



# Horizon Scanning for plant pest prioritization

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IPPC Webinar Series: Climate change and phytosanitary measures

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## Definition of horizon scanning

A systematic examination of potential threats and opportunities within a given context

In this case:

Potential threat = invasive species

Given context = agriculture, forestry and environment

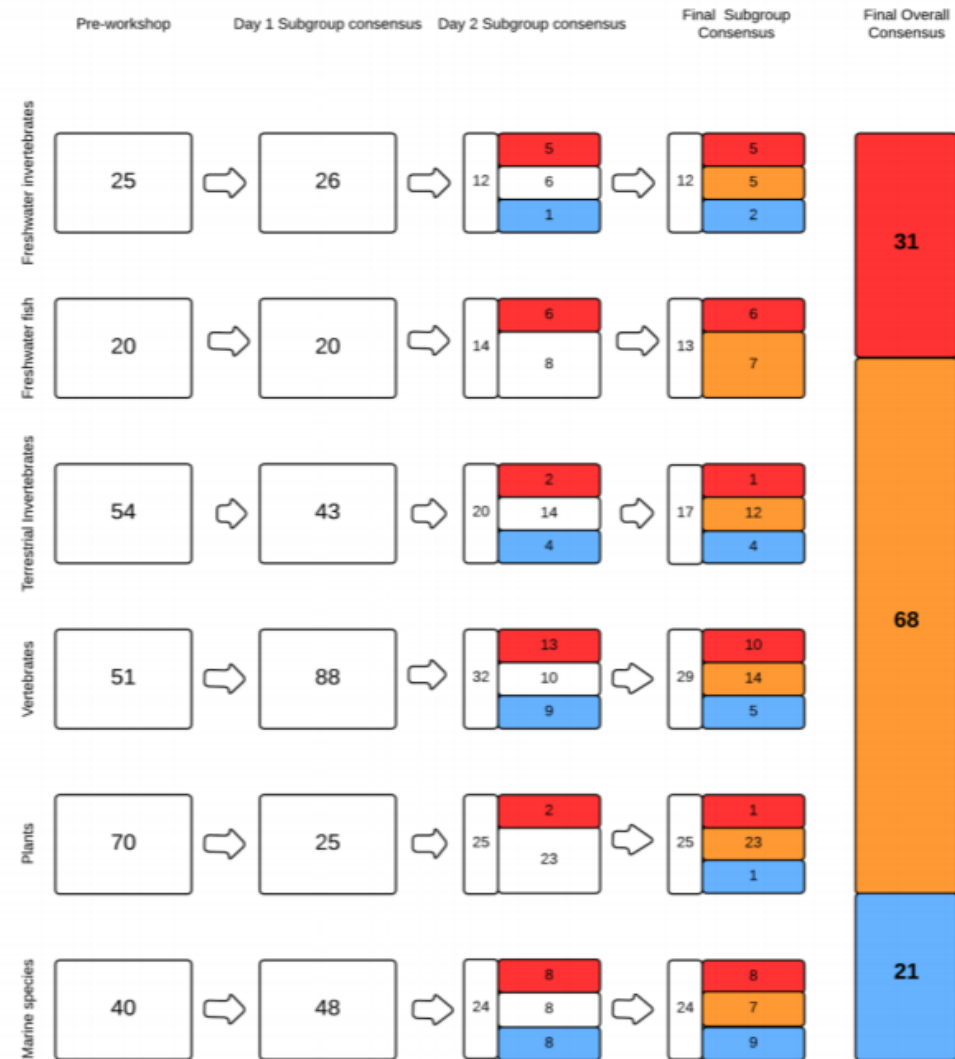
Horizon scanning can help prioritize species for PRAs and other purposes



# Prioritizing invasive species through horizon scanning

## Three key elements:

1. Large and broad scanning to start with a workable lists
2. Shortening the lists
3. Consensus

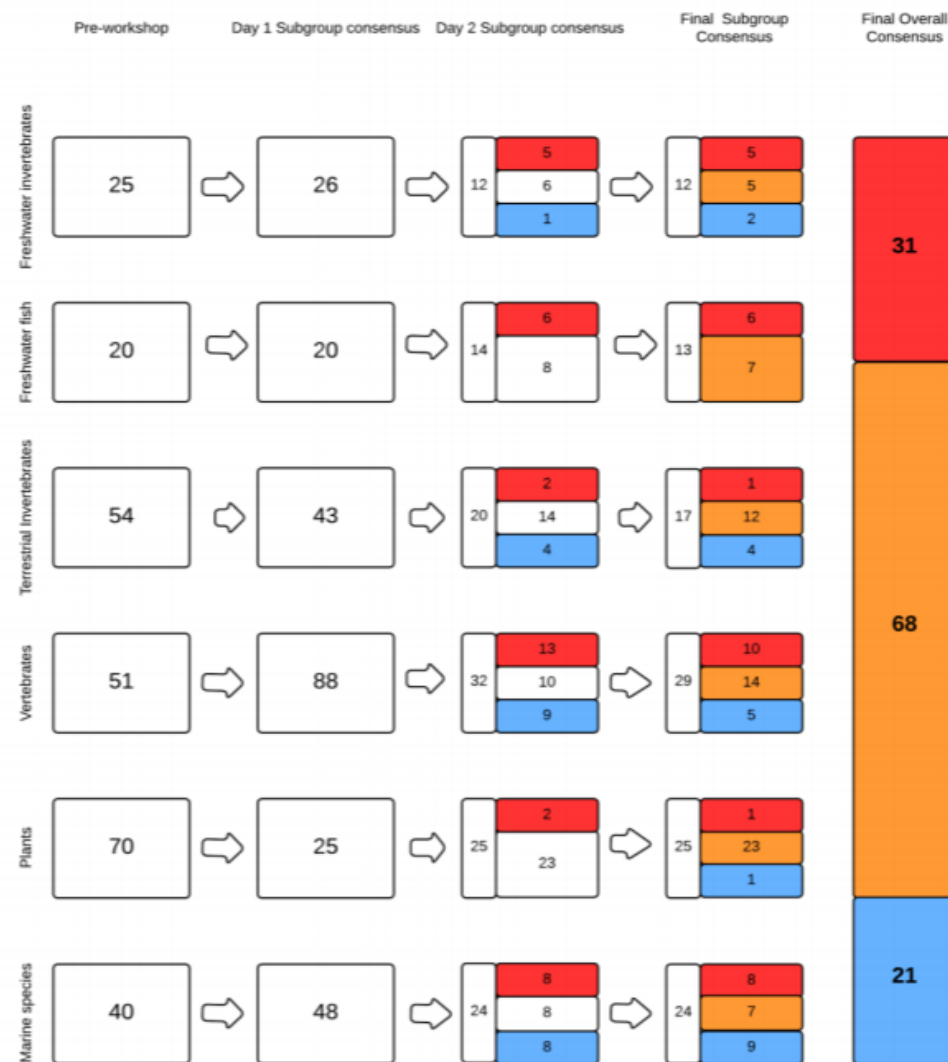




# Prioritizing invasive species through horizon scanning

## Three key elements:

1. Large and broad scanning to start with a workable lists – **Horizon scanning tool**
2. Shortening the lists
3. Consensus





Horizon scanning

The CABI tool

Conducting a scan

Scan results

Help and  
feedback



## Horizon Scanning Tool

Prioritizing invasive species threats

- Identifies **potential invasive species threats** to a country, state or province
- Using information from CABI **Compendia datasheets**
- Provides lists of species absent in the **area at risk** that may come from a **source area**, on a particular **plant or part of plant**, through a particular **pathway** ...



# Uses of the Horizon Scanning Tool

To prioritize species for pest-initiated PRAs

Which potential invasive pests most urgently need PRAs?

To select representative pests in pathway-initiated PRAs

E.g. Which pests are likely to arrive with commodity X from country Y?

Other utilities

E.g. Which pests are already in neighbouring countries and need surveillance or contingency plans?





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## Accessing the Horizon Scanning Tool

[www.cabi.org/horizonscanningtool](https://www.cabi.org/horizonscanningtool)

Or via a link from:

**The Compendium page of the New CABI Digital library**

<https://www.cabidigitallibrary.org/journal/cabi-compendium>

If you are interested in a demo, let me know

**CABI**

### Horizon Scanning Tool

Prioritizing invasive species threats

The Horizon Scanning Tool is a decision support aid that helps you identify and categorize species that might enter a particular geographic area from another geographic area.

Free	Premium
<ul style="list-style-type: none"><li>Refine by habitats, pathways and taxonomic groups</li><li>Access ISC datasheets</li></ul>	<ul style="list-style-type: none"><li>Refine by additional filters - plant hosts and plant parts in trade</li><li>Access ISC and CPC datasheets</li></ul>
<a href="#">Begin scan</a>	<a href="#">Sign in / Sign up</a>

The tool uses CABI data to generate a list of species that are absent from your selected 'area at risk' but present in 'source areas' i.e. geographic areas with similar climates to your 'area at risk', neighbouring areas or selected trading partners.

#### Using the Horizon Scanning Tool

- Select your 'area at risk' or area of interest which doesn't currently have a pest/invasive species present
- Select potential 'source areas' where species are present and act as points of entry to your 'area at risk'
- Scan for results
- View species results

# Horizon scanning for potential invasive plant pests in Ghana

## Objectives:

- Establish a list of potential invasive alien plant pests (invertebrates and pathogens) that may become harmful to Ghanaian agriculture, forestry or environment.
- Rank these species according to their potential threat and the urgency of carrying out a full pest risk analysis, or taking management measures.

The prioritisation was carried out by a panel of experts from Ghana in research institutions and academia with experience in entomology, bacteriology, mycology, nematology and virology



## Step 1. Preliminary horizon scanning

Carried out in a workshop, using the CABI Horizon Scanning Tool

Area at risk: Ghana

Source country: Africa

Filters: Plant pests only, invertebrates and plant pathogens

Result: +1800 species!

g/HorizonScanningTool/Country/SearchResult

Pathways	Preferred scientific name	International common name	Taxonomic group	View datasheet
Plant hosts	Acalitus vaccinii	blueberry bud mite	Invertebrates	CPC (Basic)
Plant parts in trade	Acanthacris ruficornis		Invertebrates	CPC (Full)
Habitats	Acanthiophilus hellianthi	fly, capsule	Invertebrates	CPC (Full)
Taxonomic group	Acanthocoris scabrator	squash bug	Invertebrates	CPC (Full)
	Acanthopius discoidalis	armoured bush cricket	Invertebrates	CPC (Basic)
	Acanthoscelides macrophthalmus		Invertebrates	CPC (Basic)
	Acanthoscelides obtectus	bean bruchid	Invertebrates	CPC (Full)
	Acarus siro	flour mite	Invertebrates	CPC (Full)
	Acaudaleyrodes rachipora	babul whitefly	Invertebrates	CPC (Basic)
	Aceria ficus	fig blister mite	Invertebrates	CPC (Basic)
	Aceria guerreronis	coconut mite	Invertebrates	CPC (Full) ISC (Full)
	Aceria malherbae		Invertebrates	CPC (Basic)
	Aceria mangiferae	mango bud mite	Invertebrates	CPC (Basic)
	Aceria oleae	olive bud mite	Invertebrates	CPC (Basic)
	Aceria sheldoni	citrus bud mite	Invertebrates	CPC (Basic)
	Aceria tulipae	dry bulb mite	Invertebrates	CPC (Full)
	Achlysiella williamsi		Invertebrates	CPC (Full)
	Acidovorax avenae subsp. avenae	bacterial leaf blight	Bacteria	CPC (Full)
	Acleris undulana		Invertebrates	CPC (Basic)
	Aconurella prolixa		Invertebrates	CPC (Basic)
	Acraea acerata	sweet potato butterfly	Invertebrates	CPC (Full)
	Acraea eponina		Invertebrates	CPC (Basic)
	Acronium mavidis	black bundle disease	Fungi/Chromista	CPC (Full)

(62)

Africa (62)

Algeria ✗ Angola ✗ Benin ✗  
Botswana ✗ Burkina Faso ✗  
Burundi ✗ Cabo Verde ✗  
Cameroon ✗  
Central African Republic ✗

Show more +

Pathways

Plant hosts

Plants parts in trade

Habitats

Taxonomic group

Bacteria ✗ Viruses ✗ Protozoa ✗  
Fungi/Chromista ✗  
Invertebrates ✗  
Diseases of unknown aetiology ✗

## Step 1. Preliminary horizon scanning

Carried out in a workshop, using the **CABI Horizon Scanning Tool**

Area at risk: Ghana

Source country: Africa

Filters: Plant pests only, invertebrates and plant pathogens

Result: +1800 species!

Only species with **full datasheets** and **invasive elsewhere** were retained

Ca. 270 invasive plant pests already present in Africa but not yet in Ghana were listed

g/HorizonScanningTool/Country/SearchResult

Pathways	Preferred scientific name	International common name	Taxonomic group	View datasheet
Plant hosts	Acalitus vaccinii	blueberry bud mite	Invertebrates	CPC (Basic)
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Africa (62)

Algeria ✗ Angola ✗ Benin ✗  
Botswana ✗ Burkina Faso ✗  
Burundi ✗ Cabo Verde ✗  
Cameroon ✗  
Central African Republic ✗

Show more +

Pathways

Plant hosts

Plants parts in trade

Habitats

Taxonomic group

Bacteria ✗ Viruses ✗ Protozoa ✗  
Fungi/Chromista ✗  
Invertebrates ✗  
Diseases of unknown aetiology ✗

## Step 2. First modification of the list

- In workshop
- Removed less important species
- Added species that had not been captured or highly invasive species that are not yet in Africa (partly based on quarantine list of plant pests for Ghana)
- Through expert opinion (consensus)
- Defined a list of pests to be included in the prioritization process
- **Finally 110 arthropods, 60 pathogens and nematodes not yet present in Ghana were selected**

### Step 3. Definition of a scoring system

- In the workshop, we defined a scoring system, structured as a “mini pest risk analysis”:
- Final score = Likelihood of entry x likelihood of establishment x (magnitude of socio-economic impact + magnitude of environmental impact)
- The system also asked information on the likely pathway of arrival and confidence levels (for information)

### Step 3. Definition of a scoring system

**Likelihood of entry (1-5)**

**Likelihood of establishment (1-5)**

**Potential socio-economic impact (1-5)**

**Potential environmental impact (1-5)**

## Step 3. Definition of a scoring system

### **Likelihood of entry (1-5)**

### **Likelihood of establishment (1-5)**

1. Ghana climatically unsuitable or host plants not present
2. Only few areas in Ghana climatically suitable; or host plants rare
3. Large areas in Ghana climatically suitable and host plant rare; or only few areas in Ghana climatically suitable but host plants at least moderately abundant
4. Large areas in Ghana climatically suitable and host plants moderately abundant
5. Large areas in Ghana climatically suitable and host plants very abundant

### **Potential socio-economic impact (1-5)**

### **Potential environmental impact (1-5)**

## Step 3. Definition of a scoring system

### **Likelihood of entry (1-5)**

### **Likelihood of establishment (1-5)**

### **Potential socio-economic impact (1-5)**

1. The species does not attack plants that are cultivated or utilised
2. The species damages plants that are only occasionally cultivated or utilised
3. The species damages plants that are regularly cultivated or utilised but without threatening the cultivation, utilisation or trade of this crop
4. The species has the potential to threaten, at least locally, the cultivation of a plant that is regularly cultivated or utilised; or to regularly attack a crop that is key for the Ghanaian economy without threatening this latter.
5. The species has the potential to threaten, at least locally, a crop that is key for the Ghanaian economy

### **Potential environmental impact (1-5)**



## Step 4. Scoring of species

- Started in workshop but mostly done remotely and independently by at least 3 assessors per species

Species	assessor	Taxonomic group	Native distribution (s)	Already present in Af	Present in Neighbour	Likelihood (1-5) of er	Confidence in likelih	Likely pathway of arr	Confidence in likely p	Likelihood (1-5) of es	Confidence in likelih	Magnitude (1-5) of se	Confidence in magni	magnitude (1-5) of e	Confidence in magni	Overall score (A*B* (	Confidence in Overal
Bactrocera zonata		Insect	AT	Y	?	3	H	UN; CO	M	5	H	4	H	3	H	105	H
Drosophila suzuki		Insect	As	Y	N	3	M	CO; ST	M	3	M	3	M	2	L	45	M
Orseolia oryzivora		Insect	Afr	Y	Y	4	H	CO	H	4	M	3	M	2	L	80	M
Pieris brassicae		Insect	EU	Y	? N	3	M	UN	L	4	H	4	H	2	L	72	M
Mahasena corbetti		Insect	AT	N	N	2	H	CO	H	4	L	3	M	2	L	40	L

## Step 5. Consensus building

- In a new workshop, across experts to harmonize scores and define the prioritization list
- At the end, a final risk score was obtained for all assessed species by calculating the median score for all four questions and the final score
- This score was validated by the group through consensus.
- Species were then ranked according to their potential threat for Ghana
- Action to be taken for the highest ranked species were discussed e.g. PRAs, Surveillance programmes, surveys to assess if already in Ghana, EWRR programmes, Contingency plans, Collaborative research, etc.

## Final results - scores

<b>Arthropods</b>	<b>score</b>	<b>Pathogens and nematodes</b>	<b>score</b>
<i>Maconellicoccus hirsutus</i>	160	<i>Xanthomonas oryzae</i> pv. <i>oryzae</i>	150
<i>Aleurothrixus floccosus</i>	150	<i>Armillaria heimii</i>	150
<i>Liriomyza trifolii</i>	150	<i>Thanatephorus cucumeris</i>	150
<i>Thrips palmi</i>	150	<i>Meloidogyne enterolobii</i>	150
<i>Aonidiella orientalis</i>	140	<i>Meloidogyne mayaguensis</i>	150
<i>Unaspis citri</i>	125	Maize dwarf mosaic virus	140
<i>Spodoptera eridania</i>	120	Maize lethal necrosis disease	140
<i>Bemisia tabaci</i> (MEAM1)	120	<i>Clavibacter michiganensis</i> subsp. <i>michiganensis</i>	125
<i>Brevipalpus phoenicis</i>	120	<i>Xanthomonas oryzae</i> pv. <i>oryzicola</i>	125
<i>Callosobruchus chinensis</i>	120	Tomato spotted wilt virus	125
<i>Dialeurodes citri</i>	120	Banana bunchy top virus	120
<i>Diaphorina citri</i>	120	Cassava brown streak Virus	120
<i>Dysmicoccus neobrevipes</i>	120	<i>Ralstonia solanacearum</i> Race 2	105
<i>Icerya purchasi</i>	120	Maize chlorotic mottle virus	105
<i>Liriomyza huidobrensis</i>	120	Cocoa Yellow Mosaic	105
<i>Liriomyza sativae</i>	120	<i>Meloidogyne hapla</i>	100
<i>Scirtothrips dorsalis</i>	120	<i>Xanthomonas campestris</i> pv. <i>musacearum</i>	90
<i>Trioza erytrae</i>	120	Maize stripe virus	90
<i>Aonidiella citrina</i> (Coquillett)	120	<i>Meloidogyne ethiopica</i>	90
<i>Rhynchophorus ferrugineus</i>	112		

## Final results – actions (arthropods)

Species	Score	Suggested actions
<i>Maconellicoccus hirsutus</i>	160	Surveys for its potential presence in Ghana
<i>Aleurothrixus floccosus</i>	150	Surveys for its potential presence in Ghana
<i>Liriomyza trifolii</i>	150	Since only <i>Liriomyza</i> sp. is reported in Ghana, sample <i>Liriomyza</i> spp. in the country for molecular analyses and morphological ID to assess which species is present
<i>Thrips palmi</i>	150	Since only <i>Thrips</i> sp. Is reported in Ghana, sample <i>Thrips</i> spp. and related genera for molecular analyses and morphological ID to assess which ones are present in Ghana
<i>Aonidiella orientalis</i>	140	Conduct a full PRA
<i>Unaspis citri</i>	125	Surveys for its potential presence in Ghana and conduct a full PRA
<i>Spodoptera eridania</i>	120	Surveys with pheromone traps and sampling
<i>Bemisia tabaci</i> (MEAM1)	120	Sample <i>B. tabaci</i> in Ghana for molecular analyses to assess which sibling species is present
<i>Brevipalpus phoenicis</i>	120	Conduct a full PRA
<i>Callosobruchus chinensis</i>	120	Surveys to check if the species is not in Ghana. Because the other one is abundant
<i>Dialeurodes citri</i>	120	Conduct a full PRA
<i>Diaphorina citri</i>	120	Conduct a full PRA
<i>Dysmicoccus neobrevipes</i>	120	A paper suggests that it may present in Uganda (only record in Africa), but the information is not clear. Ask the authors or specialists in Uganda
<i>Icerya purchasi</i>	120	Check with Togo if the presence reported in Togo is confirmed. If yes, make surveys in Ghana
<i>Liriomyza huidobrensis</i>	120	Since only <i>Liriomyza</i> sp. is reported in Ghana, sample <i>Liriomyza</i> spp. in the country for molecular analyses and morphological ID to assess which species is present
<i>Liriomyza sativae</i>	120	Since only <i>Liriomyza</i> sp. is reported in Ghana, sample <i>Liriomyza</i> spp. in the country for molecular analyses and morphological ID to assess which species is present
<i>Scirtothrips dorsalis</i>	120	Since only <i>Thrips</i> sp. Is reported in Ghana, sample <i>Thrips</i> spp. and related genera for molecular analyses and morphological ID to assess which ones are present in Ghana

# Horizon scanning for prioritising invasive alien species with potential to threaten agriculture and biodiversity in Ghana

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## Prioritization of invasive alien species with the potential to threaten agriculture and biodiversity in Kenya through horizon scanning

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**Abstract** Invasive alien species (IAS) rank among the most significant drivers of species extinction and ecosystem degradation resulting in significant impacts on socio-economic development. The recent exponential spread of IAS in most of Africa is attributed to poor border biosecurity due to porous borders that have failed to prevent initial introductions.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10530-022-02824-4>.

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In addition, countries lack adequate information about potential invasions and have limited capacity to reduce the risk of invasions. Horizon scanning is an approach that prioritises the risks of potential IAS through rapid assessments. A group of 28 subject matter experts used an adapted methodology to assess 1700 potential IAS on a 5-point scale for the likelihood of entry and establishment, potential socio-economic impact, and impact on biodiversity. The individual scores were combined to rank the species

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## Further actions : surveys for presence in Ghana

- Surveys for presence in Ghana: thrips, leaf miners and white flies (4 pest species found in Ghana)
- Surveillance programmes (Diaphorina citri was found)
- Several **PRAs** have been conducted
- Building of a **Risk Register** that is regularly reviewed



# Climate change considerations in horizon scanning?

## Possible – but not yet implemented in our approach

- Horizon scanning implied a fast assessment of many species – Including climate change scenarios would seriously slow down the process
- The species list is meant to go to a risk register that is regularly updated.
- Quantitative horizon scanning methods using climatic modelling to identify species with the potential to become plant pests are presently being developed (e.g. in a new Euphresco project)





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