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David Paez, Vanja Dukic, Jonathan Dushoff, Arietta Fleming-Davies and Greg Dwyer*
(gdwyer@uchicago.edu). *Combining Models and Experiments to Understand How Evolution Affects Insect Outbreaks*. Preliminary report.

Cyclic outbreaks of defoliating insects severely damage forests, damaging valuable timber and contributing to climate change. Observations of high virus mortality observed during outbreaks, and the ability of simple insect-pathogen models to qualitatively reproduce outbreak data, suggests that viruses may drive outbreaks. The strong selection imposed by viruses on their hosts, however, suggests that selection may also play a role, but the spatial scales involved make it difficult to test this hypothesis directly. To test for effects of natural selection on insect outbreaks, we instead constructed a mathematical model that allows for increased resistance due to virus spread during outbreaks, and for reduced resistance due to a cost of resistance during population troughs. We then estimated the parameters of the model using small scale field experiments with a baculovirus of the gypsy moth, we inserted the parameter estimates into the models, and we compared the resulting model predictions to data on gypsy moth outbreaks. The model that includes the effects of natural selection provides a much better explanation for outbreak data than do models that do not include selection, suggesting that selection plays an important role in driving outbreaks of this important forest pest. (Received September 04, 2015)