Enabling ecological change amid climate change is key to preserving biodiversity and ecosystem services, says study

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As the need to address climate change becomes increasingly urgent, so too does the concurrent need for proactive stewardship of the Earth's

rapidly changing biosphere, according to research published today in the journal *Science*.

"There is actually a lot we can do to help systems cope with oncoming climate change," says Simon Fraser University biology professor and author Jonathan Moore, who with University of Washington professor Daniel Schindler, reviewed and assessed the potential benefits of forward-looking approaches. "From restoring connectivity to reducing local stressors to conserving future habitats—all of these proactive approaches can help the ecosystems that we rely upon to adapt to climate change."

With that in mind, in order for species and ecosystems to adapt and be resilient it is critical to move beyond preservation-oriented approaches and include those that enable ecological change, Schindler notes. "Local efforts to conserve biodiversity and regenerate habitat complexity will also help maintain a diversity of future options for species and ecosystems in an unpredictable future."

While species movement into new habitats has been key to the biosphere's adaptive response to a changing world, climate change is also transforming those ecosystems, leading to the loss of some species and the addition of others.

The authors note that conservation should not just focus on "climate change losers" but also on proactive management of emerging opportunities and pressures. In the Arctic, warming oceans and shrinking sea ice may create more fish production but threaten some species like polar bears that rely on the ice for hunting seals. Ice loss in the Arctic Ocean also increases pressures from industrial activities such as shipping traffic and oil and gas exploration that pose environmental risks. These pressures need to be managed in a forward-looking approach to steward the Arctic ecosystem into the future.

The Earth's biodiversity has a history of change, with genes, species, populations, and ecosystems all shifting fluidly with a changing world. "Earth's systems have incredible capacity to adapt and be resilient to changes," says Moore. "That is what has allowed some species to persist for millions of years. But our actions are seriously undermining that adaptive capacity."

The authors caution that even with the most aggressive emission reduction strategies, further warming will "persist for decades" before potentially recovering, and strategies to enable adaptation and resilience will be key for maintaining functioning ecosystems and for conserving biodiversity.

"Natural resource management and conservation efforts will need to embrace the dynamic aspects of the biosphere to help maintain functioning ecosystems and protect biodiversity amid ongoing climate change," says Moore.

Schindler says it is important and urgent for humanity to reduce greenhouse gas emissions, and "the reality is that the world is warming and that systems are changing. We often expect that ecosystems will always look the same, or that certain species will always be found in the same locations. The biosphere has never been static—and we need to embrace management approaches that maintain a dynamic and fluid biosphere. Thus, conservation and management need to be prospective—looking to the future, and proactive—taking action for the future."

More information: Jonathan W. Moore et al, Getting ahead of climate change for ecological adaptation and resilience, *Science* (2022). DOI: 10.1126/science.abo3608