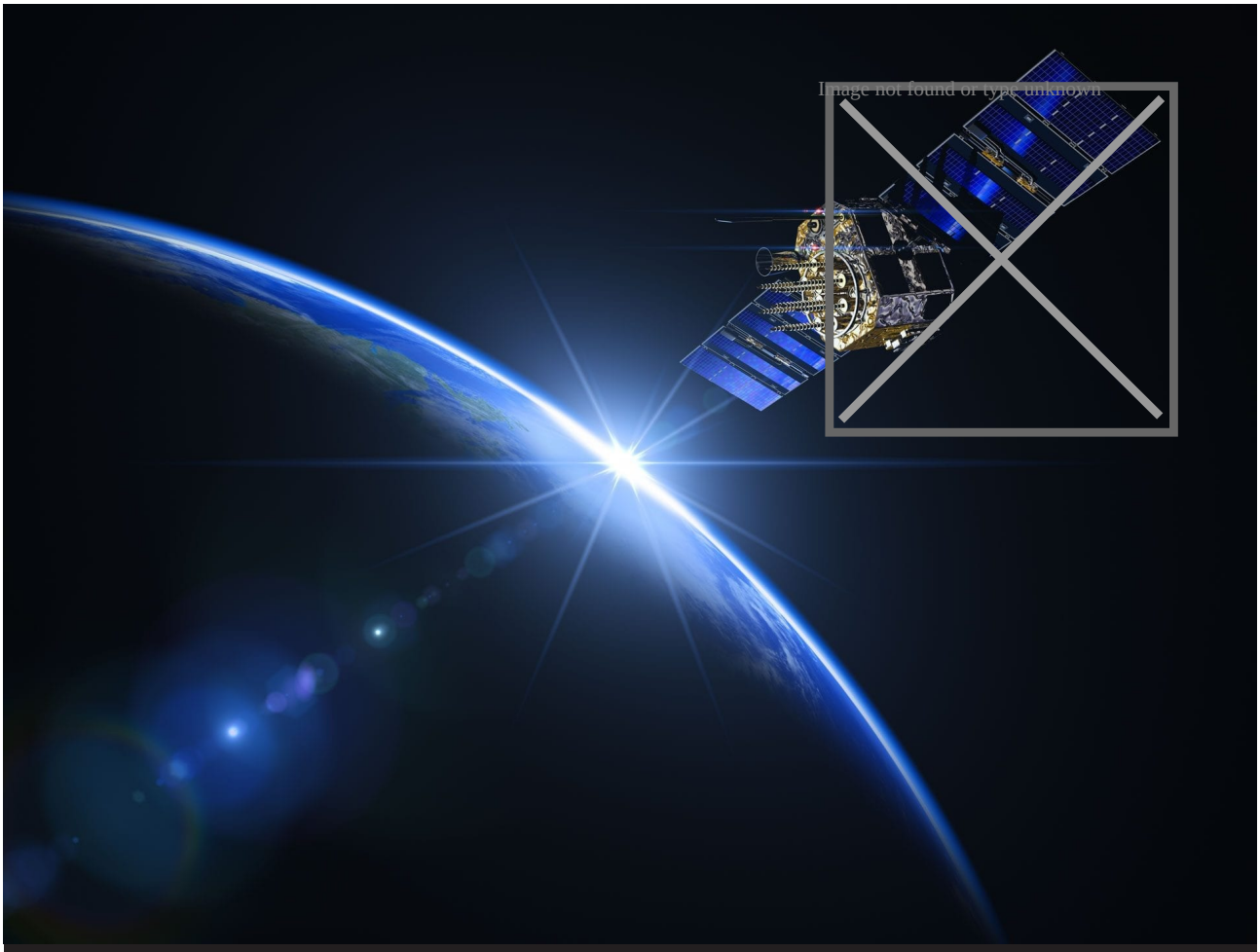

EARTH OBSERVATION TO IMPROVE CRITICAL DATASETS FOR PEST RISK MODELLING

Locations	Australia, Brazil, China, Germany, Kenya, Pakistan, United Kingdom
Dates	01/04/2023 - 31/03/2025

Summary

Rising temperatures have led to pests, diseases and weeds establishing in areas of the world that were previously uninhabitable. Furthermore, growth in global trade and new trade pathways increase the risk of accidental movement of pests. Earth Observation (EO) and climatic data can help by improving predictions about where potential agricultural pests and diseases may be a threat. Information produced by models can help decision makers understand and prepare for future risks. Working with a consortium of researchers, this project will use EO data to improve the data layers used in models that predict where pests can establish, including irrigation, areas under protected agriculture and climatic canopy conditions, demonstrating the improvements made to species distribution estimations for key pests and biological control agents.

The problem

Climate change has changed the way pests and diseases establish and spread around the world. Where countries and habitats would be deemed as inhabitable by the species, rising temperatures, wet and/or dry land are now expanding the distribution of species into new areas.

Likewise, the consequences of increased global trade and pathways have led to insects travelling between countries accidentally, widening the species' reach.

Non-climatic habitat factors can also have a significant effect on species ranges, allowing them to persist beyond their natural ranges. Irrigation and protected agricultural structures, such as glasshouses, are used specifically to allow crop species to be grown successfully in locations where the climate is otherwise inhospitable. The same conditions that allow the crops to be grown in hostile climates allow pest species to persist beyond their natural limits.

Species distribution databases such as Global Biodiversity Information Facility (GBIF) and iSCAN do not reliably distinguish between species distribution records collected from natural habitat situations and those from artificial habitats. Bioclimatic models (species distribution models) that ignore the role of these artificial habitat modifications routinely make significant errors, incorrectly projecting habitat suitability into inclement climates eg extreme weather conditions.

Methodically, these problems can lead to overestimating the pest risk and adversely affect biosecurity risk management, misdirecting resource allocation for preparedness activities, and undermining the reputation of pest risk assessment.

Advances in Earth Observation (EO) technology, also known as satellite remote sensing technology, have opened up new possibilities for addressing agricultural challenges in the face of climate change.

What we are doing

The EO4AgroClimate project aims to develop a more dynamic approach to detect actively used irrigation systems using data derived from EO sources and test improvements against existing pest models. It will also model the effect that changing climates may have on the efficacy of biological control agents using data derived from EO sources.

This project will use EO-derived data to enhance three critical modelling datasets: **irrigation** (knowing whether pest observations have taken place in natural rainfed conditions or irrigated systems – a variable often not recorded and one that will become increasingly important as part of climate adaptation), **protected agriculture structures** (poly tunnels and glasshouses are known to increase yield and lengthen growing seasons but they can affect pest risk models), and **canopy temperature** (the microclimate is difficult to measure – a methodology developed by the project team will be used to make this variable more robust and integrated with EO sources).

The datasets produced will help to contextualize species distribution data from repositories, as well as improve the performance of environmental niche models leading to more accurate, high-resolution, and timely information for pest risk assessment.

Project partners will use EO and climate data to deliver the following improved datasets for pest and disease modelling:

- EO-derived global map of irrigated areas
- EO-derived protected agriculture map
- EO-derived canopy temperature dataset

Datasets will be validated through CABI regional centres in conjunction with local agricultural research organizations in Pakistan, Kenya, South America, and China. The irrigation and canopy temperature datasets will be used to model biopesticide suitability. The layers produced will be used to test differences in model performance for biosecurity pests of concern for the UK and Australia.

Three use cases will be developed for each dataset to illustrate their scientific, policy or commercial potential application.

The data layers produced will be made available through the BioSuccess App to help growers guide their biopesticide applications.

The irrigation and PA datasets will be published through the CliMond website and integrated into CLIMEX, the industry-standard software.

Results so far

The EO4AgroClimate project was launched in April 2023. Partners are currently working on the irrigated areas, protected agriculture and canopy temperature datasets.

The project will be presented at the 2023 Annual Meeting of the International Pest Risk Research Group (IPRRG) in Nairobi, Kenya. The event is the inaugural meeting of IPRRG in Africa and is being delivered in partnership with the Kenya Plant Health Inspectorate Service, CABI and Cervantes Agritech.

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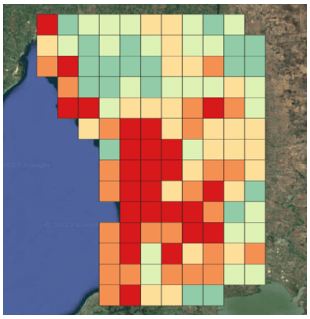

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