



Data science and modelling

The opportunity

Farmers need access to high-quality evidence to support their decision making, particularly in the face of climate change and variability. Data science and modelling are key tools for generating this evidence – identifying trends and patterns, filling information gaps, predicting likely future scenarios, and offering insights into the best course of action. Our core strengths in this area help farmers tackle complex problems related to pests and diseases through the application of data-driven approaches and development of bespoke tools. This work can help farmers and policy makers build stronger agricultural systems and respond to a changing environment.

Providing solutions

CABI uses a wide range of data sources to build and validate models that offer insights for decision making. For example, information on the likelihood of the establishment, occurrence and potential damage caused by pests and diseases can help inform actions at both a farm and policy level. At the farm level, models can be built to optimize the timing of interventions against pests and diseases, contributing to benefits such as rationalized use of pesticides or improving confidence in the effectiveness of slower acting products such as fungal biopesticides. At the policy level, these models can contribute to pest risk analyses, designed to prevent the entry and establishment of emerging or regulated pests.

Data-driven approaches to support pest and disease management are underpinned by access to high quality datasets. The resolution and availability of datasets is improving continually and they provide the 'building blocks' necessary for accurate modelling. Environmental data can be collected remotely through earth observation sources and provide information on conditions such as temperature and humidity. These datasets cover large areas – including inaccessible places – and are easily updated without multiple visits to the field. As well as environmental data, information relating to the biology and distribution of pests is key. These data can be obtained through globally accessible data sources, including CABI data resources, or primary data generated through research partnerships between CABI and local partners.

CABI is uniquely placed to collaborate with networks of partners, using data science and modelling to strengthen food systems and protect the environment. Through projects that combine data from many sources, we work with partners to model both challenges and solutions.

Our data science and modelling expertise

We develop research-led solutions to support sustainable development and the strengthening of food systems. Our strengths in data science and modelling include:

Alerting farmers about impending pest risks – We combine the best sources of weather and land-use data with knowledge about an organism's biology and locally collected field data to create pest models. Advisory messages and recommended actions to take are shared with users. For example, the Pest Risk Information Service (PRISE) which uses a novel combination of earth observation technology, field data and plant-pest lifecycle modelling, allows us to deliver a science-based pest risk service to farmers helping to protect their yields and livelihoods.

Mapping and monitoring the spread of invasive weeds – Our expertise helps us understand and prevent threats from invasive weeds. *Parthenium hysterophorus*, for example, is widely considered one of the most damaging weeds in the world. It is a critical threat to agriculture and human prosperity in Pakistan, although the extent of its spread is largely unknown. CABI has been working with partners to apply novel processing and analysis techniques to earth observation data to provide detailed mapping of this weed.

Predicting the potential establishment of insects – Through our species distribution and environmental niche modelling work at CABI, we are able to better understand the potential distribution of both invasive pest species and associated biological control agents. We also use model outputs to advise on the areas most suitable to survey for classical biological control agents of invasive weeds.

Supporting the uptake of biological control options – By integrating advanced earth observation and environmental data, we can improve confidence in the use of biological control interventions. Through our BioSuccess project in China, models were built to help predict the efficacy of a fungal biopesticide and the outputs aim to help government level pest management agencies make decisions on the most appropriate pest control method.

Examples of our work

Pest outbreaks can be devastating for food security in Africa. Between 2017-2022, **PRISE** delivered pest alerts to farmers in Kenya, Ghana, Zambia and Malawi. Reaching over 1.8 million farmers, alerts identified the 'time to action window' which enabled farmers to take timely preventative action against key pests on maize, beans and tomato. Endline data shows that PRISE alerts allowed farmers to, on average, achieve yields 13% higher than the control group. A return on investment of 1:182 means that farmers earned an extra £1.5 billion in produce value.

In Pakistan, CABI helped national decision makers use **earth observation data** to assess the extent of the parthenium weed problem in different parts of the country and create regional action plans. CABI coordinated field data collection campaigns to validate analyses produced using satellite data, built capacity and links with researchers in-country, and ran workshops to get results used in research, extension and policy-making circles.

CABI's expertise in digital development

Using our expertise in digital development, we turn data and science-based knowledge into actionable, practical information that addresses real needs such as helping to prevent and tackle invasive crop pests. This helps to transform smallholder farmers' livelihoods and helps agricultural and environmental professionals be more effective in their work.

Contact us

To find out more about working with us on data science and modelling, contact **Bryony Taylor** at enquiries@cabi.org

www.cabi.org/digdev

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