Common Pool Resource Issues in Managing Herbicide Resistant Weeds

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Common Pool Resource Issues in Managing Herbicide Resistant Weeds

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Outline

- Problem context of herbicide resistance (HR)
- Common pool resource (CPR) complications
- Lessons from other CPR situations
- Implications for developing private and public collective institutions
Escalating herbicide resistance poses serious economic and environmental risks (NRC).

- Potential economic impacts include lower yields and increased costs.
- Potential environmental impacts include soil erosion, water quality, human health, etc.
- Public and private programs to control HR weeds have not slowed its spread overall.
Problem Context cont’d

- No silver bullet technology on horizon
- Mobile herbicide resistance traits move across farm boundaries
- Solutions require collective action by heterogeneous growers in varying settings.
- This complexity requires interdisciplinary research by natural and social scientists working with growers.
Sustainable HR management will require private and/or public collective institutions to address CPR issues via adaptive management strategies.
Common Pool Resource Complications

- Grower actions affect the welfare of other growers via weed gene movement.
- Hence, strategies to promote individual HR BMPs are insufficient to optimize the welfare of the farm community as a whole.
- Some form of private and/or public collective action is necessary.
Design Principles for CPR Mgmt (Ostrom)

1. Clearly defined resource boundaries
2. Rules adapted to local conditions
3. Broad participation by “appropriators”
4. Monitoring accountable to the appropriators with sanctions
5. Scale of graduated sanctions
6. Cheap and easy conflict resolution mechanisms
7. Self-determination of the community recognized by higher authorities
8. Larger issues may need “polycentric” governance with multiple layers.
Lessons from other CPR programs

- Invasive and noxious weed control
  - State regulatory approach
  - Formation of weed management areas recognizes need for community-wide effort
  - WMAs can define problem boundaries as watersheds, land use areas, etc.
  - Non-compliance procedures defined
Lessons from other CPR programs

- Boll weevil eradication
  - Caused by mobile insect that affected common pool of regional resources
  - Three agencies in polycentric approach
    - State DoAs – regulatory
    - APHIS – technical advice
    - CSREES – info dissemination & education
  - Required 2/3 vote on referendum to expand into new areas
Lessons from other CPR programs

- Irrigation (Ostrom, Stern and Dietz)
  - Common pool of regional water resources
  - Collective approaches were alternatives to privatization or government programs
  - Spain, California and Nepal examples
  - Recognition of need for adaptive management
But CPR programs are complex....

- Agrawal (2003) – meta review
- Factors affecting formation do not have unequivocal effects, e.g., size of group
- Higher group heterogeneity not always a disadvantage
- Need to account for resource, social/political contexts and personal values
Concluding observations

1. HR results from the interplay of biophysical, technological, economic and social factors. Leave any out at your peril!
2. Research on the roles of human and social capital in causing and arresting HR has been neglected.
3. Reliance on individual farmer approaches will fail with mobile HR traits.
Concluding observations

4. Private and public collective approaches are necessary but will impose cost.

5. Ostrom’s design principles can help guide their development.

6. Success likely will come from participatory research using local knowledge that minimizes transaction costs.


Socio-Economic Drivers of HR

- Crop prices
- Costs of alternative herbicide technologies
- Company HR BMP incentives
- Farm household income
- Grower personal values about environmental stewardship
Socio-Economic Drivers of HR

- Farm program provisions, e.g., conservation compliance
- Community social network (support and peer pressure)
- Grower education
- Other?
Resistance management depends on gene mobility, BMP use and pesticide market structure (Miranowski & Carlson).

Environmental assessments of HR therefore must integrate human behavior.

Altering spatial and dynamic patterns of HR environmental impacts requires more interdisciplinary science.
HR Environmental Assessment

- Voluntary ag conservation programs, e.g., education, without incentives have limited effect (Ervin).
- Knowledge of socioeconomic factors with large HR management leverage under CPR conditions is needed.
- The challenge is to design programs for local conditions that integrate learning and adaptive management.
Salient Questions

1. How does the interplay of biophysical, economic and social factors affect growers’ herbicide management?
2. Can we identify different types of growers that are influenced by different sets of factors?
3. What variables influence the efficacy of private or public collective management institutions?