



Modeling Reintroduction in a Time of Change

How will rising temperatures impact a second chance for grizzlies in the North Cascades Ecosystem?



Photo courtesy John Ashley-Pryce

The North Cascades Ecosystem—13,500 square miles of largely roadless mountains and forests spanning the US-Canada border—is home to the most imperiled grizzly bear population in the US.

Humans and bears have shared this rugged landscape for countless generations. But the mid-1800s arrival of European American fur traders spelled disaster for bears. In just 30 years, nearly 3,200 grizzly pelts passed through the region's trading posts, while uncounted others were killed by miners and homesteaders. While much grizzly habitat survived this period and gradually returned to a wilder state, the bears never bounced back.

Sightings in recent decades have been few and far between, and the population is considered functionally extirpated. Today, the National Park Service and US Fish & Wildlife Service are engaged in an [Environmental Impact Statement](#) process to evaluate options for restoring grizzly bears to the landscape.



NPS Photo/Roger Christophersen

Left: Grizzly tracks were found in the snow in 1989 near Mt. Baker in the Mount Baker-Snoqualmie National Forest.

Above: The most recent sighting of a grizzly bear in the North Cascades Ecosystem (NCE) was in 2015, near Manning Park, BC.

Shifting Ground

Reintroduction offers a last chance to conserve an imperiled species, while restoring the

ecological role they played. However, success hinges on the quality of habitat available in a species' former home. Today, grizzly habitat in the NCE is in a state of rapid change, with

temperatures in Stehekin, WA, already an average of 5°F warmer than when recording began in the 1910s.

By the late 2000s, temperatures in the NCE may average 10°F higher than they did at the turn of the century. Lengthening growing seasons, increasing wildfire, shrinking snowpack, and shifting seasonal water availability may have profound impacts on plant communities. What will this mean for grizzly food sources? Will the ecosystem be able to support these large omnivores in years to come?

Visualizing Multiple Futures

To estimate the NCE's future carrying capacity (the number of individuals the landscape can support), researchers turned to two different scientific models that fit together like puzzle pieces.

The first, a dynamic vegetation model, simulates how different types of plants respond to changes in climate and CO₂ concentrations. When these responses are matched with existing data about NCE grizzly habitat quality, they form snapshots of future grizzly habitat quality under different greenhouse gas emissions scenarios.

The second puzzle piece is a model that estimates how many grizzly bears an area can support based not just on habitat quality, but on observations about grizzly survival, dispersal, and reproduction made in other populations.

In all, researchers tested 36 different model combinations representing different grizzly demographics and behaviors, ways of simulating global atmospheric circulation, timeframes, and greenhouse gas emissions scenarios. "It's really important to recognize that there's a range of possible futures that depend on what we do," said researcher Meade Krosby, "and how our planet and everything that lives on it respond to what we do."

A Strong Signal

When the results came in, they showed a sweeping pattern. “All the models across every angle of combinations,” said researcher Jason Ransom, “pointed toward high-quality grizzly bear habitat getting better.” The total carrying capacity of female bears in the NCE was projected to increase from 139 under current conditions to 241–289—up to doubling the potential population size.

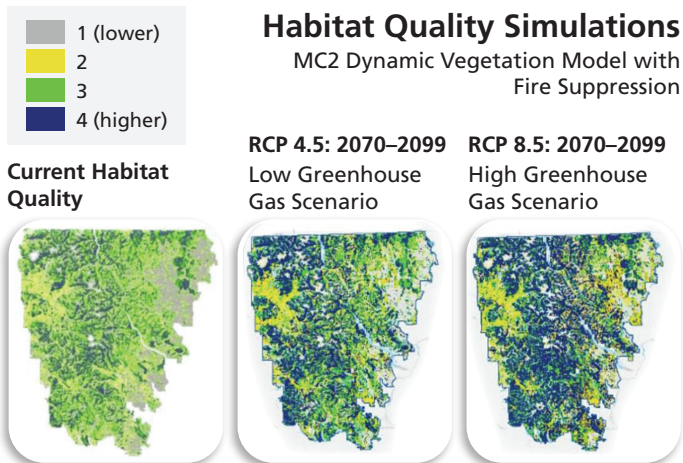


Figure 1. Projected changes in grizzly habitat quality in the NCE, using a 20 global atmospheric circulation model average.

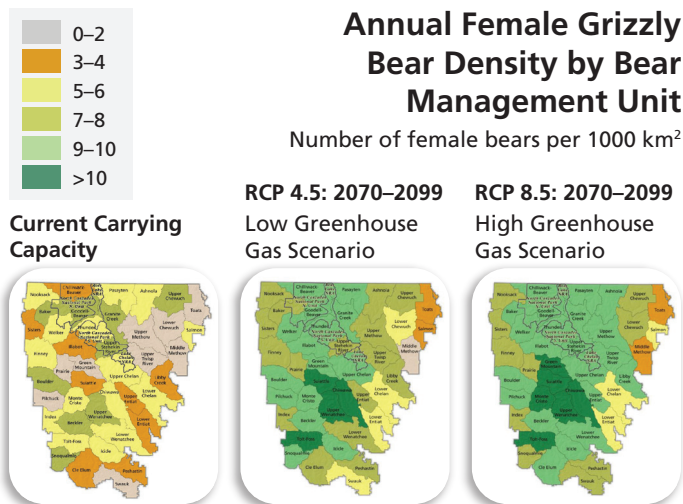


Figure 2. Projected changes in the spatial distribution of average annual female grizzly bear density, given the most plausible home range size of 108 mi² and using a 20 global atmospheric circulation model average.

While models offer science’s best crystal ball for the future, no model perfectly simulates every relationship. For instance, beyond vegetation quantity, climate-linked shifts in vegetation timing (growth, flowering, and fruiting) may trigger a separate cascade of changes through the interconnected ecosystem grizzlies rely on. Moreover, this study does not reach beyond the end of the century. “It’s not like warming just stops,” said Meade Krosby. “Even a species like grizzly that’s really wide-ranging and really flexible in terms of what it can eat and all these things that make it more adaptable than other species—even grizzlies will have limits.”

Preparing for a Stress Test

Why consider reintroducing imperiled species in the face of an uncertain future? Like approaching a tough problem with an array of tools and strategies, biologically diverse communities are better prepared to stand up to environmental stress. Grizzly bears are a keystone species with an impact to match their massive size: through hunting, foraging, and (naturally) digestion, they help regulate prey populations, aerate soil, disperse seeds, and cycle nitrogen and nutrients through the ecosystem. “If we can return bears here” said Jason Ransom, “there’s a relationship that gets to be reborn.”

What’s the big idea?

- Grizzly bears were a keystone species in the North Cascades Ecosystem hunted to the vanishing point over the past 200 years.
- If the species is reintroduced, its success will depend on habitat which is already changing due to rising temperatures.
- Models show high-quality grizzly habitat is projected to increase through the end of the century, and the number of grizzly bears the NCE can support is projected to rise.
- Questions remain; we do not know how grizzlies or their habitat may respond to continued warming past 2100.

“Having the original cast of characters gives you much more resilience for whatever’s coming.”

– Jason Ransom

Study Leads



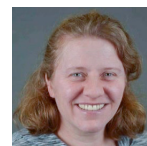
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Study Citation: Ransom, Jason I., Andrea L. Lyons, Katherine C. Hegewisch, and Meade Krosby. “An Integrated Modeling Approach for Considering Wildlife Reintroduction in the Face of Climate Uncertainty: A Case for the North Cascades Grizzly Bear.” *Biological Conservation* 279, (2023): 109947. [doi:10.1016/j.biocon.2023.109947](https://doi.org/10.1016/j.biocon.2023.109947).