Tools to Track and Control Pests and Infectious Diseases

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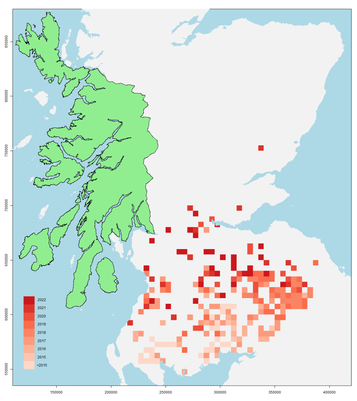
We have developed an **advanced toolkit** of **statistical methods**, making best use of **limited data** to **quantify** the **hidden spread** of **pests** and **diseases** in Scotland.

We **estimate costly-to-measure characteristics** and **produce risk assessments** that **target control efforts**.

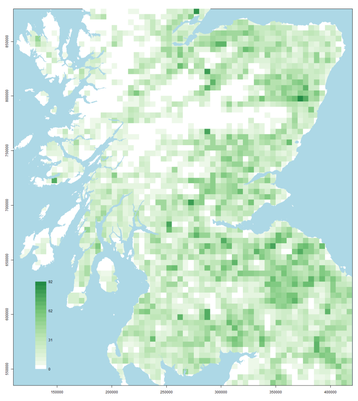
Our insights **support non-academic partners**:

Great Spruce Bark Beetle

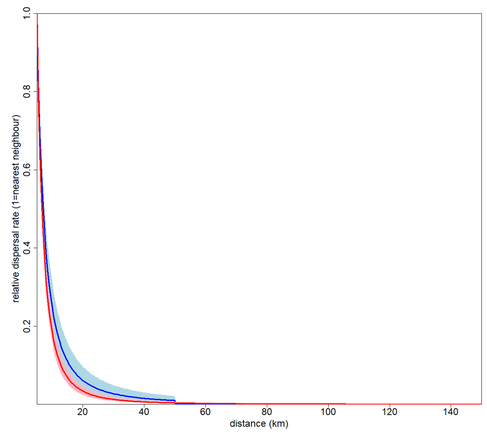
- The **great spruce bark beetle**, a **forest pest**, is **spreading towards** the West of Scotland Pest Free Area (green):

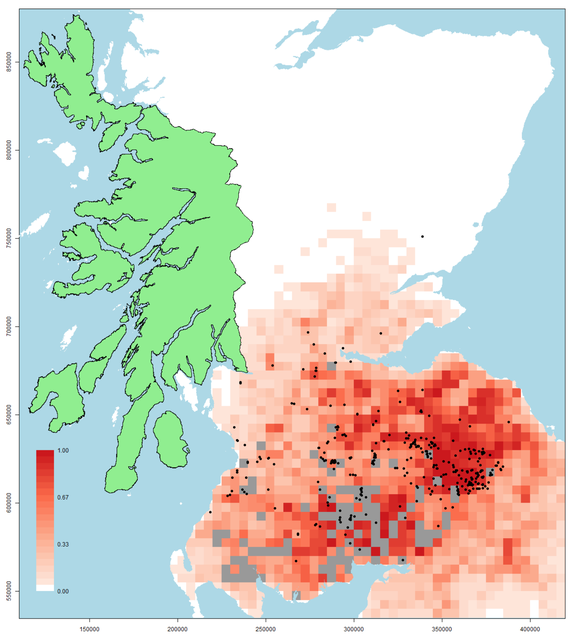


- **Scottish Forestry** monitor pest spread using helicopter and on-the-ground surveys (red, right).



- Using **reported pest sightings**, and data on the **spatial distribution** of **coniferous forest** (left), BioSS has **modelled** the **spatial pest spread**.
- Model **outputs inform Scottish Forestry's Action Plan** for the Pest Free Area.
- Difficult to measure **dispersal** was shown to **rapidly decay** with **distance**:

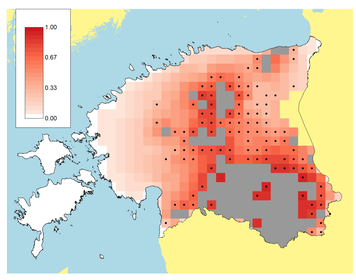




- **Risk maps** showed **projections** of **future spread** (e.g. in 2022, left).
- **Identified high-risk areas** (dark red) **matched subsequent infections** (black dots).

African Swine Fever

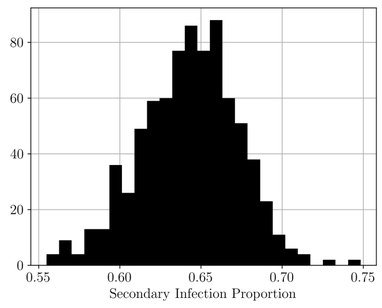
- **EPIC**, Scotland's *Centre of Expertise on Animal Disease Outbreaks*, is using these approaches to inform **Scottish Government** policy colleagues on threats from:
- **ASF** outbreaks pose a **significant threat** to domestic and wild **pigs**.
- Despite **outbreaks in Europe**, it has **not yet** been reported **in Scotland**.
- To test preparedness, BioSS produced **risk maps** for Estonian wild boar (right).



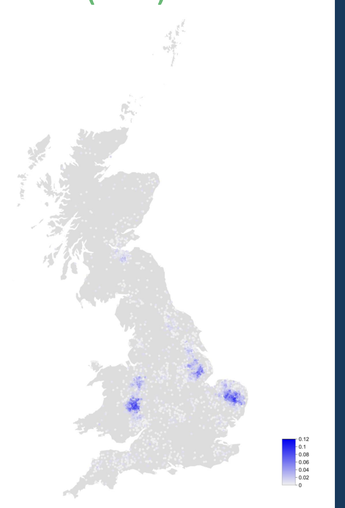
- Methods **use case-only data**, replacing the need to know populations at risk.
- These methods provide **valuable insights** from overseas outbreaks and are **ready to apply to future Scottish outbreaks**.

Highly Pathogenic Avian Influenza

- HPAI spreads in Scotland via. **primary** *(e.g. migratory birds)* and **secondary** *(e.g. local farm-to-farm)* **infection routes**, but their **relative importance** is **unknown**.



- From HPAI **farm breakdowns**, BioSS have **inferred** that **secondary infections** are **crucial** in UK outbreaks (left).
- **Transmission rate and distance estimates** may be used to **inform control zones** around infected premises.
- This analysis **predicts high-risk areas** in the UK (right) and can be used to **quantify** and **target effective policy response**.



User-friendly software is being developed to **widen access** for non-computational scientific users...