The response of ecosystems to an increasingly variable climate

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A wide range of ecological communities ranging from polar terrestrial to tropical marine environments are affected by global climate change. Over the last century, atmospheric temperature has increased by an average of 0. 6^0 C and is expected to rise by 1.1- 6.4^0C over the next 100 years. This rising temperature has increased the intensity and frequency of weather extremes due to which a large number of species are facing risk of extinction. Studies have shown that species existing on lower latitude are more sensitive to temperature variability compared to species existing on higher latitude but temperature is increasing rapidly in higher latitude compare to lower latitude. This uneven distribution of temperature sensitive species and warming rate has highlighted the need for combined studies of temperature variability and sensitiveness of species to predict how the ecosystems will respond to increasingly variable climate. Using a generalized Rosenzweig-MacArthur model, I explored how temperature variability and sensitivity of species will affect the extinction risks of species and how the connectance and species-richness of ecological communities will govern this response. This study showed that risk of extinction of species mostly depends on their sensitivity to temperature deviation from the optimum value and level of temperature variability. Among these two, sensitivity of species to temperature deviation was most prominent factor affecting extinction risk. In this study, connectance did not show any effect on mean extinction risk and time taken by a certain proportion of species to reach pre-defined extinction thresholds. But, species-richness showed some effect on mean extinction risk of species. It was found that risk of extinction of species in species-rich communities was higher compared to species-poor communities. Species-rich communities also took shorter time before they lost 1/6 of the species and the time taken to lose 1/6 of the species decreased with increasing the number of species in the food webs. The present study also suggests possible tipping points due to increasing temperature variability in near future. In further studies, different sensitivity of species at different trophic levels and the possible evolution of sensitivity of species should also be consider while predicting how ecological communities will respond to changing climate in the long run.

Key words: Extinction Risk, Extinction Threshold, Species Richness, Temperature Sensitivity, Temperature Variability, Tipping Points, Tolerance curve, Weather extremes