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Effect of the introduction of refractory vectors in a vector-borne disease

A model for a vector-borne disease is considered, in which some vectors are refractory to infection by the pathogen. The model describes two populations of vectors: wild vectors can be infected by the pathogen, while refractory vectors cannot. However, refractoriness comes at the cost of reduced fitness. Interbreeding between wild and refractory vectors can produce both types of vectors, as described in the model by a somewhat complicated demography. This model for vectors is then coupled to a simple SIR model for hosts, and the dynamics of the whole system is studied. We show that in the absence of disease, refractory vectors can become established in the population. When the disease is present, this has the effect of lowering the basic reproduction number, rendering the disease easier to control.