Nature and climate crises: Two sides of the same coin

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Credit: Jonathan Borba from Pexels

A changing climate means changing habitats. This in turn further intensifies the effects of climate change that cause biodiversity loss. To stop this cycle, researchers are looking to nature-based solutions.

Biodiversity, the unique variety of life on our planet, is more than just flora and fauna. It's the lynchpin to the continued existence of our species. Remove the pin, and everything begins to come apart—climate, food chains, weather, the economy, our way of life and place in the natural world.

Yet the degradation of Earth's biodiversity is caused by human activities: urbanization, pollution, deforestation and commercial fishing. Due to such factors, the rate of species extinctions is accelerating. More species are now threatened with extinction than ever before in human history.

"With biodiversity loss, we not only lose nature, we lose some of our best defenses against climate change," said Myron Peck, who leads the Department of Coastal Systems at the Royal Netherlands Institute for Sea Research (NIOZ). "Our oceans, forests, peat bogs and wetlands all act as natural carbon sinks, absorbing harmful carbon from the atmosphere."

It's clear that it's impossible to address biodiversity loss without tackling climate change, and equally impossible to tackle climate change without addressing biodiversity loss. This is acknowledged in the new EU Adaptation Strategy in February 2021.

"We are living in a world where everything is interconnected," said Elisa Furlan, an environmental scientist at Italy's Centro Euro-Mediterraneo sui Cambiamenti Climatici. "Climate-related and human-made hazards have become increasingly systemic, the result of the complex and dynamic interactions happening among human, economic, political, and natural systems."

Because of this interconnectedness, we're essentially left with a vicious circle where the increasing temperatures and extreme weather brought on by climate change causes biodiversity changes and loss of ecosystem

services, which subsequently leads to more climate change, which causes more biodiversity loss, and so on.

How do we stop this downward spiral?

According to the World Wildlife Fund, nature-based solutions harness the power of nature to address climate change. Common examples include restoring and protecting forests and wetlands, bringing nature into urban settings, restoring coastal areas, and implementing best practices in sustainable agriculture. Not only do these solutions prevent biodiversity loss they also build resilience against a future of rising sea-levels, desertification, extreme flooding and wildfires.

A good example of nature-based solutions at work can be found right here in Europe, in the Marine Protected Area (MPA) networks established throughout the EU seas with nationally designated areas and the EU network called Natura 2000. However, while these areas have made headway in terms of protecting critical species today, according to Peck, they've stopped short of implementing the measures needed to ensure their resilience for a future defined by a changing climate. "There simply can't be long-term restoration without regulation," he said.

Furlan agrees, noting that coastal areas are particularly vulnerable to the effects of climate change. "Marine areas are subjected to the one-two punch of natural stressors, like waves and storms, and to the pressures created by changes in land use, the shipping industry, and mass tourism," she said.

Add to this a general lack of understanding about how these factors affect marine life, and the inadequate governance mentioned by Peck, and what you're left with is a critically important habitat that has been left to fend for itself.

"Marine and coastal ecosystems support a large proportion of the world's biodiversity and play an important role for society by, for example, regulating climate, providing food resources, and contributing to our well-being through cultural and recreational opportunities," added Furlan. "By taking this for granted, we've set the scene for a perfect storm."

Gathering blue intelligence

For Peck, Furlan, and others, priority must be given to providing policymakers with the nature-based solutions needed to protect our critical coastal ecosystems for the long-haul.

Leading the EU-funded Horizon 2020 FutureMARES, Peck and his team is researching the potential benefits of introducing habitat-forming species like reef-building corals and canopy-forming macroalgae into coastal areas.

"Our main concern is to restore biodiversity, and that process starts by making these damaged habitats healthier," he said. "After all, a healthy habitat has a better chance of withstanding climate change than a depleted one."

Similarly, the EU-funded Horizon 2020 MaCoBioS project is providing evidence-based guidance that policymakers can use to halt the loss of biodiversity in Europe's marine areas. "Delivering on the targets set out in the EU 2030 Biodiversity strategy and 7th Environment Action Programme starts with understanding the interrelationship between climate change, biodiversity and ecosystems," explained Furlan, who helps coordinate the project.

To address this knowledge gap, the project is studying several critical marine habitats, including the coral reefs of the Caribbean, the seagrass beds of the Mediterranean, and the kelp forests of the North Sea.

"Each of these unique areas are subjected not only to climate change, but also fishing, recreation, and pollution," said Furlan. "As such, they serve as a lens for examining how these pressures lead to a decline in biodiversity and how such a decline impacts connected ecosystems."

With this information, researchers will quantify the combined impact that human activities and climate change have on these ecosystems.

"Our goal is to create models that decision-makers can use to implement effective, nature-based mitigation actions that ultimately results in resilient marine habitats," added Furlan.

Learning today to prepare for tomorrow

Further north, researchers are working to understand and predict changes in Arctic marine biodiversity. They are studying its implications on fisheries (the economic lifeblood of many Arctic communities) and carbon sequestration, which has important implications on the global climate.

"We still don't have a good understanding about how marine biodiversity in the Arctic responds to climate-related pressures like temperature, salinity, and pH, as well as land- and ocean-based stressors such as invasive species, pollution, and fishing," said Marja Koski, a researcher at the National Institute of Aquatic Resources, part of the Technical University of Denmark, and coordinator of ECOTIP. "How organisms will respond to combinations of these stressors is largely unknown."

According to Koski, the current method of describing and modeling marine biodiversity has its limitations. In fact, despite a century of detailed taxonomic studies, over 90% of Arctic marine species are currently thought to be undiscovered. This means we can't predict the consequences that a change in, for instance, the composition of plankton

communities will have on carbon sequestration and fisheries.

"Our knowledge is still fragmented in terms of how biological changes interact with human decisions and behavior, including how fisheries are managed in the Arctic," explained Koski. "This limits our ability to jointly develop adaptation options with local communities and Indigenous Peoples in the Arctic."

To fill this knowledge gap, the project is using new molecular methods on environmental DNA (eDNA) to detect invasive species, in the Arctic. eDNA refers to DNA that can be collected from the environment (for example water samples). "The use of eDNA for species monitoring is revolutionary as it saves time, costs, and workload without impairing the target organism or the ecosystem," noted Koski.

ECOTIP is also investigating the concept of ecosystem tipping points, irreversible changes of ecosystems, like the possible melting of the Greenland ice sheet. "Such changes have a cascading effect across the entire ecosystem, which ultimately impacts fisheries and the ocean's ability to act as a carbon sink," explained Koski.

According to Koski, having information like this is key to being able to predict and mitigate the effects climate change has on biodiversity—and the effect biodiversity has on climate change. After all, if we don't understand the mechanisms of why things happen, we cannot even fathom predicting what might happen in future.

"We can observe the changing distributions of zooplankton in the North Sea, for example, but if we don't know what causes the distribution shifts, how can we implement effective regulations," asks Koski? "Being able to extrapolate what we do know to other areas and conditions is how we stop the cycle of biodiversity loss."

Deepening knowledge of the many factors spinning this cycle is the first step. And, as a result, we are better positioned to project the changes we see today to future scenarios—helping us prepare for the changes yet to come.

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