

Title: Modeling Bee Pollination of Almond Orchards with Cross- and Self-Diffusion

Authors: Kamuela E. Yong, Yi Li, Stephen D. Hendrix

Abstract:

California's almond industry is one of America's top agricultural exports valued at \$1.9 billion per year. Successful production of almonds depends on the pollinator services of primarily honeybees, although pollination by wild bees is being investigated as an alternative because of recent problems with honeybees. We are modeling pollinator services of honey and wild bees, as well as their interactions in almond orchards. We use the Shigesada-Kawasaki-Teramoto model (1979) which describes the density of two species in a two-dimensional environment of variable favorableness with respect to intrinsic diffusions and interactions of species. We apply the model to almond pollination by wild and honey bees with environmental favorableness based on empirical data measuring the attractiveness of the canopy for honey and wild bees. Using the spectral-Galerkin method in a rectangular domain, we numerically solve the 2D nonlinear parabolic PDE and examine the result of varying the parameters. We hope to determine what circumstances the presence of wild, solitary bees can increase the dispersion of honeybees, thus increasing pollination.