Water and Market Failures

Competitive Market Benchmark

- Efficient markets allocate resources to their highest valued use
- In competitive markets, the point where supply meets demand is a *Pareto-efficient* price/quantity equilibrium: Not possible to find a reallocation that would make at least one person better-off without making at least one person worse-off
- An efficient market maximizes social surplus, the value gained from participating in a market

Assumptions of Competitive Market

- Competitive market based on assumptions of *excludable* and *rivalrous* private goods
- Excludability: Some individual can exclude others from use of a good (legal and physical)
- Rivalrous consumption: What one person consumes cannot be consumed by another
- Zero social costs of production and consumption
- Perfect information about costs of production and consumption
- Market failures occur when assumptions of competitive market are violated, and resources are used inefficiently

Water Quality: Externalities

Negative Externalities

- Any negatively valued impact resulting from any action that affects someone who did not fully consent to it through participation in voluntary exchange
- Generators of externalities only consider private costs of economic activity and ignore social costs
- Receivers of externalities incur health and clean-up costs
- Economic result: Artificially low production costs lead to overproduction of the good that generates the externality
- Example: Effluent from waste treatment plants, factories, urban and agricultural runoff

Generic Solutions to Externalities

Command-and-Control (Rules!)

- Set water quality standards (concentration or technology)
- Monitor compliance
- Punish non-compliance; punishment equal to social costs
- Information and credible commitments are keys to enforcement

Voluntary Incentives

- Reward conservation behavior
- Grants and tax incentives
- Certification/information disclosure programs (e.g., Toxic Release Inventory)

Market Incentives

- Pollution taxes
- Tax is equal to social costs of each unit of pollution
- Pollution markets
- Polluters “own” certain number of pollution allowances, and trade with one another

Water Appropriation: Common-Pool Resources

Characteristics of CPR

- Non-excludable, but rivalrous
- Leads to overconsumption of rivalrous goods
- Private costs of consumption do not reflect total social costs
- Costs of consumption by one individual are spread to the entire group

Prisoner's Dilemma Interpretation

- Nash equilibrium: A pair of strategies is in Nash equilibrium if, given the strategy of the other player, neither player will unilaterally change strategies
- Nash equilibrium of Prisoner's Dilemma is Pareto-inefficient—both actors could do better
- Tragedy of the commons: Rational actors following private incentives lead to Pareto-inefficient overconsumption and eventual resource destruction

Groundwater Appropriation Prisoners' Dilemma
Annual recharge rate =100 acre-feet

Back	City		
		50 acre-feet (Cooperate)	100 acre-feet (Defect)
	50 acre-feet (Cooperate)	$1000, $1000	$600, $1200
Farmer	100 acre-feet (Defect)	$1200, $600	$700, $700

Water Pollution Prisoner's Dilemma: Absorption Capacity 100-lbs per day (payoffs are costs of drinking water treatment)

Back	City 2		
City 1		50 lbs (Cooperate)	100 lbs (Defect)
	50 lbs (Cooperate)	$700, $700	$1200, $600
	100 lbs (Defect)	$600, $1200	$1000, $1000

Institutional Solutions to CPR Dilemmas

Overview

- Cooperation is goal
- “Mutual coercion, mutually agreed upon” strategies (punish defection)
- Collaborative strategies (facilitate voluntary cooperation)

Local Governance Institutions

- Clearly defined boundaries
- Congruence between local rules and watershed conditions
- Local participation in collective-choice
- Monitoring accountable to appropriators
- Violators receive graduated sanctions
- Local, low-cost conflict resolution arenas
- Recognition of right to organize by macro-political authorities

Water Infrastructure: Public Goods

Pure Public Goods

- Non-rivalrous and non-excludable
- Beneficiaries of public good vary geographically
- National public good: Mississippi River Flood Control
- Regional public good: Irrigation Systems
- Local public good: Drinking water systems
- Private supply of pure public good is unlikely because it is costly to exclude beneficiaries and force them to pay for the good
- Logic of collective action: Beneficiaries prefer to “free ride” on the provision of a good
- Privileged group: One person has very high demand, but others free ride
- Solutions similar to CPR, but added important solution of government provision (Central Valley Project, State Water Project, etc).

Water Infrastructure Supply Prisoners' Dilemma
Cost of irrigation system =$100

Back	Farmer 2		
		Invest $50 (Cooperate)	Free ride (Defect)
	Invest $50 (Cooperate)	$1000, $1000	$600, $1200
Farmer 1	Free-ride (Defect)	$1200, $600	$700, $700