Temperate ponds will have more species as the climate warms

Ponds are considered to be ideal early warning systems that can be used to assess the effects of climate change at the local level. A recent study suggests warmer temperatures are likely to significantly increase the number of species found in ponds in temperate areas, especially at high altitudes. However, despite an overall increase, some species would also become extinct.

Ponds are useful for monitoring long-term changes in freshwater ecosystems caused by a warming climate. It is easier to measure the species richness in ponds than in other freshwater ecosystems because they have clear boundaries, are relatively small in size and are sensitive to environmental changes, such as those caused by climate change.

This study investigated the impact of climate warming on the richness of five groups of species, aquatic plants, snails, beetles, dragonflies and amphibians, in 113 freshwater ponds at high and low altitudes in Switzerland. Three future scenarios, based on a temperature rise of 3.4°C by 2090-2100 were modelled: one where only the effect of temperature warming was considered and two others where other environmental factors, such as water quality, were included. One of these two scenarios was conservative, in that it only assumed there will be small changes in environmental conditions, and the other scenario was pessimistic, in that it assumed there will be large changes.

In response to just climate warming, species richness in the study ponds is likely to increase significantly by 2090-2100. Overall, local species richness (in each pond) of the five study groups combined is predicted to increase from 34 to 70 species – a rise of 106 per cent.

When other environmental factors, such as water quality, in addition to temperature rises were considered, local species richness also increased significantly. The conservative scenario predicted overall local species richness would increase by 88 per cent and in the pessimistic scenario by 82 per cent.

Vascular plants showed a smaller increase in local species richness than predicted by temperature rise alone, under both the conservative and pessimistic scenarios. This smaller increase is due to the high sensitivity of vascular plants to degradation of water quality in the ponds as a result of changing environmental conditions, such as land-use change.

The increase in local species richness among the different groups varied for all three scenarios. For example, when only a rise in temperature was considered, the local species richness of vascular plants increased by 68 per cent; snails by 84 per cent, beetles by 119 per cent, frogs by 119 per cent and dragonflies by 128 per cent.

The overall increase in local species richness in ponds at high altitudes (up by 150 per cent) is likely to be almost twice as high as the increase in lowland ponds (up by 83 percent). High-altitude ponds are currently nutrient-poor and species richness is likely to benefit from an increase in nutrients from other environmental changes, for example, increased farming in a warmer climate. Lowland ponds are relatively nutrient-rich and extra nutrients are likely to reduce the increase in species richness.

Although this study suggests there will be an overall increase in species richness at the local scale, some pond species would become extinct, particularly species that can only tolerate colder temperatures. The diversity of these specialised species will suffer greatly from climate change at the regional scale.


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Theme(s): Biodiversity, Climate change and energy, Water