



BIO VIZ BACKGROUNDER

Protecting Wildlife in a Changing Climate

As climate change alters habitats on Earth, some species are shifting their ranges. Protecting sensitive species means planning for their future movements. This backgrounder accompanies the data visualization *Protecting Wildlife in a Changing Climate* available at sciencebulletins.amnh.org and sos.noaa.gov/datasets

How are climate and wildlife connected?

Where a species is distributed on Earth depends in large part on climate: the long-term atmospheric conditions of an area. Some species are adapted to very specific climates occurring in limited areas; others are adapted to a broad range of conditions and thus are distributed more widely.

Knowing where individuals of a species are found—both historically and at present—is not enough to characterize the particular climatic conditions the species needs to thrive. By reckoning a species' documented range

with patterns of temperature, precipitation and other physical data of the area, scientists can model a species' **bioclimatic envelope**—a hypothesis of the distribution of the climate that suits it, which can be mapped (see below).

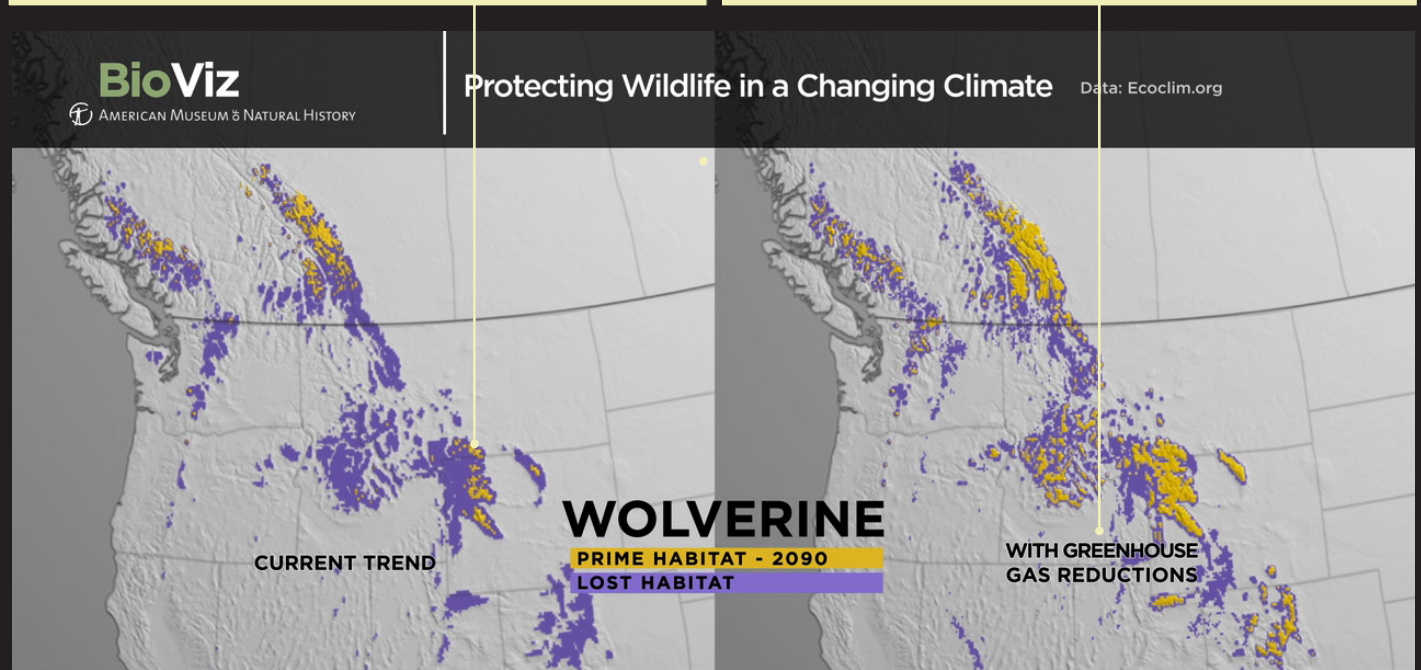
How do scientists predict how climate change might affect wildlife?

Bioclimatic envelopes are based on computer climate models, the tools that scientists use to predict climatic changes into the future. By running these models forward in time, scientists can forecast how a species' bioclimatic

Navigating the visualization

Data: These maps are based on computer model simulations of the wolverine's future bioclimatic envelope in the United States (labeled "prime habitat"). Yellow does not represent the definite future range of wolverines; rather, it predicts where climate conditions may be most suitable for the species.

Comparison: Yellow indicates the portion of the current-day bioclimatic envelope that may remain in 2090 under two trends of greenhouse-gas emissions—left is "business as usual" (B1 scenario); right is with significant transition to green energy sources (A2 scenario). Purple indicates the portion of the bioclimatic envelope that would be lost.



To protect wildlife, we must plan for their future now:
One step is to reduce emissions of greenhouse gases so habitats shift less.

envelope might shift as the world warms; i.e. where the climate that a species needs might be found in the future. Overall, hundreds of plant and animal studies are documenting that species are shifting poleward and upward in elevation in order to remain in their ideal climate envelope. Long-term model forecasts depict similar trends.

Where a species might live decades or centuries from now depends on how much warming will actually occur. That amount depends primarily on future levels of greenhouse gas emissions, which depends on our actions today to reduce emissions. To explore different scenarios, scientists plug varying future emission levels into their climate models and project the bioclimatic envelopes forward. This helps assess what different mitigation approaches might mean for sensitive species.

Why are wolverines so climate-sensitive?

Wolverines (*Gulo gulo*) are elusive wild creatures, not only obscure to the public, but still poorly understood even by biologists. These carnivores are the largest members of the weasel family, weighing about the same as a cocker spaniel, with thick fur and large, flat, snowshoe-like feet. They roam extensively, traveling as much as 28 miles (45 kilometers) in a single day. While the species' range has been loosely identified—wolverines live in arctic, subarctic, and boreal areas of northern North America and Eurasia—recent studies are advancing knowledge of their specific habitat requirements.

The work suggests that wolverines have a rather particular bioclimatic envelope. This cold-loving species is stressed by warm weather—wolverines tend to avoid areas where summer temperatures exceed 72°F. They also tend to live in regions where deep snow persists well into spring: female wolverines dig insulated snow dens to birth their

kits, abandoning the dens after weaning about mid-May.

In the United States, the wolverine's bioclimatic envelope maps to isolated mountaintops in Washington, Montana, Idaho, and Wyoming. "Business-as-usual" projections of greenhouse gas emissions show that this envelope will shrink and move northward as climate change persists, suggesting a significant loss of wolverine populations in the United States over this century. Furthermore, the projections suggest that much ideal wolverine habitat would move outside of the national parks—such as Yellowstone and Glacier—and other protected landscapes that currently preserve that habitat. Other North American species that might face similar issues are the Canada lynx, the pika, and many cold-water fish species.

What can be done to help protect wildlife in a changing climate?

Beyond reducing greenhouse gas emissions, supporting conservation initiatives known as **wildlife corridors** is a critical step to aid wolverines and other threatened species as global climate changes. Wildlife corridors connect disparate patches of protected lands so that animals can move safely among them. The land proposed as ideal for corridors currently has multiple uses—for example, human settlement, industrial operations, logging and mining. Designating such land as a corridor does not mean making it all a park, but rather ensuring that these uses also accommodate wildlife on the move.

One of the best examples of a wildlife corridor is called Yellowstone to Yukon (Its geographic area is labeled "connected habitat" in the visualization.) As the world's last ecologically intact temperate ecosystem, this region retains enough variety in landscapes and species so that its residents may more easily adapt to a changing climate.

Related resources

Associated data visualization

AMNH Science Bulletins: *Protecting Wildlife in a Changing Climate*

[www.amnh.org/explore/science-bulletins/\(watch\)/bio/visualizations/protecting-wildlife-in-a-changing-climate](http://www.amnh.org/explore/science-bulletins/(watch)/bio/visualizations/protecting-wildlife-in-a-changing-climate)

Datasets formatted for NOAA's Science on a Sphere
sos.noaa.gov/Datasets/dataset.php?id=348

Collaborators

Dr. Healy Hamilton
www.worldviews.net

Ned Gardiner, NOAA Climate Services
www.climate.gov

General resources

Yellowstone to Yukon
y2y.net

Wildlands Network
www.twp.org

On the Track of the Elusive Wolverine
www.fs.fed.us/pnw/sciencef/scifi114.pdf

