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Dynamics and optimal control of an eco-epidemiological model

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In [1] the authors considered a four-species eco-epidemiological model. It is assumed that population can be divided into prey population, susceptible predator population, predator population infected by the first disease and predator population infected by the second disease.

For example, a Black-footed ferret depends entirely on Prairie dogs as a food source. This Black-footed ferret population can be infected by the Sylvatic plague and Canine distemper virus [2].

In this study, an eco-epidemiological model with two disease strains in the predator population incorporating harvesting and optimal control is formulated and analyzed. The existence, uniqueness, non-negativity and boundedness of the solutions are investigated. The basic reproduction number and some sufficient conditions for the existence of four equilibrium points are obtained.

In addition, some sufficient conditions are proposed to ensure the local and global asymptotic stability of equilibrium points of the proposed model. Theoretical results are illustrated by using numerical simulations. The approach used by [3] is utilized.

References

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- [3] A. Molter, J. I. M. Bezerra, E. Rafikova, D. E. Nava, M. Rafikov, Dynamics and biological control of the sugarcane borer with two parasitoids, *Ecological Modelling*, 481:110371, 2023.