Common Pool Resource Challenges in Herbicide Resistance Management

8th International IPM Symposium, Salt Lake City, Utah
David Ervin, Prof. Emeritus, Economics and Env. Mgmt.
Senior Fellow, Institute for Sustainable Solutions
Portland State University
March 26, 2015
Outline

- Common pool resource (CPR) challenges with herbicide resistance
- Why community-based approaches?
- Design principles
- Evidence and lessons from community-based programs for CPR management

Acknowledgment: Joint work with George Frisvold
Harvesting ragweeds and corn!
Multiple SOA resistance is rising! (Heap)
2000-2005: 17% of growers hand-weeded
 5% cotton acres at  $2.40/A

2006-2010: 92% of growers hand-weeded
 52% cotton acres at  $23.70/A

Source. S. Culpeper. U. Georgia
Herbicide resistance (HR) occurs due to selective ecological pressure on weeds.

Weed resistance mobility occurs from natural processes, e.g., pollen drift, water flows, and from machinery operations.

Hence the genetic pool of weeds susceptible to control by certain herbicides is a common pool resource shared across farms and the community landscape.
Common Pool Resource Challenges

- Grower actions affect other growers via weed gene movement (*nonexcludable externality*).
- If farmers feel their control actions will not be matched by their neighbors, they have less incentive to manage HR on their lands.
- It’s an assurance problem! (Individual decisions depend on those of the group.)
- With mobility, strategies to control HR farmer by farmer will not optimize welfare; some form of collective action is necessary (Ostrom).
Why Community-Based Approaches?

1. Voluntary education and tech assistance for individual farmers are not working well.
2. Top-down prescriptive regulation could be used, but……
   • Lack of flexibility increases control expense
   • Prescriptive practices often stymie innovation
   • High monitoring and enforcement costs to check compliance across the landscape (Do we really want a weed police?)
Why Community-Based Approaches?

3. Public or private technology/practice subsidies can have similar problems…….
   - Difficult to identify strategic targets
   - Additionality? Will payments just become income transfers without altering behavior?

4. Resource privatization is generally infeasible due to geographic scope of weed mobility.

5. What’s left? -- Community-based common pool resource management, an exercise in institutional (socio)economics (Ostrom et al)
Design Principles for CPR Mgmt (Ostrom et al.)

1. Clearly define resource boundaries
2. Adapt rules to local conditions
3. Ensure broad participation by “appropriators”
4. Monitor accountability to appropriators with sanctions
5. Employ graduated sanctions
6. Use cheap and easy conflict resolution mechanisms
7. Recognize self-determination of the community, e.g., state statute
8. Consider “polycentric” governance (multiple layers) for larger issues
Meta analysis of 91 CPR studies found good empirical support for all principles.

Suggested refinement of principles 1, 2 & 4:

1a. Clearly defined boundaries: Individuals or households who have rights to withdraw resource units from the common-pool resource (CPR) must be clearly defined.

1b. Clearly defined boundaries: The (geographical) boundaries of the CPR must be well defined.
2a. Congruence between appropriation and provision rules and local conditions: Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions.

2b. Congruence between appropriation and provision rules and local conditions: The benefits obtained by users from a CPR, as determined by appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules.
Evidence on CPR Design Principles (Cox, Arnold and Tomas)

- **4A. Monitoring**: Monitors are present and actively audit CPR conditions and appropriator behavior.

- **4B. Monitoring**: Monitors are accountable to or are the appropriators.
CPR applications relevant to HRM

- **Public initiatives** (e.g., invasive and noxious weed control)
- **Joint private-public** strategies (e.g., boll weevil eradication)
- **Producer associations** with sanctions written in state law (e.g., pink bollworm control in CA, AZ and NM)
Agrawal (2003) – meta review of studies

- Factors affecting formation do not have unequivocal effects, e.g., size of group.
- Higher group heterogeneity is not always a disadvantage.
- Need to account for resource, social/political contexts and community/personal values

But CPR programs are complex....
Insights from literature

- Exchange of information important
  - Multi-directional vs. uni-directional flow
  - Listening is underrated

- Building institutional capacity takes time and requires maintenance (even after crises subside).

- “If/then” statements based on scientific information that show economic consequences are more effective than exhortations of what people “should” do.
1. HR is a *wicked problem* (interacting biophysical, technological, economic and social systems) that defies simple solutions.

2. Private and/or public collective approaches are necessary when mobile HR traits exist.

3. Ostrom’s design principles can help guide CPR management, but context matters.

4. Success will likely require participatory research that uses local knowledge and social capital to foster trust and minimize transaction costs.
References


References


Thank you! Dave Ervin dervin@pdx.edu