Stage 2. Pest risk assessment:
Assessment of impacts

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Assessment of impacts in PRA

12. Impact in the current area of distribution – *more guidance*

Briefly describe the economic, ecological/environmental and social impacts in the current area of distribution.

Briefly describe the existing control measures applied against the pest.

Rating of the magnitude of impact in the current area of distribution	*Low* ☐	*Moderate* ☐	*High* ☐
Rating of uncertainty	*Low* ☐	*Moderate* ☐	*High* ☐

The rating chosen should be based on the highest type of impact.

13. Potential impact in the PRA area – *more guidance*

Consider whether impacts in the area of potential establishment will be similar to that in areas already infested, taking into account availability of plant protection products, natural enemies, cultural practices, etc.in the area of potential establishment. Consider other consequences (e.g. export loss) if applicable.

Will impacts be largely the same as in the current area of distribution? Yes /No

If No

Rating of the magnitude of impact in the area of potential establishment	*Low* ☐	*Moderate* ☐	*High* ☐
Rating of uncertainty	*Low* ☐	*Moderate* ☐	*High* ☐

14. Identification of the endangered area

Define the endangered area (see definition in ISPM 5): describe in which part of the area of potential establishment ***significant impact is expected.***

12. Impact in the current area of distribution

Aim is to assess the impact in **the current area of distribution**, to better assess in a following step **the potential impact in the PRA area (EPPO region)**.

If the pest **has already entered** and **is established in part of the PRA area**, the assessment of current impacts **in the PRA area** should be taken into account in addition to **impacts elsewhere** as these impacts can differ between each other.



Different types of impact should be assessed:

- Economic impact *sensu stricto*
- Environmental impact
- Social (socio-economic)

and both direct (i.e. on the host) **and indirect** (e.g. on the ecosystem services) **impacts.**

12. Impact in the current area of distribution

- **Economic impact *sensu stricto*** (Negative effect on **crop yield** and/or **quality** of cultivated plants or on **control costs**)

Effects are usually **expressed** as a **relative decrease (%)** per crop per ha or **relative increase in total control costs**.

It is important to take into account the **annual variation** in crop yield and quality that **normally** occurs in different crops:



- for some crops (e.g. tomatoes or flowers under protected conditions), **fluctuations are small** and a **10% yield loss** can be considered as a **massive impact**
- for others (e.g. fruits), **fluctuations are substantial** and only a **> 50% yield loss** can be considered as a **massive impact**



12. Impact in the current area of distribution

- **Environmental impact** (Any impact **on environmental conditions** resulting from the presence, introduction or spread of a pest)

It includes:

- **Impact on native biodiversity** (e.g. decline in native species populations, changes in the composition and structure of communities, hybridization, transmission or vectoring of diseases, competition, predation, allelopathy)
- **Alteration of ecosystem processes and patterns** (e.g. modifications of habitats, changes in nutrient and availability, modifications of natural successions, of trophic and mutualistic interactions)
- **Conservation impacts** (e.g. occurrence in habitats of high conservation value, causing harm to vulnerable species)



Pistia stratiotes.
Photo by J.-P. Reygrobellet

12. Impact in the current area of distribution

- **Social impact** (The impacts on **human well-being**, other than economic impacts)

It includes:

- **Landscape effects** (e.g. land use function [agriculture, living areas] and contribution to the wellbeing (aesthetic value, (cultural-) historic value)
- **Loss of employment**
- **Effects on human and animal health** (in addition to effects on plant health)
- **Effects on products and services** (e.g. water quality, animal grazing, hunting and fishing, tourism; in addition to effects on plant health).



12. Impact in the current area of distribution



Points to note:

- Data may be **lacking** for some parts of the current range:

> **Canada.** No evidence of economic damage was found in the literature. In Manitoba, *C. nebraskensis* was first found in 2009 (Harding *et al.*, 2018 citing Desjardins, 2010) and by 2011 it was found in 83% of 270 surveyed maize fields below the economic injury level (Harding *et al.*, 2018). In 2014-2015, the disease was detected in 38% of maize fields (64 of 169) in 15 of the 21 counties evaluated.

- In some cases, it might be difficult to attribute economic impact to particular species:

> **Mexico.** The record for Mexico is considered unreliable by the NPPO of Mexico (see section 6). Infected maize plants were found in seven fields sampled in 2021 in the Panotla municipality (Tlaxcala). The plants showed signs of leaf blight and wilt symptoms, and at the R4 stage, symptom severity reached approximately 70-80% and disease incidence was 100% (Flores-López *et al.*, 2024).

Goss's systemic wilt. Photo by T. Jackson-Ziems

12. Impact in the current area of distribution



Points to note:

- The impact can **vary substantially** from one year to the next (because of different factors)

Table 2. Estimated losses caused by *Clavibacter nebraskensis* in 2020-2024 in the USA (Crop Protection Network, 2021–2025)

	2016	2017	2018	2019	2020	2021	2022	2023	2024
Loss in millions bushels	90.8	70.5	68.2	9.8	4.6	3.6	12.8	2.2	1.5
millions kg	2306,32	1790,7	1732,28	248,92	116,84	91,44	325,12	55,88	38,1

Goss's systemic wilt. Photo by T. Jackson-Ziems

12. Impact in the current area of distribution

Points to note:

- Data published in different sources **may differ** in terms of temporal coverage, crops covered, units, and calculation methods.

Table 1. Yield losses because of *Clavibacter nebraskensis* reported in the literature

Yield losses at field level	Context and year	Reference
As high as 40–60% prior to the availability of resistant dent maize hybrids	Production, early 1980s	Mallowa *et al.*, 2016 citing Claflin *et al.*, 1978
Reported as 50% on susceptible hybrids	Production (Iowa), 2012	Mallowa *et al.*, 2016 citing pers. comm. by AE Robertson
Up to 60 bushels/acre (3700 kg/ha) in northwestern Indiana	Production, 2008	Wise *et al.*, 2010
Approaching 50% during severe epidemics in fields planted with susceptible cultivars	Production (Nebraska Extension)	Jackson *et al.*, 2007b
Can exceed 30%	Production (Minnesota extension services)	Malvick, 2018
May exceed 50% for very susceptible hybrids	Production, general statement	Claflin, 1999
For the most susceptible hybrid, yield 55% lower in inoculated plots than non inoculated plots	Inoculated field trials	Malvick *et al.*, 2014



Goss's systemic wilt. Photo by A. Robertson

12. Impact in the current area of distribution

Online tools: an example



https://cropprotectionnetwork.org/yield-loss-calculator

12. Impact in the current area of distribution

CROP PROTECTION NETWORK
A Product of Land Grant Universities

Yield Loss Calculator

Calculate yield and economic losses due to Soybean Invertebrate Pests

Start Year: 2010
End Year: 2020
Search | Reset

Category: Defoliators and fruit feeders
Diseases/Insect Pests: Armyworm complex; Banded cucumber beetle; Bean leaf beetle; Blister beetle

Country/Regions: Canada
States/Provinces: Alberta; British Columbia; Manitoba; New Brunswick

Results

Year	% Loss	Bushels Lost	$(USD) Loss	$(USD) Loss per Acre	Details
2009	3.85%	10,761,681	$102,551,007	$14.34	Production Losses
2010	9.65%	24,572,026	$266,781,865	$40.18	Production Losses
2011	7.57%	28,275,749	$345,114,144	$35.54	Production Losses
2012	5.64%	25,434,817	$364,825,308	$36.19	Production Losses
2013	3.70%	17,258,852	$226,605,594	$21.54	Production Losses
2014	4.11%	23,086,974	$244,799,538	$21.53	Production Losses

https://cropprotectionnetwork.org/yield-loss-calculator

12. Impact in the current area of distribution

Suggested subheadings:

12.1 Nature of **the damage** (*This section can refer to the pest overview*)

12.2 Impact **observed**

12.3 Existing **control measures** (*as they influence the impact*)

Key management measures available and effective against *C. nebraskensis* are as follows:

- ***Use of resistant cultivars*** (e.g. Langemeier *et al.*, 2017; Wise *et al.*, 2010; Bayer, 2022; Kloppers, 2025a; Njom *et al.*, 2025). See section 2.6.1.
- ***Rotation with non-host crops*** (Schuster, 1975; Langemeier *et al.*, 2017; Njom *et al.*, 2025; Claflin, 1999). See section 6.2.2.
- ***Removing or incorporating crop debris*** (Schuster, 1975; Jackson *et al.*, 2007a; Langemeier *et al.*, 2017). See section 6.2.2.
- ***Other management-related methods in the literature***
  - Selection of seed from non-infested areas should decrease the chance of harvesting infected seed (Schuster, 1975).
  - Wise *et al.* (2010) mentions that *C. nebraskensis* is regulated in many countries and that certain countries require phytosanitary certificates for maize seed with tests or inspections required to determine that the seed lot or seed source is free from the pathogen.
  - Cleaning equipment thoroughly and the harvesting of infested fields last to minimise spread to uninfested fields is recommended (Kgatle, 2025; Kloppers, 2025a).

Control methods

Cibrián Tovar et al. (1995) reported that no control measures were developed for *P. mexicanus* in Mexico, and measures known for *Dendroctonus adjunctus* and *D. mexicanus* were useful against *P. mexicanus*. These measures include:

- forest management aimed at maintaining the health of forest stands (e.g. through the removal of damaged, suppressed/stressed trees, and slash/harvesting residues);
- timely removal of individual trees with signs of infestation (during periods when larvae develop and before the flight of adults);
- elimination of susceptible trees (those recently infested, i.e. those having 20 or more reddish-brown pitch tubes, but not those trees which have very few attacks and where the resin tubes are white – to these trees insecticides can be applied);
- application of insecticides to the trunks of felled trees (if not debarked), possible with oil;
- cutting the infested trees (in winter, when *P. mexicanus* is dormant); cut trees should be directed towards open areas where they are exposed to direct sun rays;

12. Impact in the current area of distribution

Suggested subheadings:

12.1 Nature of **the damage** (*This section can refer to the pest overview*)

12.2 Impact **observed**

12.3 Existing **control measures** (*as they influence the impact*)

12.4 Rating of **the magnitude of impact** and **uncertainty**

Rating of uncertainty is based on a three-level scale. Guidance on the rating of uncertainties is available as a remark in section 17 of this guidance.

Rating of the magnitude of impact in the current area of distribution	*Very low* ☐	*Low* ☐	*Moderate* ☐	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* ☐	*High* ☐

Reasons for the uncertainty rating, especially when moderate or high, can be recorded.

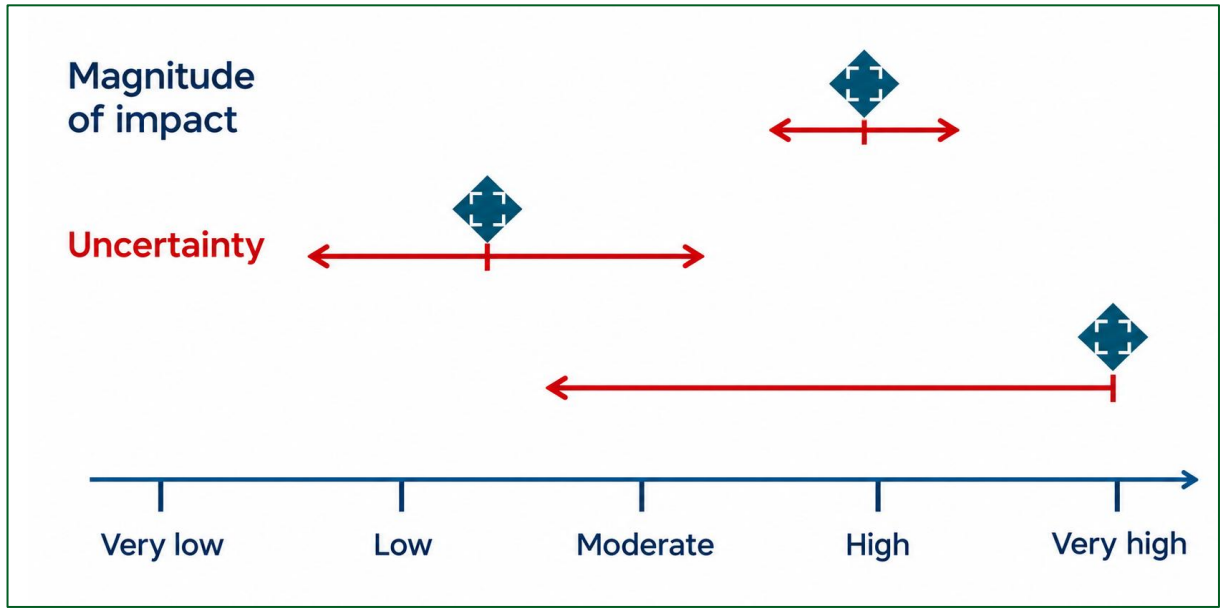
12. Impact in the current area of distribution

12.4 Rating of the **magnitude of impact** and **uncertainty**

Rating of uncertainty is based on a three-level scale. Guidance on the rating of uncertainties is available as a remark in section 17 of this guidance.

Rating of the magnitude of impact in the current area of distribution	*Very low* ☐	*Low* ☐	*Moderate* ☐	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* ☐	*High* ☐

Reasons for the uncertainty rating, especially when moderate or high, can be recorded.



Uncertainty	Interpretation / Meaning	Examples to justify the uncertainty rating	Certainty
Low	There is little doubt about the assessment and the risk rating The assessor is confident	There is direct relevant evidence to support the assessment. The situation can easily be predicted. There are reliable / good quality data sources (e.g. for pest records data provided by NPPOs/RPPOs). The interpretation of data/information is straight forward. Data/information are available from a peer reviewed journal article. Data/information are not controversial, contradictory Personal communication is from experts regarded as specialists on the question raised.	**High**
Medium	There is some doubt about the assessment and the risk rating The assessor has some confidence	There is some evidence to support the assessment. Some evidence for the prediction of the situation is available, but this prediction may be unreliable Some information is indirect, e.g. data from a other species has been used as supporting evidence, The interpretation of the data is to some extent ambiguous or contradictory.	**Medium**
High	There is considerable doubt about the assessment and the risk rating The assessor has little confidence	There is no direct evidence to support the assessment, e.g. only data from other species have been used as supporting evidence The situation cannot be readily predicted because the evidence is poor, and difficult to interpret, e.g. because it is strongly ambiguous. The information sources are considered to be of low quality or contain information that is unreliable, e,g, because it is strongly contradictory.	**Low**

Alan MacLeod 09/03/2011; revised 28/04/2011

13. Potential impact in the PRA area

13. Potential impact in the PRA area – *more guidance*

Consider whether impacts in the area of potential establishment will be similar to that in areas already infested, taking into account availability of plant protection products, natural enemies, cultural practices, etc.in the area of potential establishment. Consider other consequences (e.g. export loss) if applicable.

★ Will impacts be largely the same as in the current area of distribution? Yes /No

Many factors should be considered, e.g. host availability and climatic suitability, available plant protection products, natural enemies, cultural practices, export loss.

If **impacts** are considered **largely similar**, there is no need to provide details, but only the reasoning explaining why it would be similar.

If the answers are **different for different parts of the PRA area**, this should be specified, and details should be provided. In such case, it is recommended to give **two tables** of the rating of the magnitude of impact.

If **data are not available** for the pest in question, extrapolation using related species should be explored.

13. Potential impact in the PRA area

It should be clear indications if the pest is likely to have **an unacceptable economic impact** in the PRA area.

Approaches to estimate economic impact are covered in ISPM No. 5 *Glossary of phytosanitary terms* (Supplement 2)*:*

International Plant Protection Convention



Photo by Pennsylvania Department of Agriculture (US)

ISPM 5 Glossary of phytosanitary terms – Supplement 2

This supplement was adopted by the Fifth Session of the Interim Commission on Phytosanitary Measures in April 2003.
The supplement is a prescriptive part of the standard.

SUPPLEMENT 2: Guidelines on the understanding of "potential economic importance" and related terms including reference to environmental considerations

1. Purpose and scope

These guidelines provide the background and other relevant information to clarify *potential economic importance* and related terms, so that such terms are clearly understood and their application is consistent with the International Plant Protection Convention (IPPC) and the International Standards for Phytosanitary Measures (ISPMs). These guidelines also show the application of certain economic principles as they relate to the IPPC's objectives, in particular in protecting uncultivated/unmanaged plants, wild flora, habitats and ecosystems with respect to invasive alien species that are pests.

https://www.ippc.int/en/publications/622/

13. Potential impact in the PRA area



Different types of impact should be assessed:

- Economic impact *sensu stricto* (direct)
- Environmental impact
- Social (socio-economic)

The **ecological conditions** may be suitable or not to build up to levels at which significant damage is caused to the host plant(s).

Non-commercial crops private gardens, amenity plantings (might play role).

Take into account the **existing and potential control measures** (plant protection products, biological control agents) and their costs.



Spathius polonicus, a parasitoid of *Agrilus planipennis.* Photo by K. Makarov

13. Potential impact in the PRA area

Table 6. Guidance on rating economic, environmental and social impacts to the sector from the EPPO Capra PRA Scheme.

Rating	Magnitude of potential economic consequences (crop)	Environmental impact	Social impact
1 [Very low]	**No** yield and/or quality losses and/or increase in costs is expected.	**Local**, short-term population loss, no significant ecosystem effect	**No** social disruption
2 [Low]	Yield and/or quality losses are expected but they **cannot be distinguished from normal variation** and are insufficient to justify additional measures; additional costs are expected to be negligible.	**Some** ecosystem impact, reversible changes, localised	**Significant** concern expressed at **local level**
3 [Moderate]	Yield and/or quality losses are **limited** but they exceed normal variation, some targeted measures may be necessary with limited additional costs.	**Measurable** long-term damage to populations and ecosystem, but little spread, no extinction	**Temporary changes** to normal activities at **local** level
4 [High]	Yield and/or quality losses can be **considerable**, targeted measures may frequently be needed which are expensive.	**Long-term irreversible** ecosystem change, spreading beyond local area	Some **permanent** change of activity **locally**, concern over wider area
5 [Very high]	Yield and/or quality losses will be **severe** and/or high mortality of plants is expected; targeted measures intensively used which are very expensive.	**Widespread, long-term** population loss or extinction, affecting several species with serious ecosystem effects	**Long-term** social change, **significant loss of employment**, migration from area



Saperda candida.
Photo by P. Baufeld

13. Potential impact in the PRA area

The potential impact can be **analysed quantitatively** when:

- enough data are available,
- economic impact is unclear.

Key categories:

- direct economic losses
- control costs
- trade implications
- government response expenditures

Country-based examples

Pessimistic scenario, impact would be similar to US 'outbreak' years or specific severe cases.

Rating of the magnitude of impact in the area of potential establishment	*Very low* ☐	*Low* ☐	*Moderate* ☐	*High* x	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* x	*High* ☐

Optimistic scenario. Yield losses exceeding normal variation are expected and some targeted measures would likely be necessary.

Rating of the magnitude of impact in the area of potential establishment	*Very low* ☐	*Low* ☐	*Moderate* x	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* x	*High* ☐

Uncertainty (same in both cases): whether economic impact assessment applies to other EPPO countries; impact in other climatic conditions; speed of capacity-building/knowledge/awareness raising in EPPO countries.

Scenarios:

Pessimistic:

- early detection,
- resistance cultivars,
- low monoculture rates,
- etc.

Optimistic:

- undetected for long time,
- spreads widely,
- monoculture,
- susceptible cultivars,
- etc.

Group exercise

1) **Conduct literature review** of economic, environmental and social impacts

2) **Assess different types** of impact

3) **Score magnitude and uncertainty** in the current range and in the area of potential establishment

