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Oscillations in a Patchy Environment Disease Model

For a single patch SIRS model with a period of immunity of fixed length, recruitment-death demographics, disease related deaths and mass action incidence, the basic reproduction number $\mathcal{R}_0$ is identified. It is shown that the disease free equilibrium is globally asymptotically stable if $\mathcal{R}_0 < 1$. For $\mathcal{R}_0 > 1$, local stability of the endemic equilibrium and Hopf bifurcation analysis about this equilibrium are carried out. Moreover, a practical numerical approach to locate the bifurcation values for a characteristic equation with delay-dependent coefficients is provided.

For a two-patch SIRS model with travel, it is shown that there are several threshold quantities determining its dynamic behavior and that

1) travel can reduce oscillations in both patches;

2) travel may enhance oscillations in both patches;

3) travel can also switch oscillations from one patch to another.