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Epidemics are often managed by strategies mainly based on expert opinions, although the spread of a disease results from complex interactions between biological processes, to which may be added human interventions. Thus, it is no easy task to optimize disease management, especially when alternative strategies cannot be tested experimentally.

Therefore, this project aims to develop a comprehensive spatiotemporal model which simultaneously simulates the propagation of an epidemic in a heterogeneous landscape and the impact of several innovative management strategies. The key parameters of the model will first be identified by a sensitivity analysis and, when possible, estimated through experiments or statistical analyses of epidemiological data. Then, a wide range of potential management strategies will be tested through the model by Monte Carlo simulations.

The model developed in this project will be applied to sharka, caused by *Plum pox virus* (PPV, genus *Potyvirus*), a quarantine pathogen in the European Union. Indeed, this model is interesting to circumvent the difficulty in carrying out experiments due to the sanitary status of this pathogen. Besides, the improvement of management strategies for this disease is vital because it is the most devastating viral disease of stone fruits (e.g. peach, apricot and plum trees), with a cost of more than 10 billion Euros between 1975 and 2005 in the world. In France, the management of the epidemics is based i) on regular visual inspections of the orchards and ii) on the removal of symptomatic trees. The first step of the project is to make the model flexible enough to include this current management strategy, by taking into account the mandatory observation, sampling and control processes.

Finally, the general approach of this Ph.D project may be used to help managing other sanitary crises due to epidemics.