Food Security: The Role of Biological Modelling

Thursday 8th October 2015

Overview

The British and Irish Region will be hosting an afternoon meeting on "Food Security: The Role of Biological Modelling" on Thursday, 8th October 2015, at Fowden Hall, Rothamsted. The event will take place between 13:30 and 17:00, with the Region AGM beforehand at 13:00. There will be a small charge, with a reduction for IBS members.

The speakers confirmed are:

- Professor Jim Smith (University of Warwick)
- Dr Nicole Augustin (University of Bath)
- Dr Nik Cunniffe (University of Cambridge)

The full programme can be found below.

Details

Date: Thursday 8th October 2015

Time: 1.30 pm

Venue: Fowden Hall, Rothamsted Conference Centre, Harpenden (clickhere for directions)

Costs

IBS member: £25

IBS student or retired member: £10

Non-IBS member: £50

The registration fee includes afternoon tea and coffee.

Programme

13:00 - 13:30	**AGM of the British and Irish Region**

Decision Support for Addressing Food Poverty in the UK: from production to consumption

Jim Smith (University of Warwick)

13:30 - 14:15

A team of researchers based at Warwick University has been tasked with just such a challenge when building a decision support system - being built to inform decision-making for policies concerning food poverty within the UK.

Eliciting the information needed to score the efficacy of ameliorating policies that might be enacted when the underlying process model is extremely large and complex - like the one above - brings its own peculiar challenges. Here necessarily probablility judgments are made collaboratively and it is rare that one agent owns all probability judgments in the system. So interesting new foundational and methodological issues have arisen associated with the status of inference supported by combinations of such judgments. This talk reports on some of the challenges in building such systems. We argue that it is first necessary to elicit the structure of the overall, agreed structure describing in broad terms the underlying nature of the dynamics of the system. This needs to be elicited from representatives of all domain experts across the system as a whole. This then needs to be populated with expert judgments with knowledge of different subdomains of the system. I will review some recent work on probabilistic inference underlying integrated decision support for huge processes like those for food modelling. I argue that in a surprising number of such dynamic environments - including the ones we are encountering within food systems modelling - it is in fact formally justified to distribute the inference between different panels of experts and then use an agreed framework like the one above to knit these separate judgments to properly score different policies. I will give some simple ilustrations of how this model building process can be enacted and how we plan to provide local government with the tools it needs to find bench mark evaluations of the potential deliterious consequneces that various saving policies it might enact concerning malnutrition over the poor households over which it has a responsibility.

Space-time modelling of blue ling for fisheries stock management

Nicole Augustin (University of Bath)

14:15 - 15:00

Fish accounts for a substantial portion of the global population's intake of animal protein. Estimating fish abundance is required for stock management but survey data on fish abundance is not always available. Fishery catch data offer a rich potential source of information for management, if modelling can separate out the effects of fishing effort, species behaviour and population abundance. Here we model catch data from the blue ling fishering industry off the northwest coast of Scotland, using Generalized Additive Mixed Models with a space time interaction represented via a novel tensor product of a soap film smooth of space with a penalized regression spline of time. The use of soap film smoothers avoids imposing correspondences between spatially adjacent areas that are in fact separated by the stock boundary. The blue ling data poses several challenges for model checking and validation due to its unbalanced, spatially clustered and preferential nature. After model selection, checking and validation there is evidence for increasing relative blue ling abundance from 2000-2010 in some spatial locations.

15:00 - 15:30

Break for tea and coffee

Mathematical models for the spread and control of plant pathogens

Nik Cunniffe (University of Cambridge)

15:30 - 16:45

Plant pathogens reduce yield, often greatly, and are significant threats to food security. Effective control is therefore very important. I describe recent work using stochastic spatial models to optimize control strategies for plant diseases, initially focusing on citrus pathogens. The citrus industries in Florida and Brazil - two of the largest production regions in the world - have had to deal with citrus canker for a number of years. However, more recently, citrus greening (huanglongbing) has invaded these areas, leading to significant losses. I show how spatial individual-based models can be fitted to the spread of both pathogens, and how fitted models can be used to optimize cultural disease controls. I also show how the same framework can be used to scale-up from experimental data on Bahia bark scaling, a citrus disease for which the etiology - and even the causal agent - is in fact unknown. I will then change tack, and present work concentrating on role of arthropods in plant-pathogen interactions. In particular, I will describe initial modelling work showing how the preference of individual insect vectors for infested vs. non-infected plants can affect disease spread, and how this has different consequences for persistently and non-persistently transmitted diseases. I will also present results of a population genetics model that tracks how similar decisions made by plant pollinators can interact with plant disease resistance. As time permits, I will conclude by introducing a large-scale spatial stochastic meta-population model for landscape-scale spread, as has recently been used for a number of pests and pathogens. The application I will present will be modelling the spread and control of the tree disease sudden oak death in Californian forests, but the models can also be applied to crop plants, as will be shown via an application to sampling presented as joint work with Dr Stephen Parnell).