

# A Model for Colony Collapse Disorder in Honeybees

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Honeybee pollination accounts annually for over \$14 billion in United States agriculture alone. Within the past decade there has been a mysterious mass die-off of honeybees, an estimated 10 million beehives and sometimes as much as 90% of an apiary. There is still no consensus on what causes this phenomenon, called Colony Collapse Disorder, or CCD. Several mathematical models have studied CCD by only focusing on infection dynamics. We created a model to account for both healthy hive dynamics and hive extinction due to CCD. The system of three ordinary differential equations exhibits regions of bi-stability and even tree-stability in parameter space, accounting for multiple hive population behaviors including CCD. Numerical analysis leads to parameter estimation and critical hive sizes for multiple scenarios.