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Improving local conditions can improve ecosystem resilience to global changes

Improving local water quality could mitigate the damaging effects of rising CO_2 on marine ecosystems, new research suggests. Scientists in Australia found that nitrogen pollution in seawater, when acting in combination with heightened CO_2 concentrations, had a significant effect on the growth of turfing algae, which displace kelp forest ecosystems.

In today's world, pressures on ecosystems come in many forms, including pollution, increasing temperatures, habitat fragmentation and rising CO_2. Although the effects of such pressures are often measured separately, it is important to understand how they interact, since they may have stronger effects when working together than when acting alone.

Nutrient pollutants in southern Australia, such as agricultural fertilisers, enable mats of turfing algae to displace natural kelp forests in coastal waters. Rising levels of CO_2 are also thought to increase algal growth, however, little is known about the combined effect of these two factors.

In this study, researchers examined the simultaneous effects of nitrogen oxide pollution and increased CO_2 on the growth of turfing algae, and investigated whether reducing pollutant levels could restrict the algae's increased CO_2-driven growth. They put a sample of algae in plastic tanks filled with seawater, and placed the tanks in a harbour. This ensured that conditions, such as temperature and light levels, were similar to the natural environment, but allowed the researchers to control pollutants and CO_2 levels.

In the first stage of the experiment, tanks underwent different combinations of treatments. Nitrogen oxide concentrations were either low (similar to levels found in coastal waters near natural catchments) or high (similar to levels found in coastal waters near more polluted shores). CO_2, which was bubbled through the water tanks, was either at current concentrations, or concentrations predicted for 2050 by atmospheric models.

After six months, to assess whether reducing nutrient pollution could help limit the effects of increased CO_2, researchers reduced the levels of nitrogen oxide in the tanks that had been treated with high nutrients and CO_2.

The results revealed that the nutrients, in isolation from CO_2, increased the algae's cover by 14% under high concentrations, and that the effect of increased CO_2 alone was weaker (2% increase in cover). However, when algae were exposed to both high nutrient and CO_2 concentrations, their combined influence was much greater than the sum of their individual effects, showing an increase of 37% in cover.

When nutrients were reduced in tanks that had experienced high CO_2 and nutrient concentrations for six months, the growth of algae slowed significantly. The researchers stress that this has important policy implications. Although global pressures, such as rising CO_2, must be dealt with on an international level, policies developed and implemented on the national and local levels can increase resilience against the pressures. These results demonstrate, for example, that local policies to reduce water pollution can help mitigate the effects of globally increasing CO_2.

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