

Common Property  
Externalities  
Public Goods

"ECOLOGICAL ECONOMICS"



IT'S A NEW FIELD...  
THEY PUT PRICETAGS  
ON NATURE...



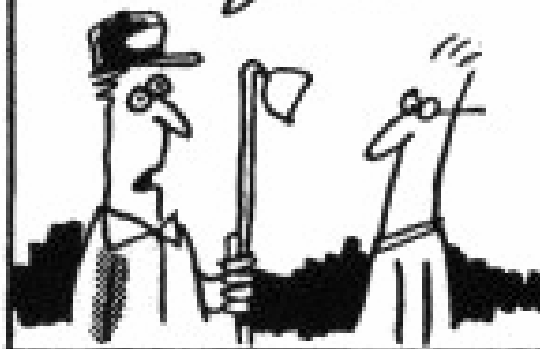
...FOR EXAMPLE, BEE  
POLLINATION IS A  
THIRTEEN-BILLION-  
DOLLAR-A-YEAR  
SERVICE  
INDUSTRY...



...AND WETLANDS FILTER  
A TRILLION BUCKS  
WORTH OF FRESH  
WATER ANNUALLY...



WHAT'S FERTILE  
FARMLAND WORTH?



WAL-MARTED OR  
SUBDIVIDED?



# Main topics

1. externalities
2. inefficiency of competition with externalities
3. market structure and externalities
4. allocating property rights to reduce externalities
5. common property
6. public goods

# Externalities

externality occurs if

- someone's consumption or production activities hurt or help others outside a market
- well-being of a consumer or production capability of a firm are affected directly by actions of other consumers or firms, rather than indirectly through changes in prices

# POSITIVE EFFECTS OF ENVIRONMENTAL DESTRUCTION

HEY, MY ALLERGIES ARE GONE!

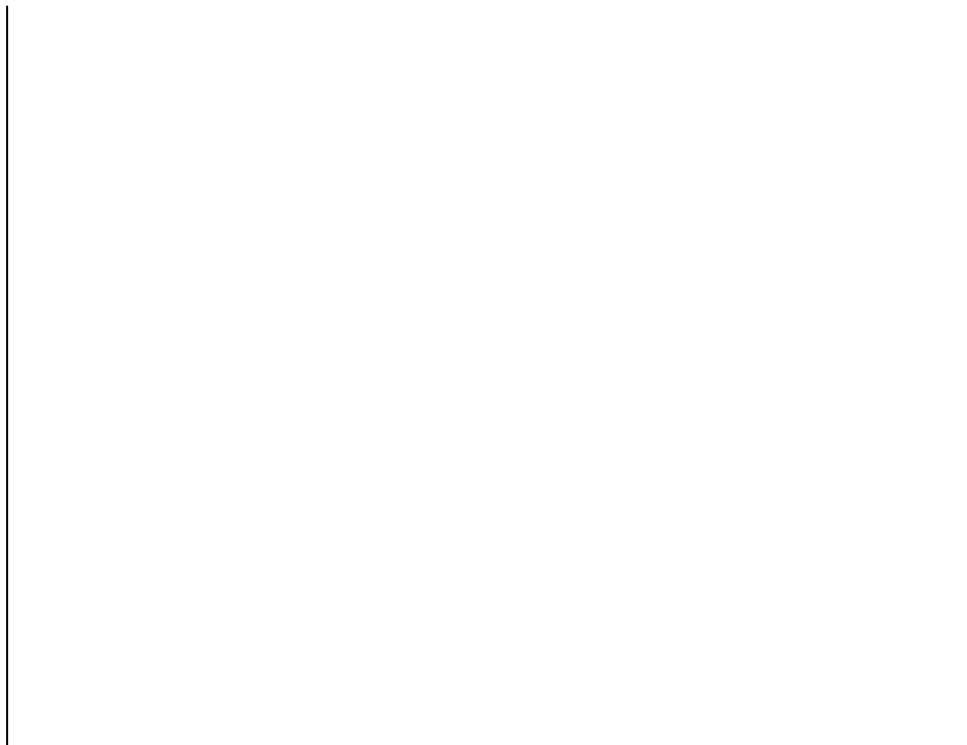


-SINGE

# Inefficiency of competition with externalities

- competitive firms and consumers do not have to pay for harms of their negative externalities
- so they produce excessive pollution

# Welfare Effects of Pollution in a Competitive Market



# Reducing externalities

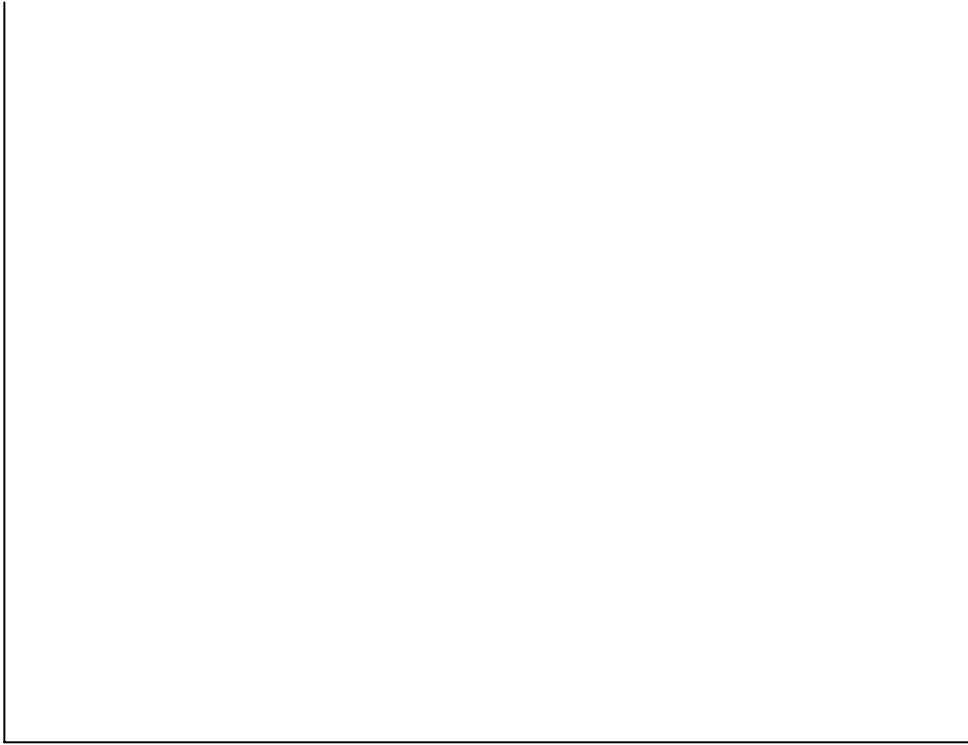
- competitive markets produce excessive negative externalities
- hence government intervention may benefit society

# Government intervention

- direct approach: *emissions tax, fee, effluent charge*
- indirect approach: *emissions standard*  
(quantity restrictions on outputs or inputs)
- because output and pollution move together, regulating either works



# Taxes to Control Pollution



# Optimal regulation

- unfortunately, government usually does not know enough to regulate optimally
- government needs to know:
  - marginal social cost curve
  - demand curve for product
  - how pollution varies with output
- also has to enforce its regulations

# Cost-benefit analysis

- instead of using the supply-and-demand analysis to show that competitive market produces too much pollution
- use a cost-benefit diagram
- welfare is maximized by reducing output and pollution until the marginal benefit from less pollution equals the marginal cost of less output

# Cost-Benefit Analysis of Pollution



# Emission standards for ozone

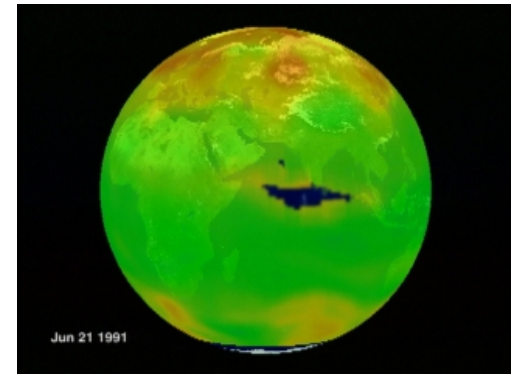
- ozone is a major air pollutant
- it is formed in the atmosphere through a chemical reaction between organic gases and nitrogen oxides in sunlight

# Standards

- Clean Air Act of 1990 sets national air-quality standards for major pollutants:  
 $\leq 0.12$  parts per million (ppm)
- California Air Resources Board (CARB) has an even tighter standard: 0.09 ppm

# Costs and benefits

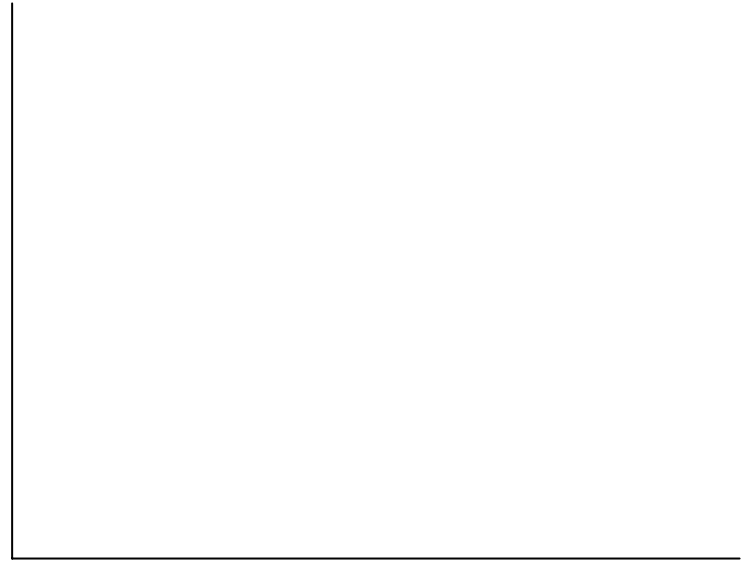
- cost of reducing ozone: greater expenses of
  - manufacturing
  - driving
- benefit
  - better health in urban areas
  - increased agricultural yields in rural areas
- consequently, optimal level differs in urban and rural areas



# Los Angeles

- benefits of reducing ozone level  $>$  costs over past several decades
- however, CA standards may be too strict even in LA
- Krupnick and Portney (1991) est. that reducing ozone to CA standard has an annual
  - benefit to human health and materials of about \$4 billion
  - annual cost about \$13 billion

# Emissions Standards for Ozone



# Monopoly and externalities

- monopoly output may be less than social optimum even with an externality
- competition is not necessarily better than a monopoly with an externality

# Monopoly, Competition, and Social Optimum with Pollution



# Allocating property rights

- *property right*: an exclusive privilege to use an asset
- *Coase Theorem*: optimal levels of pollution and output results from bargaining between polluter and their victims if property rights are clearly defined
- parties generally won't negotiate unless property rights are clearly assigned

# Coase Theorem results

- if there are no impediments to bargaining, assigning property rights results in *efficient outcome*: joint profits are maximized
- efficiency is achieved regardless of who is assigned the property rights
- who gets the property rights affects the income distribution (property rights are valuable)

# Profits under Alternative Emissions Choices (Daily)

	Factory's Profit(\$)	Fisherman's Profit (\$)	Total Profit (\$)
No filter, no treatment plant	500	100	600
Filter, no treatment plant	300	500	800
No filter, treatment plant	500	200	700
Filter, treatment plant	300	300	600

# Bargaining with Alternative Property Rights

	Right to Dump \$	Right to Clean Water \$
<i>No cooperation</i>		
Profit of factory	500	300
Profit of fishermen	200	500
<i>Cooperation</i>		
Profit of factory	550	300
Profit of fishermen	250	500

# Problems with Coase approach

- Coase approach works only if
  - property rights clearly defined
  - parties can bargain successfully
- three common causes of bargaining failure
  - transaction costs are very high
  - firms engage in strategic bargaining behavior
  - either side lacks information about costs or benefits

# Pollution markets

- SO<sub>2</sub> markets under the Clean Air Act (see text)
- southern Californian smog market started in 1994
- South Coast Air Quality Management District (AQMD)
  - regulates emissions in four southern California counties
  - allocated credits for one pound of nitrogen oxides or sulfur oxides, two of the main polluting agents there, to firms
- AQMD believed that allowing trading would cut cost of complying with clean air regulations by \$58 million, 42% of total

# Solved Problem

- firm produces  $Q^*$  output using labor ( $L$ ) and energy ( $E$ )
- using energy produces gunk:  $G = G(E)$
- what is the effect of a tax  $t$  per unit of energy on the energy used and gunk produced if the firm continues to produce  $Q^*$ ?

Answer



# Comparing Fees and Standards

- an optimal emissions fee or emissions standard induce firms to produce efficiently
- major difference:
  - fees (but not standards) produce tax revenues
  - thus, when a standard is used rather than a fee, firms are better off, government is worse off by amount of the fees

# Uncertainty

- if government has imperfect information, whether fees or standards are better depends on the shapes of *MB* and *MC* curves for abating pollution

# Advantage of fees

- firms have greater flexibility if their production processes or the value of their output changes
- with a standard, firms cannot increase the amount of energy used

# Advantage of standards

- government may need less information to impose a standard
  - government needs to know only how much pollution it will let firms produce
  - government has to know how the fee affects amount of pollution firms produce
- difference is less important than it appears: optimal standards or fees requires full information about benefits and costs

# Solved problem

- government
  - knows  $MC$  of abating pollution
  - but is unsure about  $MB$ : 50% chance it's  $MB^1$  and 50% it's  $MB^2$
  - is risk neutral
- should it use an emissions fee or an emissions standard to maximize expected welfare?

# Answer

- *Show how the government sets a fee or a standard:*
- government uses its expected marginal benefit curve to set a standard at  $S$  or a fee at  $f$
- government expects that  $e$  is the equilibrium

Fee, Marginal Benefit, Marginal Cost, \$



# Answer (cont.)

- *Show the deadweight loss from an improperly set fee or standard:*
- if true  $MB$  curve is  $MB^1$ , optimal standard is  $S_1$  and the optimal fee is  $f_1$ , so setting  $f$  or  $S$  (too high) causes  $DWL = DWL_1$
- if  $MB^2$  is true  $MB$ , setting  $f$  or  $S$  (too low) causes  $DWL = DWL_2$
- thus,  $DWL$  from a mistaken belief about  $MB$  does not depend on whether the government uses a fee or a standard

## Answer (cont.)

- *Explain:*
- when the government sets an emissions fee or standard, the amount of gunk produced depends only on the marginal cost of abatement and not on the marginal benefit
- because the standard and fee lead to the same level of abatement, at  $e$ , they cause the same deadweight loss.

# Common property

- *common property*: resources to which everyone has free access
- overuse of common property because people don't have to pay to use it
- examples
  - fisheries
  - common pools (petroleum, water...)
  - internet
  - roads

Design Classroom Experiment:  
Need 15 Volunteers

# Private goods

private goods have properties of

- *rivalry*: only one person can consume the good (it is depletable)
- *exclusion*: others can be prevented from consuming the good

# Public goods

- *public good*: commodity or service whose consumption by one person doesn't preclude others from also consuming it
- example: national defense
- public good lacks rivalry
- some public goods lack exclusion
  - produce positive externality
  - excluding anyone from consuming them is inefficient

# Club good

- public good with exclusion (e.g., tennis club)
- similarly, concert:
  - security guards prevent people who don't have tickets from entering a concert hall
  - marginal cost of adding one more person is zero as long as the hall is not filled



# Demand for public goods

- market demand curve is social marginal benefit curve
- private good
  - social marginal benefit = private marginal benefit
  - market demand is *horizontal* sum of the demand curve of individuals
- public good
  - social marginal benefit is sum of marginal benefit to each consumer
  - market demand (willingness-to-pay) curve is *vertical* sum of individuals' demand curves

# Inadequate Provision of a Public Good



# Free riding

- benefit from actions of others without paying
- people are often unwilling to pay for their share of a public good

# Providing public goods

- to ensure that nonexclusive public good is provided, government usually
  - produces it
  - compels others to do so
- government has difficulty learning cost and benefits
- government learns benefit (value of public good) by
  - survey
  - citizens vote

# Voting

- whether majority votes for a public good depends on preferences of
  - *median voter*:
    - person with respect to whom half the populace values the project more and half less
- *efficient* to provide public good if value  $\geq$  cost
- majority voting may not lead to efficiency (see traffic light example in book)

# 1. Externalities

- externality occurs when a consumer's well-being or a firm's production capabilities are directly affected by actions of others rather than indirectly affected through changes in price
- pollution is a negative externality

## 2. Inefficiency of competition with externalities

- because producers don't pay for harm from their negative externalities, their private costs < social costs
- thus, competition leads to excessive production of externalities
- if government action leads to firms internalizing externality, problem is avoided

### 3. Market structure and externalities

- noncompetitive market may produce too little, too much, or the optimal amount of output and externalities
- thus, competition is not necessarily better than monopoly with externalities
- pollution tax that would be optimal in a competitive market may exacerbate monopoly externality problem

## 4. Allocating property rights to reduce externalities

- externalities arise because property rights are not clearly defined
- Coase Theorem: allocating property rights to either party results in an efficient outcome if parties can bargain
- bargain is often costly or otherwise difficult

## 5. Common property

- common property is a resource to which everyone has free access
- they are overexploited because people ignore externalities
- example: delays due to congestion on a bridge

# 6. Public goods

- public goods lack rivalry
- once public good is provided to anyone, it can be provided to others at no extra cost
- excluding anyone from consuming a public good is inefficient
- markets provide too little of a nonexclusive public good
- government has difficulty learning how much public good is valued