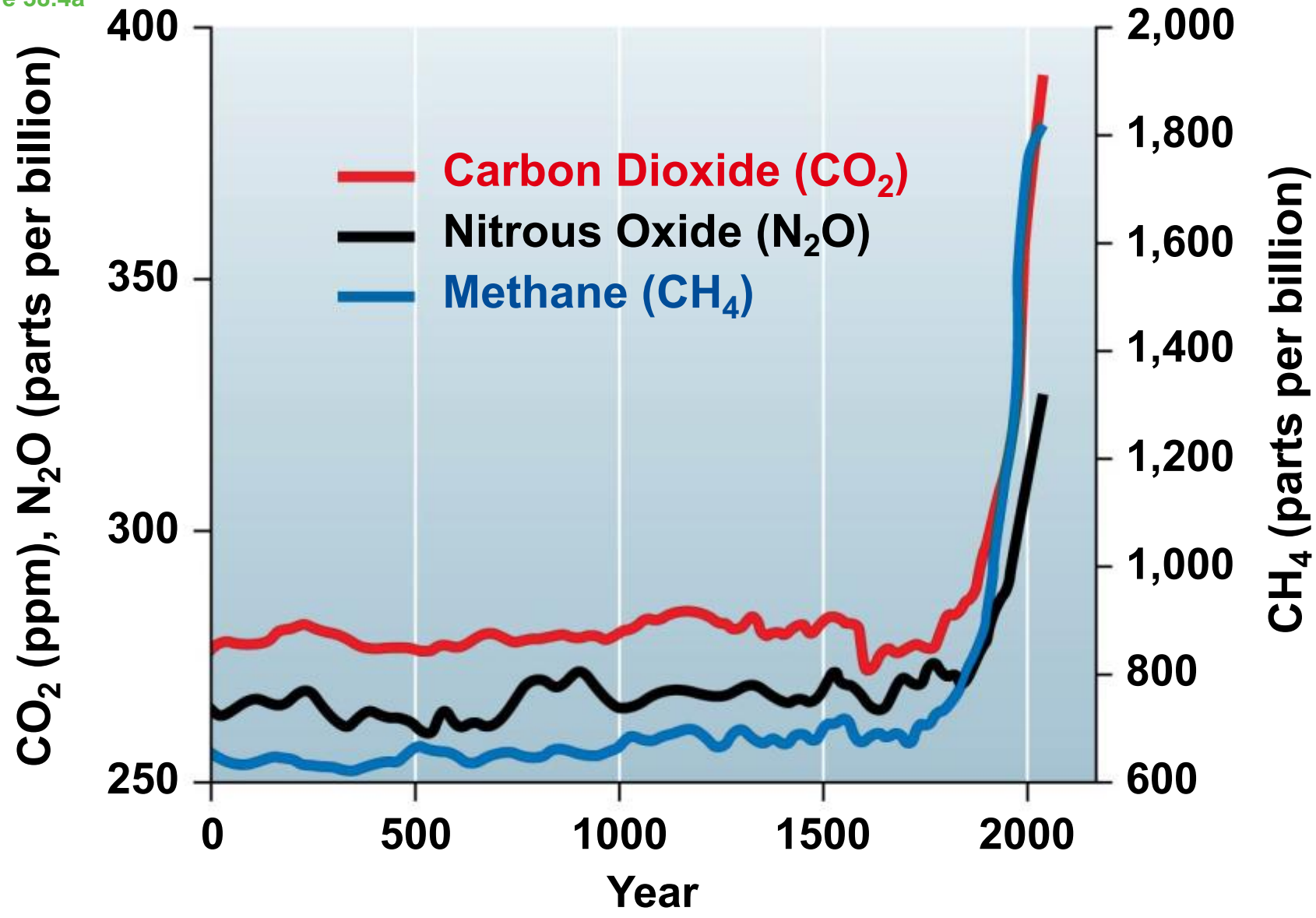
1938 1981 2009

# The fertile crescent ?



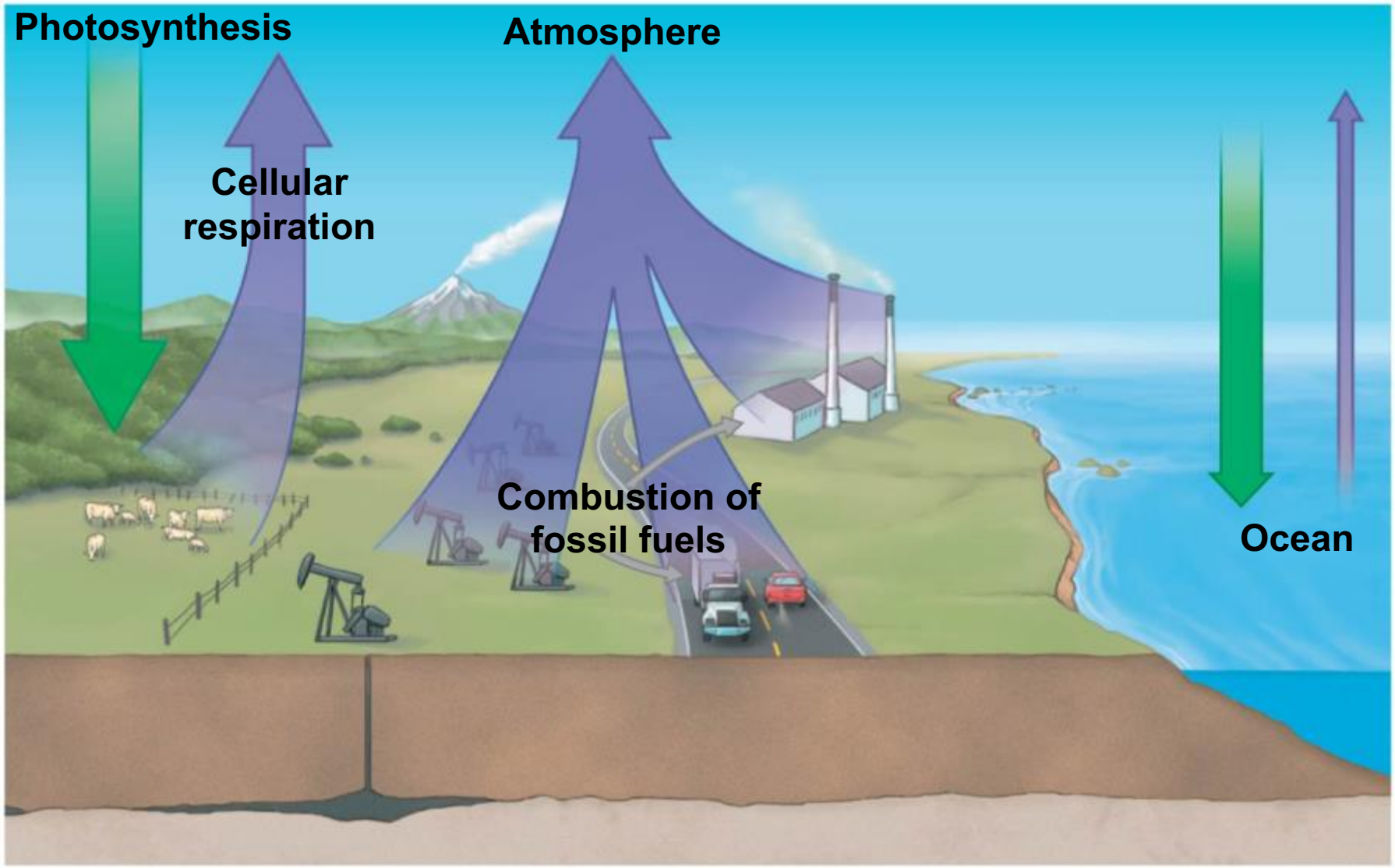

http://www.spiegel.de/international/world/grossbild-547763-1151885.html

Figure 38.4a




Data from Climate Change 2007: The physical science bases: Contribution of Working Group I to the fourth assessment report of the International Panel on Climate Change, IPCC Secretariat.

Figure 38.4b



# Not only temperature…

- $CO_2$ may also be absorbed into the ocean.
  - $CO_2$ dissolves in water: it becomes carbonic acid.
  - Decreases in ocean pH
  - Organisms that construct shells or exoskeletons out of calcium carbonate ($CaCO_3$), including corals and many plankton, are most likely to be affected.

  - Falkowski 1994. Photosynth Res 39(3):235-258 "Phytoplankton … fix between 30 and 50 billion metric tons of carbon annually, which is about 40% of the total."

# Conservation Biology and Restoration Ecology

# 38.7 Protecting endangered populations is one goal of conservation biology

- **Conservation biology** is a goal-oriented science that seeks to understand and counter the rapid loss of biodiversity.

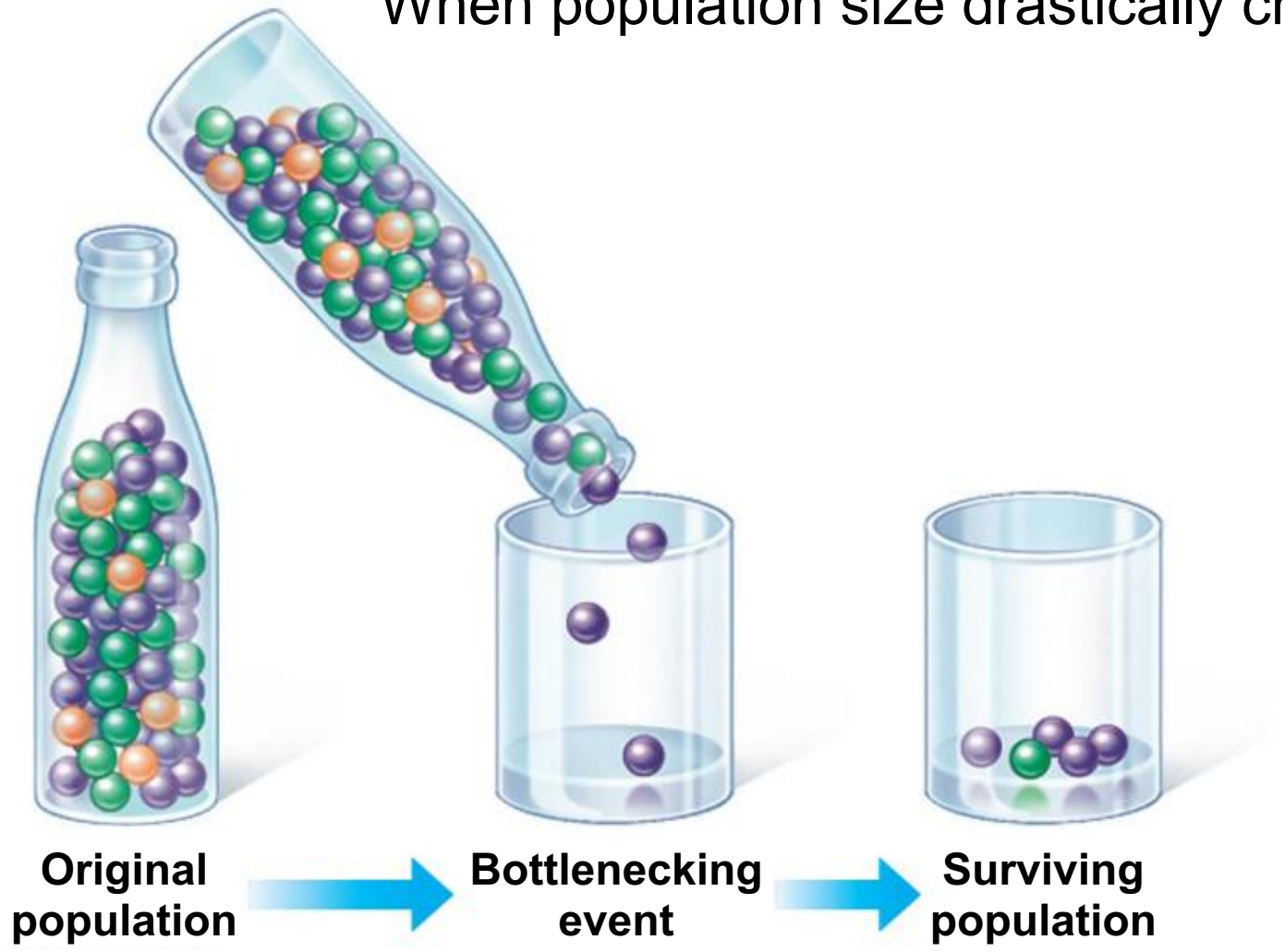
# 38.7 Protecting endangered populations is one goal of conservation biology

- The black-footed ferret in the United States
  - was reduced to just 18 individuals,
  - has been bred in captivity, and
  - was reintroduced into the wild.
- Today, about 1,000 adult ferrets from Canada to Mexico.
- So things are ok now?

Figure 13.12a-3

# The bottleneck effect

When population size drastically changed



# 38.8 Sustaining ecosystems and landscapes is a conservation priority

- Conservation biology often aims to sustain the biodiversity of entire ecosystems and **landscapes**, a regional assemblage of interacting ecosystems.
- **Landscape ecology** is the application of ecological principles to the study of the structure and dynamics of a collection of ecosystems.
- Edges, or boundaries between ecosystems, are prominent features of landscapes.

Figure 38.8a

# 38.8 Sustaining ecosystems and landscapes is a conservation priority

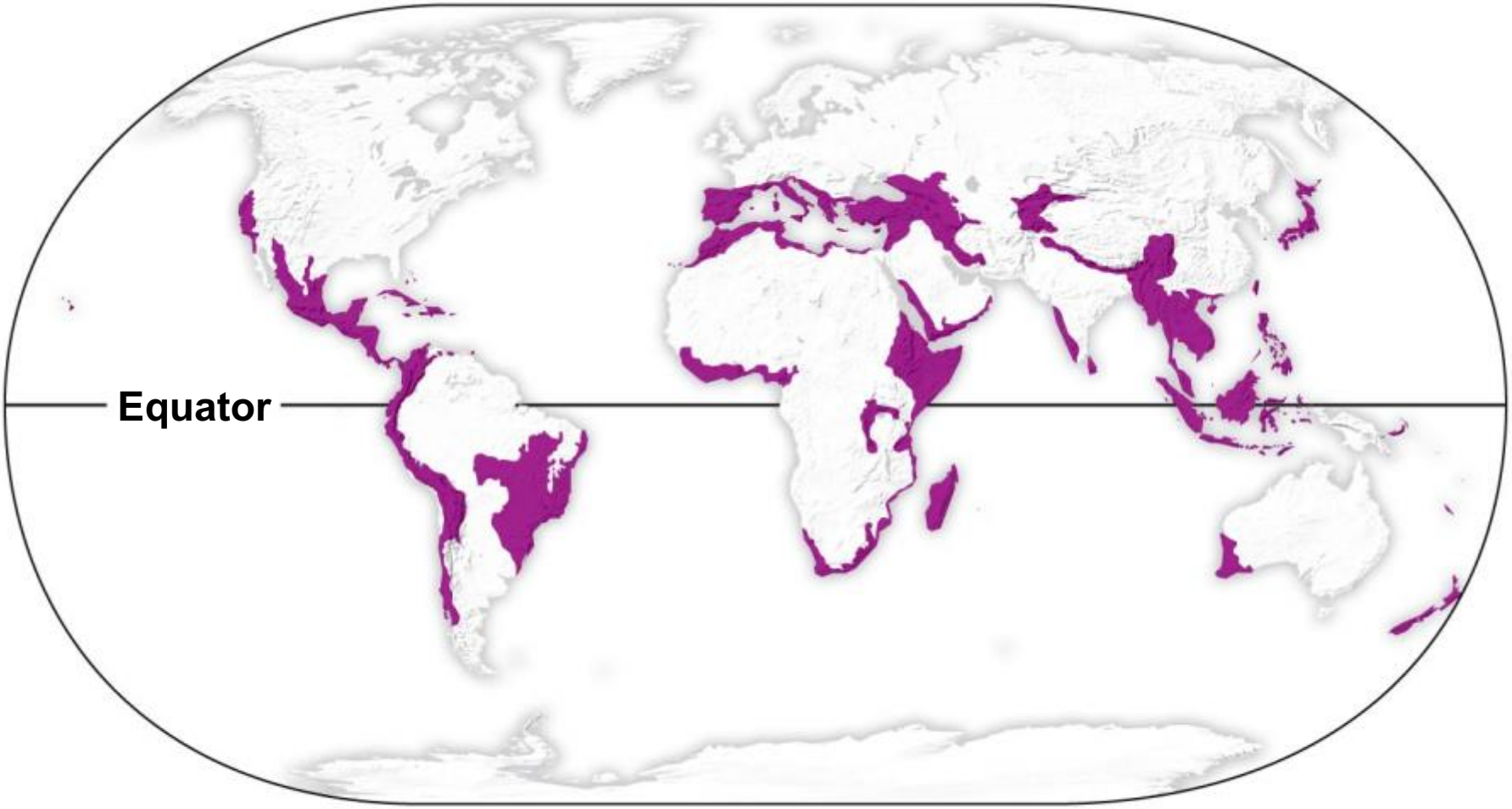
- Where habitats have been severely fragmented, a **movement corridor**, a narrow strip or series of small clumps of high-quality habitat connecting otherwise isolated patches, can be a deciding factor in conserving biodiversity.
- In many areas, bridges or tunnels have reduced the number of animals killed as they try to cross highways.

Figure 38.8c

Only for protecting wild animals
https://www.quora.com/Are-collisions-with-animals-a-major-problem-on-the-German-Autobahn

Figure 38.9a

# Biodiversity hotspots




**Adapted from N. Meyers et al., Biodiversity Hotspots for Conservation Priorities, *Nature*, Fig. 1, Vol. 403: 6772 (Feb. 24, 2000). Copyright © 2000 by Macmillian Publishers Ltd. Reprinted with permission.**

Figure 38.9b

Conservation is difficult for migratory species

# 38.11 SCIENTIFIC THINKING: The Yellowstone to Yukon Conservation Initiative seeks to preserve biodiversity by connecting protected areas

- Pluie is a gray wolf captured in western Canada in 1991 who was then fitted with a radio tracking collar and released.
- She traveled from Alberta to British Columbia in Canada, to Montana, Idaho, and Washington before returning to British Columbia

# 38.11 SCIENTIFIC THINKING: The Yellowstone to Yukon Conservation Initiative seeks to preserve biodiversity by connecting protected areas

- Pluie, her mate, and three cubs were shot while travelling outside the boundary of a national park.
- Reserves could shield animals briefly, but true protection would have to include safe passages between reserves.

- Google: shoot wolf sticker