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FOREST POPULATION DYNAMICS MODELS

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In the first part of this presentation we will present a mathematical model for forest growth and we compare this model with a computer forest simulator named SORTIE. The main ingredient taken into account in both models is the competition for light between trees. The parameters of the mathematical model are estimated by using SORTIE model, when the parameter values of SORTIE model correspond to the ones previously evaluated for the Great Mountain Forest in USA. We will see that the best fit of the parameters of the mathematical model is obtained when the competition for light influences only the growth rate of trees. We will construct a size structured population dynamics model with one and two species and with spatial structure.

The second part of the talk a pine tree forest with a parasite called nematode. Since this parasite colonizes pine trees to reproduce, it is natural to introduce a predator-prey (or consumer-resource) relationship between the trees and the parasites. In order to investigate the behaviour of the resulting system, we will use numerical simulations, and we will introduce a parasite into a population of trees that: 1) is not oscillating around the positive equilibrium; 2) has some damped oscillations; 3) has some undamped oscillations. This will correspond to three scenarios for parameter values. As one may expect, this will lead to complex dynamics, since we combine the oscillations produced by the predator-prey system with the oscillations coming from the demographic properties of the prey.

In the last part of the presentation, we will consider a class state-dependent delay differential equations with infinite delay. This class will covers the above examples of models for forest. We will discuss the existence and uniqueness of a maximal semiflow in a weighted space of both Lipschitz functions and C^1 functions. We will obtain a blow-up result when the time approaches the maximal time of existence. We will conclude the presentation with an application to prove the existence of global positive solutions for a spatially structured forest model.

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