How Climate Change Could Undermine Biodiversity Conservation Goals

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In a new study published in the journal Communications, Earth & Environment, University of Montana researchers and colleagues explore how ***climate change*** could challenge efforts to protect biodiversity within the network of protected areas around the globe.

The team examined how potential shifts in ecoregions and biomes caused by ***climate change*** might ***change*** their representation within the global protected area network. They also considered the implications for conservation targets that call for 30% of Earth's habitats to be formally protected by 2030.

"At its most basic level, this study attempts to understand what shifts in the distribution of the Earth's ecoregions and biomes will mean for the capacity to conserve and protect biological diversity using protected areas," said Solomon Dobrowski, the paper's lead author and a professor of forest landscape ecology in the University's W.A. Franke College of Forestry and Conservation.

Scientists have divided Earth's terrestrial areas into roughly 800 ecoregions. An ecoregion is an ecosystem defined by distinctive geography and biota. These combinations of plants and animals act as surrogates for the planet's biodiversity and provide a means for scientists, international organizations and countries to track whether protected areas represent the planet's biodiversity.

Countries around the world use protected-area designations to conserve biodiversity. Protected areas come in lots of flavors, Dobrowski said, like national parks in the U.S. But one thing they all have in common are fixed boundaries that delineate a place on the ground.

Climate change will likely affect what ecosystems are represented in protected areas, Dobrowski and his co-authors contend in the new study, but how remains unclear. It's also unclear how that could affect the effectiveness of conservation strategies that rely on protected areas – like the United Nations's draft of the Post-2020 Global Diversity Framework, better known as 30 by 30, which calls for permanently protecting 30% of the Earth by 2030 through expanding the protected area network, among other initiatives. (In the U.S., there also is the America the Beautiful initiative, which aims to conserve 30% of America's lands and waters by 2030.)

The 30 by 30 framework will be addressed at the UN Biodiversity Conference COP-15, which kicks off online in October.

"The UN, in coordination with many countries and international conservation organizations, is promoting the expansion of the protected area network so that 30% of all ecoregions are protected by 2030," Dobrowski said. "But what happens when plants and animals, and therefore ecoregions, move over time to track their optimal ***climate*** but the protected area boundaries stay fixed in place?

"Even if 30% of a given ecoregion may be protected now, as the ecoregions shift in response to ***climate change***, that protection and representation within the protected area network will ***change***," he said.

To address these questions, the scientists used spatial ***climate*** analogs – present day locations that share similar ***climates*** to those projected for a location in the future – to examine how a 2-degree Celsius rise in global temperatures could alter the distribution of ecoregions. Then the scientists analyzed what that those ***changes*** could mean for achieving 30 by 30.

They found that roughly half of the Earth's land area will experience ***climate*** conditions that correspond with different ecoregions.

"***Climate change*** has the potential to dramatically shift the ecosystems of the planet," Dobrowski said. "We project by mid-century that over 50% of ecoregions globally will have a ***climate*** associated with a totally different ecoregion. We look at the world around us, and we see ecosystems that we are used to seeing. We think they're stable, but they're not. And those kinds of ***changes*** are going to challenge our ability to conserve biodiversity globally."

The authors recommend that efforts to protect biodiversity will need to explicitly consider how ***climate change*** will drive ***changes*** in the patterns of biodiversity.

"We're dealing with a moving target in terms of trying to capture the planet's biodiversity in protected areas," said co-author Caitlin Littlefield, formerly a UM postdoc and now with Conservation Science Partners. "In this work, we provide a model for how people can anticipate dynamic and shifting patterns of biodiversity and respond with strategic conservation investments."

To extend their results more broadly, the group also created an online tool, Analog Atlas (*https://plus2c.org/*), to inform the public of the ways ***climate change*** could alter the ecosystems where they live and play. ***Climate*** analogs contextualize ***climate change*** by asking a simple question: "Where can I find the ***climate*** of my future, today?" Dobrowski said.

Users can select any land area on the globe and see another location where the current ***climate*** matches future predicted conditions for that selected location.

"We are really excited about the Analog Atlas," said co-author Sean Parks of the Aldo Leopold Wilderness Research Institute. "It allows users to conceptualize ***climate change*** through maps, street views and statistics such as expected ***changes*** in the number of hot days, freezing nights and fire conducive days,"

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