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Ecological stability, epidemiological stability and reservoirs of infection

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The structure of an ecosystem and the interaction of the species within it can determine whether a pathogen can persist. We have described a model for interacting species that are hosts and non-hosts of a pathogen. The population densities of the ecosystem species can determine the value of the basic reproduction number, \mathcal{R}_0 . We have defined concepts of ecological and epidemiological stability, shown how changes in the ecosystem can change the dynamics of the pathogen, and how the introduction or removal of a pathogen can lead to changes in the ecosystem structure. In particular, the so-called dilution effect, where an increase in biodiversity leads to a reduction in the prevalence of an infectious disease, has been the subject of speculation and controversy. We have found criteria for when the dilution effect is present, or when the opposite (amplification) effect may occur. Another concept often used informally in the literature is that of a reservoir of infection. Finding a robust definition of a reservoir is not straightforward, particularly as the presence of other species in an ecosystem, even non-host species, can change the value of \mathcal{R}_0 .

Collaborative research with Hans Heesterbeek.

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