



Food and Agriculture  
Organization of the  
United Nations



International  
Plant Protection  
Convention



Department  
for Environment  
Food & Rural Affairs

# *CABI innovations in early warning systems*

PRISE, Plant clinics, Horizon scanning tool, Insight analysis, Pest risk analysis

---

London, 21 – 23 September 2022

## International Plant Health Conference



## How early is early warning?

- Predicting timing of an already established problem
  - (Pest Risk Information Service PRISE)
- Rapid recognition and identification of a newly arrived problem
  - (Plant clinics)
- Identification of a potential external threat
  - Horizon scanning tool; HST
  - Insight reporting
  - Pest risk analysis tool; PRA



## Within-season early warning: Pest Risk Information Service (PRISE)

- Developed in Kenya, Zambia, Malawi and Ghana
- Models give the optimum time to apply intervention for maximum efficacy
- Essential to spot the pest early/in advance if biological control is to be used



## Within-season early warning: Pest Risk Information Service (PRISE)

- Pest and disease development is strongly linked to ambient conditions
- Global satellite data is now available covering many different variables e.g. precipitation, temperatures, evapotranspiration, vegetation health indices
- These data can be used to drive early warning models

Optimizing the timing of management interventions against fall armyworm in African smallholder maize: Modelling the pattern of larval population emergence and development

Alyssa Lowry<sup>a,\*</sup>, Léna Durocher-Granger<sup>b</sup>, MaryLucy Oronje<sup>c</sup>, Daniel Mutisya<sup>d</sup>, Tibonge Mfuné<sup>e</sup>, Christine Gitonga<sup>f</sup>, Monde Musesha<sup>e</sup>, Bryony Taylor<sup>g</sup>, Suzy Wood<sup>a</sup>, Duncan Chacha<sup>c</sup>, Tim Beale<sup>g</sup>, Elizabeth A. Finch<sup>a</sup>, Sean T. Murphy<sup>a</sup>

<sup>a</sup> CABI, Bakeham Lane, Egham, Surrey, UK

<sup>b</sup> CABI, Leusderend 32, 3832, RC, Leiden, the Netherlands

<sup>c</sup> CABI, Canary Bird, 673 Limuru Road, Muthaiga, Nairobi, Kenya

<sup>d</sup> Kenya Agricultural and Livestock Research Organisation (KALRO), Agricultural Mechanization Research Institute, Katumani, Machakos, 340-90100, Kenya

<sup>e</sup> Zambia Agricultural Research Institute (ZARI), Mount Makulu Research Station, Chilanga, Zambia

<sup>f</sup> KALRO, Food Crops Research Centre, Muguga, Kikuyu, 30148-00100, Kenya

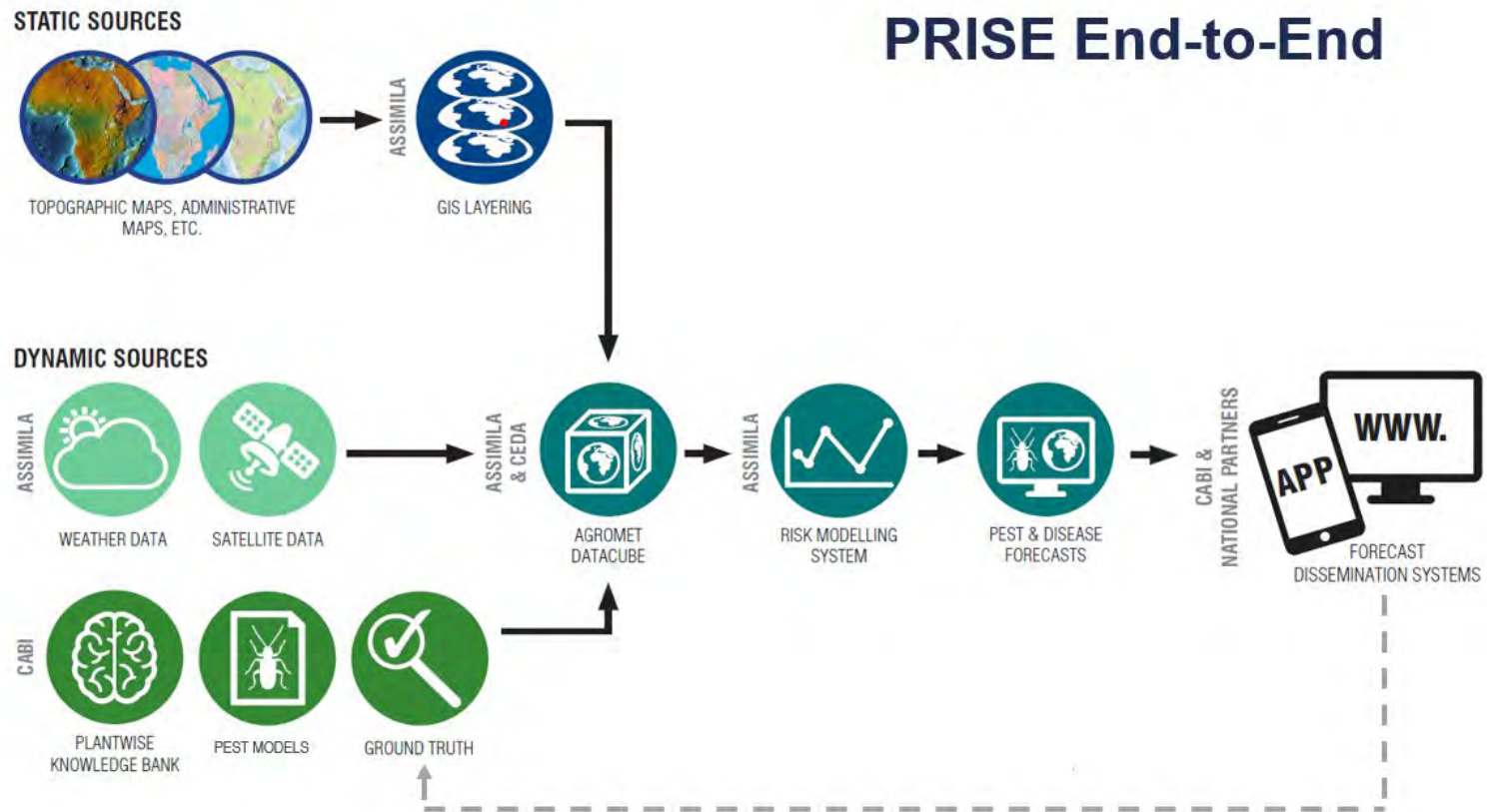
<sup>g</sup> CABI, Nosworthy Way, Wallingford, UK

<https://www.sciencedirect.com/science/article/pii/S026121942200062X>





# Within-season early warning: Pest Risk Information Service (PRISE)



## Extension of messages to farmers

### SMS advisories to smallholder farmers



"If you planted tomatoes in November the best time to take action will be 8-10 days after planting. Until then you can use other methods. Reply A for more"

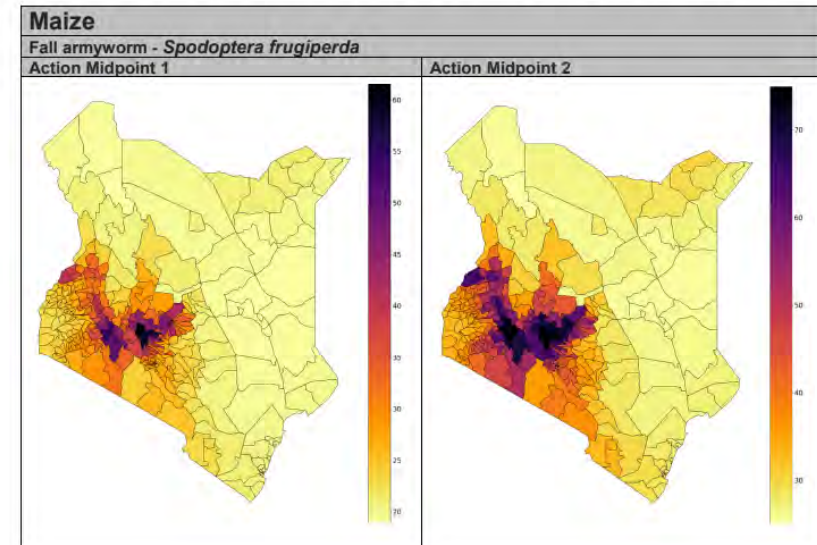
## Tailored bulletins to extension workers

Kenya Update 13/05/21



The Pest Risk Information Service (PRISE) bulletin service provides pest information focusing on some of the most damaging pests of maize, tomato and bean crops.

The IPM advice contained in this document has been approved and validated by in-country experts. Always check for these pests in the field before alerting farmers.





## CABI modelling: Future pest risk

- Species distribution modelling- *Paracoccus marginatus*\*
- CLIMEX- future climate scenarios -  
*Halyomorpha halys* Switzerland \* \*

\* Finch et al (2021) <https://doi.org/10.1002/ps.6151>

\*\*Stoeckli et al (2020). <https://doi.org/10.1007/s00484-020-01992-z>



## Plant clinics; unashamedly modelled on the human health system.





## The plant clinic:

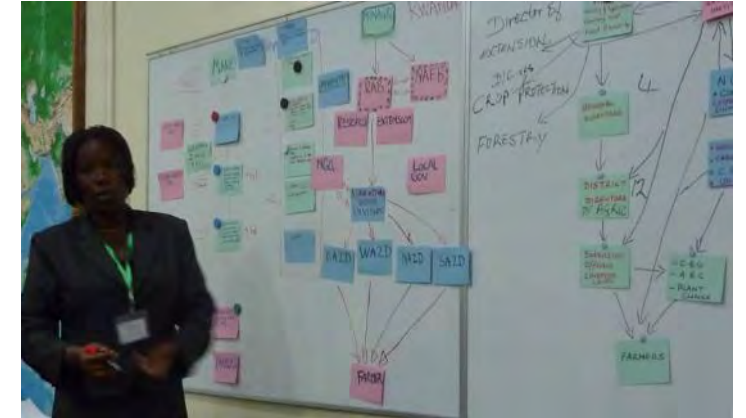
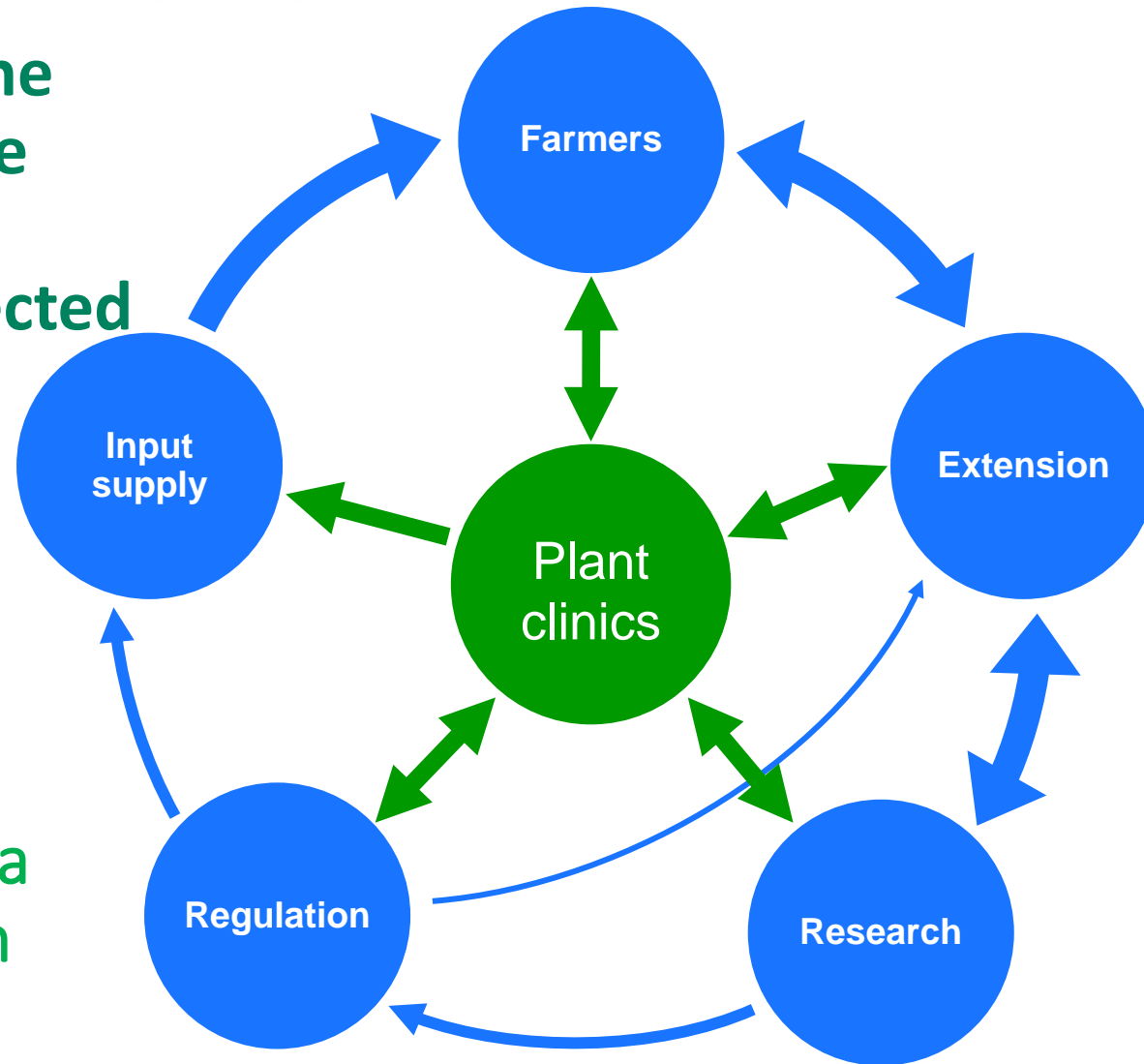
Plant clinics are regular events where farmers can get advice on growing their crops.

Medical		Crop equivalent
The GP	is	the plant doctor
GP surgery	is	the plant clinic
The pharmacy	is	the agro dealers supply shop
The medical diagnostic laboratory	is	the plant diagnostic laboratory
Medical regulator	is	Pesticide board



Ensuring the parts of the system are interconnected

Concept of a plant health system



## General Surveillance

Early warning system?

If all parts of a plant health system are working correctly;

In the case of unfamiliar problem pests or disease.....

- Sent to the diagnostic laboratory
- Identified by experts
- Information on diagnosis and control measures supplied to the farmer





## General Surveillance

Early warning system?

Problems with this idea;

Extension workers cannot be familiar with every problem on every crop:

- Too much traffic to laboratories (expense)
- Labs often don't have the identification skills
- Delays can lead to a deterioration of the sample and problems getting the results back to the farmer by which time it will be too late
- The problem has already arrived in the country



## General Surveillance

Nevertheless the system can work:

If the problem:

- Has unique symptoms or appearance is striking
- Is on a widely grown crop
- Is present on an otherwise healthy crop

It is likely that it will be identified as something new and would be picked up by a clinic



## Diseases and pests picked up at

### Clinics:

Banana xanthomonas wilt

Cassava brown streak virus

Maize lethal necrosis disease

Fall army worm

**Social networks:** Banana skipper

### CABI Diagnostic and Advisory service:

	Invertebrates	Plants	Viruses	Bacteria	Fungi
2017	4		3	1	1
2018			2		
2019	5		2		
2020	5	1			
2021	1	1			





## Invasive threat prediction Horizon scanning tool

A website that allows you to see what pests/diseases you have not got and what could be coming your way



**CABI** **Horizon Scanning Tool**  
Prioritizing invasive species threats

Area at risk:

☒ I am only interested in plant pests

# Invasive threat prediction HST

## *What does it do?*

- Helps with first step of risk assessment
- Uses distribution database to find list of pests that are:
  - Absent in specified area at risk (eg your country)
  - Present in specified source area
- Output is a (long) list of species
- Filters can be applied

The screenshot shows the CABI Horizon Scanning Tool interface. At the top, the CABI logo and the title 'Horizon Scanning Tool' are displayed, with the subtitle 'Prioritizing invasive species threats'. Below this, a search bar is set to 'Area at risk: Kenya'. A checkbox labeled 'I am only interested in plants' is checked. On the left, a 'Refine by' sidebar lists various filters: Source areas, Pathways, Plant hosts, Plant parts in trade, Habitats, and Taxonomic group. The main results area shows 'Results: 364 species found' and a table of species. The table has two columns: 'Preferred scientific name' and 'International common name'. The first few rows of the table are as follows:

Preferred scientific name	International common name
Abutilon indicum	country mallow
Abutilon theophrasti	velvet leaf
Acanthocoris scabrator	squash bug
Acanthoscelides macrophthalmus	
Aceria guerreronis	coconut mite
Aceria tulipae	dry bulb mite
Aeschynomene indica	Indian jointvetch
African cotton mosaic disease	
Ahasverus advena	foreign grain beetle

# Invasive threat prediction HST

## Selections other than countries;

The tool also assists with the selection of:

- **Trade partners**  
UN Comtrade data
- **Countries with matching climate zones**  
Köppen-Geiger climate classification system

Select from Zimbabwe's top 10 trade partners (imports, by value)

All trade	Animal & plant commodity trade
<input type="checkbox"/> All	<input type="checkbox"/> All
<input type="checkbox"/> South Africa	<input type="checkbox"/> South Africa
<input type="checkbox"/> Singapore	<input type="checkbox"/> Zambia
<input type="checkbox"/> China	<input checked="" type="checkbox"/> Mexico
<input type="checkbox"/> Zambia	<input type="checkbox"/> Mauritius
<input type="checkbox"/> India	<input type="checkbox"/> Thailand
<input type="checkbox"/> Mozambique	<input type="checkbox"/> Mozambique
<input type="checkbox"/> Japan	<input type="checkbox"/> United Kingdom
<input type="checkbox"/> United Kingdom	<input type="checkbox"/> United States
<input type="checkbox"/> Mauritius	
<input type="checkbox"/> United States	

Select climate zones to add geographic areas with matching climates to Zimbabwe:

<input type="checkbox"/> All	<input type="checkbox"/> Desert (arid, hot) <a href="#">zone map</a>
<input type="checkbox"/> Humid subtropical (monsoon-influenced) <a href="#">zone map</a>	<input type="checkbox"/> Subtropical highland (warm) <a href="#">zone map</a>
<input checked="" type="checkbox"/> Steppe (semi-arid, hot) <a href="#">zone map</a>	<input type="checkbox"/> Tropical savannah (wet) <a href="#">zone map</a>

**All climate zones**





# Invasive threat prediction HST

Comparing UK with “Europe” provided 2623 potential plant pests

The screenshot displays the CABI Horizon Scanning Tool interface. At the top, the CABI logo and the title "Horizon Scanning Tool" are visible, with the subtitle "Prioritizing invasive species threats". Below this, the "Area at risk" is set to "United Kingdom", and a checkbox labeled "I am only interested in plant pests" is checked. A red "Start Scan" button is present. The results section shows "Results: 2623 species found" in green text, which is circled in red. Below this, there are filters for "Source areas", "Pathways", "Plant hosts", "Plant parts in trade", "Habitats", and "Taxonomic group". The results are displayed in a table with columns for "Preferred scientific name", "International common name", "Taxonomic group", and "View datasheet". The table shows 10 results, with pagination indicating "Page: 1 of 105".

Preferred scientific name	International common name	Taxonomic group	View datasheet
Abacarus kôrösicsomai		Invertebrates	CPC (Basic)
Abelmoschus esculentus	okra	Plants	CPC (Full) ISC (Full)
Abraxas pantaria	light magpie	Invertebrates	CPC (Basic)
Acacia	wattles	Plants	CPC (Basic)
Acalitus phloeocoptes	plum, blister mite	Invertebrates	CPC (Basic)
Acalypha australis		Plants	CPC (Basic) ISC (Basic)
Acalypha indica	Indian copperleaf	Plants	CPC (Basic)

# Invasive threat prediction HST

Comparing UK with “Europe” provided 2623 potential plant pests

Adding “lettuce” as the only crop reduced this to 60

Adding “virus” only reduced this to 6

The screenshot shows the CABI Horizon Scanning Tool interface. At the top, the CABI logo and the title "Horizon Scanning Tool" are displayed, with the subtitle "Prioritizing invasive species threats". Below this, the "Area at risk" is set to "United Kingdom", and a checkbox "I am only interested in plant pests" is checked. A red circle highlights the "Results: 6 species found" text. The interface includes a "Refine by" section on the left with filters for "Source areas", "Pathways", "Plant hosts", "Plant parts in trade", "Habitats", and "Taxonomic group". The "Taxonomic group" filter is currently selected. The main results table lists 6 species, all of which are viruses. The table has columns for "Preferred scientific name", "International common name", "Taxonomic group", and "View datasheet".

Preferred scientific name	International common name	Taxonomic group	View datasheet
Artichoke yellow ringspot virus		Viruses	CPC (Basic)
Cucurbit aphid-borne yellows virus	Cucurbit aphid-borne yellows	Viruses	CPC (Full) ISC (Full)
Cucurbit yellow stunting disorder		Viruses	CPC (Full) ISC (Full)
Lettuce Italian necrotic virus		Viruses	CPC (Basic)
Tomato chlorotic spot virus		Viruses	CPC (Basic)
Tomato infectious chlorosis virus		Viruses	CPC (Full)

# Insight reporting

## *What is it?*

- Spotting “emerging issues” (equivalent to the EFSA newsletters)
- Monitoring information for possible changes to risk (to the country)
  - Media
  - Scientific literature
- Changes to probability (of entry etc)
  - Eg Spread to a nearer country, or to a trading partner
- Changes to potential consequences/impact
  - Eg New highly effective control method; New host
- Change of risk may need change of risk management

**Pest Insight Report: Kenya**  
Media and Scientific Literature Monitoring  
Draft 02, December 2021  
CABI



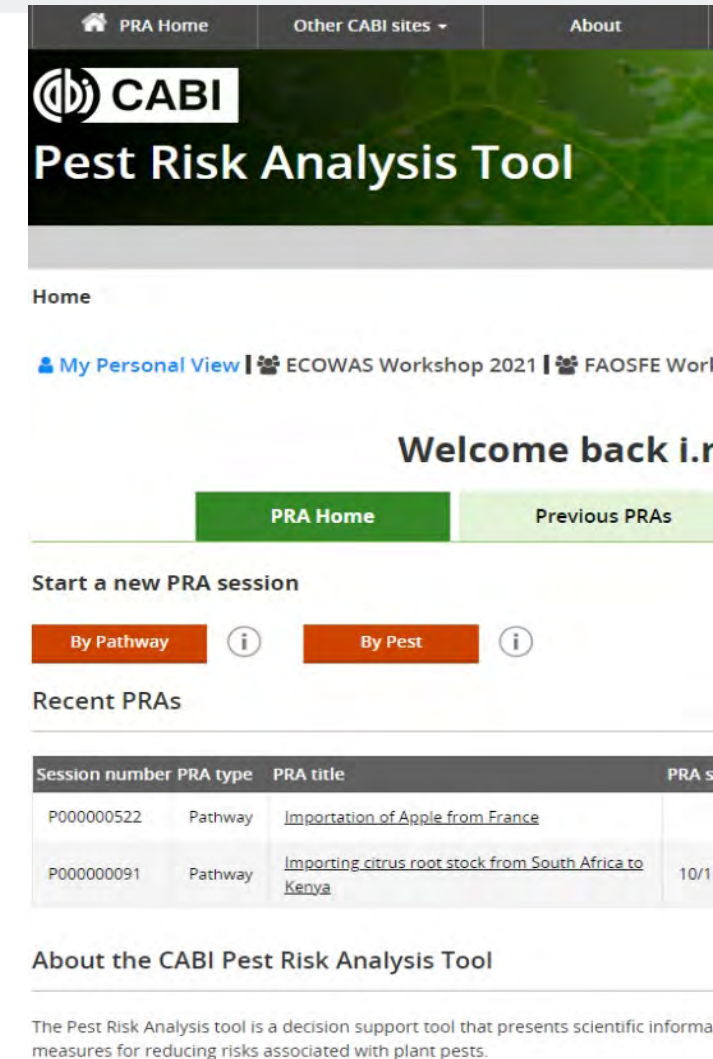


# Invasive threat prediction

## Pest Risk Analysis Tool

*What does it do?*

- Generates a list of potential pests for a commodity (similar to HST)
- Guides user through a formal PRA according to ISPM11 (IPPC)
- Provides access to information (but no assessment or analysis)
- Generates a report
- Allows team working; off/online work
- Various enhancements have been made based on user feedback



The screenshot shows the CABI Pest Risk Analysis Tool website. At the top, there is a navigation bar with links for 'PRA Home', 'Other CABI sites', and 'About'. Below this is the CABI logo and the title 'Pest Risk Analysis Tool'. A 'Home' link is visible. A user is logged in, with links for 'My Personal View', 'ECOWAS Workshop 2021', and 'FAOSFE World'. A 'Welcome back i.n' message is displayed. There are two buttons: 'PRA Home' and 'Previous PRAs'. Below these, there is a section 'Start a new PRA session' with two options: 'By Pathway' and 'By Pest', each with an information icon. A 'Recent PRAs' section follows, containing a table with the following data:

Session number	PRA type	PRA title	PRA s
P000000522	Pathway	<a href="#">Importation of Apple from France</a>	
P000000091	Pathway	<a href="#">Importing citrus root stock from South Africa to Kenya</a>	10/1

Below the table is a section 'About the CABI Pest Risk Analysis Tool' with a paragraph: 'The Pest Risk Analysis tool is a decision support tool that presents scientific information and measures for reducing risks associated with plant pests.'



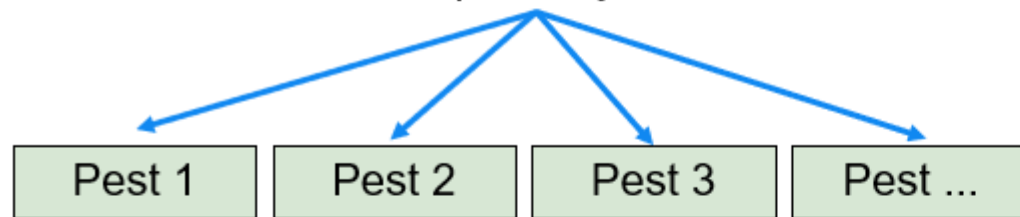
# Invasive threat prediction

## PRA Tool

### By Pathway

E.g. a request to import onions from South Africa to Zambia

Identify the pests that are associated with the pathway

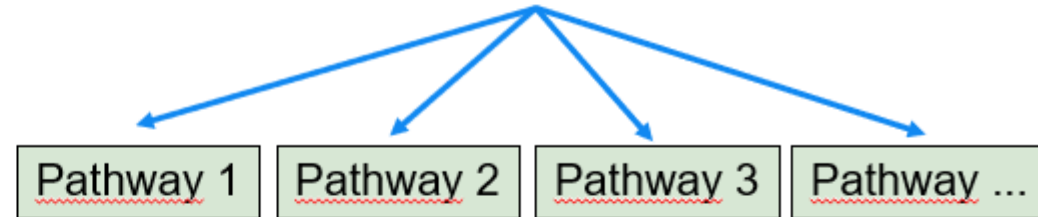


Conduct a risk assessment for all the major pests that may be introduced to the risk area via this pathway

### By Pest

E.g. risk of red palm weevil (*Rhynchophorus ferrugineus*) for Ghana

Identify the potential pathways for pest entry to the risk area



Assess the likelihood of introduction of the pest via each pathway. Then continue the single pest risk assessment

# Risk register

## UK Plant Health Risk Register



Department for Environment, Food & Rural Affairs

Search for a Pest or Organism

1,299 pests in the Risk Register

e.g. Asian longhorn beetle

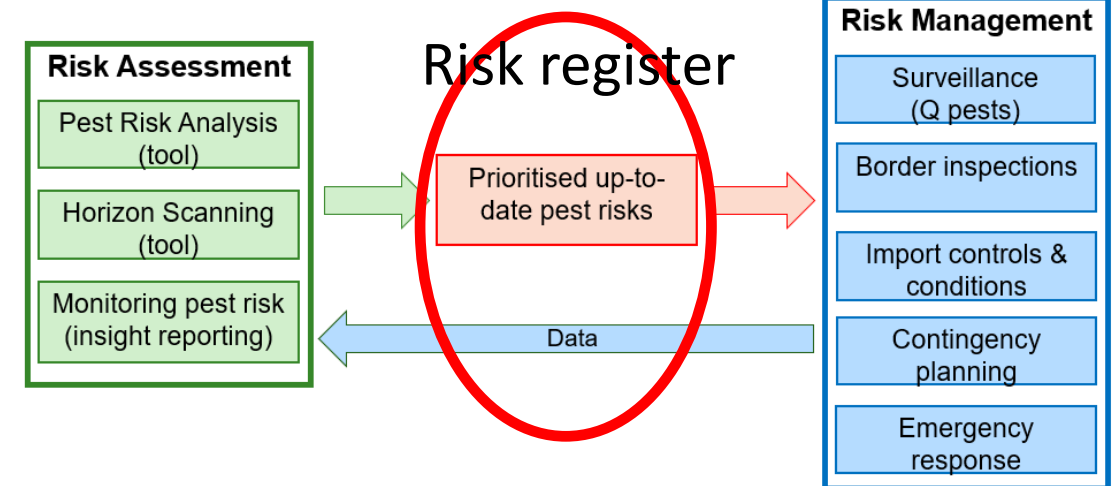
Search

☒ Preferred Name ☒ Synonym ☒ Common Name ☒ Host



Advanced Search

Download Entire Risk Register





# UK Risk Register Details for *Anoplophora glabripennis*

## Scenario and Pathways

### Scenario for Risk Register

[show / hide](#)

- Pest is introduced

### Pathway Assessed for Entry to UK

[show / hide](#)

- Wood packaging material

### Common Pathways

[show / hide](#)

This section is currently being developed as part of the next phase of the Risk Register.

## Risk Ratings and Current Mitigations

### Unmitigated Risks

[show / hide](#)

Likelihood [1 - 5]					4
Entry [1 - 5]					4
Establishment [1 - 5]					5
Spread [1 - 5]			2		
Impact [1 - 5]					4
Impact - Economic [1 - 5]				3	
Impact - Environmental [1 - 5]					4
Impact - Social [1 - 5]					4
Value at Risk [1 - 5]					5
Likelihood x Impact [1 - 25]				16	
UK Relative Risk Rating [1 - 125]				80	

### Current Mitigations

[show / hide](#)

#### Key mitigation for pest

Regulated quarantine pest. (UK eradication experience)

- Regulation
- Surveillance
- Industry Scheme
- Contingency Plan
- Awareness
- Research

### Mitigated Risks

[show / hide](#)

Likelihood [1 - 5]			2		
Entry [1 - 5]			2		
Establishment [1 - 5]					4
Spread [1 - 5]			2		
Impact [1 - 5]					4
Impact - Economic [1 - 5]				3	
Impact - Environmental [1 - 5]					4
Impact - Social [1 - 5]					4
Value at Risk [1 - 5]					5
Likelihood x Impact [1 - 25]			8		
UK Relative Risk Rating [1 - 125]			40		

## To be forewarned is to be forearmed

Having the information is not enough;

- The data needs to be used; so as to reduce the risk to crop health/plant health in as many ways as possible

HOW TO IDENTIFY FALL ARMYWORM

African armyworm *Spodoptera exempta*Beet armyworm *Spodoptera exigua*African cotton leafworm  
*Spodoptera littoralis*Spotted stem borer *Chilo partellus*African maize stalk borer *Busseola fusca*

7

HOW TO IDENTIFY FALL ARMYWORM



Inverted "Y" © Matt Bertone, NCSU

2



Raised dots on body segments © Russ Ottens, Bugwood.org

3



Clumps of frass formed during (fresh) feeding © CABI

4



Food and Agriculture  
Organization of the  
United Nations



International  
Plant Protection  
Convention



Department  
for Environment  
Food & Rural Affairs

London, 21 – 23  
September 2022

# International Plant Health Conference

شكرا جزيلًا  
mercì  
शुक्रिया  
zikomo  
xie-xie  
obrigado  
efharistó  
merci  
zikomo  
gracias  
asante  
thank you  
urakoze  
danke  
terima kasih  
dhanyawaad  
ke itumetse  
tak

CABI is an international intergovernmental organisation, and we gratefully acknowledge the core financial support from our member countries (and lead agencies) including:



Ministry of Agriculture and  
Rural Affairs,  
People's Republic of China



Agriculture and  
Agri-Food Canada



Ministry of Agriculture and  
Rural Affairs



Swiss Agency for Development  
and Cooperation SDC

