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# 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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**USDA ERS and Farm Foundation Conference “Public  
and Private Sector Policy Implications of Research on  
the Economics of Herbicide Resistance Management.”**

**November 8, 2013**

# Outline

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- Problem context of herbicide resistance (HR)
- Common pool resource (CPR) complications
- Lessons from other CPR situations
- Implications for developing private and public collective institutions

# Problem Context

- 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.






# Working Hypothesis



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**

# Design Principles for CPR Mgmt (Ostrom)

- 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

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- 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.**

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# 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?



# HR Environmental Assessment

- **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?**