

PhD Scholarship: What makes bark beetles invasive?

The role of Allee effects in the establishment of invasive alien insects

We are offering funding for a 3-year PhD scholarship for a project at the University of Canterbury, in collaboration with Scion (The New Zealand Forest Research Institute), *Better Border Biosecurity*, and the United States Forest Service. The project will investigate population dynamics of invasive forest insects and will be supervised by Dr Ecki Brockerhoff and Professor Dave Kelly.

The person

Prospective candidates should have a first class MSc or BSc (Honours) in Biology, Zoology, Entomology, Forestry or other relevant discipline. An interest in insect ecology and/or population ecology and modelling, and an ability to undertake field work safely, are essential. We offer a scholarship stipend (living allowance) of \$25,000 (after tax) per year plus funds for uni fees and operational costs.

The project

This project will examine the population dynamics of small founder populations of alien invasive species, using field studies and modelling. The work aims at determining the minimum size of populations that can establish successfully in a new territory. The topic and methods are of interest to both applied ecology and ecological theory.

Species moved unintentionally via international trade are an important threat to biosecurity. Increasing global trade and the widespread use of wood packaging materials with many commodities has led to an increase in the arrival and establishment of wood borers and bark beetles. Phytosanitary measures have been implemented but ongoing interceptions at the border and discoveries of newly established wood and bark borers in several countries suggest that this invasion pathway remains a problem.

The establishment of introduced, potentially invasive, species progresses through a number of phases. Following the arrival of potential founder populations, establishment requires the presence of suitable habitat, host plants and climatic conditions as well as successful reproduction. If these conditions are met, then the spread of a potential invader can occur which, eventually, may cause ecological and economic impacts. However, recent advances in our understanding of population dynamics of invasive species suggest that most arrivals of potential invaders do not lead

to establishments. Small populations such as those at the earliest stage of establishment in a new region may ultimately fail to establish because of stochastic dynamics and low population growth. Due to a variety of mechanisms, population growth may decline with decreasing density. This phenomenon, referred to as the 'Allee effect' can cause low-density populations to exhibit negative population growth. A strong Allee effect creates a threshold density below which populations tend to decrease toward extinction. Such a threshold is of critical importance to establishment of invading populations but the exact size or density at the Allee threshold is difficult to predict without specific population data, which are rarely available for alien invasive species during the establishment phase.

Bark beetles are useful as a model system to investigate this because different species exhibit varying levels of aggregative behaviour, and this is critical to understanding Allee effects. The aim of this project is to characterize the population size and density at the Allee threshold, for selected beetle species. We envisage that this will be done using a combination of laboratory and field experiments as well as modelling. The results of this project are expected to further our understanding of population ecology and our ability to prevent and manage biological invasions. The results may also be applicable to theoretical analysis of Allee effects in conservation contexts, where rare species may become abruptly more threatened as density declines.

The project is a collaboration with Scion, *Better Border Biosecurity* (, the Ministry of Primary Industries, and the US Forest Service. It will be based in Christchurch with field sites elsewhere in New Zealand and at institutions of overseas collaborators.

Applications and contact

Applicants should submit a CV and a cover letter outlining their interest in the project no later than 30 November 2012. The project could start immediately.

For more information contact:

- Dr. Eckehard Brockerhoff, Scion & Adjunct in the School of Biological Sciences, University of Canterbury (eckehard.brockerhoff@scionresearch.com), or
- Prof. Dave Kelly, School of Biological Sciences, University of Canterbury (dave.kelly@canterbury.ac.nz).