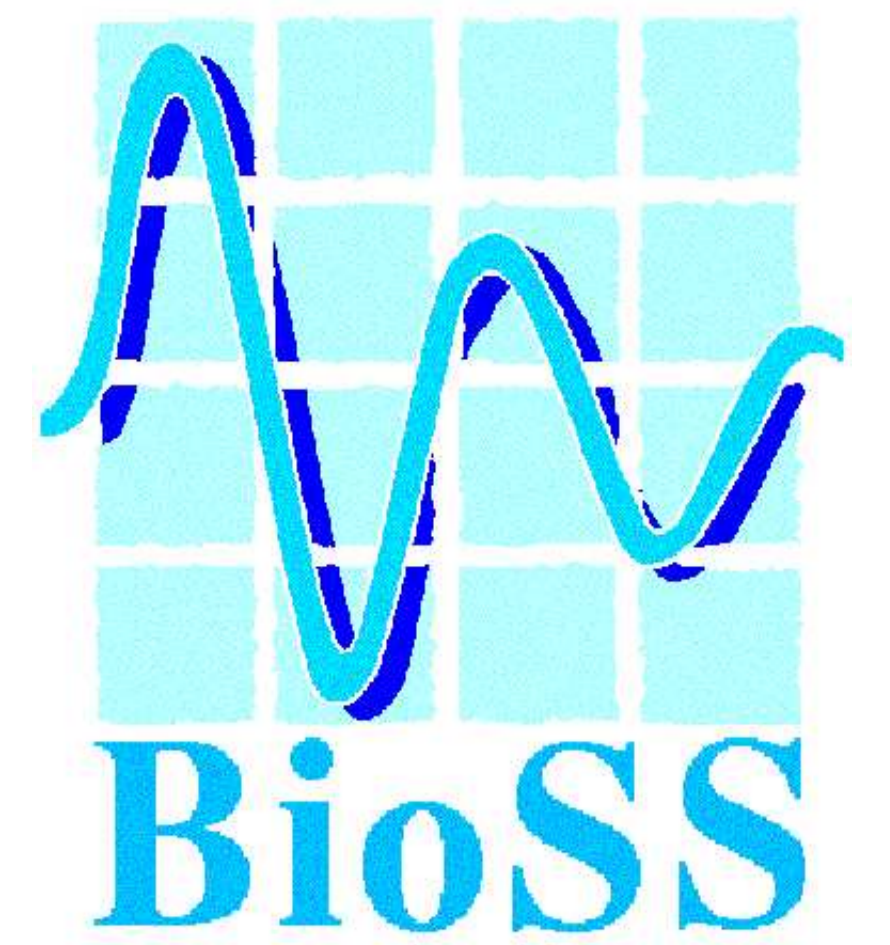


Assessing risks to biodiversity for European ecosystems

Adam Butler, Glenn Marion & Stijn Bierman
Biomathematics & Statistics Scotland



The ALARM project

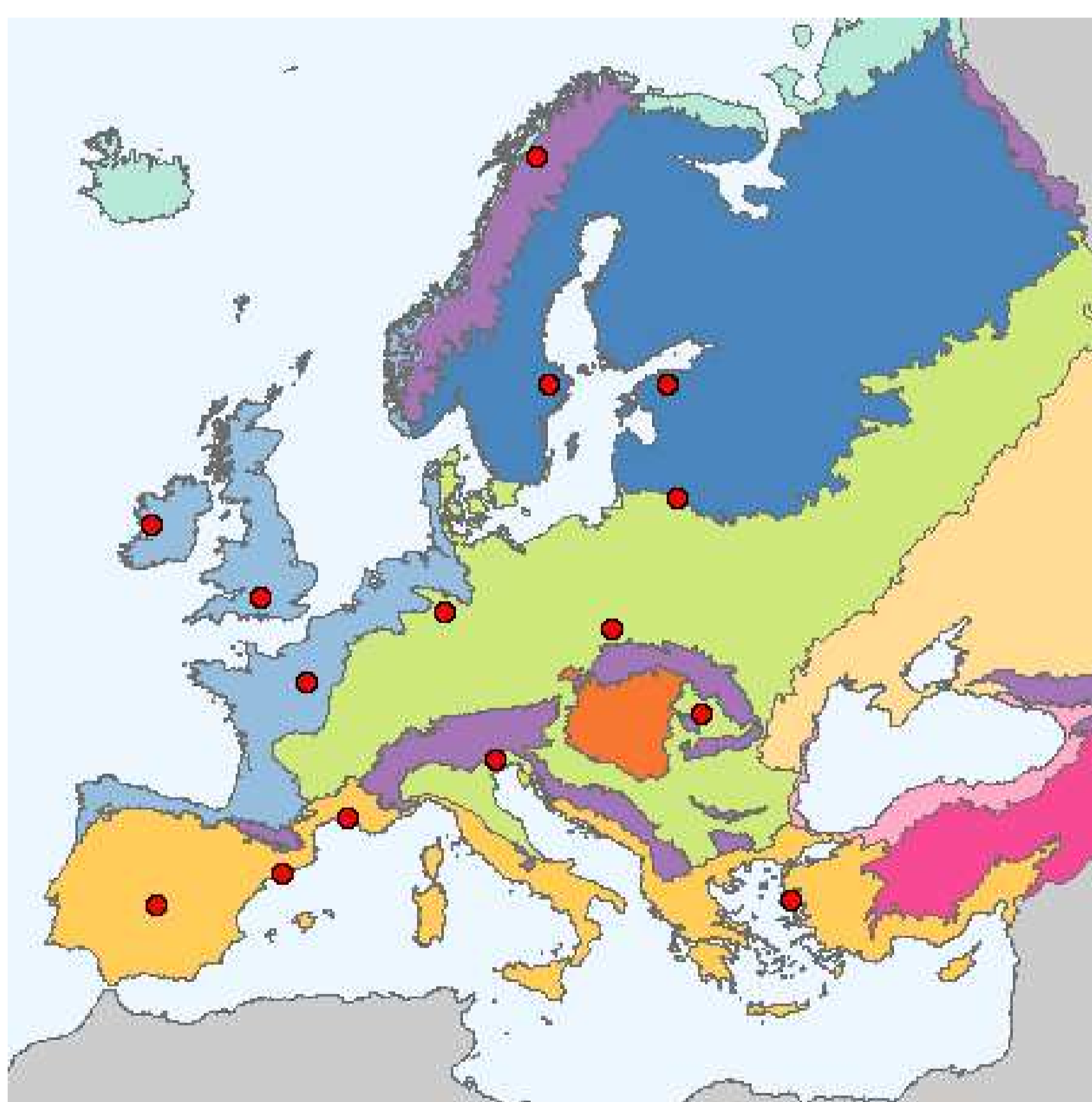
www.alarmproject.net

ALARM ('Assessing Large scale Risks to biodiversity with tested Methods'), and is a project of the Sixth Framework Programme of the European Union. It runs from 2004-2009, and involves over 200 scientists working in 67 organisations in 35 countries.



Key objectives

- To develop an **integrated large scale risk assessment for biodiversity** in terrestrial and freshwater ecosystems.
- To focus on four key **pressures** to biodiversity - **climate change, environmental chemicals, loss of pollinators and biological invasions** - and on the **interactions** between them.
- To develop a network of **field sites** across Europe at which a set of common experiments can be undertaken, to develop a set of **generic tools** for the assessment of risks of biodiversity, and to develop methods for the **dissemination** of scientific knowledge and knowledge quality to the user community.
- To contribute to the development of **evidence-based and outcome-oriented policy measures** in the field of biodiversity conservation.



The ALARM Field Site Network

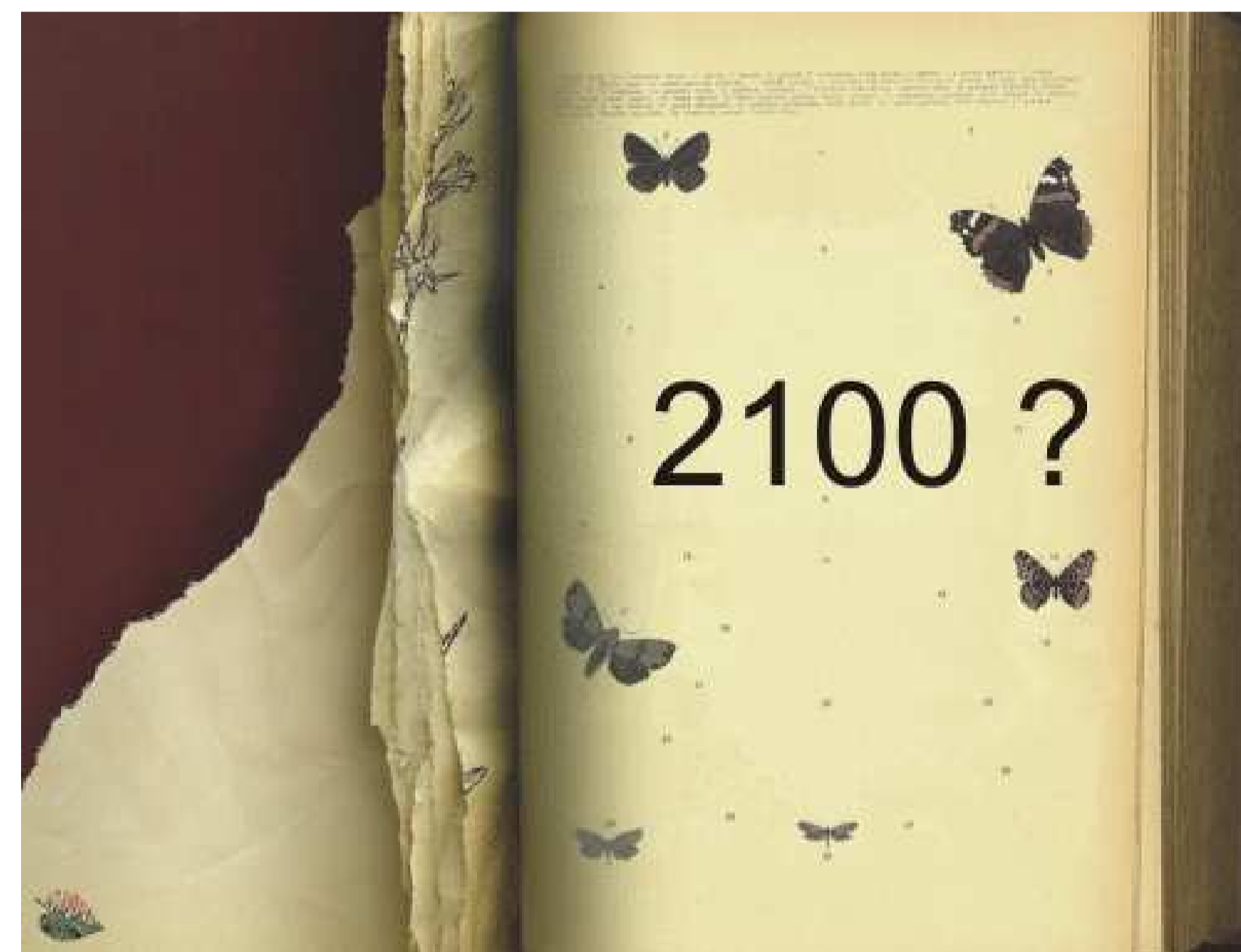
Some key scientific publications so far

- Araujo & Rahbek (2006) How does climate change affect biodiversity? *Science* **313**, 1396-1397.
- Biesmeijer *et al.* (2006) Parallel declines in pollinators and insect-pollinated plants in Britain & the Netherlands. *Science*, **313**, 351-354.
- Schroter *et al.* (2005) Ecosystem service supply & vulnerability to global change in Europe. *Science*, **310**, 1333-1337.
- Thuiller *et al.* (2004) Biodiversity conservation - Uncertainty in predictions of extinction risk. *Nature*, **430** (6995).

Risk Assessment Toolkit

Glenn Marion (glenn@bioss.ac.uk, 0131 650 4898)

A key element of ALARM involves the development of a **Risk Assessment Toolkit** (RAT).



Structure of the toolkit

The RAT will provide a web interface to a database that allows the user to access:

- the outputs of risk assessments created by the scientific teams within ALARM;
- metadata about the quality, scale and scope of these assessments;
- generic tools for the creation of future risk assessments.

Some risk assessments will produce **detailed quantitative outputs** that relate to the impact of specific pressures in specific locations, whilst other assessments will be based upon **expert judgements** about the relative threats posed by different pressures at a European level.

Application of the toolkit

The RAT will provide a bridge between the detailed scientific work being done within the individual modules of ALARM, and the **integrated assessments of risk** that are required by the **user community** (who include scientists outside ALARM, policy makers, and the public).

The RAT will not be used directly for **policy development**, however - another ALARM product, the **KerALARM deliberation support tool** (<http://keralarm.c3ed.uvsq.fr>), will use the information contained in the RAT to provide an interactive environment in which users can compare the impact of different policy scenarios upon various aspects of biodiversity and ecosystem function. The RAT will also link with other public outputs of ALARM - which include a **book** and TV documentary ('Bye, bye, butterfly').

The role of BioSS

BioSS is a Scottish organisation that undertakes research, consultancy and training in mathematics and statistics as applied to agriculture, the environment, food and health. BioSS has three roles in ALARM: to provide **research-led technical support** to the scientific elements of the project, to develop **training materials** on quantitative risk assessment methods, and to contribute to the **production of the RAT**. The common theme across these elements is a focus on the **impact of uncertainty** upon quantitative and qualitative risk assessment.

ALARM research at BioSS

www.bioss.ac.uk/alarm

Our research is based around two main themes:

Analysing species atlas data

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The largest area of ALARM research at BioSS involves the development of methods for analysing **spatial data on species distributions**. Species atlas data record whether a species was present or absent within a particular region - usually, in the UK, a 10x10km grid cell - and provide a rich source of information on the **relationship between environmental conditions and biodiversity**. However, the data are typically compiled from a set of diverse observational data rather than from a designed experiment or systematic survey, and this creates challenges for the statistical analysis of such data.

Our work for ALARM focuses on developing methods by which atlas data can be used to:

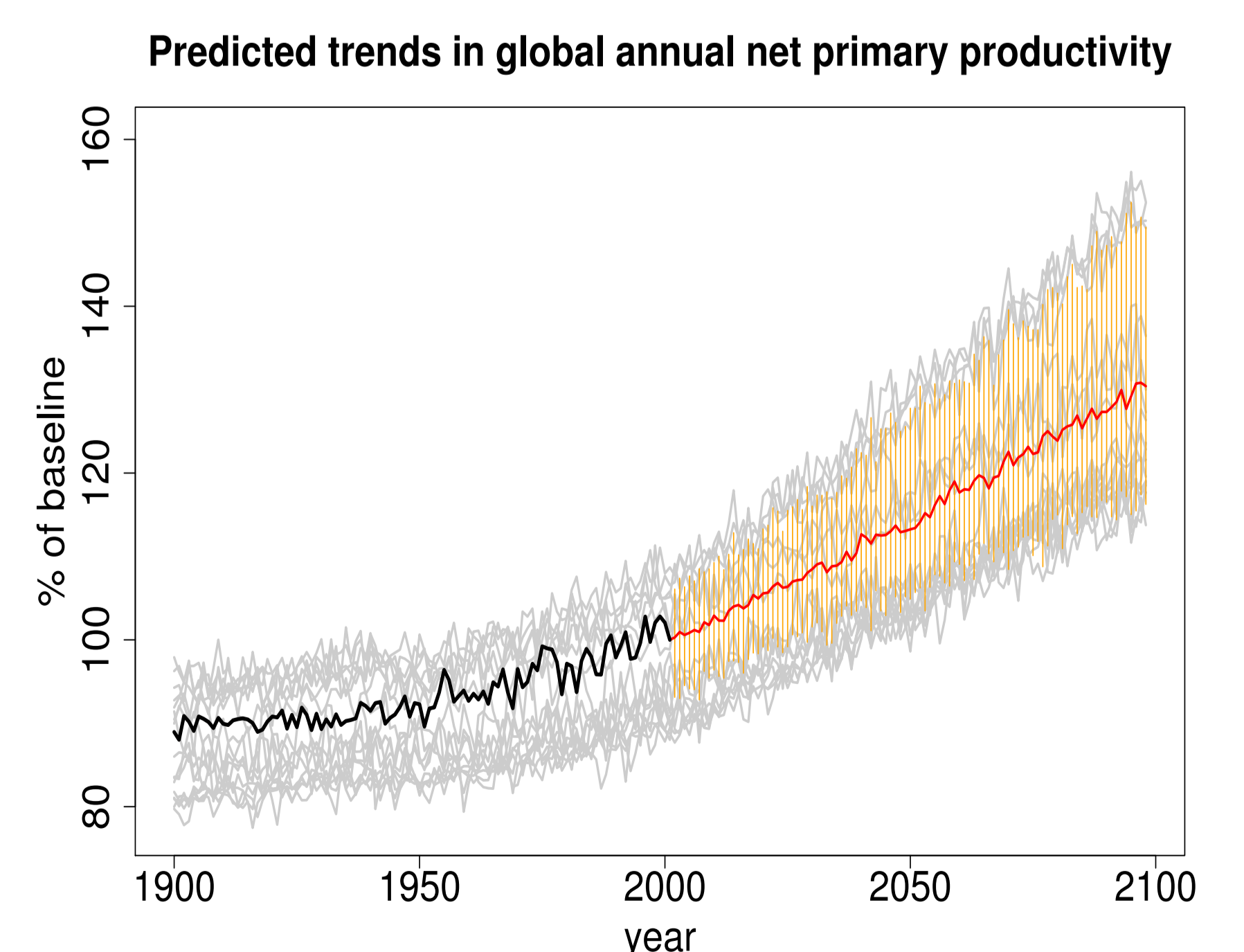
- determine the impact of **climate & land use change** upon the ranges of vulnerable species;
- predict the **likely spread** of a non-native species across a heterogeneous landscape;
- examine the relationship between pesticide exposure and **pollinator loss**.

Quantifying uncertainty in complex models

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Complex models of ecosystem function are frequently used to make predictions about **aggregate properties** of the biosphere at global and regional scales contingent upon projected environmental inputs e.g. a particular projection of future climate. **Climate projections are uncertain**, because they depend (a) on the socio-economic forces that will drive future greenhouse gas emissions and (b) on which climate model is used to study the response of climate to these emissions, and (c) on the values of parameters within this model.

Our current research involves **quantifying** the impact of these uncertainties upon projections generated by the Lund-Potsdam-Jena (LPJ) vegetation model:



Future research will involve using a somewhat simpler model (LANDCLIM) to identify and quantify the **additional uncertainties** that are introduced through the use of an ecosystem model as a proxy for the real world.