**To the editor(s) of Ecology:**  
In this manuscript, we propose a new mathematical framework for modeling the temperature-dependent intra- and interannual dynamics of diapausing multivoltine insect pests. There have been previous phenology models for both the applied and theoretical aspects but generally the models run for a single growing season. This limitation is due to the model requiring a start date or ‘biofix’ to be fixed each year generally by observing pheromone traps for pest activity. Using a weekly 33-year time series of a devasting fruit pest, *Cydia pomonella* (more commonly known as the coding moth), we show that Gurney et al.’s (1983) tractable formalism can be extended to model diapause dynamics through fall and winter.

By fitting our mathematical model to historical data, we show that we can reliably predict the dynamics across years without the need for a biofix. Finally, we show how our model can be a useful tool in exploring the possible consequences of climate change on pest dynamics. By simulating our model under warmer temperatures, we predicted an increase in pest activity due to the additional generation and increased survivorship. Importantly, we use the new framework to show that warming temperatures can increase the overlap (development synchronization) among life-stages which can increase the need for more frequent biological or chemical interventions.

Our mathematical model is highly versatile and can be easily modified for other pest species to better understand changes in population dynamics under new climate regimes.

A close up of a logo

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Damie Pak and on behalf of the coauthors.