USDA
United States Department of Agriculture

Animal & Plant Health
Inspection Service

The Objective Prioritization of Exotic Pests (OPEP):

A new system for prioritizing pests

Plant Epidemiology & Risk Analysis Laboratory
Center for Plant Health Science & Technology

Why have a model for prioritizing exotic plant pests?

How should pests be prioritized?

Ideally, we want to spend our limited resources on:

- Pest that pose the greatest risk
- Activities that give us the greatest benefit for the cost (“bang for the buck”)

What is risk?

The **likelihood** of an **adverse event**, and the **magnitude** of the associated **consequences:**

- **Adverse event** – establishment of an exotic pest
- **Likelihood** that an exotic pest will enter the US and become established
- **Consequences** (impacts) that are likely to occur should the pest become established

Risk = Likelihood X Consequences

A HIGH impact pest with a

LOW likelihood of introduction

=

A LOW impact pest with a

HIGH likelihood of introduction

Why a new process?

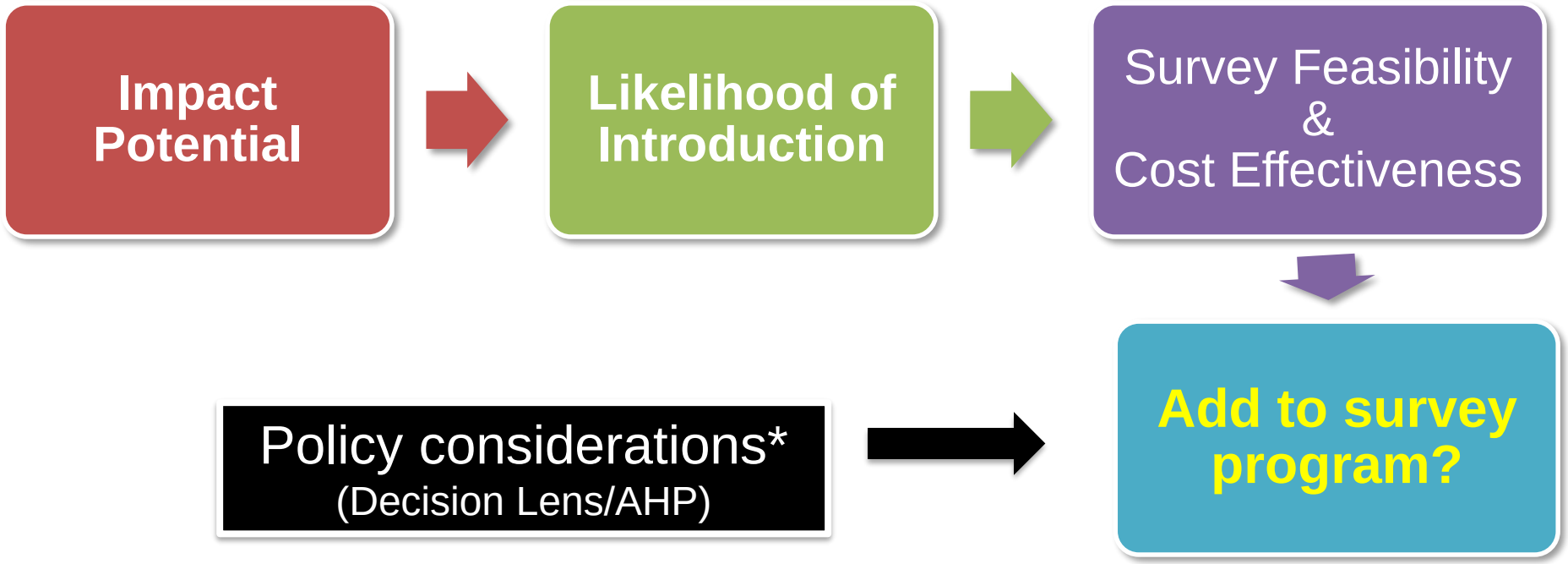
- **Objective** – evidence-driven, not opinion-driven
- **Valid & comparable across pest types**
- **Transparent** – separates analysis based on scientific information from that based on policy
- **Separate uncertainty from risk score**
- **Flexible** – can be used to look at risk by region and host
- **Defendable**
  - Uses methods that can be tested & statistically validated
  - Based on other proven PPQ risk assessment methods

Objective Prioritization of Exotic Pests (OPEP)

Phase I:
Completed
(working on
validation)

Phase II:
To be completed
FY 2018

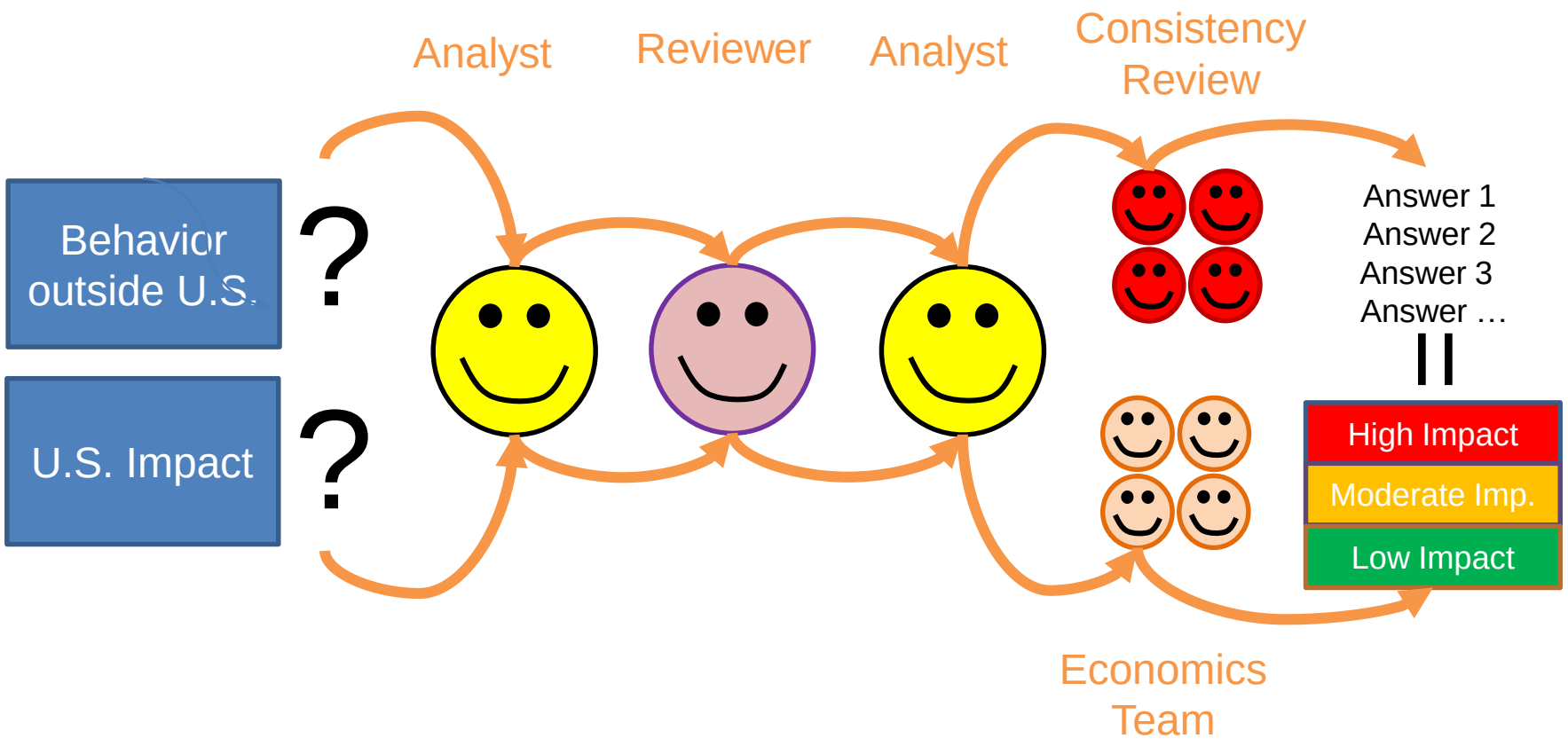
Phase III:
To be completed
FY 2019



Factors considered in categorizing impacts

- Severity of unmitigated damage (e.g., yield loss, mortality)
- Frequency of severe outbreaks
- Impact on production practices
- Environmental & social impacts
- Level of management & cost of control
- Amount of research into methods of control (incl. host resistance/ biocontrol)
- Ease of control

Predicted Impact Model Development:
(based on previous U.S. invasions)



Model Results

- Best predictor of pest behavior in the United States is behavior outside the U.S. and the level of control/ research on the organism, **when the pest has been introduced into novel areas**
- Specific biological characteristics are not as important in predicting impact
  - e.g., Number of hosts not found to be related to impact

Model Results (cont.)

- If a pest has **not** been introduced into a novel area, we may not be able to make a prediction

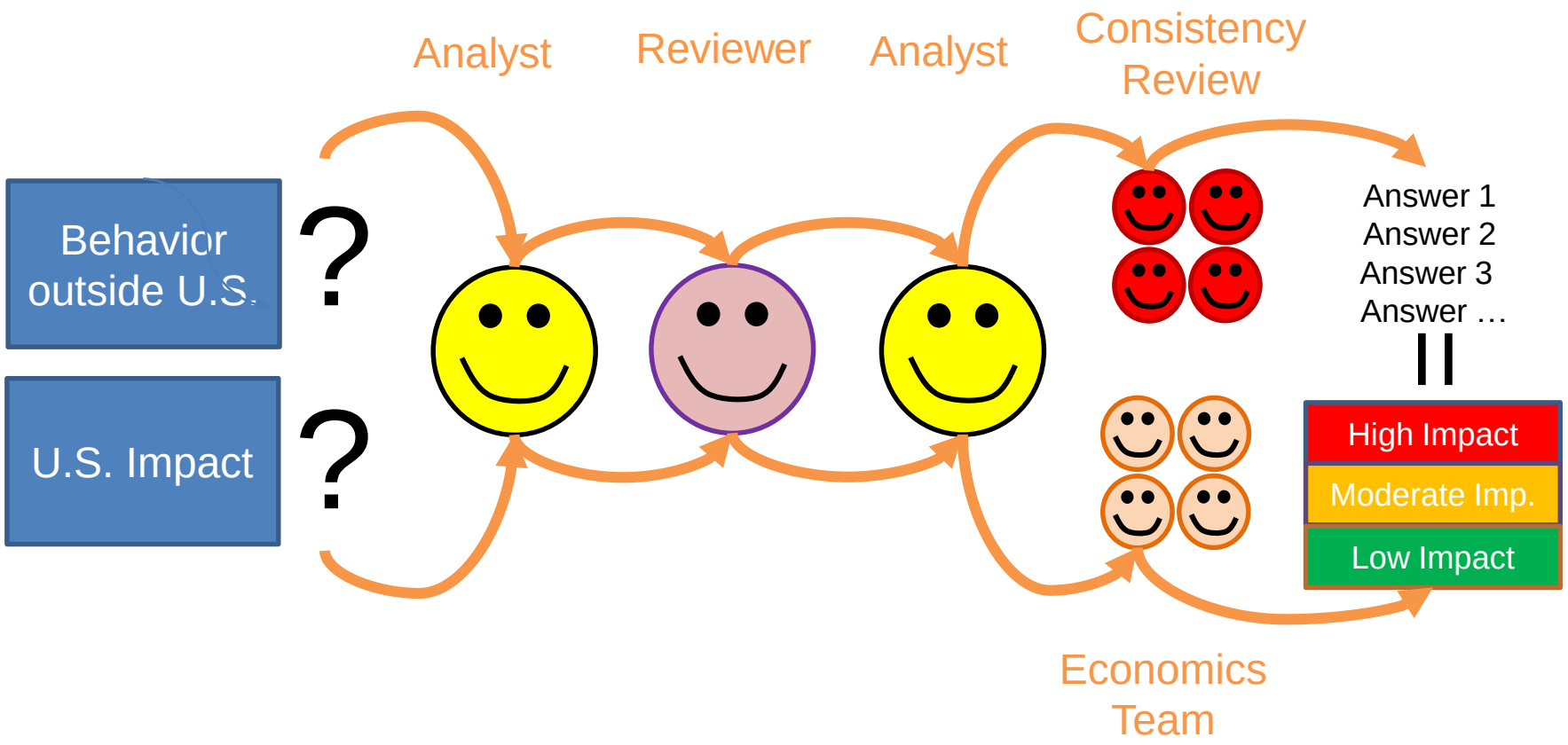
Model Development: Scoring

Developed a scoring system based on how predictive each variable (question) is; the most predictive variables receive the greatest weighting.

Additional Component: Consideration of US Conditions

- Are there already organisms in the US that fill the same ecological niche?
- Are there tools in the US that have already been developed and are in use that would be effective at controlling the pest?
- Would current production practices or conditions in the United States be effective at mitigating the pest?

Predicted Impact Model Validation:
(used same process)



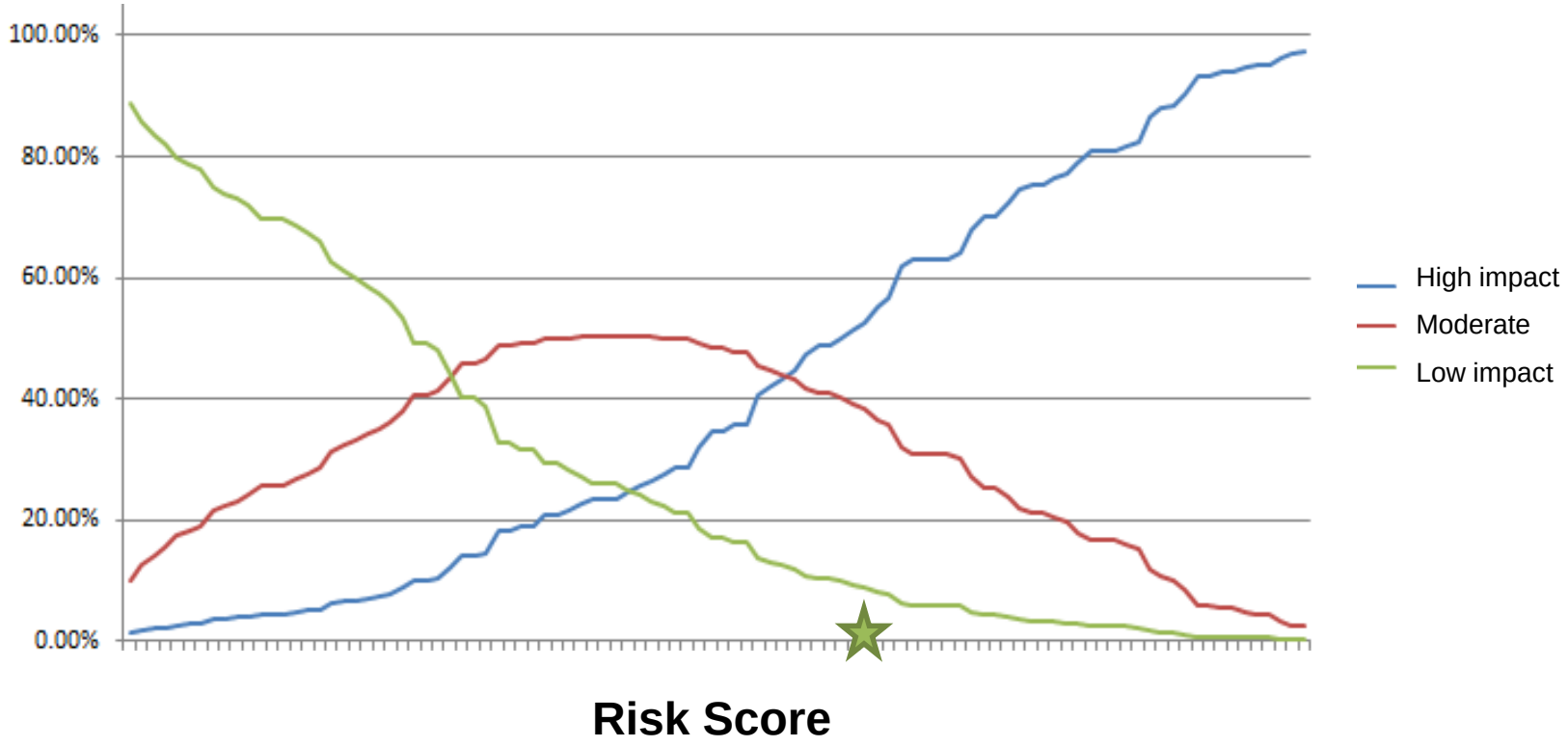
est Damage

		select one:	Uncert.	Alternate Choice I	Alternate Choice II	Score	Comments/ Evidence
9	**The organism generally attacks:** **[a]** Healthy host plants **[b]** Primarily stressed hosts, but will attack healthy hosts and overcome the defenses of healthy hosts if populations are high enough **[c]** Stressed, dying, or dead hosts. **[N/A]** **[a] is the default unless you have other evidence. If you are analyzing a storage pest, unless the pest also attacks living plants, answer 'n/a'.*	c	low	b	b	-2	The species develops best in fresh, moist wood; the larvae d develop in dry dead trees (Moraal and Hilszczanski 2000). In these buprestids are generally secondary pests, attacking w trees, but tree survival or mortality often depends on whethe beetles attack the weakened tree (Moraal and Hilszczanski
10	**Does the damaging stage(s) of the organism feed on the following plant parts?** **[a]** Yes, commonly damages or feeds on this plant part **[b]** Yes, occasionally damages or feeds on this plant part **[c]** No, does not damages or feeds on this plant part **[?]** Unknown, or conflicting information						
	a) Foliage? (consumes leaves, defoliator)	c	low	b	b	0	Adults provide supplementary feeding in the crowns of oaks parenchymal tissue of leaves (Wachtendorf 1955 in Moraal a Hilszczanski 2000). However, the larvae are considered the d stage of this insect and they feed under the bark.
	b) Stems, branches, trunks?	a	negl	b	b	0	Larvae excavate galleries (up to 155 cm long) under the bark (Wachtendorf 1955 in Moraal and Hilszczanski 2000).
	c) Shoots and growing points? (including vegetative stems)	c	negl	b	b	0	Larvae do not feed on these plant parts.
	d) Fruit?	c	negl	b	b	-3	Larvae do not feed on these plant parts.
	e) Seeds? (Answer N/A for corn kernels if they are considered	c	negl	b	b	-2	Larvae do not feed on these plant parts.
	f) Flowers?	c	negl	b	b	0	Larvae do not feed on these plant parts.
	g) Roots/below ground parts? (consumes bulbs, corms, tubers, tuberous roots, and rhizomes)	c	low	b	b	0	Larvae do not feed on these plant parts.
11	**Does the damaged caused by organism result in the following:** **[a]** Yes, commonly causes this type of damage **[b]** Yes, occasionally causes this type of damage **[c]** No, does not cause this type of damage **[?]** Unknown, or conflicting information *NOTE: 1) If this arthropod vectors a pathogen, consider damage caused by the pathogen as well as by the arthropod itself. Be clear in the explanation in comments/ evidence whether the damage is from the pathogen, arthropod or both. Unless the pathogen is always associated with the arthropod, you should answer "b" if the type of damage is only caused by the pathogen. 2) When discussing damage, please give the host and the country in which the damage was done. Also, please say whether the damage was*						
	a) Host mortality of perennial hosts. (Answer N/A all hosts are annual crops) *This relates to impacts on both commercial and non-commercial hosts. If the host is a field crop or annual crop, answer 'n/a'. This question relates to woody perennials. Include host mortality for annual crops (e.g., cabbages) in the 'yield reduction' question below.*	a	low	b	b	8	As a result of larval activity, twigs and branches in the top of will die; in a later stage the tree may die (Moraal and Hilszc Germany, A. biguttatus is considered an important factor in t mortality; they attack weakened trees, but survival vs. mortal on whether the beetles are present (if the beetles are prese trees die) (Moraal and Hilszczanski 2000). Typically, infestati

Evaluation of exotic pests for CAPS Pest Prioritization

- Each pest on the proposed list was assessed using one of the models and was given a “risk score”
- Based on that score we determined:
  - Probability of being a high impact pest
  - Probability of being a moderate impact pest
  - Probability of being a low impact pest

Ordinal logistic regression to determine impact likelihoods



CAPS Pest Prioritization

- Pests are prioritized based on likelihood of causing serious impacts

- NOTE: Model is NOT used for pests where there little to no documented evidence of damage by the pest AND the pest has not been introduced outside of its native range.

Future Work

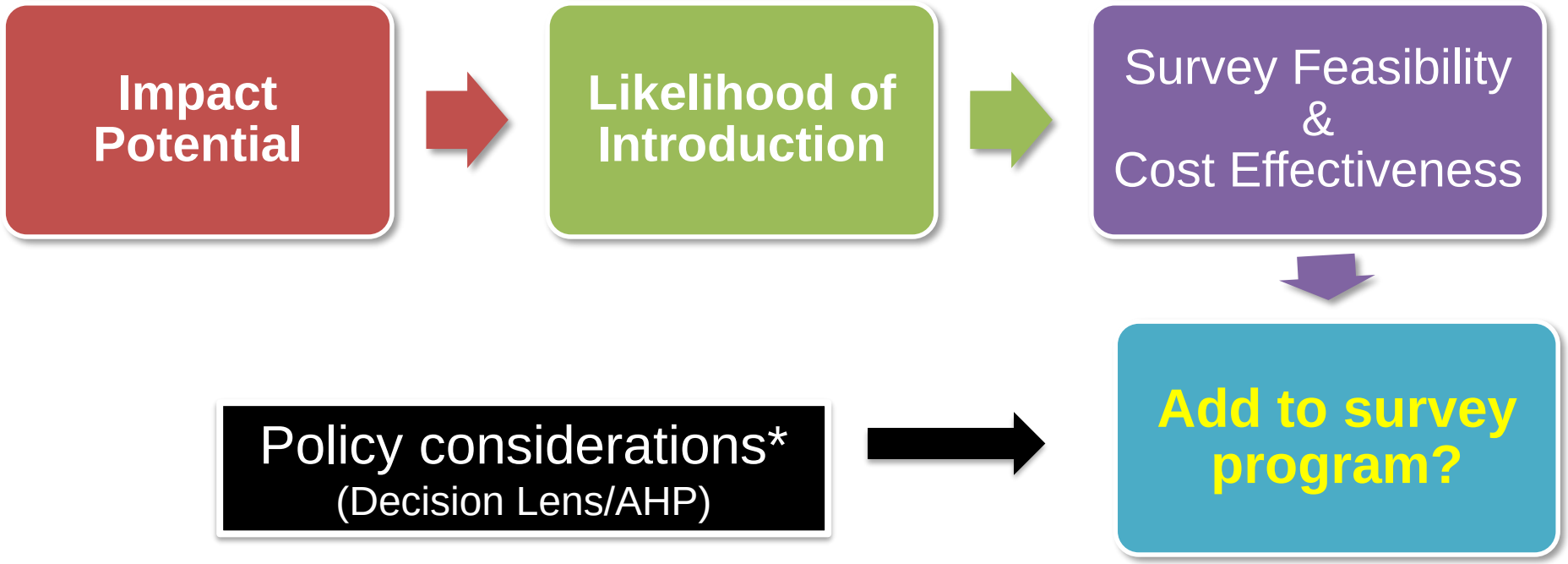
- Developing impact model for mollusks
- Developing model for considering likelihood of introduction
- Developing a tool for considering cost effectiveness of survey

Objective Prioritization of Exotic Pests (OPEP)

Phase I:
Completed
(working on
validation)

Phase II:
To be completed
FY 2018

Phase III:
To be completed
FY 2019



Uncertainty and Risk Assessment

When conducting risk assessment, analysts should separate **evidence** from **uncertainty** in order to ensure that risk is not artificially elevated by uncertainty.

In the past many pests were “guilty by association”

The *absence of information* is sometimes evidence.

For example, the **lack of information** about economic impacts of a pest is often evidence that there are no significant impacts (or they would have been noticed and reported); this is particularly true when a pest is widespread and has been introduced into novel areas.

Risk analysis, uncertainty and decision-making:

1. Risk assessment is not a crystal ball: We can't predict everything
2. We often don't always know what we don't know
3. We have to evaluate pests and make predictions and decisions with incomplete information (we "do the best we can with what we've got")
4. There is always a chance that our prediction may be wrong
5. Our estimates of risk may change as we get more information
6. There will always be pests that surprise us (that we didn't even know we should worry about)

*** But, there *are* pests and pest situations that we can be fairly certain about.**

By focusing on those organisms that we determine have a **high probability** of causing **serious impacts**, we can **free up resources** that can then be spent on those pests that will inevitably surprise us.

When EVERYTHING is “high risk” then nothing is high risk.

Questions??