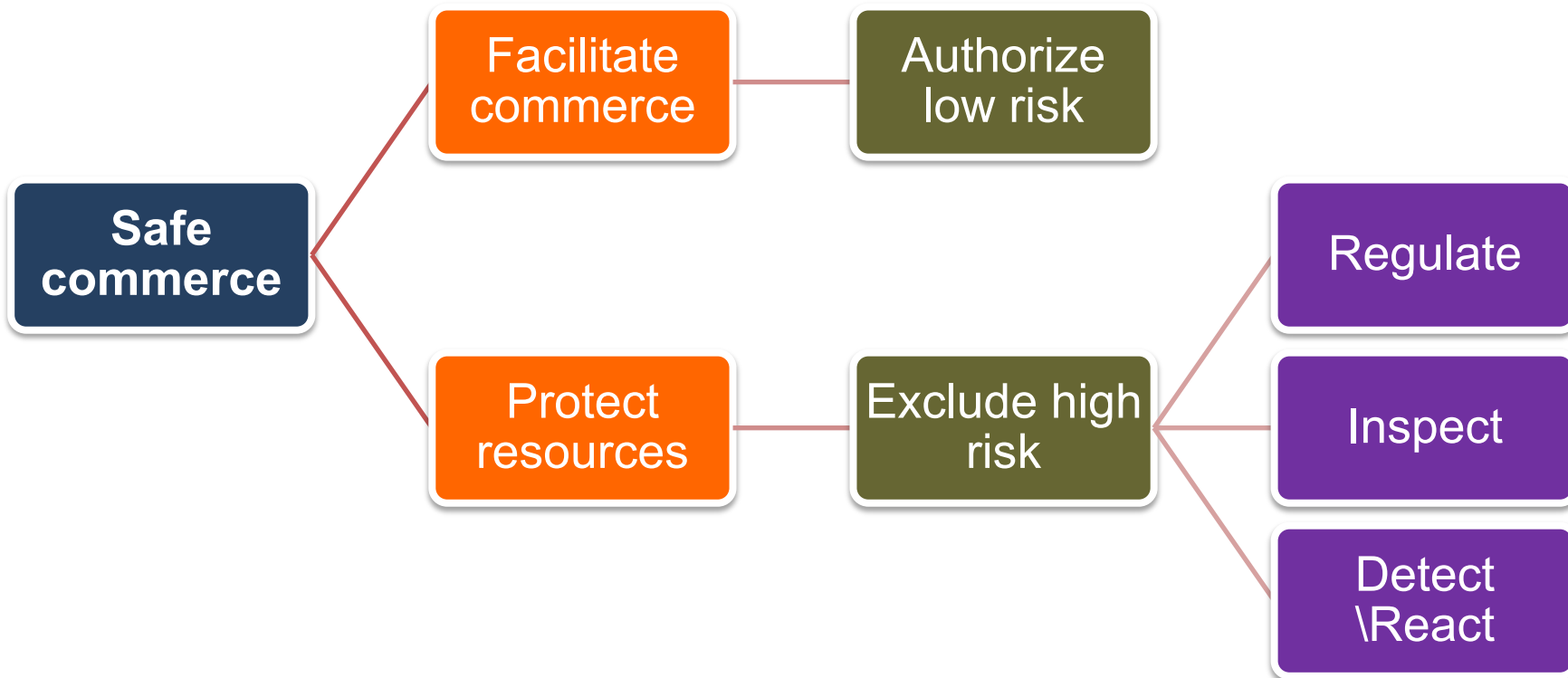# REFRAMING RISK: AN UPDATED APPROACH TO PRIORITIZATION

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APHIS' Mission

Safe commerce
- Facilitate commerce
  - Authorize low risk
- Protect resources
  - Exclude high risk
    - Regulate
    - Inspect
    - Detect \React

Source: Seminar on Interpreting Interception Data, R.L. Griffin, 1/21/13, Raleigh, NC

Questions Asked of Us

- What are the benefits of APHIS' actions?

- Are our actions producing the intended results?

Objectives

- Measure damages mitigated or avoided per dollar spent

- Why is such a measure needed?
  - Show progress
  - Affect change
  - Prioritization

Measurement Issue

- Risk has been traditionally viewed as the likelihood of pest introduction

- Lack of common framework for measuring risk (expected impacts) along the safeguarding continuum
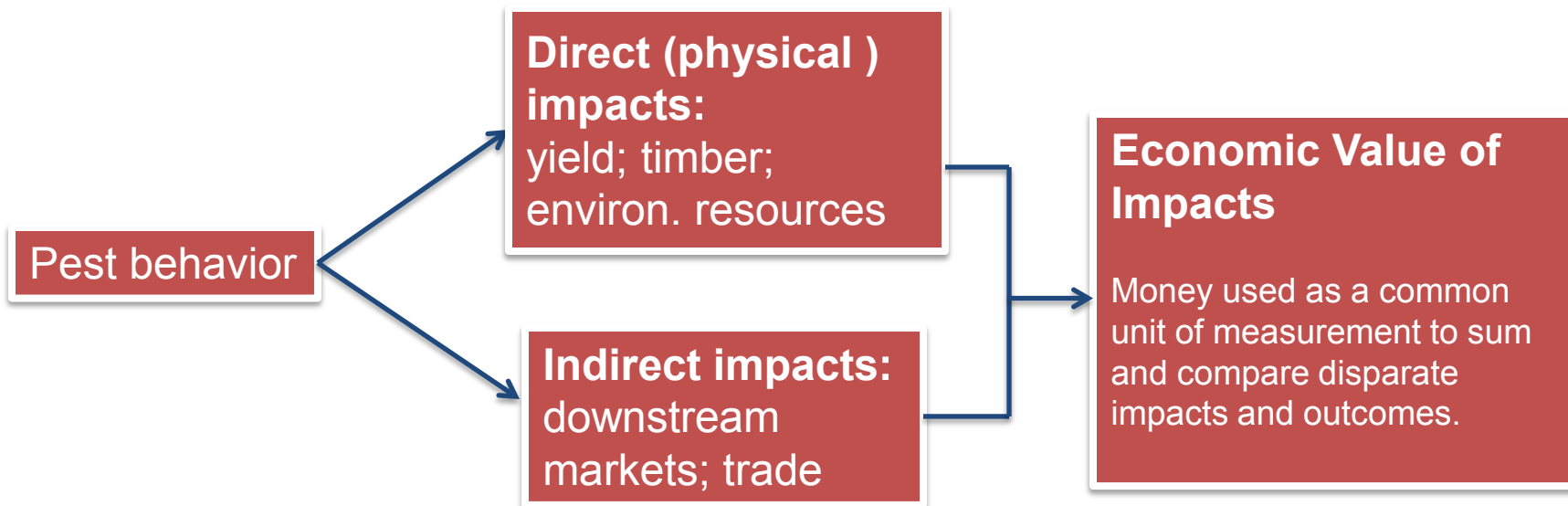
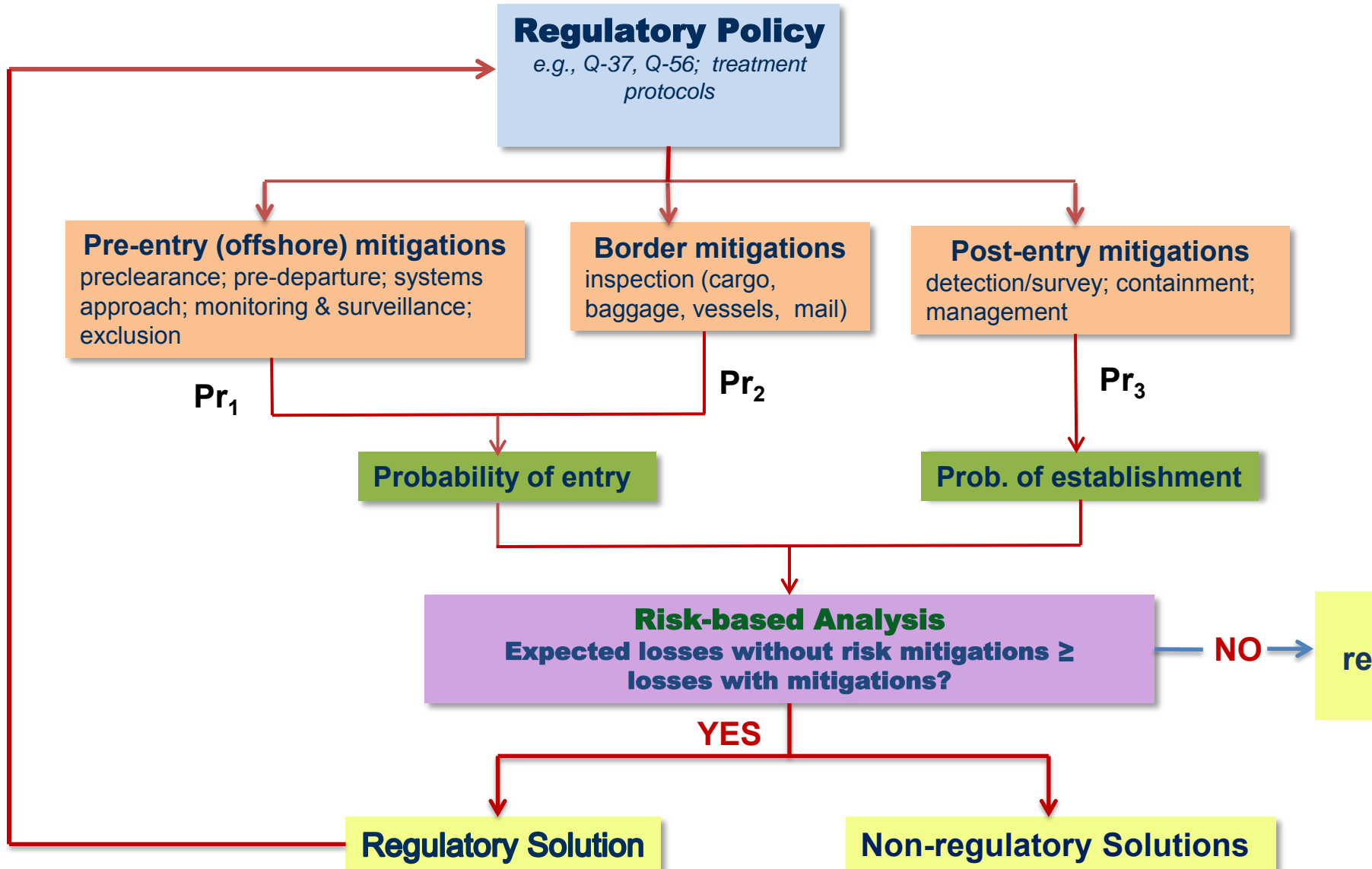# Risk Definition

Economic perspective on risk:

Risk implies future uncertainty about deviation from expected outcome.

**Risk (or expected impact) =
Likelihood x Consequences**

Biological and Economic Impacts

Pest behavior

Direct (physical) impacts:
yield; timber; environ. resources

Indirect impacts:
downstream markets; trade

Economic Value of Impacts

Money used as a common unit of measurement to sum and compare disparate impacts and outcomes.

Safeguarding Flowchart

Regulatory Policy
e.g., Q-37, Q-56; treatment protocols

Pre-entry (offshore) mitigations
preclearance; pre-departure; systems approach; monitoring & surveillance; exclusion

Border mitigations
inspection (cargo, baggage, vessels, mail)

Post-entry mitigations
detection/survey; containment; management

Pr_1

Pr_2

Pr_3

Probability of entry

Prob. of establishment

Risk-based Analysis
Expected losses without risk mitigations ≥ losses with mitigations?

NO → re

YES

Regulatory Solution

Non-regulatory Solutions

Our Goals

1. Prioritize pests

2. Evaluate what actions to take

3. Prioritize across pest programs
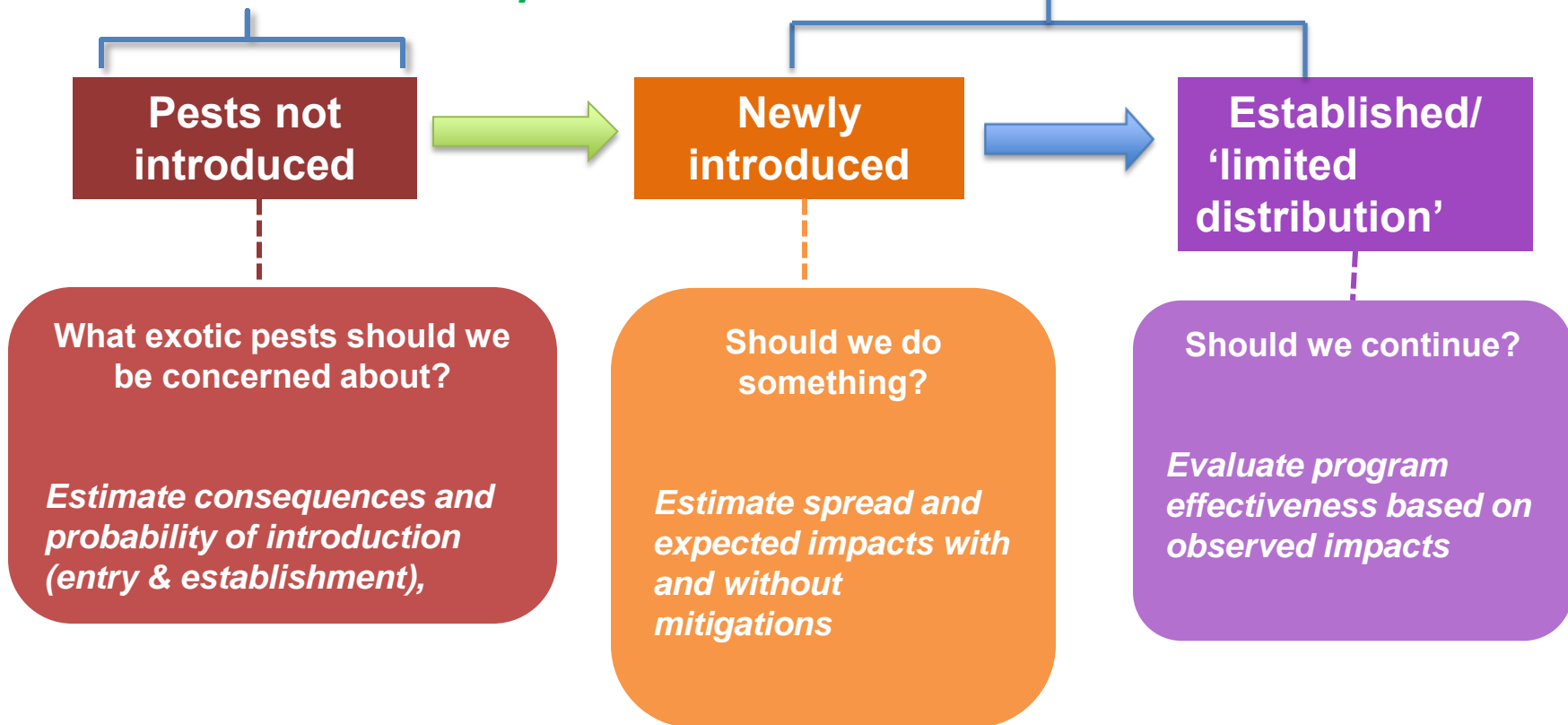
New Model for Evaluating Impacts

- Multiple choice yes/no questions (criteria) predictive of impact

- Selected factors considered in evaluating impacts:

  - unmitigated damage

  - frequency/severity of outbreaks

  - current production practices

  - private cost of control

  - research

Model Development

		select one:	Uncert.	Score	Comments/ Evidence	Reviewers: please put your initials before any comments.
1a	Is the organism *capable* of dispersing naturally more than 1 km/year? [YES] [NO] [?] unknown					
1b	Does the organism *typically* disperse naturally more than 1 km/year? [YES] [NO] [?] unknown *For this question, consider all non-human mediated dispersal mechanisms including water, wind, flight, and phoresy. As specifically as possible, identify the main mechanisms of dispersal in "comments/evidence." If you can't find information on the species, you may (and are encouraged to) use information on closely related species, but raise your uncertainty level.*					
2	Reproduction is: [a] sexual [b] parthenogenic [c] both [?] unknown *Information from closely related species may be used as long as the reproductive strategy is the same for all members of the taxonomic group. If you use this type of information, raise your uncertainty level.*					
3	Does the organism typically have more than one generation per year? [YES] The organism typically has more than one generation per year or the number of generations per year varies. [NO] The organism typically has only one generation (or less) per year. [?] The number of generations per year is unknown *Do NOT use information from closely related species to answer this question.*					
4	Oviposition: [a] eggs are placed by themselves a relative distance from any					

Model Development (cont.)

- Identified over 100 non-native arthropods and 80 pathogens that have become established in the United States

- Team of entomologists/pathologists & economists classified each pest/pathogen in terms of its _observed_ impacts in the United States
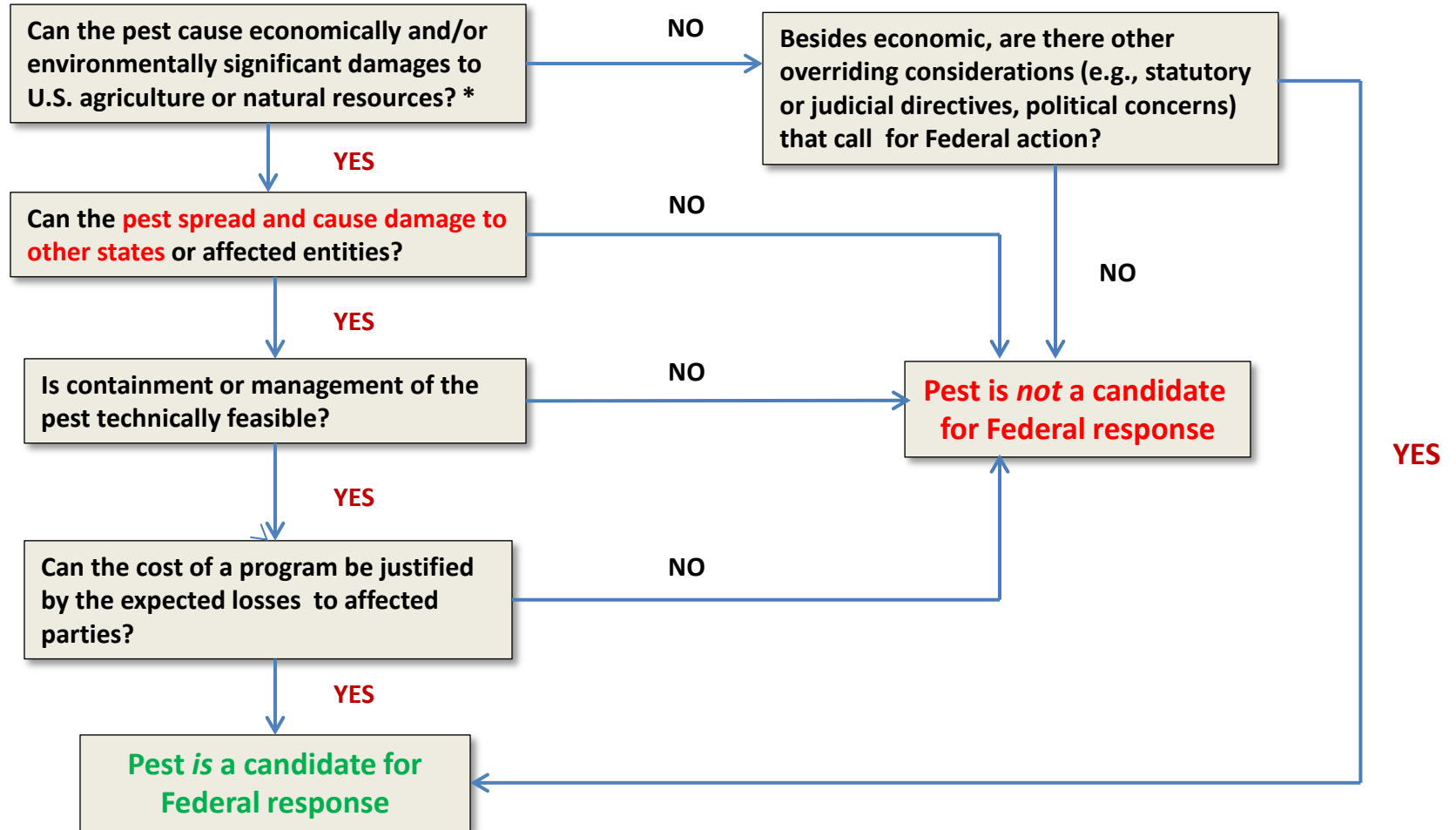
| Very High | High | Medium | Low | Negligible |

Model Development (cont.)

- Each pest/pathogen was analyzed *as if it were not present in the U.S.* using the potential questions

- Statistician compared results to observed impacts

- Each question were tested as to how well it predicted actual impact; non-predictive questions were removed

- Weighted each question by its predictive power

Acceptable Level of Risk

- Determine whether a pest poses a risk that is greater than an established *threshold* for *acceptable level of risk*

- Apply the same criteria for evaluating pest impacts across exclusion & detection programs

DECISION TREE FOR FEDERAL ACTION

Can the pest cause economically and/or environmentally significant damages to U.S. agriculture or natural resources? *

NO →

Besides economic, are there other overriding considerations (e.g., statutory or judicial directives, political concerns) that call for Federal action?

↓ **YES**

Can the pest spread and cause damage to other states or affected entities?

NO →

↓ **YES**

NO

Is containment or management of the pest technically feasible?

NO →

↓ **YES**

Pest is *not* a candidate for Federal response

Can the cost of a program be justified by the expected losses to affected parties?

NO →

↓ **YES**

YES

Pest *is* a candidate for Federal response

* Economic significancy is based on established thresholds for acceptable level of risk.

Economic Commodity Models

- Partial equilibrium models of major agricultural commodities

- Linkages between fresh and processed sectors in producing and non-producing regions

- International and domestic trade

Commodity Models – cont'd

Consideration of ***market prices*** enables estimation of impacts on all affected entities in society, including:

- Producers in affected areas
- Producers in unaffected areas
- Consumers
- Trade

Stakeholders

Commodity Models – cont'd

- Small grains – wheat, soybean, corn, sorghum, barley, oats, rice, forage
- Nursery stock
- Seed (grains)
- Non-citrus tree fruits – pear, apple, peach, plum, sweet cherry, tart cherry
- Citrus fruits – orange, grapefruit, tangerine, lemon
- Potato

Limitations of Past Analyses

- Did not account for temporal spread;
- Use of total value of production overstated impacts;
- Only affected producers considered;
- Impacts limited to costs or financial impacts;
- Options not always evaluated;
- Inconsistent linkages between pest control operations and outcome.
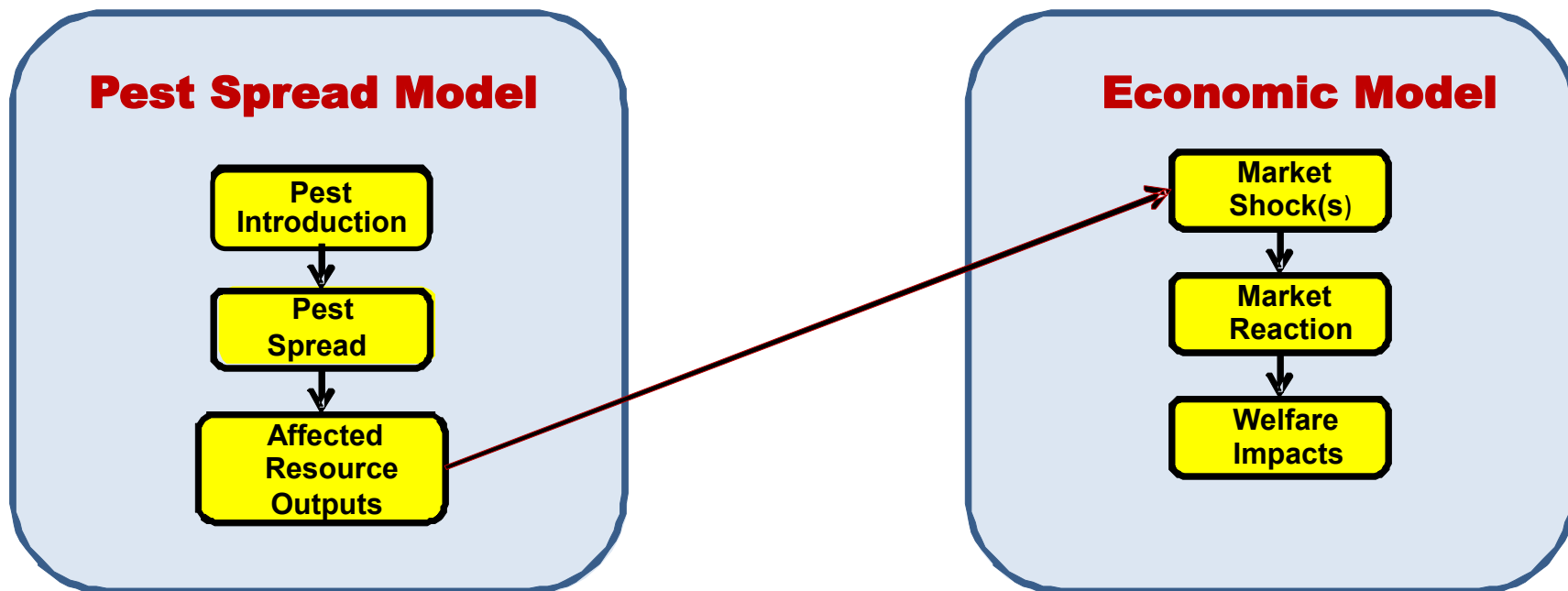
Economic Criteria for Prioritizing

EFFECTIVENESS (are objectives achieved?)

Benefits = losses with a program – losses without a program < 0

EFFICIENCY (objectives achieved at the lowest average cost?)

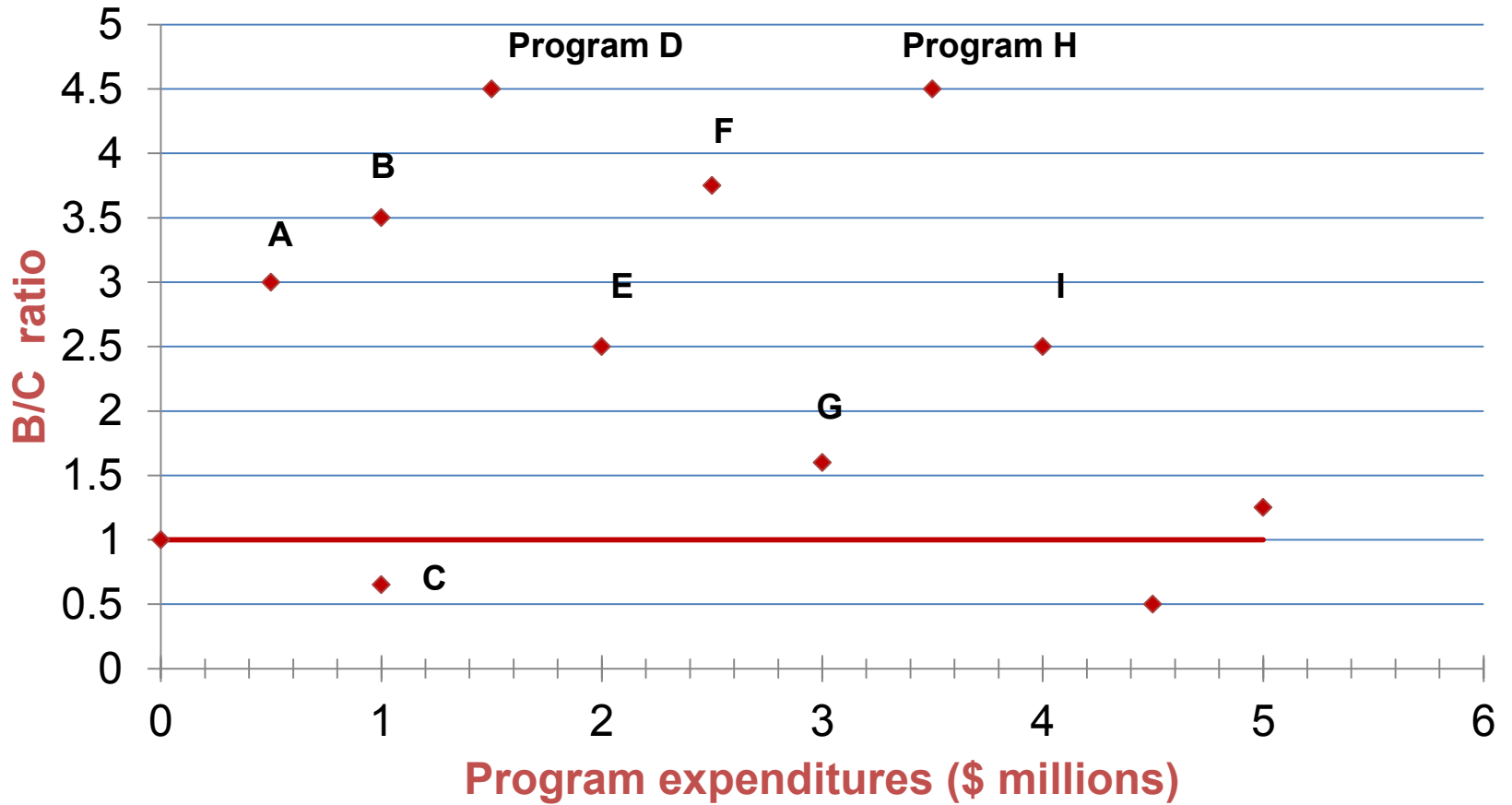**Net benefits = benefits – program costs**

Non-economic Criteria for Prioritizing

- Types of damages where **Federal role** is justifiable (e.g., environmental versus commercial pests, or multi-host versus single-commodity pests);

- Availability of control tools;

- Availability of funding from non-APHIS sources;

- Inability of industry/stakeholders to organize;

- Statutory directives.

Example: Results of Analysis of the Emerald Ash Borer Program

	With Program (40.6 km) 44 years until colonization	With Program (52.9 km) 34 years until colonization	Without Program (240 km) 8 years until colonization
Present values in million dollars[1]			
Damages from newly infested area until colonization	3,707	3,820	6,224
Avoid Losses (Without program - With program)	2,517	2,404	--
Program Cost until colonization	692	619	0
Net Benefit (Avoided losses - Program Cost)	1,825	1,725	--
Benefit-cost ratio (Avoided losses/Program Cost)	4	4	
[1]Present values discounted at a rate of 3.9%.			

How Measures are Used for Prioritizing

Questions?

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