Beyond quarantine and host-range screening: risk assessment for weed biocontrol agents

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Preview outline

- Current approaches have worked well historically
- May be too limited to meet future challenges
- Future decisions may be disputed or challenged
- Ecological risk assessment paradigm
- Advantages of an integrated approach

A history of success

- Only one example of detrimental non-target impacts of a biological control agent
  - Louda et al. 1997, *Rhinocyllus* on native thistles
- However, this paper alone has been cited 195 times
- Weed biological control agents are routinely referred to as “invasive insects” by many authors in the conservation biology literature

Current approaches limited

- Web of Science, 2007-present
  - 14 publications on insect classical biocontrol agents of weeds
    - Life cycle of insect: 1 paper
    - Potential geographic range of insect: 1 paper
    - Host-range tests: 12 papers
- Narrow focus may lead to errors
  - Releases made
  - Releases not attempted

Current state of risk assessment

"*There are currently no known broad scientific principles or reliable procedures for identifying the invasive potential of plants, plant pests, or biological control agents in new geographic ranges*…"

-National Research Council. 2002. Predicting Invasions of Nonindigenous Plants and Plant Pests

Trouble ahead

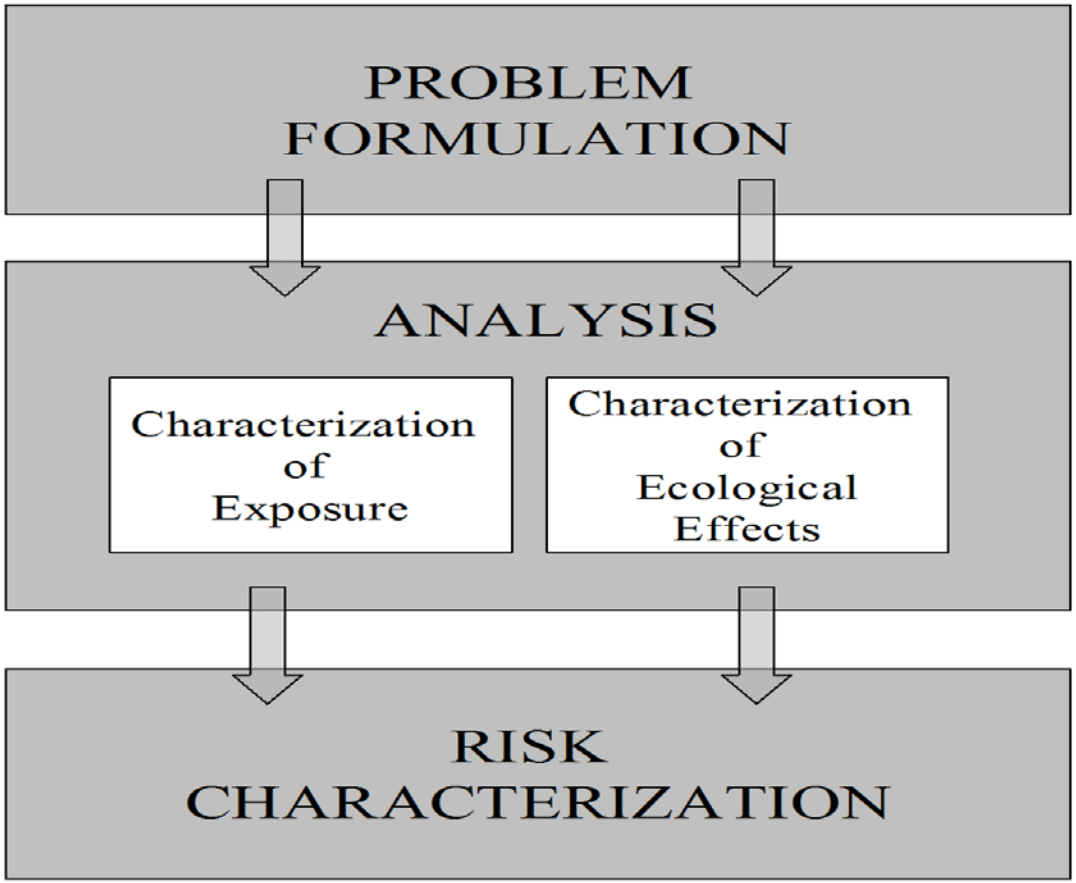
- WTO Sanitary and Phytosanitary (SPS) Agreement raises the bar for adequate risk assessment
- 1980 Supreme Court benzene decision and “de minimis” risk – requires quantitative assessments, not just qualitative ones
- Application of these strict standards to biocontrol releases may be inevitable

Implications for biological control agents

- What risk thresholds might apply for non-target effects of biological control agents?
- How might the legal (i.e., T&E) status of a non-target host affect the threshold?
- What are “acceptable risks”?

- If the practice of referring to biocontrol agents as invasive species (Louda 2003, Conservation Biology) catches on, stricter standards may be imposed, and/or legal challenges may become commonplace

Ecological Risk Assessment



Extension to biological control

- Stressors: Biological control agents
- Receptors: Non-target host plants
- Effects: Adverse non-target impacts
- Measurement endpoint: Damage to or oviposition on non-target host plant
- Exposure analysis typically short-changed in current practice for biocontrol agents

Problems with current approach

- Really safety assessment rather than risk assessment
- Native host-range surveys
- No-choice host-range tests
- Problem: In no-choice tests the investigator finds the plants for the insects rather than letting the insects find the plants for themselves

Why this is a problem

- Insect movement behavior determines success at finding food such as host plants.
    - Kareiva and Odell, 1987, American Naturalist
    - Andersen and Karieva, 1993, Evolution of Insect Pests
    - Andersen, 2004, Biological Control
- Standard tests in which the investigator finds the food for the insects exclude this factor from consideration

A proposed solution

- Models (possibly individual-based models like Andersen 2004, *Biological Control*) of biocontrol agent movement can help assess risks of non-target impacts

- Such models could easily be extended to real landscapes (from GIS and/or remote sensing data)

- Such regional spatially-explicit models could be used to predict risks due to spread of biocontrol agents into geographic range of a non-target host

Appropriate technology (i.e., “the right tool for the job”): Regional environmental risk assessment

- Built to deal with multiple spatially-distributed stressors

- Integrates GIS technology with conceptual risk models
- Uses relative risks and/or risk rankings rather than absolute risks (i.e., estimated probabilities)
- Produces a map of combined relative risk across the assessment region relevant to regional management goals

(W.G. Landis, ed. 2004. Regional ecological risk assessment using the relative risk model. CRC Press.)

How applying the risk assessment paradigm can help

- The complexity of the problem
- The scale of the problem
- Decision support
- Risk communication
  - Stakeholders
  - Policymakers
  - Natural resource managers

Recommendations

- Pursue scientifically ambitious integrated risk assessments
- Don’t short-change exposure analysis
- Don’t avoid taking a regional approach
- Risk assessments should be explicitly linked with cost-benefit analyses in a unified decision-theory framework

Thank you