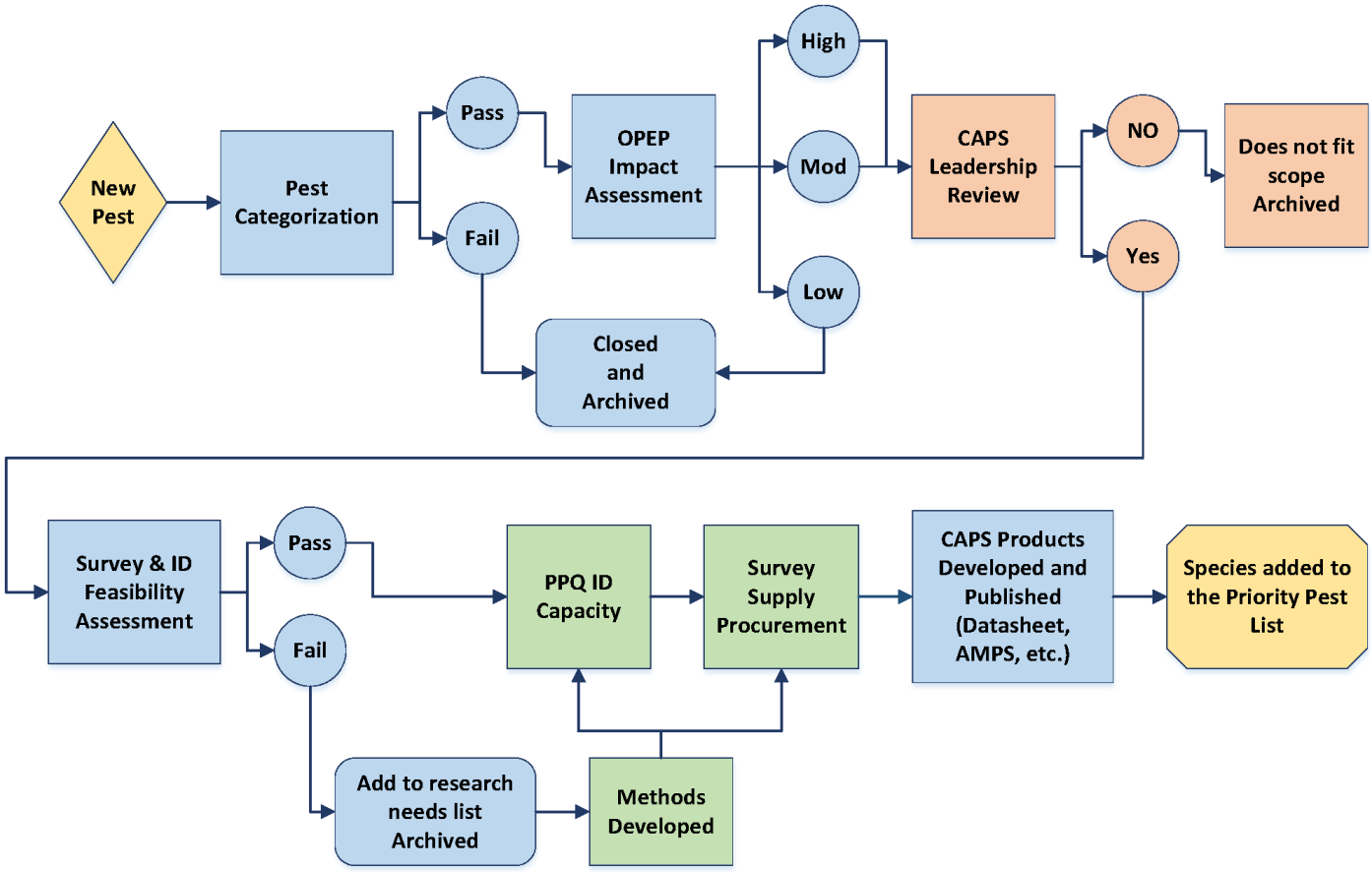
Pest Assessment and Prioritization Process

PPQ Science and Technology (S&T) develops the Pests of Economic and Environmental Importance (EEI) list using the standardized assessment and prioritization process: 1) Pest Categorization, 2) Objective Prioritization of Exotic Pests (OPEP) Impact Assessment model, and 3) Survey and Identification/Diagnostic Feasibility Assessment (Feasibility Assessment) (Fig. 1). The Pest Categorization determines if an organism is a plant pest and whether it is established in the United States. The Impact Assessment predicts the impact in the United States. The Feasibility Assessment evaluates the survey and identification/diagnostics methods for species that make it through steps one and two of the process.

Figure 1. Pest Assessment and Prioritization Process



Steps in the Process

1. Pest Categorization

Prior to 2019, S&T used the CAPS Pre-Assessment to evaluate if an organism was appropriate for the CAPS program. It determined if: 1) the organism is a plant pest; 2) the organism causes measurable damage; 3) the organism is established in the United States; and 4) there is a pathway of introduction for the organism. Because the OPEP Impact Assessment also addresses damage and pathway, questions two and four of the Pre-Assessment became redundant when OPEP was adopted for prioritizing pests.

Pest Categorization is a simple assessment tool that determines if an organism is a plant pest (question 1) and if it is established in the United States (question 3). In 2019, S&T began using Pest Categorization in place of the CAPS Pre-Assessment. If an organism is a plant pest and not established in the United States it moves to Impact Assessment. Completed Pest Categorizations are available to stakeholders at the PestLens website (https://pestlens.info/).

2. Impact Assessment Model

The Objective Prioritization for Exotic Pests (OPEP) Impact Assessment model, developed by S&T, predicts potential pest impact. For the results of the assessment to be meaningful, the species must have spread outside of its native range, and/or have caused significant impacts within its native range. Species that have not spread outside of their native range receive an "undetermined" rating, and a summary of the known information is archived and available at the PestLens website (https://pestlens.info/).

The Impact Assessment model is completed in an Excel spreadsheet with results captured in an accompanying summary report. S&T developed and validated separate models for arthropods and plant pathogens (including nematodes). Risk criteria consist of questions focused on biology and natural history, pest damage, research, and management elsewhere in the world. The questions require objective, documented evidence from primary scientific literature and are weighted based on their ability to predict impact. Each model predicts the likelihood each organism will cause high, moderate, or low impact (as defined by PPQ) in the United States. For CAPS, the results are grouped into three categories (Appendix 1). Category 1 includes organisms predicted to cause high impacts, as well as some predicted to cause moderate impacts. CAPS leadership reviews species in Category 1. Those that fit the scope of the CAPS program move to the Feasibility Assessment step.

The summary report includes a brief introduction into the region(s) and host(s) at risk in the United States, including the potential impacts or symptoms that may be observed, and a summary of the assessment results. The results also highlight any specific biological or

production practices that are likely to affect the final rating, and specific information that should be highlighted for stakeholders. Completed Impact Assessment summaries are available at the PestLens website (https://pestlens.info/).

S&T is investigating the applicability of an Impact Assessment model for mollusk species. S&T is also developing two additional models, a cost-effectiveness of survey model and a likelihood of introduction model. Upon completion, the impact (arthropod, pathogen, or mollusk), economic, and likelihood of introduction models can be reviewed together or separately, depending on need. At this time, we do not known how or if the cost-effectiveness of survey and/or likelihood models will influence the Priority Pest list.

3. Survey and Identification/Diagnostic Feasibility Assessment

Survey and Identification/Diagnostic Feasibility Assessment (formerly Post-Assessment) evaluates whether an early detection survey is possible and practical by answering the following questions:

1) Are effective survey methods available?
2) Are effective identification/diagnostic methods available?
3) Is there sufficient capacity and available expertise to identify the species if a large-scale survey is conducted?

If acceptable methods or necessary expertise/capacity does not exist, the species is added to the CAPS Research and Methods Development List. Each year, research needs are 1) presented to S&T methods development labs (Otis and Beltsville Labs) for review and 2) included in the guidance for Goal 3: "Increase Identification Capacity and Strengthen Pest Detection Technology" in the annual Plant Protection Act Section 7721 Program (PPA 7721; formerly Farm Bill) Implementation Plan. Cooperators use the implementation plan to develop research proposals.

A Pest Epidemiology and Risk Assessment Lab (PERAL) analyst completes the feasibility assessment by reviewing literature and consulting S&T methods development labs, PPQ National Identification Service (NIS), and other subject matter experts. There are separate feasibility assessment templates for plant pathogens and arthropods (see Appendix 2 for templates). The outcome of the Feasibility Assessment is available to stakeholders at the PestLens website (https://pestlens.info/) and the completed document is archived internally.

General Timeline for Developing the Prioritized Pest List

A new pest list is developed every two years. The process involves both the assessment and prioritization processes to create a pest list and the development of the tools that support planning and completing early detection surveys. The necessary support (datasheets, approved

methods, traps and lures, diagnostics, screening aids, etc.) is in place for each species on the Priority Pest list. See below for more details on the two-year timeline.

Year 1: Prioritization Process

- Pest Categorization
- Impact Assessment Model
- Feasibility Assessment

Year 2: Develop support products for new pests

- Datasheets
- Approved survey methods
- Approved identification/ diagnostic methods
- Trap and lure procurement
- Identification and diagnostic capacity
- Screening aids (if appropriate)
- Host and risk maps

Appendices

Appendix 1. Results of the OPEP Impact Assessment Model: Outcome for CAPS

Category 1 (High and some Moderate pests; Pests in Risk Groups A, B, C, and D)

- Pests have a significant likelihood to have a high impact in the United States. Pests have a greater than 20% probability of being a high impact pest.
- If the pests pass the feasibility assessment (which evaluates the survey and identification/ diagnostic method), they will be listed on the Pests of Economic and Environmental Importance List. Pests will also be added to relevant commodity manuals.
- Pests on the Pests of Economic and Environmental Importance List are Priority Pests.
- If pests fail the feasibility assessment, they will be placed on the CAPS research and methods development list.

Category 2 (Other Moderate pests; Pests in Risk Groups E, F, and G)

- Pests are most likely to have a moderate impact in the United States. Pests have a 10 to 20% probability of being a high impact pest.
- These pests will not be part of the Pests of Economic and Environmental Importance List.
- Pests will be evaluated on a case-by-case basis to determine if surveys are warranted. Pests that are recommended for survey and pass the Feasibility assessment (which evaluates the survey and identification/ diagnostic method) will be added to commodity manuals or posted as free-standing datasheets.
- If the pest is added to a commodity manual, it will be considered a Priority Pest. If the pest does not fit into an existing commodity manual, it will be added to the Additional Pests of Concern List and will not be considered a Priority Pest.
- If pests are recommended for survey but fail the Feasibility assessment they may or may not be listed as priorities for research.

Category 3 (Low impact or Undetermined pests; Pests in Risk Groups H, I, and J)

- Pests have a less than 10% probability of being a high impact pest.
- Low impact pests: pests are most likely to have a low impact in the United States.
- Undetermined pests:
    - There is not enough information available to evaluate likely impacts. Species may be reevaluated if new information becomes available.
    - The species has not spread outside of its native range. Species may be reevaluated if geographic distribution expands.
    - The species is already present in the United States and not under official control. Species are not eligible for reevaluation.

- These pests will not be included on the Pests of Economic and Environmental Importance List.
- New pests assessed will not be included in a commodity manual or posted as free-standing datasheets unless there is a significant reason (political/ trade implications, human health impacts, etc.) for including them.
- Existing pests present in a commodity manual will likely be removed from manuals over time. These pests will still be available for bundling into other surveys.

Appendix 2. Survey and Identification/Diagnostic Feasibility Assessment Templates

Arthropod Template

Scientific Name of Pest	
Common Name of Pest	
Pest List/Source	
Name of Reviewer	
Survey Method Reviewer	
ID Method Reviewer	
Date Review Completed	
Recommendation	

This questionnaire is for pests that have passed the Pest Categorization and have gone through the Objective Prioritization of Exotic Pests (OPEP) Impact Assessment model. The Survey Feasibility Assessment determines availability of survey and identification methods and capacity. A pest must "pass" all three sections to be included on the Priority Pest List.

1. **Ease of detection for this pest:**
   Please provide a summary of the literature review and information provided from subject matter experts. Include details of the survey method, including name of trap and lure and all relevant details and recommendations.

   Pest populations that are generally targeted by CAPS are small and localized. Methods described in the literature are often specific to monitoring known populations and are not always the best method to detect a new, small population. Species-specific lure and trap combinations are the most effective detection tools, but other methods (e.g., visual survey, sweep netting) may be acceptable depending on the species.

   Step 1: Conduct a thorough literature review on survey methods, pheromones, traps, etc.

   Trap names are often colloquial. "Types of traps used by PPQ_2016.xls" lists the traps used in PPQ pest detection programs and includes other names that may be found in the literature.

   For lures, consider the following questions:
   - Have attractants been identified in lab study?
   - Have attractants been evaluated in the field where the pest is established?

- Are the dosage rates of the attractant known (e.g., 1 mg/day)?

In addition to the literature, search:

- Pherobase for possible attractant. Be sure to search by synonyms and any changes in nomenclature. Pherobase: http://www.pherobase.com/database/genus/genus-A.php
- Commercial lure product lists to see if lures are already commercially available. Disregard and lures recommended for mass-trapping. Companies include: Alphascents, Chemtica, ISCAtech, Russell IPM, Synergy (Exotic Woodborer/Bark Beetle), Trécé (Trécé focuses on domestic detection, but check their monitoring page).

Use the Lure Summary template.docx to organize the lure information you collect.

Step 2: Contact subject matter experts (primary authors/specialists) for additional input. Researchers and specialists working in areas where the species is known to be present are especially helpful. When sending the email, include the scientific name in the subject line and copy S&TCAPS@aphis.usda.gov. This is important for our record keeping.

You should also include which methods you have already found. If there is a trap and lure available, ask which type of trap would be most effective for the pest at a low infestation level. Often cheap traps are used for monitoring populations where the pest is established, but a more expensive trap may actually be more effective.

If the trap and lure information in the literature is not sufficient, ask for recommendations. Specifically, what do they recommend for:

- Trap
  - Trap type
  - Trap placement (location, height, spacing, etc.)
- Lure
  - Compounds used to make the lure
  - Dosage of compounds
  - Length of effectiveness in the field
  - Source of compounds (for example Bedoukian for grandisol or a lure manufacturer if any company is formulating the lures for sale)
  - Dispenser type for lures

If it is a visual survey:

- What time of year
- Hosts
- How many plants per row/farm, etc.

A. A highly efficient method is available.

- A species-specific lure is available.

If A, keep on candidate list.

B. A moderately efficient method is available.

- A non-specific trap or lure is available.

If B, keep on candidate list. The S&T CAPS Support team will consult with CAPS leadership and Otis lab on whether survey method is sufficient for early detection.

C. Current survey method is inefficient.

- No trap or lure is available. Survey is by visual observation or other passive survey method (sweep net sampling, pitfall traps, etc.).

If C, keep on candidate list. The S&T CAPS Support team will place it on "research list" for method improvement and consult with CAPS leadership and Otis lab on cost/benefit of method improvement research.

D. It is not possible to declare negative data from current survey method.

- No specific sign or symptom is visible.

Example: Wood-boring/ bark beetles with signs of damage that resemble abiotic stress or native species; life stage of insect may not be present…how do we get truly negative data?

If D, remove from candidate list. The S&T CAPS Support team will place it on "research list" for method improvement and consult with CAPS leadership and Otis lab on cost/benefit of method improvement research.

2. Ease of identification:

National Identification Services (NIS) staff will work with domestic identifiers to answer this question. However, please include a summary of identification methods and tools (dichotomous keys, online identification guides, screening aids, etc.) found during your literature review. If you do not find any, leave this section blank.

A. A highly efficient method is available.

- Pest has unique characteristics and sample does not require dissection or additional preparation.

If A, keep on ranked list.

B. A moderately efficient method is available.

- Identification can be performed by a Domestic Identifier (does not need to be routed to taxonomic expert). Sample does not require dissection or additional preparation.

If B, keep on ranked list.

C. Identification is difficult or extremely time-consuming.

- A taxonomic expert is needed and/or sample requires extensive preparation.

If C, keep on ranked list and refer to CPHST/NIS for method improvement.

D. Identification to the taxonomic level needed is not currently possible.

- Life stage needed for identification is not likely to be found with current survey method, or morphological characters are not sufficient to differentiate from similar species.

If D, remove from ranked list and refer to CPHST/NIS for method improvement.

3. There is sufficient capacity and available expertise to identify the pest should a large-scale survey be conducted:

National Identification Services (NIS) staff will answer this question.

Yes: Keep on ranked list.

No: Remove from ranked list and refer to CPHST/NIS to determine if the necessary support and capacity can be developed for the survey including 1) Develop screening aids and other tools; or 2) Increase capacity.

References: (include pdfs of email correspondence)

Pathogen Template

Scientific Name of Pest	
Common Name of Pest	
Pest List	
Name of Reviewer	
Survey Method Reviewer	
ID Method Reviewer	
Date Review Completed	
Recommendation/Conclusion	

This questionnaire is for pests that have passed the Pest Categorization and have gone through the Objective Prioritization of Exotic Pests (OPEP) Impact Assessment model. The Survey Feasibility Assessment determines the availability of survey and identification methods and capacity. A pest must "pass" all three sections to be included on the Priority Pest List.

1. Ease of detection for this pest

A large percentage of the plant pathogens will employ a visual survey method to detect the pest.

A. Most effective:

i. A field-based screening method/assay (*e.g.,* ELISA, immunostrip) is available for the pest (often only available at the genus level), which will allow rapid screening of suspect symptomatic plant material for a pest,

ii. A visual survey protocol has been developed for the pest/disease by S&T,

iii. A symptomatic screening aid is available to aid in survey, **or**

iv. The disease/pathogen has characteristic symptoms/signs, which enable it to be easily/readily distinguished from other endemic/native pests. The disease/pathogen may have a combination of symptoms/signs that are characteristic of the disease/pathogen

If A, keep on ranked list.

B. Moderate to low-level of effectiveness:
   i. No field-based screening method is currently available, **and**
   ii. The disease/pathogen has symptoms/signs that are routinely present but they are not necessarily distinct or characteristic (could be confused with native/endemic pests).
      - Based on how easily the plant host can be surveyed and how characteristic the symptoms/signs are based on other endemic pests, visual survey could range from low-level to moderately effective.

If B and moderate level of effectiveness keep on ranked list refer to CPHST for method improvement.

If B and low level of effectiveness, remove from ranked list, place on research wait list, and refer to CPHST for method improvement.

C. No visible symptoms/signs routinely present:
   i. No field-based screening method is currently available, **and**
   ii. The disease/pathogen does not cause symptoms in a host of economic concern or it has a very long latent period.

If C, remove from ranked list, place on research wait list, and refer to CPHST for method improvement.

2. Ease of identification

National Identification Services (NIS) staff will work with domestic identifiers to answer this question. However, please include a summary of identification methods and tools (dichotomous keys, online identification guides, screening aids, etc.) found during your literature review. If you do not find any, leave this section blank.

A. Most effective
   i. Easy to isolate/culture (if applicable),

   ii. A morphological screening aid or a validated- diagnostic methods are available for screening and/or final identification, **or**

   iii. Overall, it is easy to identify organism.

If A, keep on ranked list.

B. Moderately effective
   i. Morphological identification is possible with some expertise or use of keys **and/or**
   ii. Identification is likely with literature-based molecular diagnostic methods (well-vetted, reliable, and accurate but not validated by Beltsville).

If B, keep on ranked list and refer to CPHST/NIS for method improvement.

C. Low level of effectiveness
   i. Identification is difficult or extremely time-consuming morphologically (difficult to isolate; easily confused with many native/endemic pests, etc.),
   ii. Identification to the taxonomic level needed is not currently possible, **and/or**
   iii. Literature-based methods lacking or not well-tested.

If C, remove from ranked list, place on research wait list and refer to CPHST for method improvement.

3. Diagnostic Capacity: Is there sufficient capacity and available expertise to identify the pest should a large-scale survey be conducted?
National Identification Services (NIS) staff will answer this question.

Yes: Keep on ranked list.

No: Remove from ranked list and refer to CPHST/NIS to determine if the necessary support and capacity can be developed for the survey including.

1) Validation diagnostic methods;

2) Development screening aids or other tools; or

3) Increasing capacity.

Identifier(s) Information (if available):

Regional/ State coverage	
Name	
Institution	

Status (Permanent (PPQ), yearly contract, etc.)	

Regional/ State coverage	
Name	
Institution	
Status (Permanent (PPQ), yearly contract, etc.)	

References: (include pdfs of email correspondence)