Biodiversity brings disease resistance

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A novel study of a Tibetan alpine meadow has shown a clear link between higher biodiversity and greater infectious disease resistance.

The researchers say it provides further strong evidence that maintaining biodiversity among the world's species should be a high priority.

Published in the journal *Ecology*, Australian and Chinese researchers from the University of Adelaide and Fudan University in Shanghai studied meadow vegetation at a 3500 metre-altitude research station in the Tibetan Plateau. They investigated the impacts of levels of biodiversity on the severity of a fungal disease.

"There are two main theories about the biodiversity-disease relationship in non-human species," says Professor Corey Bradshaw, Sir Hubert Wilkins Chair of Climate Change at the University of Adelaide's Environment Institute. "One is that with more species there is a greater pool of potential hosts for pathogens, so pathogens increase as biodiversity increases. The other asserts that disease decreases with higher diversity because of a 'dilution' effect, where the chance of a pathogen meeting its host species is reduced.

"Unfortunately many, if not most, of past studies have used the number of species as the simplest measure of biodiversity but have confounded the results with the abundance of hosts. Another problem is that the evidence has been largely restricted to planting experiments, which limits the extension that can be made to natural communities.

"Our experiments, on the other hand, used natural communities and species with similar abundance so we could control for confounding effects of species richness and abundance."

The researchers manipulated species richness by removing specific groups of species. The experimental plots at the Alpine Meadow and Wetland Ecosystems Research Station of Lanzhou University are highly biodiverse – up to 40 species in a one square metre plot – making them an ideal "natural laboratory". Professor Bradshaw has been working with Professor Shurong Zhou and her team from Fudan University's School of Life Sciences for several years looking at variation in ecosystem functions in response to altered biodiversity.

"The result was rather astounding," says Professor Bradshaw. "The variation in disease severity at the different biodiversity levels almost exactly matched that predicted under the dilution hypothesis. We showed unequivocally that greater biodiversity among the meadow plants reduced the overall incidence of fungal disease, even though there were more pathogens."

A second experiment looked at the impact on disease of artificial warming and nitrogen fertiliser, and showed that both warming and nitrogen fertiliser increased the disease load.

"Most interestingly, we showed that artificial fertiliser weakened the dilution effect of increasing host biodiversity, most likely by enhancing fungal spore production, infection success and lesion growth by the hosts," says co-author Professor Zhou. "Changing the delicate balance of a healthy community not only resulted in more pathogens but weakened the overall community's resistance to disease."

More information: Warming and fertilization alter the dilution effect of host diversity on disease severity DOI: 10.1890/15-1784.1

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