Modelling economic impact and strategies to increase resilience against tree disease outbreaks

Kick-off workshop

25th November 2014

University of Stirling

Itinerary

9:00 Registration and coffee

9:30 Welcome and introduction to project

9:40 Hugh Clayden (Forestry Commission)

10:10 Discussion/feedback on current state of play and key options

10:30 Morag Macpherson (University of Stirling)

10:50 Coffee

11:10 Stephen Cavers (Centre for Ecology and Hydrology)

11:30 Glyn Jones (Food and Environment Research Agency)

11:50 Julia Touza (University of York)

12:10 Chris Gilligan (University of Cambridge)

12:30 Lunch

13:30 Discussion

14:45 Wrap-up

Forestry Commission

UNIVERSITY OF CAMBRIDGE

BBSRC 20 Years of Pioneering Great British Bioscience

University of St Andrews

THE UNIVERSITY OF WESTERN AUSTRALIA

UNIVERSITY OF STIRLING

PRIFYSGOL BANGOR UNIVERSITY

Presentation Title and Abstracts

Hugh Clayden (Forestry Commission)

The tree health landscape in Scotland

This presentation will look at the main current tree health issues and policies in Scotland, as well as taking a forward look to future threats. The range of current and potential measures available to address these challenges will also be explored.

Stephen Cavers (Centre for Ecology & Hydrology)

Promoting resilience of UK tree species to novel pests and pathogens: ecological and evolutionary solutions (PROTREE)

The Tree Health and Plant Biosecurity Initiative project, PROTREE, will aim to find sustainable approaches for securing tree health through research on the ecology and evolution of tree species and their pests and pathogens, and their social and economic context. A key part of the project is to devise and test scenarios for sustainable management of tree species that takes into account both the latest scientific knowledge, and comprehensive input from stakeholders. These options should account for a risk arising from multiple known and unknown threats and provide for a more resilient national forest resource.

Morag Macpherson (University of Stirling)

Modelling economic impact and strategies to increase resilience against tree disease outbreaks

Forests provide a wide range of services such as timber and non-timber products, recreational and aesthetic values, the regulation of carbon cycles and much more. There are clear economic, social and ecological weights attached to each service, and the arrival or threat of a disease outbreak is likely to have a negative economic consequences. However measures to reduce the extent of disease spread are also likely to be costly. Optimal control models are one method used to model the economic and epidemiological trade-offs within forests. In this talk I will present two optimal control models. The first model is a system which wishes to find the optimal rotation length for a single species when a disease arrives during the rotation. I will show some preliminary results for this framework. The second model aims to find the optimal area of planting two species, when one species may be susceptible to a disease.

Chris Gilligan (University of Stirling)

Modelling Phythophthora and Chalara spread in Great Britain and some lessons learned from modelling sudden oak death and citrus diseases in the US and Brazil.

Some recent results will be presented on the use of models to inform policy while taking account of uncertainty. The presentation with describe how we have used stochastic, spatio-temporal models to predict spread and to compare control scenarios. Some approaches to parameter estimation will be described as well as the integration of epidemiological with meteorological models to predict and analyse long distance spread of inoculum.

Glyn Jones (Food & Environment Research Agency)

New Approaches for the early detection of tree health pests and pathogens

This short presentation will describe the LWEC Tree Health project centred on detection and led by Fera.

The growing number of pest and disease threats to UK woodland can be introduced naturally (i.e. as wind-borne spores from continental Europe - potentially one pathway for introduction of the disease ash die-back) or, probably more commonly, is via human activity, especially trade. For example moving infected plants (another pathway identified for ash die-back) or through the shipping of goods associated with infested timber (as was the case with the recent introduction of the Asian long-horn beetle in packaging crates for stone).

In order to improve our nation's biosecurity and protect our plants and trees we need better methods for detecting these pests and diseases that allow us to find them earlier and with greater efficiency. By detecting these threats earlier you can minimize the damage they cause, by either preventing an outbreak occurring in the first place or by finding it early and then stopping it from establishing and spreading further. At present we rely on trained inspectors to find these alien pests and pathogens, mainly via visual inspections of imported plants and plant-based products e.g. timber. However, given the volume of inspections required, the finite amount of resource available and the huge practical challenges associated with these inspections, this task is extremely difficult and the efficiency of detection is low.

This LWEC project is designed to provide better methods for detecting tree pests and pathogens; both moving in trade and in the environment. It will look at new technologies for the detecting changes in infected plants, for example, by the use of 'sniffer' technology to identify differences in the volatile chemicals given off by diseased and healthy plants or imaging techniques that can detect changes beyond the range of human vision

However, developing these new technologies is only part of the challenge. It is also necessary to make sure these new methods are fit-for-purpose and that they work in

a way that meets the needs of those enforcing tree health regulations (e.g. government), those upon who those regulation impact (e.g. woodland owners and industry) and the end-users who would be expected to use these new tools (e.g. inspectors in the field). The project seeks to actively engage with different end-users; this could be trained government inspectors (the traditional approach) or alternatives such as those working in the industry, volunteers or even the general public.

It is also important to ensure that these new approaches can be deployed effectively, for example at locations that pose the greatest risk, and in a way that offers the best cost-benefit (i.e. the best balance between cost of using the technology and the improvements it can offer in terms of better pest and disease detection). Thus, we take an interdisciplinary approach; getting experts from many different fields e.g. biology, mathematics, chemistry, engineering, physics, economics and social science, to work together to come up with the best overall solution that works technically, economically and socially.

Julia Touza (University of York)

Landscape perspective on agricultural management to prevent losses from invasive pests

Biological invasions in agricultural settings may have severe consequences on agricultural production, reducing production levels and the value of the crops. In addition, once an invader population has established, controlling it is very expensive. Therefore protection against crop pest establishment is often seen as the most cost-effective measure. The spread of invasions is an inherently spatial phenomenon, and the possibility of managing landscapes as a prevention policy to curb invasion processes is receiving increasing attention. This paper uses a stochastic spatial model to identify the key process that influence the vulnerability of a fragmented agricultural landscape to pests. We explore the effect of centripetal economics forces related to unexhausted increasing returns to scale, and centrifugal forces in the form of invasion risk, on the level of clustering of crop fields. Results show that the cost-effective distances between crop fields are determined by a delicate balance of these two forces and depend on ecological and economic parameters.