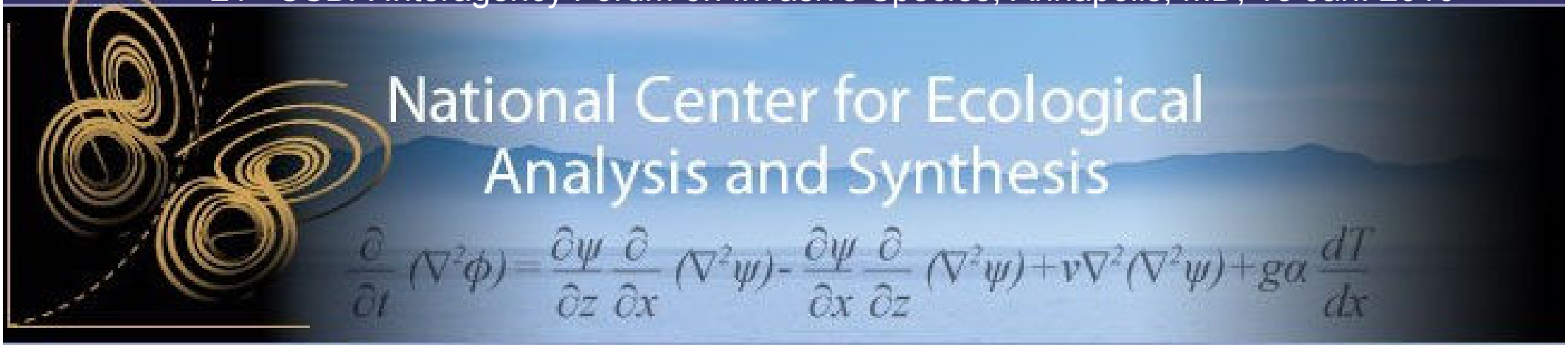
21st USDA Interagency Forum on Invasive Species, Annapolis, MD, 13 Jan. 2010



Demonstrating the Benefits of Phytosanitary Regulations: The Case of ISPM 15

Eckehard Brockerhoff, James Turner, et al.
(Scion / New Zealand Forest Research Institute)

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& several U.S. universities

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- The Nature Conservancy
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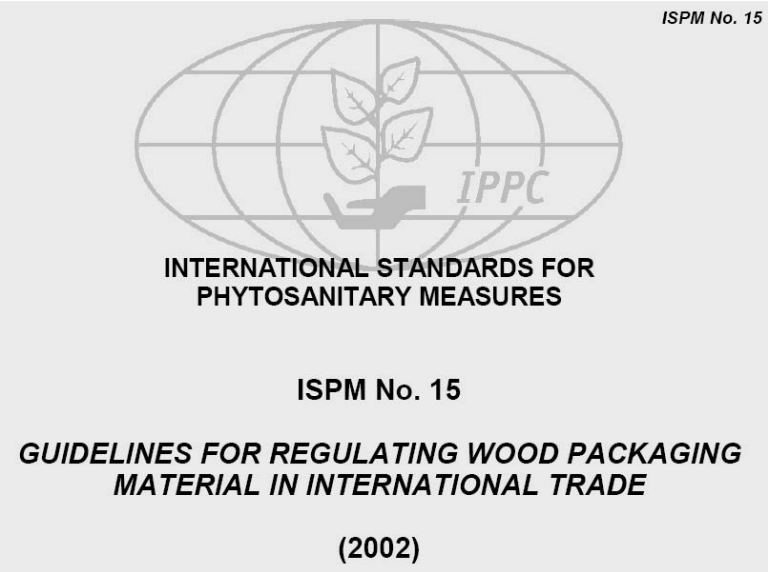
- MAF/BNZ (Carolyn Whyte, Alan Flynn) and USDA-APHIS for access to data

Structure / objectives of the Study

- **Working Group 1**
  - Temporal trends, economic impact of invaders
  - Predictive model of future impacts
- **Working Group 2** (**this presentation**)
  - Benefits and costs of phytosanitary policy
  - ISPM 15 as a case study (retrospective analysis)



International **S**tandards for **P**hytosanitary **M**easures, No. 15:

"Guidelines for Regulating Wood Packaging Material in International Trade"

– **Implemented in July 2006**

Wood packaging and borer invasions

ca. 21 pallets per container (average)

- **22 million containers per year into US**

(Richenbach et al., Jabara et al. 2008)

- **600,000 containers per year into NZ**
- **1/3 to 1/2 of containers with WPM**

Sea Container Review

MAF Discussion Paper No: 35 **2003**

Prepared for MAF Biosecurity Authority,
by the Border Management Group

Emerald ash borer in N. Am. (2002 -)

Agrilus planipennis
(Buprestidae)

Photos: www.forestryimages.org; www.emeraldashborer.info

ISPM 15: Heat treatment, fumigation

ISPM No. 15

APPROVED MEASURES ASSOCIATED WITH WOOD PACKAGING MATERIAL

Heat treatment (HT) **56°C, 30 minutes, c. $2 per pallet** (Jabara et al. 2008)

Wood packaging material should be heated in accordance with a specific time-temperature schedule that achieves a minimum wood core temperature of 56°C for a minimum of 30 minutes[3].

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ISPM No. 15

GUIDELINES FOR REGULATING WOOD PACKAGING MATERIAL IN INTERNATIONAL TRADE

An ‘analytic framework’ - Why do we need one?

- To verify effectiveness of policy regulating pathways
- Assess benefits relative to costs
- Provide guidance to ensure efficiency in future efforts
  - “Plants for planting” (under development)
  - Domestic ISPM 15 type policy
  - etc.

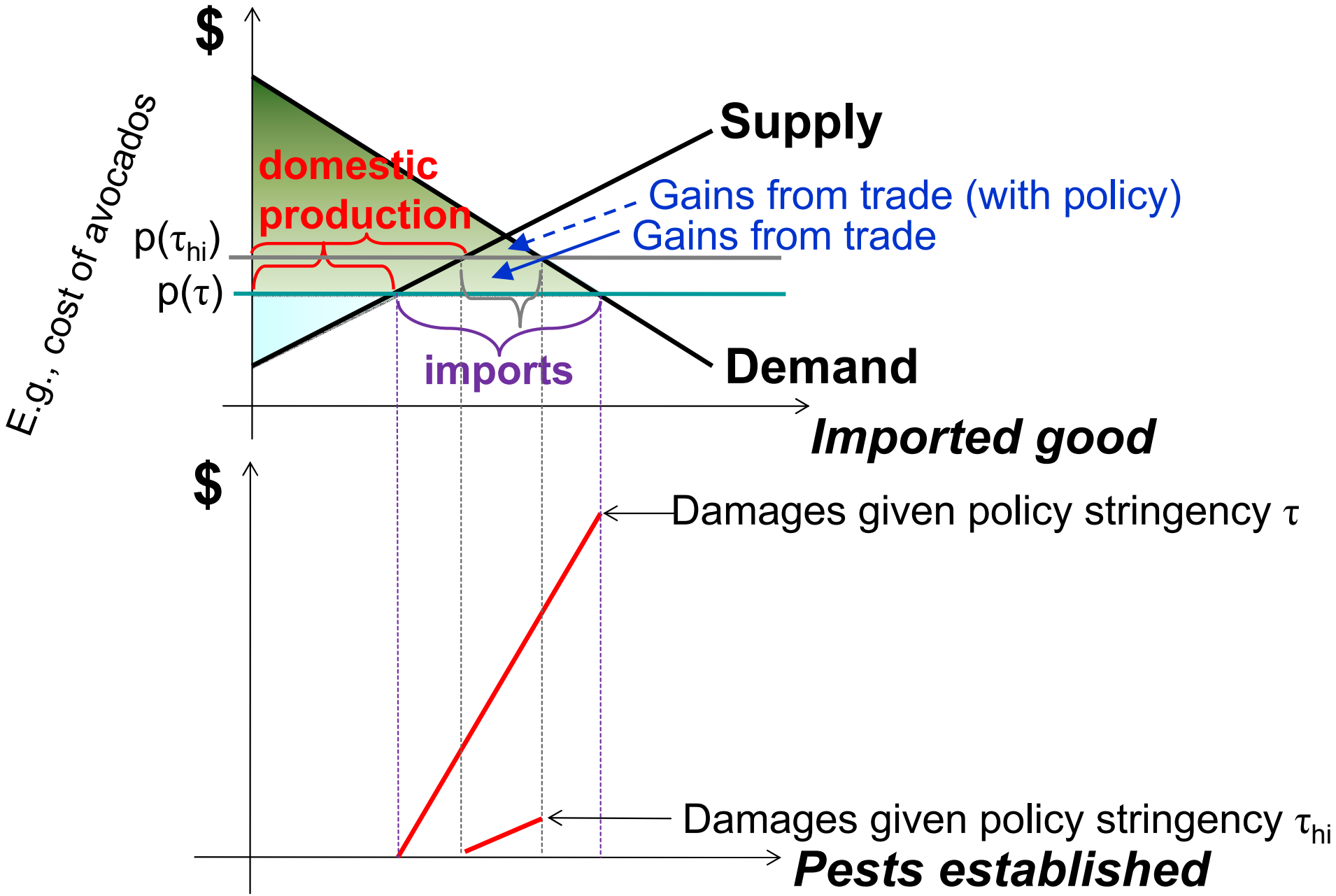
Outline

- Background √
- Analytic framework:

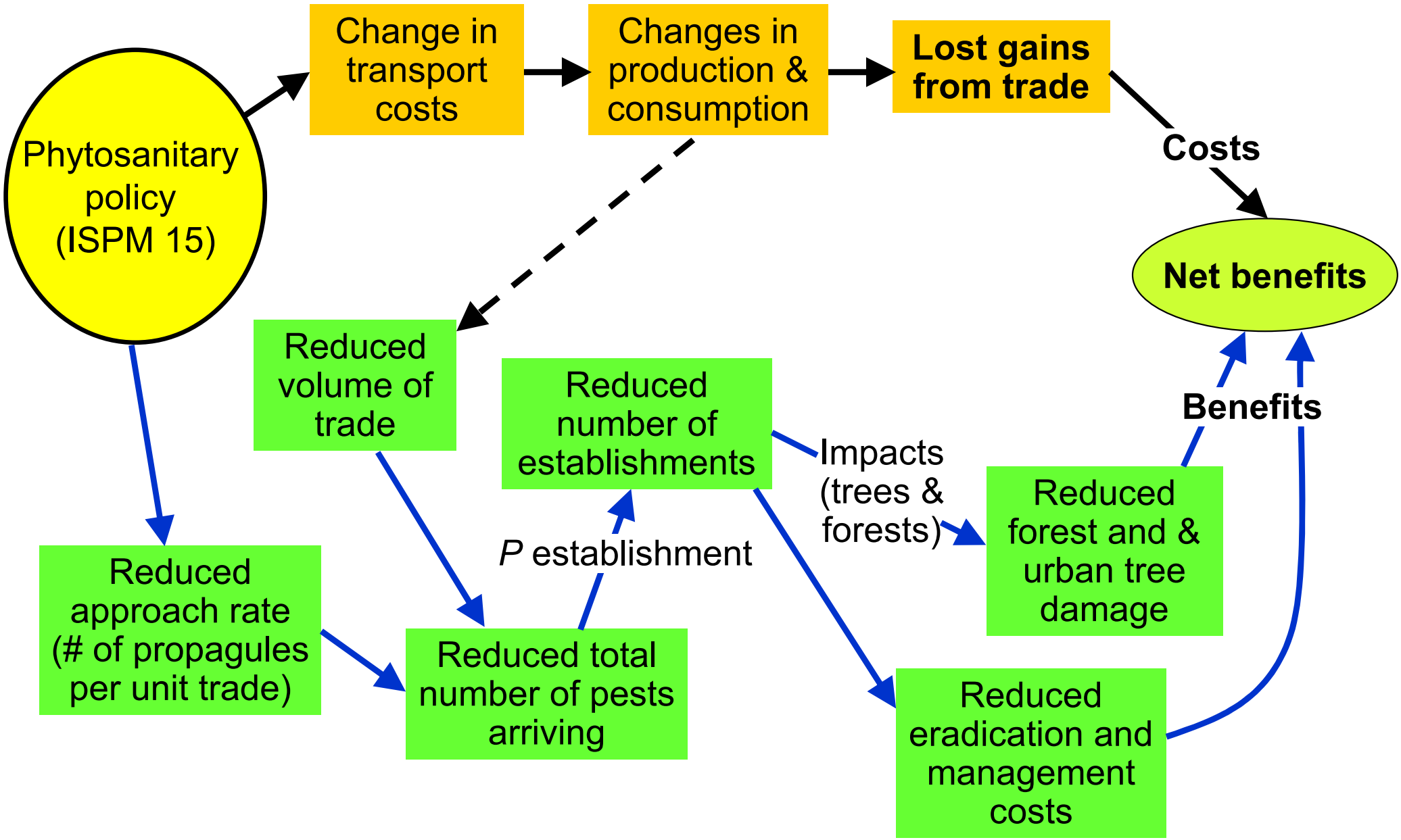
  Policy effects on…

  1. Pest arrival rate
  2. Establishment rate
  3. Trade volume / value
  4. Costs (of policy)
     vs. benefits (averted pest costs)
  5. Preliminary conclusions (work in progress)

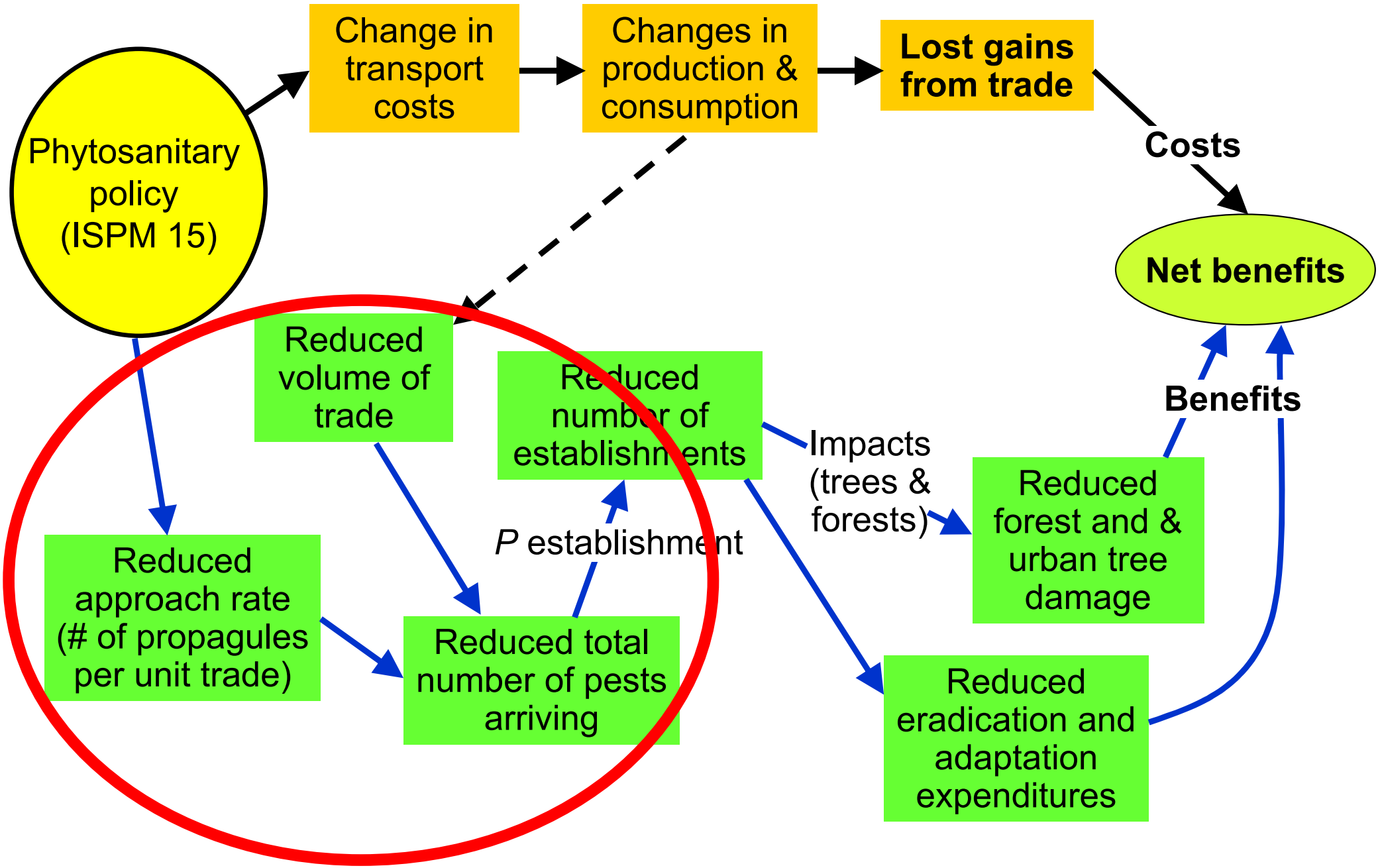
Economic theory, supply & demand model



The analytic framework



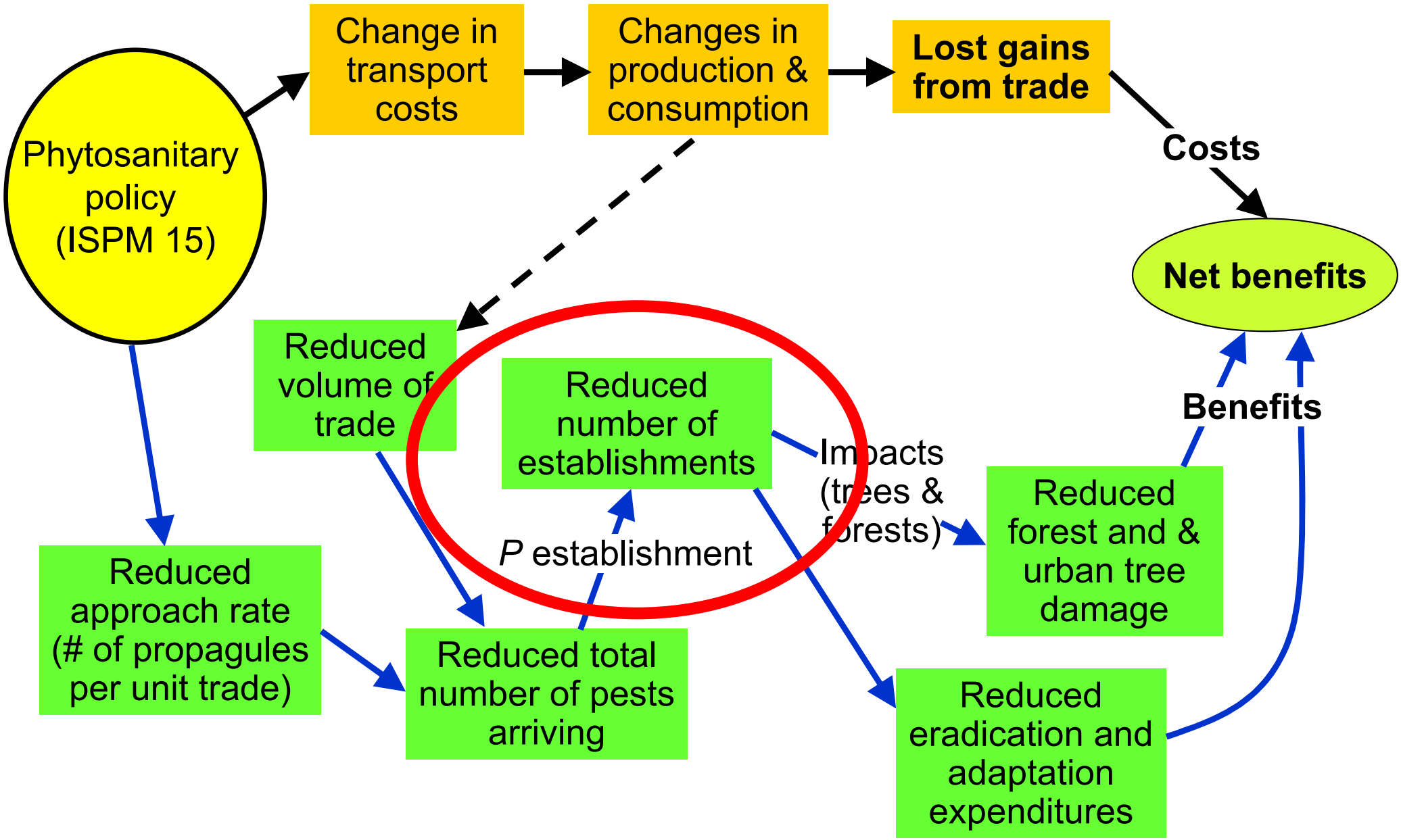
1. Policy effects on arrivals



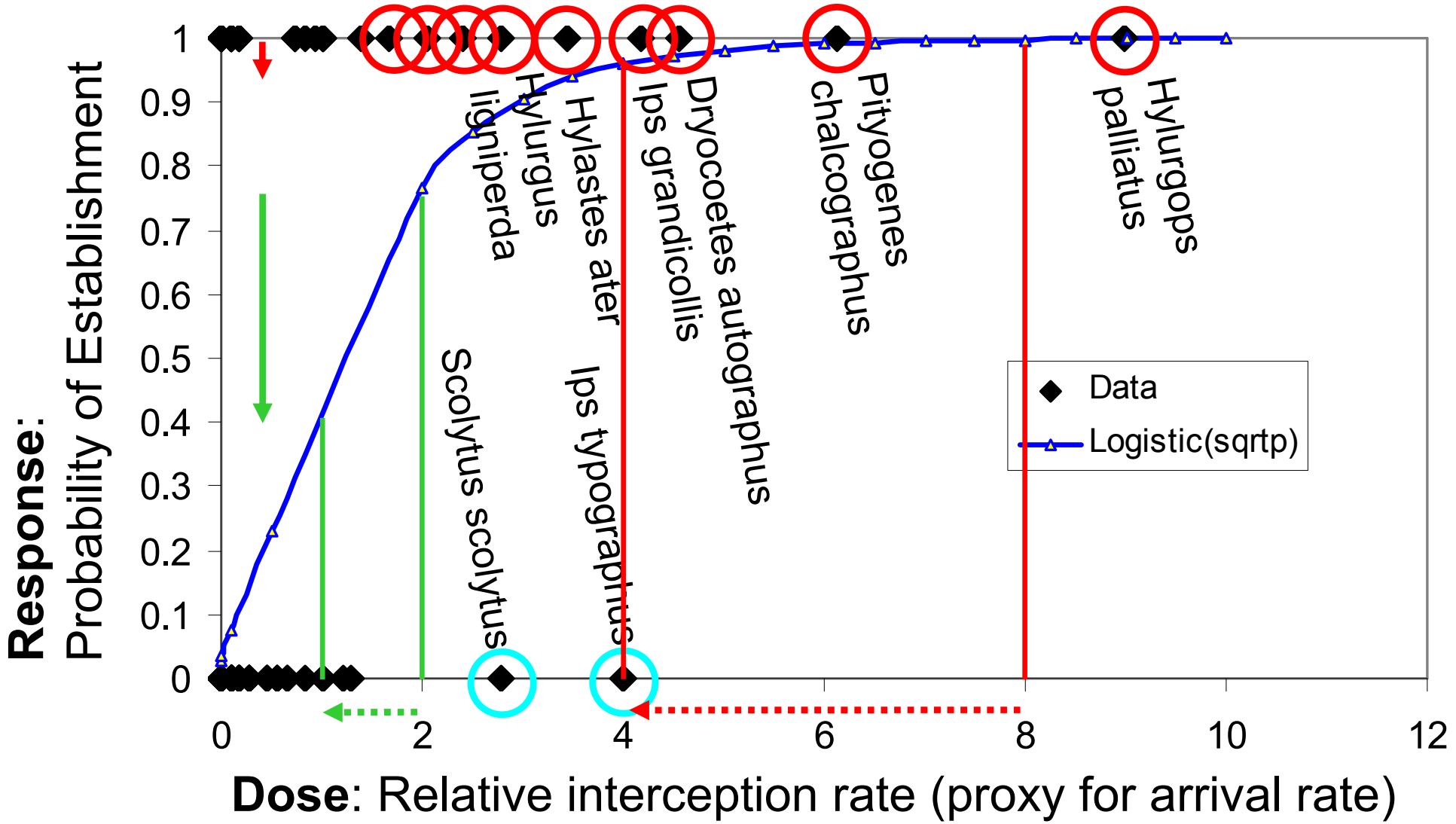
Changes in approach rate? (border)

- Treatments are effective in lab! Also at the border?
- Before–after ISPM 15 (July 2006) comparison of borer interceptions (USDA-APHIS) …
- **AQIM data**
  - Statistically robust, negatives recorded
  - 33 borer type records / 29945 entries.
  - 99% statistical power if ISPM effectiveness is >70%.
  - Approach rate, **Pre-** *vs*. **Post-ISPM** (arrivals per shipment)
- **Pest ID / Most NZ interception data**
  - Not random, no negatives recorded, confounding variables
  - Large number of observations.
  - Preliminary results show significant ISPM effect.
- **Data from other countries** (e.g., survey results)

2. Effects on establishment rate



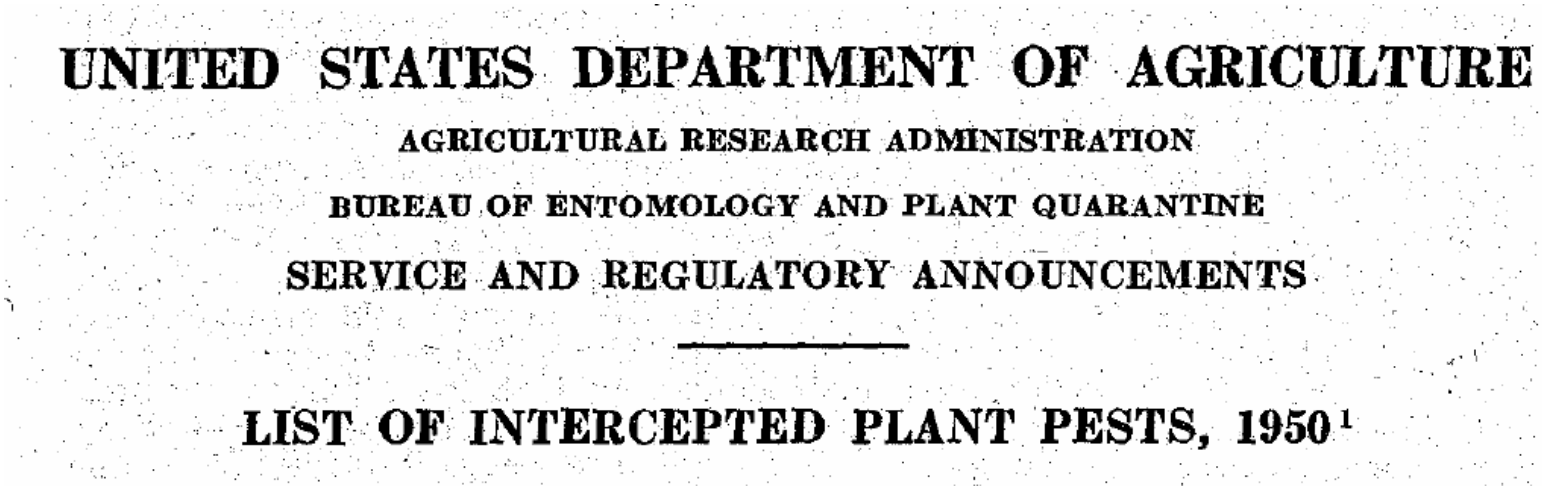
Dose-response model development:
True bark beetle interceptions (105 spp.) and establishments world-wide (more data)



Data from Brockerhoff et al. (2006) Canadian J. Forest Research 36

… Dose-response model development

- Captured interception records from 1950 – 1984 from hard copies (20,000 additional borer records)



UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

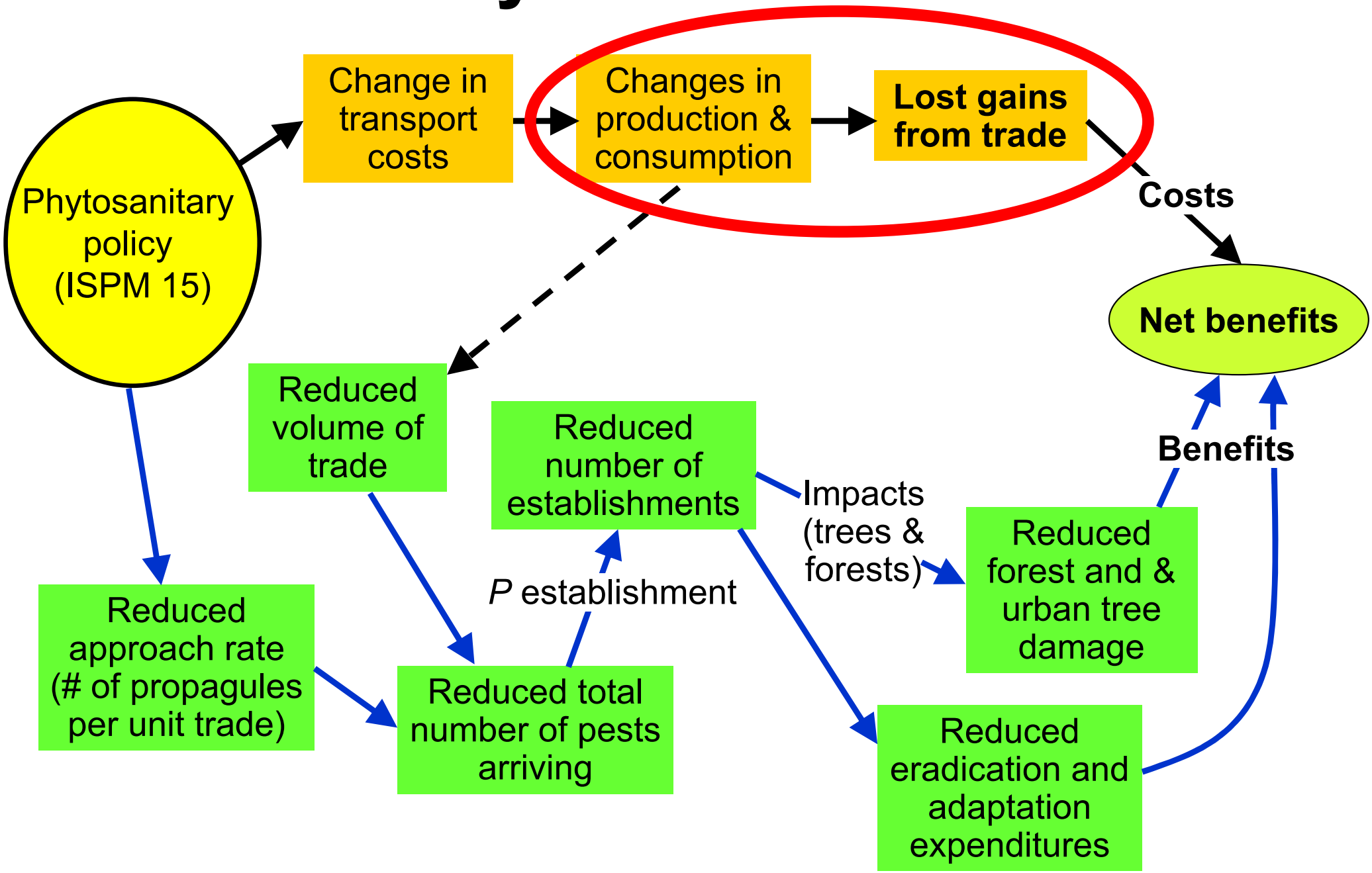
SERVICE AND REGULATORY ANNOUNCEMENTS

LIST OF INTERCEPTED PLANT PESTS, 1950[1]

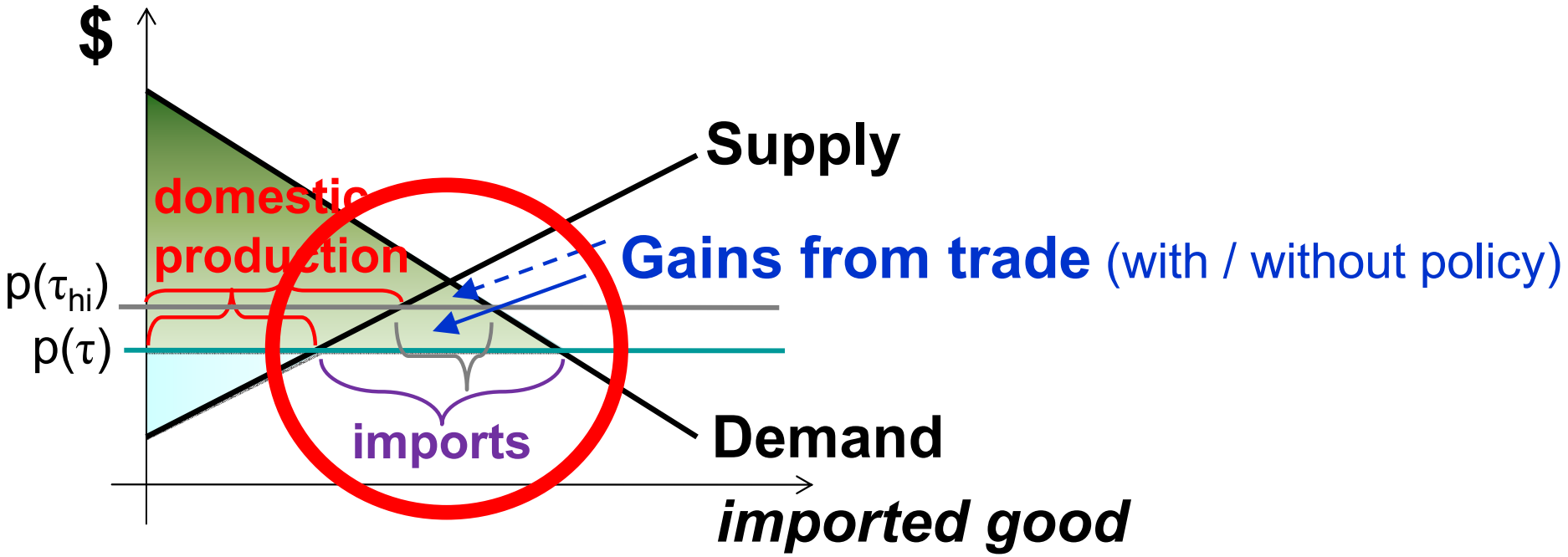
Remaining steps for dose-response analysis

- Use more sophisticated Weibull function, capable of reflecting Allee effect (Leung et al. 2004, Ecology)
- Consider size of invader species pool.
- Overall policy effect across entire species pool.

3. Policy effects on trade



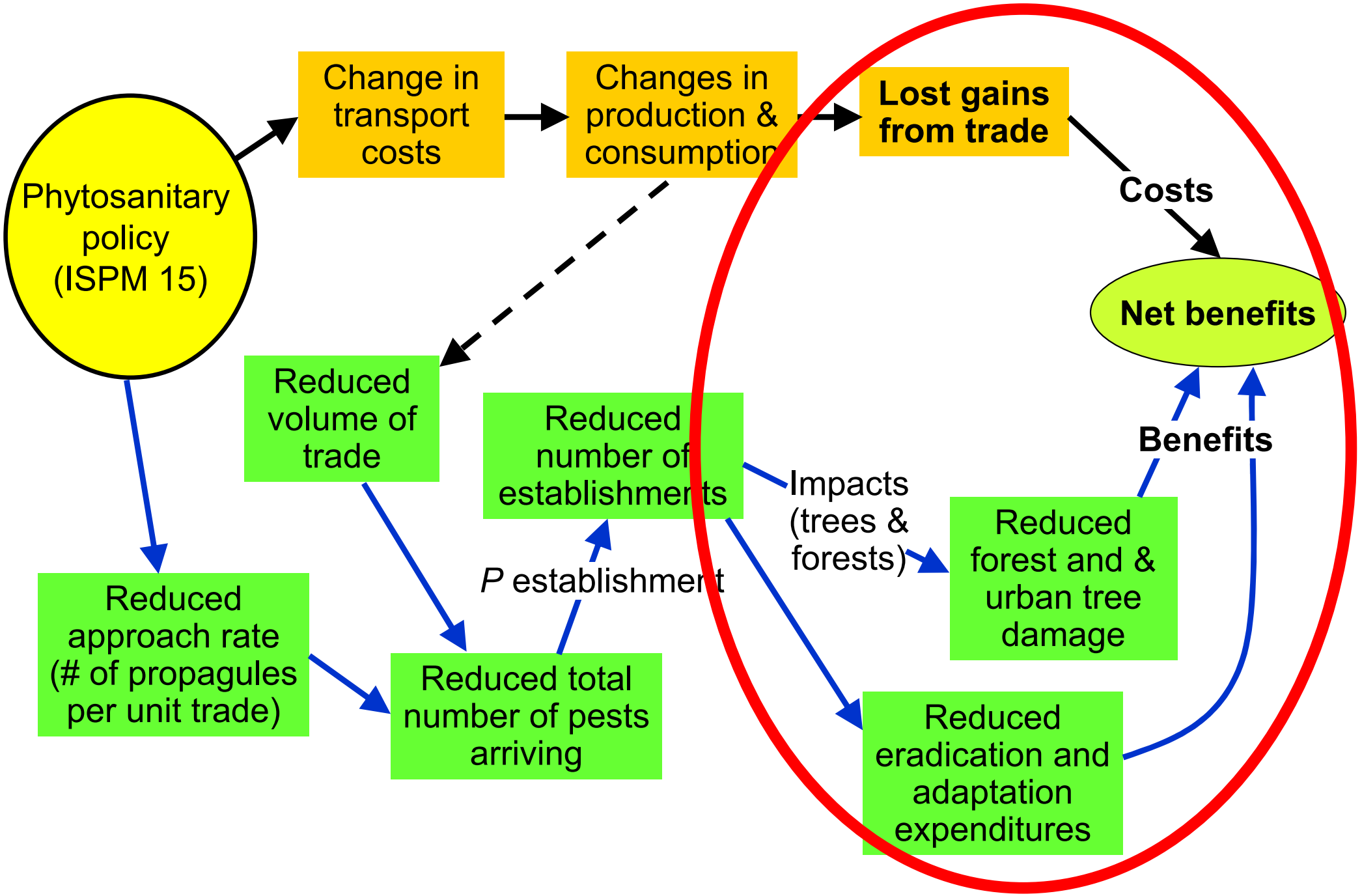
Lost gains from trade



Estimating lost gains from trade

- Trade impacts of ISPM 15
  - More expensive imports
  - Changing trade partners and commodities
- Global Trade Analysis Project
  - Multiple commodities using WPM
  - Bilateral trade
- Scenarios
  - Current ISPM 15
  - Higher heat treatment
  - US domestic trade?
- New pest pathways?

4. Costs vs. benefits



Putting it all together: Cost-Benefit Analysis

- Benefits = averted damages and response costs

  Reduced approach rates

  → reduced expected establishments

  → expect $X of avoided damage and eradication and adaptation costs.

- Costs based on lost gains from trade
  - Some trade is eliminated
  - Remaining trade is more expensive, reducing the surplus generated

Conclusions

- Proof of ISPM 15 effects at the border more difficult than expected.
- Surprising lack of suitable interception data pre-ISPM 15 (for assessment of policy).
- Final results still useful for assessing policy effects and economics.
- Implications for other policy – ‘P4P’.
- Extension: Theoretical economics paper, several other papers on pathways, establishment rates, mitigation, etc.

Expected Timeline

- Completion of analyses in 2010 and preparation of papers for publication.

- E-mails for comments or suggestions:

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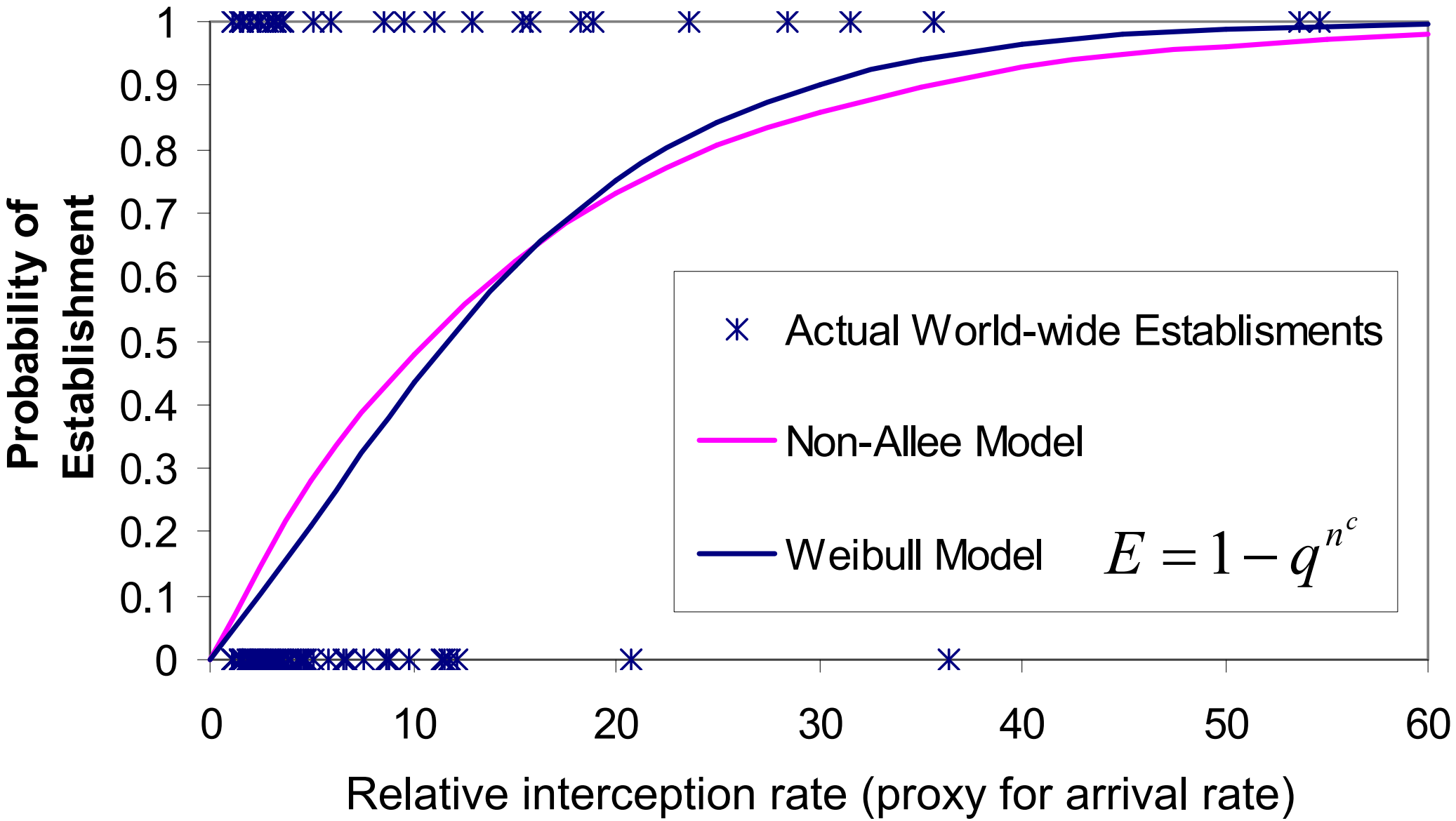
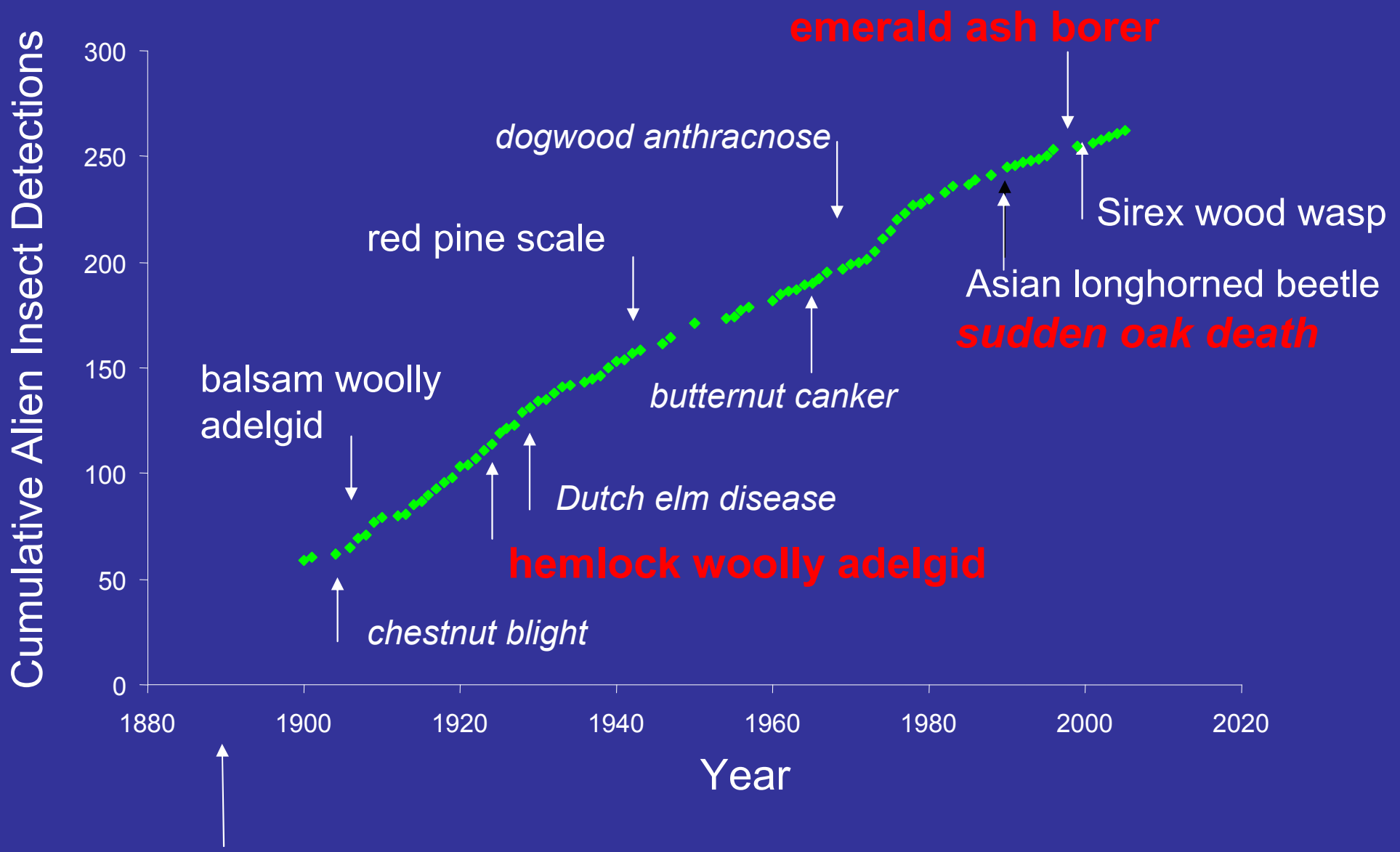
Joe Cavey – Joseph.F.Cavey@aphis.usda.gov
Kerry Britton – kbritton01@fs.fed.us

Improved model with Allee effect capability



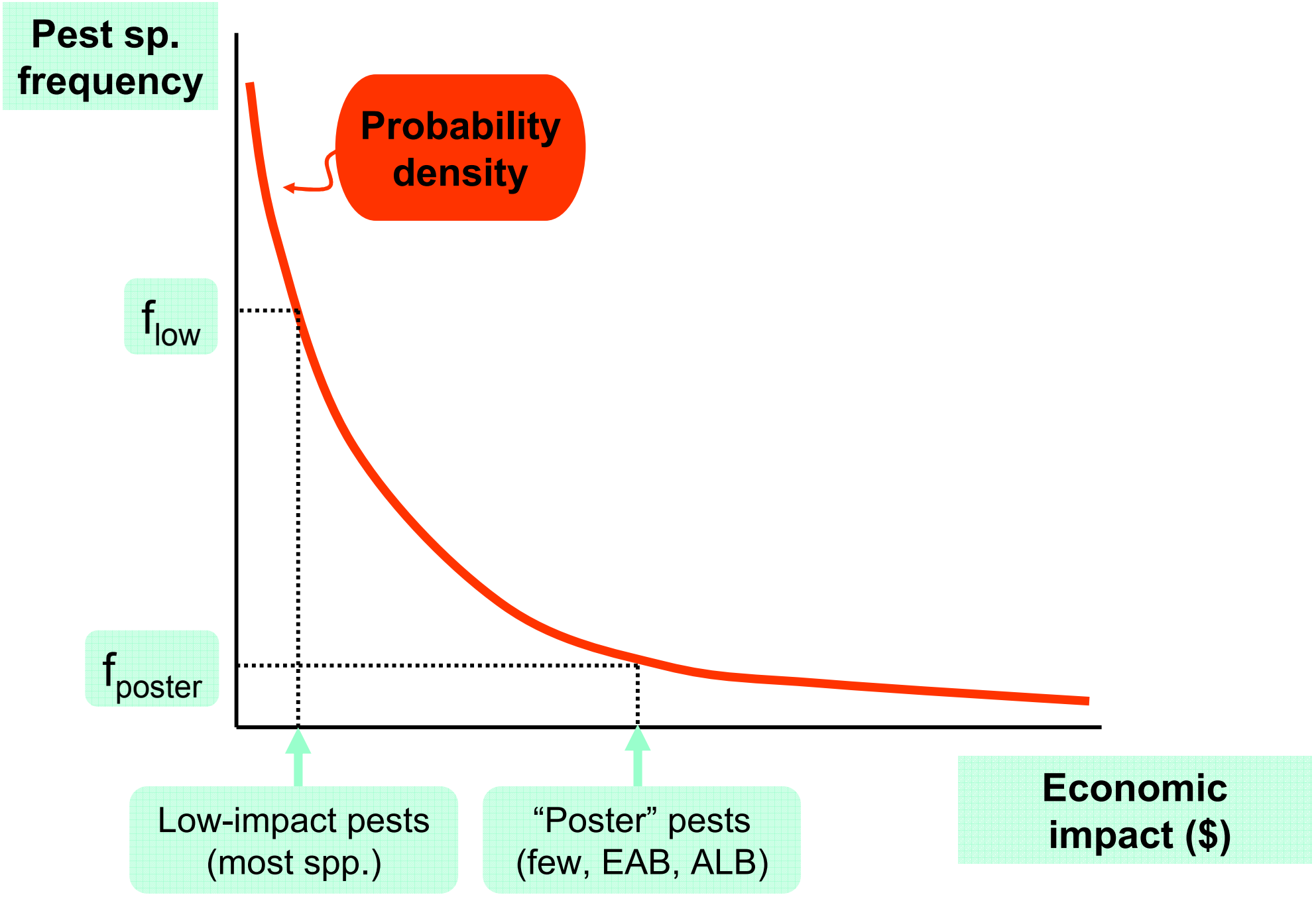
Weibull function in invasions: Leung et al. 2004, Ecology 85

Some Notable Insect & Disease Introductions



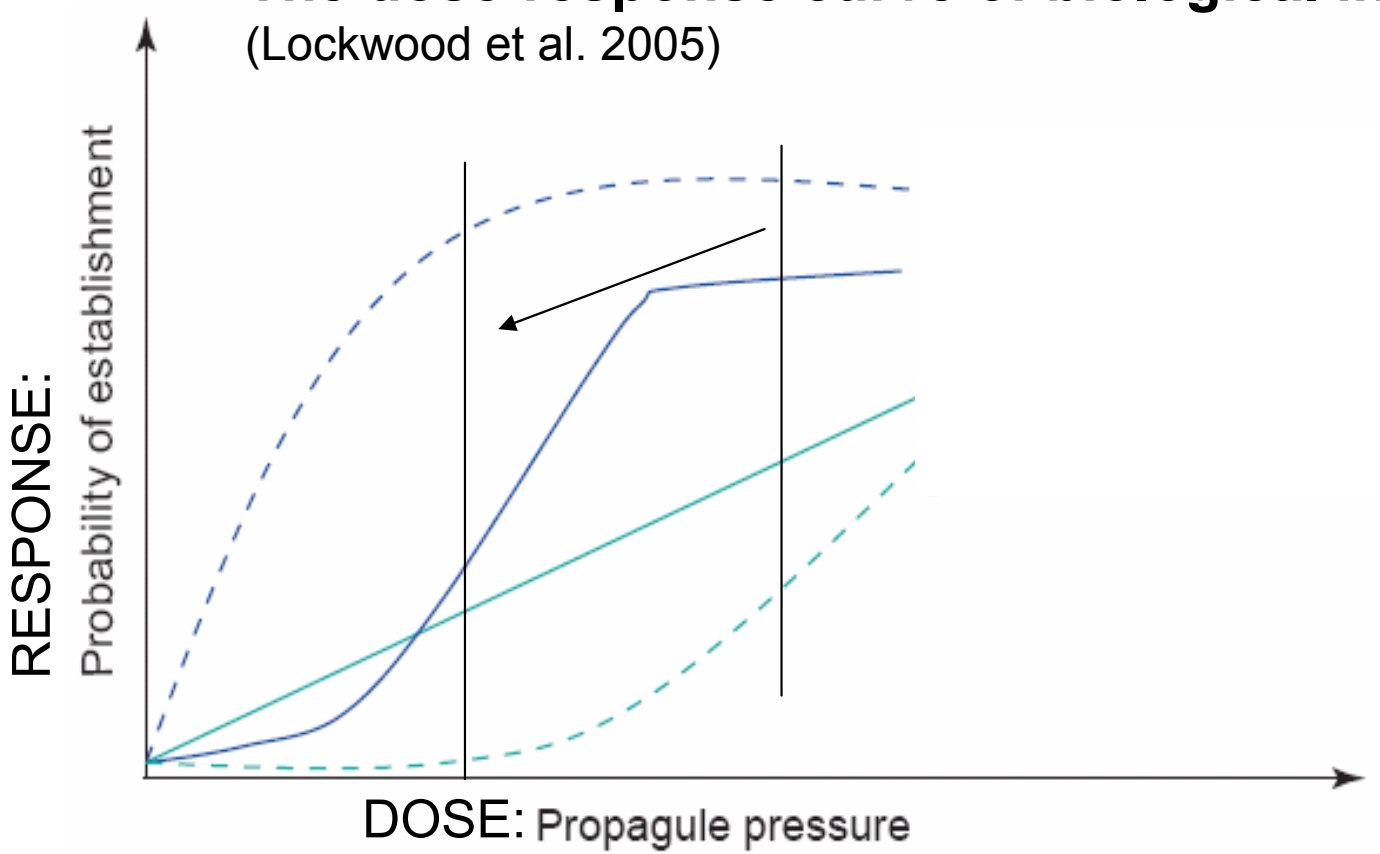
Pre 1900: **gypsy moth**, beech scale, larch casebearer, *white pine blister rust*

Economic impacts are random variables



Changes in Establishment

The dose-response curve of biological invasions
(Lockwood et al. 2005)



(e.g. # of accepted infested shipments)