

## **Interactive effects of anthropogenic nitrogen enrichment and climate change on terrestrial and aquatic biodiversity**

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Climate change and Nr from anthropogenic activities are causing some of the most rapid changes in biodiversity in recent times. Climate change is causing warming trends that result in poleward and elevational range shifts of flora and fauna, and changes in phenology, particularly the earlier onset of spring events and migration, and lengthening of the growing season. Nitrogen (N) enrichment can enhance plant growth, but has been shown to favor, fast-growing, sometimes invasive, species over native species adapted to low N conditions. Although there have been only a few controlled studies on climate change and N interactions, inferences can be drawn from various field observations. For example, in arid ecosystems of southern California, elevated N deposition and changing precipitation patterns have promoted the conversion of native shrub communities to communities dominated by annual non-native grasses. Both empirical studies and modeling indicate that N and climate change can interact to drive losses in biodiversity greater than those caused by either stressor alone. Reducing inputs of anthropogenic Nr may be an effective mitigation strategy for protecting biodiversity in the face of climate change.