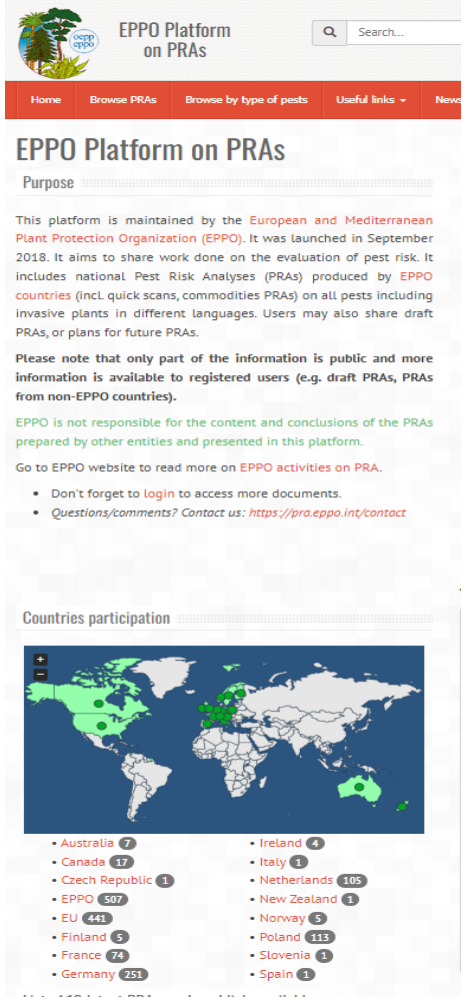
An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Integrating Plant Pest Risk Registers with National Pest Surveillance Programs

Department of Agriculture Food and the Marine
Pest Risk Analysis Unit (PRAU)

Pest Risk Analysis Unit (PRAU)
Risk Register

- PRAU tasked with developing the Plant Pest Risk register
- PRAU was created in 2020
- Part of Plant Sciences Division
- Two risk analysts
- Broad scope of risk assessments duties
- Factsheets (Link)
- PRAs (Link)
- Support research (OPRAM)
- Main role: Provide scientific grounded recommendations to risk managers on threats posed to IE biosecurity



Risk Register - Overview

- **Aim:** To develop a database of EU Regulated Quarantine Plant pests (i.e those in the Annexes of EU 2019/2072 and EU Emergency Measures)
- **Purpose:** To determine which regulated pests/pathogens pose threats to Irish biosecurity
- **Criteria:** Assess (1) whether host plants are present in Ireland (2) whether a suitable climate exists in Ireland for the pest to establish (3) their estimated risk to Irish biosecurity (4) recommend appropriate types of surveillance e.g. visual, trap etc
- **Goal:**
  (1) Database to support pest selection for the multi-annual plant pest surveillance plans;
  (2) Develop aids for plant health surveillance in the field


I

(Legislative acts)

REGULATIONS

REGULATION (EU) 2018/643 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 18 April 2018
on rail transport statistics
(recast)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 338(1) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee (1),

Acting in accordance with the ordinary legislative procedure (2),

Whereas:

Regulation (EC) No 91/2003 of the European Parliament and of the Council (3) has been substantially amen
several times (4). Since further amendments are to be made, that Regulation should be recast in the interes
clarity.

Railways are an important part of the Union's transport networks.

tistics on the transport of goods and passengers by rail are necessary to enable the Commission
develop the common transport policy, as well as the transport elements of policies relating to
o trans-European networks.

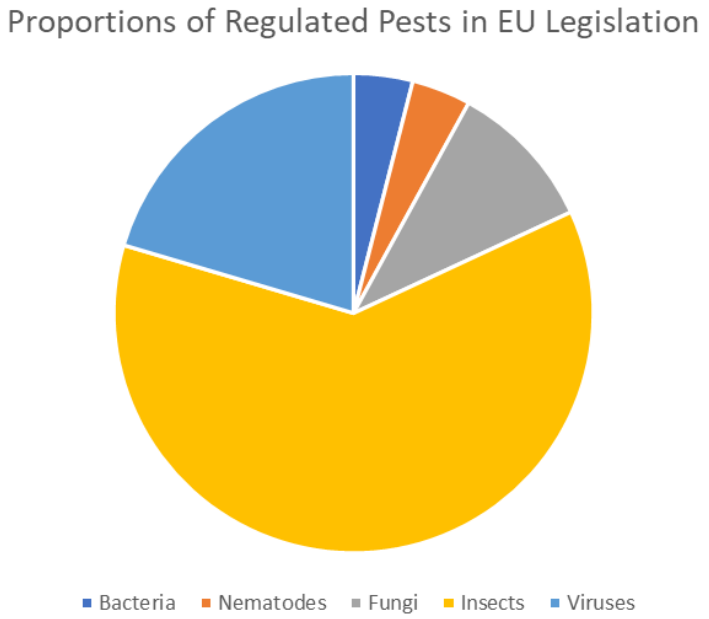
s on rail safety are also necessary to enable the Commission to prepare and monitor Unio
transport safety. The European Union Agency for Railways collects data on accidents u
2004/49/EC of the European Parliament and of the Council (5) as regards common saf
ethods of calculating accident costs.

nion level on rail transport are also required in order to fulfil the monitoring
Directive 2012/34/EU of the European Parliament and of the Council (6).

on level on all modes of transport should be collected according to
e aim of achieving the fullest practicable comparability between transp

Risk Register - Scope

- **Sections:** Bacteria; Fungi & Oomycetes; Nematodes; Insects and Mites; Viruses, viroids and phytoplasmas (minor sections for Molluscs and parasitic plants)
- **Scale:** 429 pest categories in EU legislation
- Many categories are full or partial genera, in some cases even whole families e.g. 75 categories for non-EU Tephritidae but this actually covers 385 species.
- Draft risk register developed , version 3.



Bacteria	Nematodes	Fungi	Insects	Viruses
17	17	43	262	87

Groups

- Each group is currently uploaded as a separate excel file
- Each excel file pest section typically has 26 columns: A-AA (except for bacteria and viruses which have 3 additional vector data columns: A-AD)
- This is quite a lot of data to take in at first glance therefore the columns have been colour coded to demonstrate how they group in terms of functions (Fig 2)
- An explanation of each group and columns in given in the next 2 slides

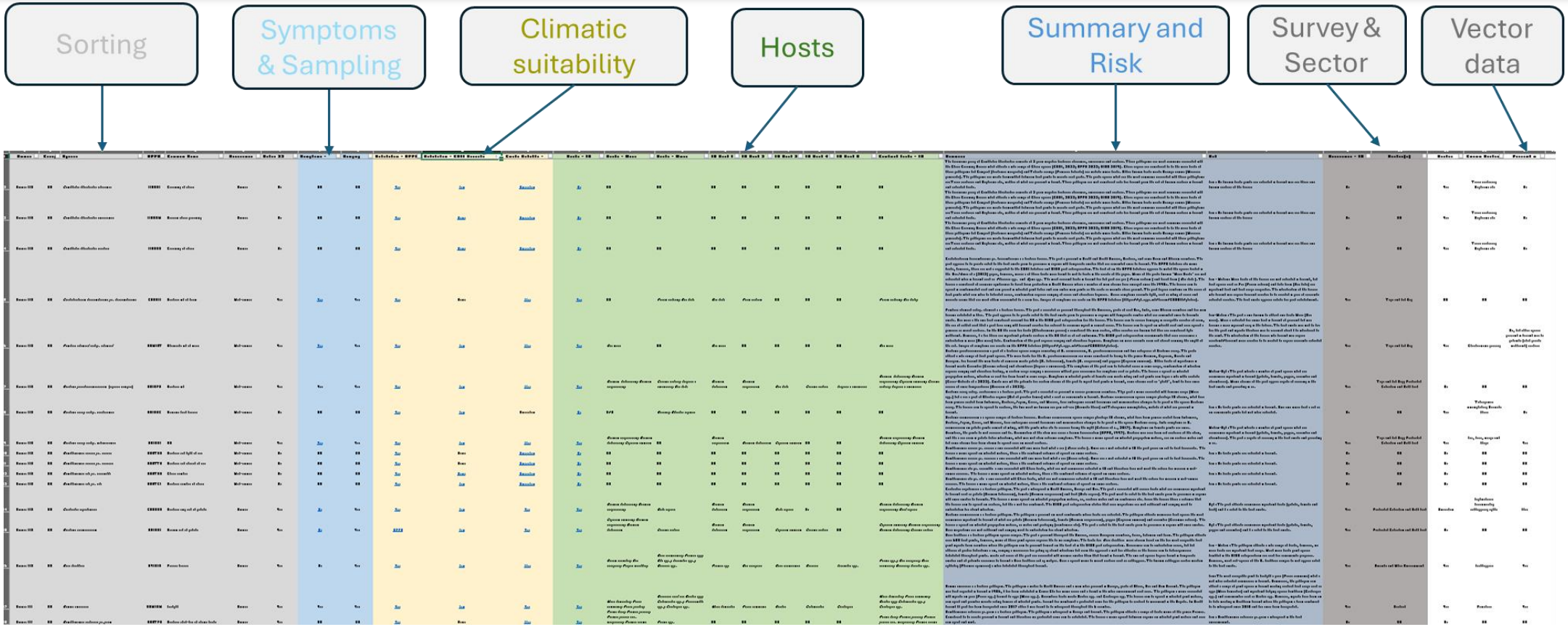


Fig 2: Colour grouping of risk register column functions

Next steps/Actions

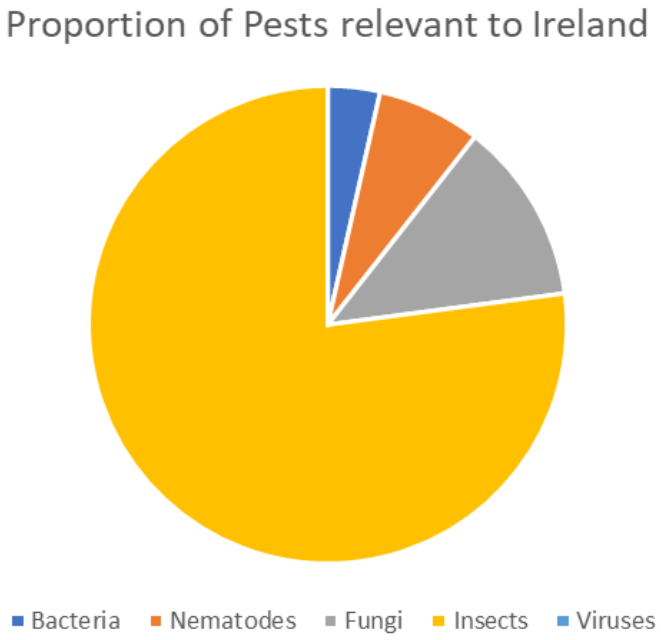
- Consultation meeting with risk managers in HPHD, Forestry Service, PSD on 26th July to review PRAU recommendations.
- Outcome of meeting should be assigned of pest host plants for surveillance and the relevant sector(s) to survey.
- PRAU recommendation is to **Bold** host plants to be surveyed for each pest in risk register.
- Currently many pests are assigned to multiple sectors based on known hosts this may need to be reduced for manageability of surveys (Fig 3).
- Decision on how to proceed with pest symptoms booklet for inspectors: organise by host plants or sectors?

Tillage and Field Veg	Orchard	Protected Cultivation and Soft Fruit	Forestry	Amenity and Wider Environment	Imports
4	1	4	0	1	0
8	5	8	1	7	0
6	5	2	14	7	1
27	20	46	49	47	0
29	10	34	1	8	1
0	0	0	1	0	0
0	0	0	0	0	0
74	41	94	66	70	2

Fig 3: Current assigned of pests to sectors based on range of host plants

Risk Register – Results to date

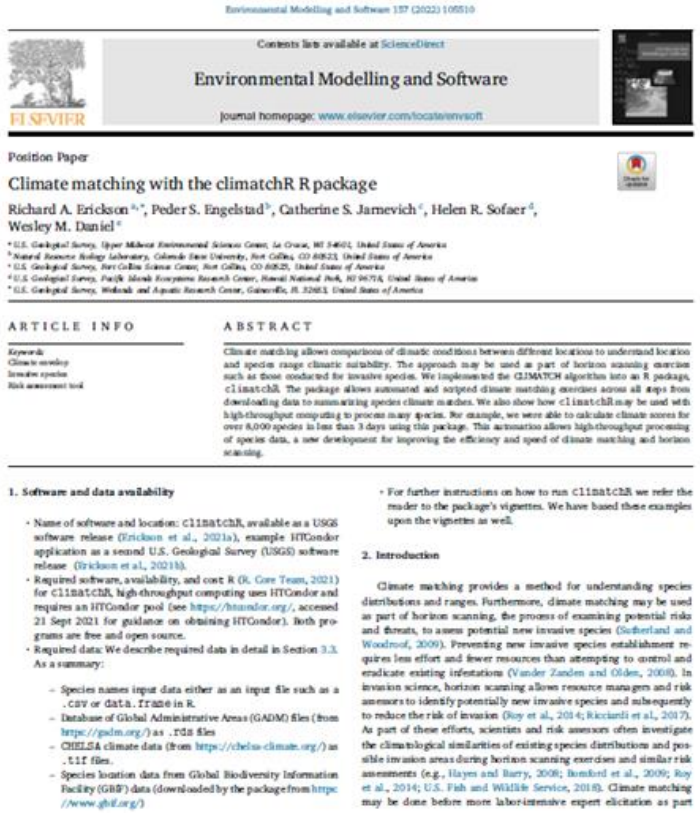
- Of 429 pest categories, 339 are considered relevant based on host and climate – varying levels of risk
- Pests organised by host plants and assigned to most relevant sector inline with Europhyt options: e.g. Forest; Orchard; Greenhouse; Tillage; Nursery; Garden centre & Public sites
- Surveillance recommendations mainly on major hosts plant(s) of highest risk
- Analysis reveals that certain key “high” risk host plants (such as Apple, potato, maize, Pine etc) can cover a significant proportion of regulated pests for each sector, in most cases. Opportunity for thorough systematic surveillance to detect infestations early that are pragmatically implementable



Bacteria	Nematodes	Fungi	Insects	Viruses
8	16	28	175	59

Integrating modelling - ClimatchR

- Version 1-3 covered fundamentals and iterations that were reviewed by specialists and risk managers
- Version 4: Further develop climatic assessment of pests
- Currently qualitative and based on expert judgement of pest biology and scientific literature
- Recent software package facilitates high throughput climatic matching of pests
- Using species distribution data available from the Global Biodiversity Information facility (GBIF) we can run these pests through this package in bulk and gain reproducible quantitative output
- Will be combined with qualitative assessment to identify discrepancies
- More robust approach supporting decision making process for which pests are relevant to Ireland



Environmental Modelling and Software 157 (2022) 105510

Contents lists available at ScienceDirect

Environmental Modelling and Software

journal homepage: www.elsevier.com/locate/envsoft

Position Paper

Climate matching with the climatchR R package

Richard A. Erickson [a,*], Peder S. Engelstad [b], Catherine S. Jarnevich [c], Helen R. Sofaer [d], Wesley M. Daniel [e]

ARTICLE INFO

ABSTRACT

Climate matching allows comparisons of climatic conditions between different locations to understand location and species range climatic suitability. The approach may be used as part of horizon scanning exercises such as those conducted for invasive species. We implemented the CLIMATCH algorithm into an R package, `climatchR`. The package allows automated and scripted climate matching exercises across all steps from downloading data to summarizing species climate matches. We also show how `climatchR` may be used with high-throughput computing to process many species. For example, we were able to calculate climate scores for over 8,000 species in less than 3 days using this package. This automation allows high-throughput processing of species data, a new development for improving the efficiency and speed of climate matching and horizon scanning.

1. Software and data availability

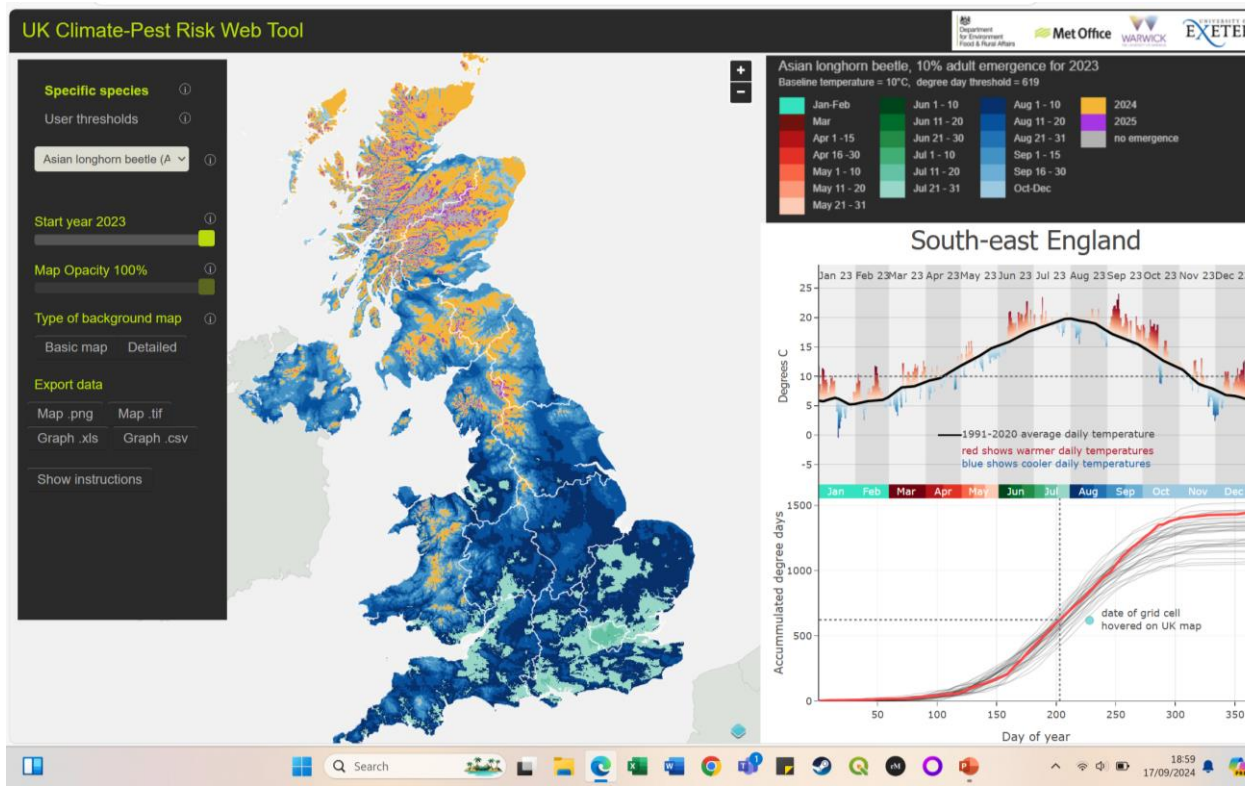
- Name of software and location: `climatchR`, available as a USGS software release (Erickson et al., 2021a), example HTCondor application as a second U.S. Geological Survey (USGS) software release (Erickson et al., 2021b).
- Required software, availability, and cost: R (R. Core Team, 2021) for `climatchR`; high-throughput computing uses HTCondor and requires an HTCondor pool (see https://htcondor.org/, accessed 21 Sept 2021 for guidance on obtaining HTCondor). Both programs are free and open source.
- Required data: We describe required data in detail in Section 3.3. As a summary:
  - Species names input data either as an input file such as a `.csv` or `data.frame` in R.
  - Database of Global Administrative Areas (GADM) files (from https://gadm.org/) as `.rds` files
  - CHELSA climate data (from https://chelsa-climate.org/) as `.tif` files.
  - Species location data from Global Biodiversity Information Facility (GBIF) data (downloaded by the package from https://www.gbif.org/)
- For further instructions on how to run `climatchR` we refer the reader to the package's vignettes. We have based these examples upon the vignettes as well.

2. Introduction

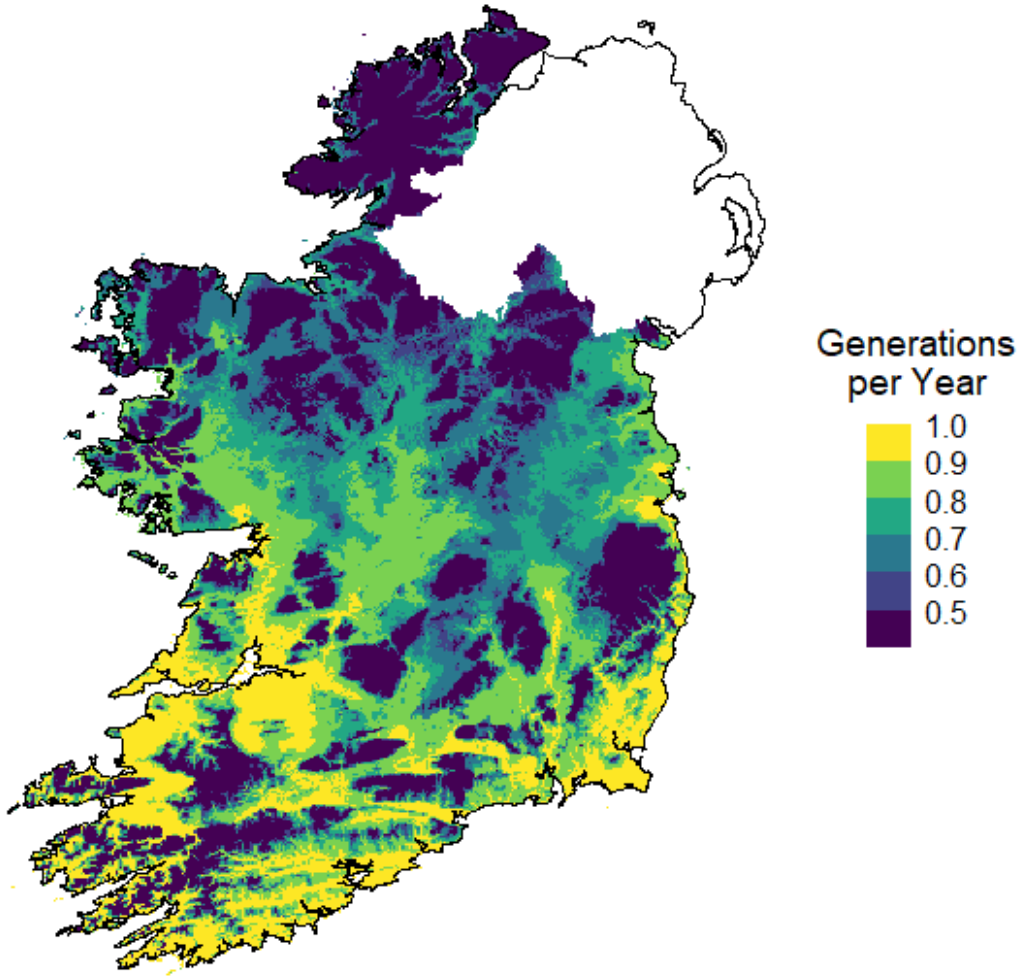
Climate matching provides a method for understanding species distributions and ranges. Furthermore, climate matching may be used as part of horizon scanning, the process of examining potential risks and threats, to assess potential new invasive species (Sutherland and Woodroof, 2009). Preventing new invasive species establishment requires less effort and fewer resources than attempting to control and eradicate existing infestations (Vander Zanden and Olden, 2008). In invasion science, horizon scanning allows resource managers and risk assessors to identify potentially new invasive species and subsequently to reduce the risk of invasion (Roy et al., 2014; Ricciardi et al., 2017). As part of these efforts, scientists and risk assessors often investigate the climatological similarities of existing species distributions and possible invasion areas during horizon scanning exercises and similar risk assessments (e.g., Hayes and Barry, 2008; Bomford et al., 2009; Roy et al., 2014; U.S. Fish and Wildlife Service, 2018). Climate matching may be done before more labor-intensive expert elicitation as part

Integrating modelling research - OPRAM

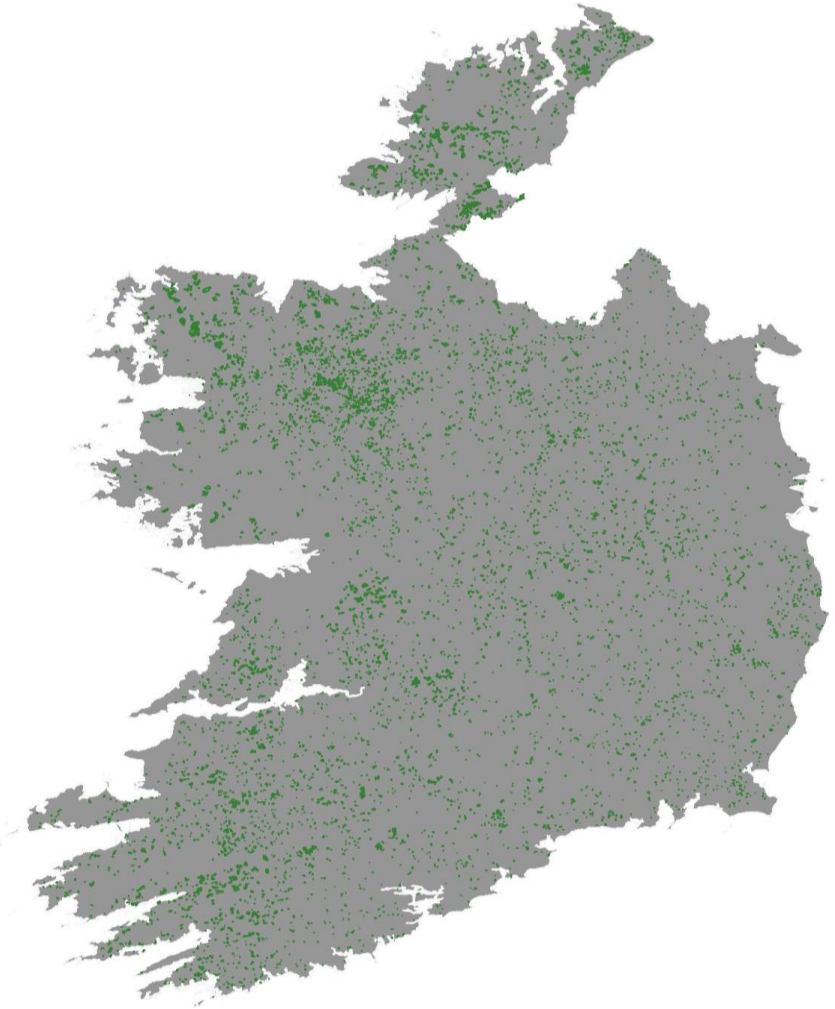
- OPRAM project
- PSSRC – 2022 call
- Online tool for modelling species establishment in collaboration with Met Eireann
- Similar to UK tool (Link) but working on with several more applications (climate change projections, overwintering strategies, lethal temperatures etc).
- Risk based approach to trapping and surveillance, ability to establish and estimate lifecycle time points relevant for surveillance
- Will be used to link modelling to GIS data
- Example *Pseudips mexicanus*



Pseudips mexicanus
Mean Number of Generations per year – (1991:2020)



Pine forestry cover (2021)

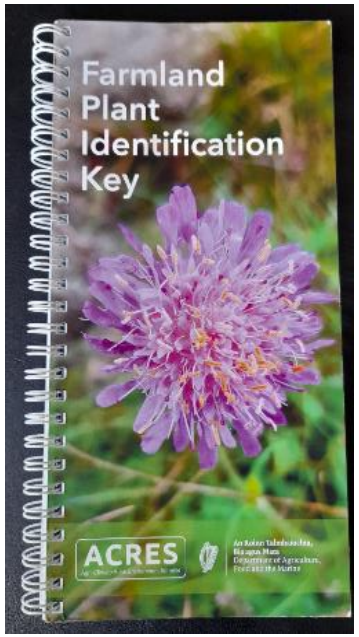


Integrating modelling - Climex

- Climex will be applied to species for which degree day info is not available and GBIF info exists to estimate species parameters
- Will begin with High Risk species initially and work our way through to lower tiers
- Derived species parameters will be applied to OPRAM tool

Risk Register – Tangible Deliverables

- ❑ A complete database of regulated quarantine plant pests detailing their relevance to Ireland – hosts and climate
- Quickly accessible information on surveillance
- Capacity to assess pests by host(s) relate their cumulative risks to our plant health sectors
- ❑ Development of visually based surveillance guides to aid plant health inspectors for surveillance
- Draft templates devised for selection of pests
- Development commencing in October for 2025 multiannual surveillance plan



RR impact on PRAU future role in NPPO

- PRAU currently works with EPPO and EFSA WGs
- Seeking nomination for EU Annexes working Group – recommends listing and delisting of pests from annexes
- This brings us a step closer to the Commission and the NPPO core work
- First look of newly proposed quarantine pests for inclusion in legislation
- Early assessment for what new pests will mean for surveillance activities and resources, PRAU will present this to stakeholder divisions, keep RR up to date; update surveillance booklets and training materials.
- Integrates RA with NPPO core functions making it integral to operations: surveillance (resource and planning), training (inspectors and diagnostic specialists), communication, research

Thank you for your time

Also : Modelling major vectors of barley yellow dwarf virus in current and future climate scenarios (Post doctoral position)