

# Departmental Colloquium

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Friday, March 10, 2017  
2:00p.m., HH-3017

## Behavioural responses to resource heterogeneity can accelerate biological invasions

### Abstract:

After an invasive species is introduced, the abundance and spatial distribution of resources in a landscape and the behavioural response of individuals determine whether and how fast it spreads in the given environment. It is therefore of interest whether and how landscape manipulations can be used to slow invasive species is of great interest. Various ideas in this direction are being discussed as management options in forest ecosystems, for example tree removal, thinning, and increasing tree diversity. Recent experiments show individual-level behavioural movement changes in response to a spatially heterogeneous resource distribution. This behaviour needs to be included into management considerations to correctly predict the effects of any control measures.

We derive a novel model for insect-host dynamics that includes three common behavioural aspects of foraging: higher movement rate in resource-poor areas, lower ovipositioning rate in resource-poor areas, and movement preference for resource-rich areas. We derive appropriate dispersal kernels from our movement model and use them to project the insect population density from one year to the next. Using a mix of analysis and simulation, we explore how several management options affect the ability and the speed of the invasive species. We parameterize our model and illustrate our results with data for Emerald ash borer, a recent highly destructive forest pest in North America.

We show that each of the three basic movement behaviours can increase the speed of invasion in a source-sink landscape above that in a homogeneous landscape with larger overall resource availability. Our results highlight the importance of empirical work on movement behaviour in different landscape types and near the interface between types.