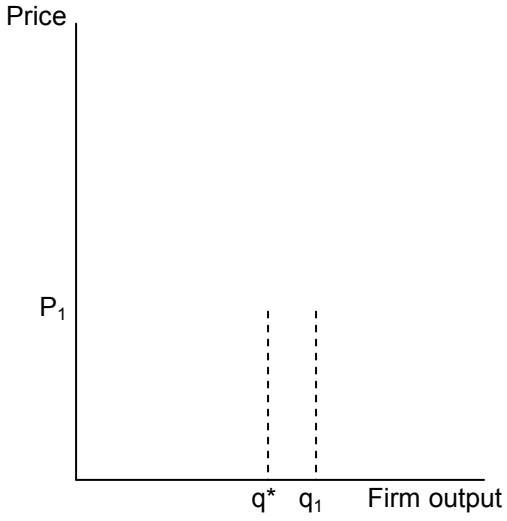
CHAPTER 18 - EXTERNALITIES AND PUBLIC GOODS

Key Concepts and Topics

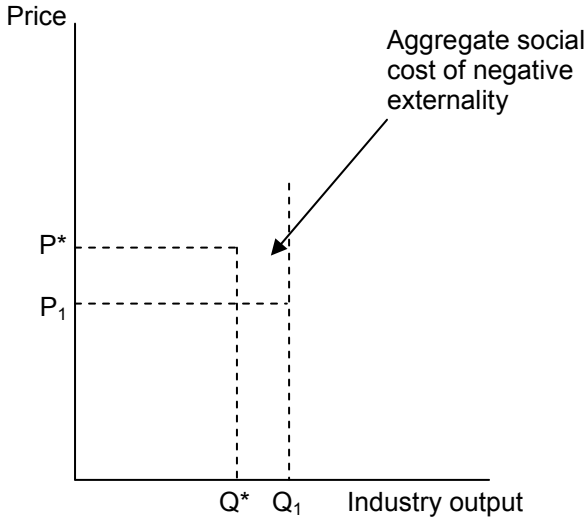
- Externalities
- Ways of Correcting Market Failure
- Externalities and Property Rights
- Common Property Resources

Externalities

- Externalities arise between producers, between consumers, or between producers and consumers
- Externalities are the effects of production and consumption activities not directly reflected in the market price
  - They can be negative or positive
- Negative Externalities
  - Action by one party imposes a cost on another party
    - Plant dumps waste in a river affecting those downstream
    - The firm has no incentive to account for the external costs that it imposes on those downstream
- Positive Externalities
  - Action by one party benefits another party
    - Homeowner plants a beautiful garden where all the neighbors benefit from it
    - Homeowner did not take their neighbors' benefits into account when deciding to plant
- Negative Externalities and Inefficiency
  - Example: Steel plant dumping waste in a river
    - Assume the firm has a fixed proportions production function and cannot alter its input combinations
      - The only way to reduce waste is to reduce output
    - Price of steel, P_1, and quantity of steel initially produced, Q_1, is at the intersection of supply and demand



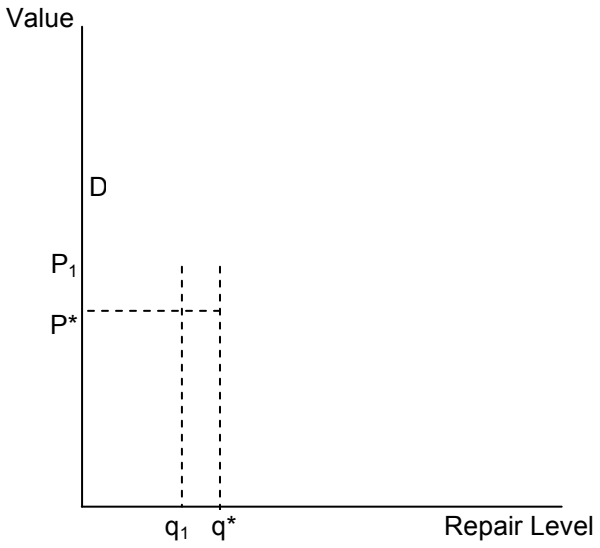
The profit maximizing firm produces at q_1 where price is equal to MC, while the efficient output level is q*, at which price equal MSC



The industry's competitive output is Q_1, at the intersection of industry supply MC^I and demand D. The efficient output Q* is lower, at the intersection of demand and marginal social cost MSC^I

- A typical steel firm's marginal cost of production is the MC curve
- Firm maximizes profit by producing where MC = Price in a competitive market
- As firm increases output, external cost on fishermen downstream, measured by the Marginal External Cost (MEC) curve, increases
- From a social point of view, the firm produces too much output and creates economic inefficiency
- The efficient level of output is at the level where the price of the product is equal to the Marginal Social Cost (MSC) of production (where MSC = MC + MEC)
- The source of the inefficiency is the incorrect pricing of the product
  - The market price P_1 is too low, which reflects the firm's marginal private cost of production, but not the marginal social cost.
  - Only at P* will steel firms produce the efficient level of output
  - The social cost of inefficiency is measured by the difference between the marginal social cost and the marginal benefit (the demand curve)
- Negative externalities encourage inefficient firms to remain in the industry and create excessive production (economic inefficiency) in the long run

- Positive Externalities and Inefficiency
  - Externalities can result in too little production
  - Example: Home repair and landscaping
    - Repairs generate external benefits to the neighbors
      - Marginal External Benefit (MEB) is the increased benefit that accrues to the neighbors as the homeowner increases repair by one level
      - Marginal Social Benefit (MSB) is the sum of the marginal private benefit (measured by D) and MEB



    - MC is horizontal because the cost of repairs is unaffected by the amount of repairs
    - D measures the marginal private benefit of the repairs to the home owner
    - The homeowner chooses to invest q_1, where MC = D
    - The efficient level of repairs is q*, where MSB = MC
    - The inefficiency arises because the homeowner does not account for the neighbors' benefits of her investment
    - P_1 is too high to encourage her to invest in the socially desirable level of house repair
    - P* is required to encourage the efficient level of supply, q*

Ways of Correcting Market Failure

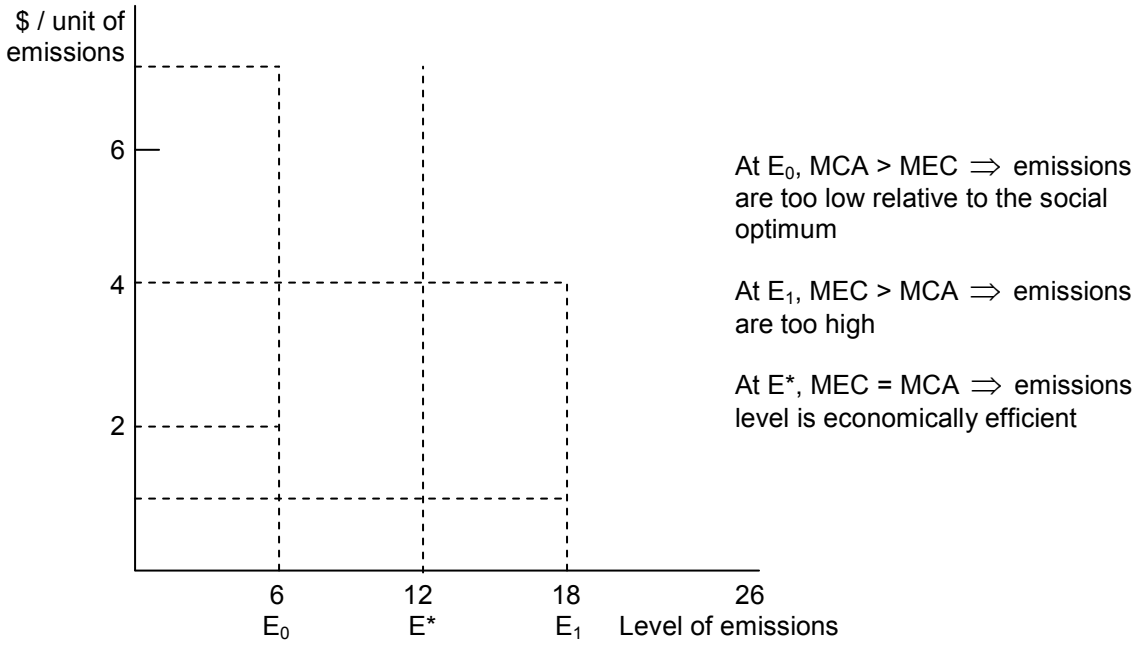
- Example: The market failure is pollution
  - Output decision and emissions decision are independent
  - Firm has chosen its profit-maximizing output level
  - MEC is marginal external cost of emissions

- Upward sloping because of increasing harm as pollution increases (i.e., MC of externality gets higher as the externality becomes more extensive)

– MCA is marginal cost of abating emissions
  - Additional cost to firm of controlling pollution
  - Downward sloping because when emissions are high, little cost to controlling them
    - Large reductions require costly changes in production process

– If the firm does not consider abatement, their profit maximizing level is 26 units of emissions, where MCA = 0

– The socially efficient level of emissions is 12, where MEC = MCA



- Ways of Correcting Market Failure

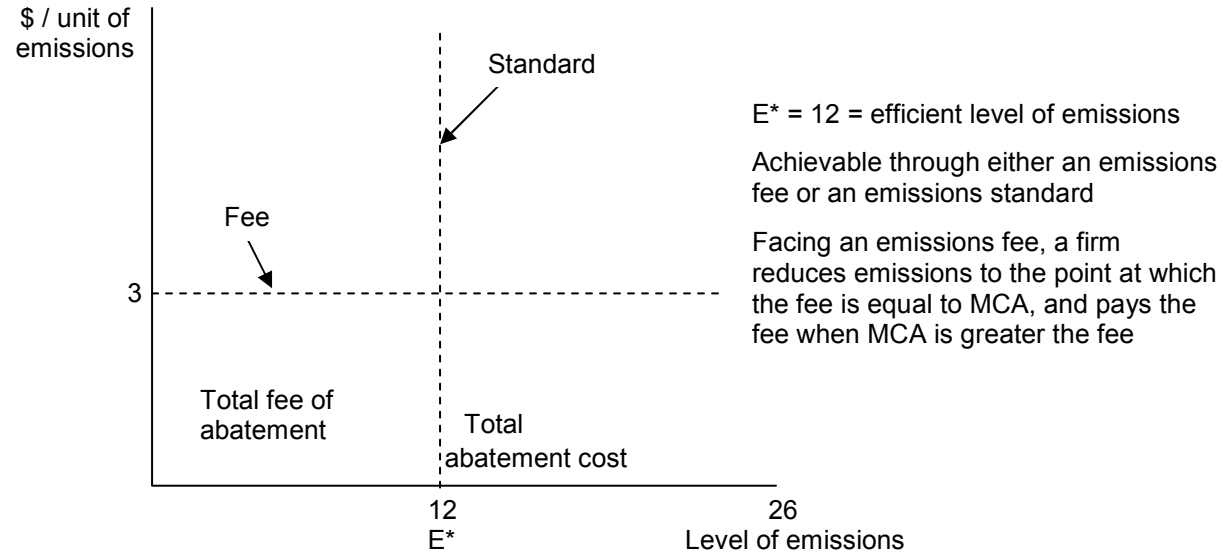
– Three ways to encourage firms to reduce emissions to the efficient level
  - Emissions standards
  - Emissions fees
  - Transferable emissions permits

– Emissions Standard
  - Legal limit on level of emissions that a firm can emit (E* = 12)
  - Enforced by monetary and criminal penalties
  - Increases the cost of production and the threshold price to enter the industry

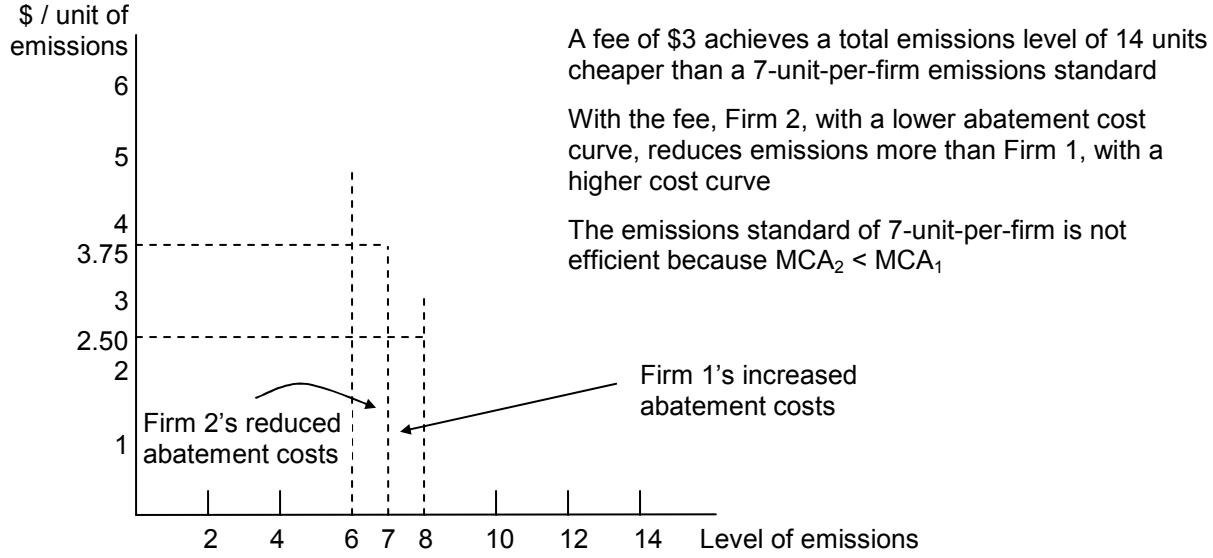
– Emissions Fee
  - Charge levied on each unit of emission

- Transferable emissions permits
  - System of marketable permits, allocated among firms, specifying the maximum level of emissions that can be generated

- Standards versus Fees
  - Assumptions:
    - Policymakers have asymmetric information
    - Administrative costs require the same fee or standard for all firms

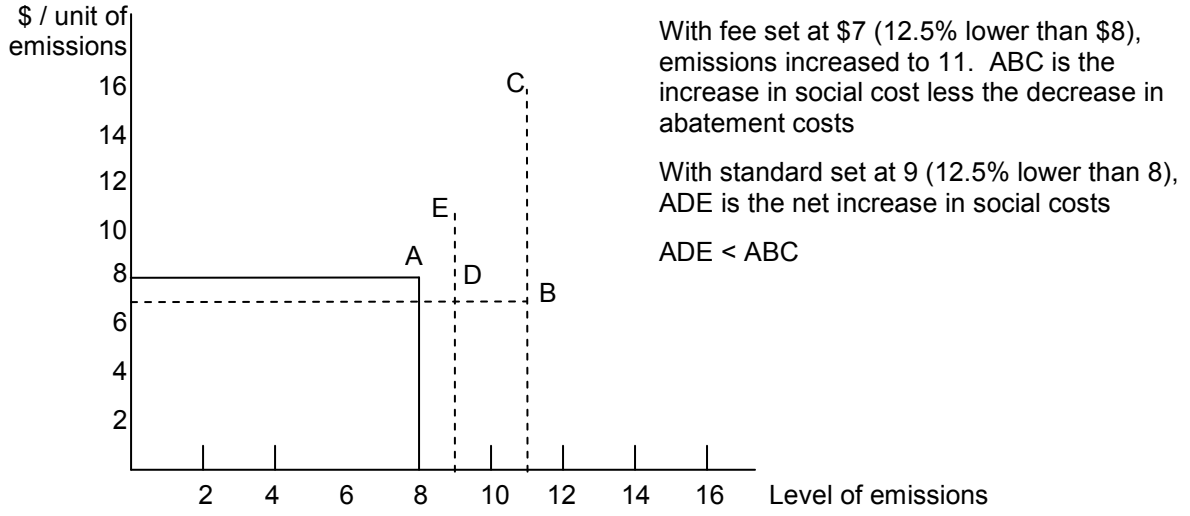


- The Case for Fees
  - Assume two firms have *same* marginal social cost curve and *different* marginal abatement cost curves, MCA_1 and MCA_2



- Emissions fees are preferable to standards in this case
  - The cheapest way to reduce total emissions by 14 units is for Firm 1 to reduce by 6 and Firm 2 by 8 units
- What if the regulatory agency forces each firm to cut emissions by 7 units
  - MAC_1 increases to \$3.75
  - MAC_2 decreases to \$2.50
    - This is not cost minimizing because one firm can reduce emissions at a lower cost than the other firm
    - Marginal cost of abatement must be *equal* between firms for reductions to occur at *minimum* cost
- Advantages of Fees
  - When equal standards must be used, fees achieve the same emission abatement at lower cost
  - Fees create an incentive to install equipment that would reduce emissions further

- The Case for Standards
  - Assumptions:
    - Steep marginal external cost curve
    - Flat marginal cost of abatement
  - An emissions fee of \$8 would be efficient but because of limited information, fee is set at \$7
    - Firms emissions increase and with steep MEC, this will lead to significant additional social costs

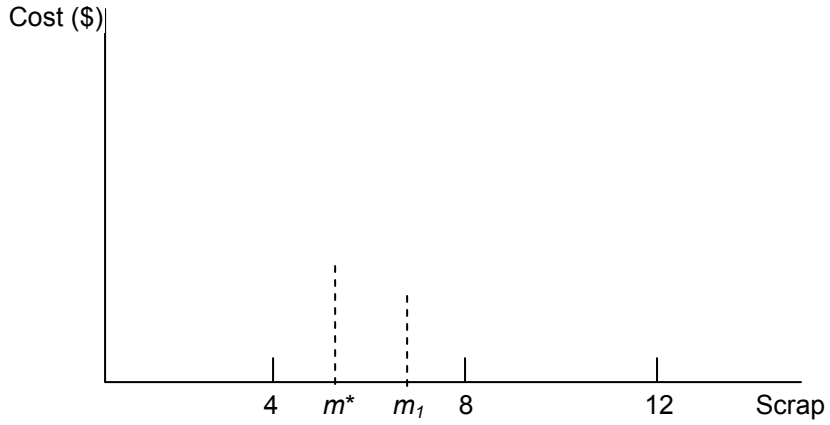


  - What if standard is used instead and has the same percentage mistake
    - Standard set at 9 instead of 8
    - Increase in social cost and decrease in abatement costs
    - Net increase in social costs is smaller than with fees

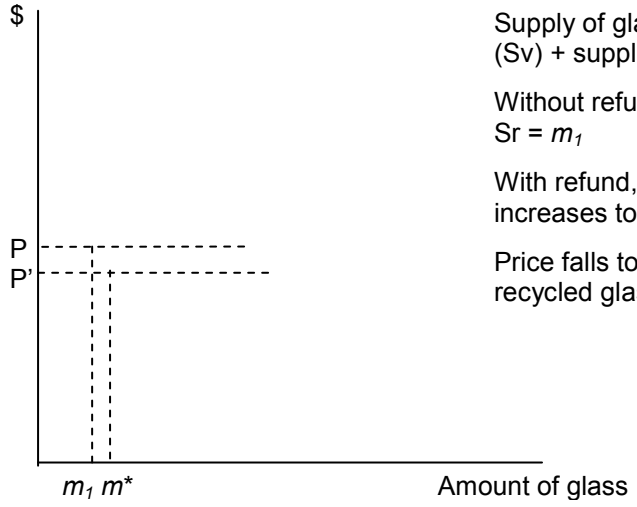
- Summary: Fees vs. Standards
  - Preferred policy depends on the nature of uncertainty and the slopes of the cost curves
    - If the costs and benefits of abatement were known and all firm's costs were identical, an emissions standard is preferred
      - Preferred when MEC is steep and MCA is flat
    - If the costs of abatement varied among firms, an emissions fee is preferred
    - If firms' costs vary and have incomplete information on costs and benefits, neither a standard nor a fee will generate an efficient outcome

- Transferable Emissions Permits
  - Permits help develop a competitive market for externalities
    - Agency determines the level of emissions and number of permits
    - Permits are marketable
    - High cost firm will purchase permits from low cost firms
  - The market for externalities is appealing since it combines the system of standards with the system of fees
  - Marketability of the permits allows pollution abatement to be achieved at minimum cost

- Recycling
  - Households can dispose of glass and other garbage at little or very low cost
  - The low cost of disposal creates a divergence between the private and the social cost of disposal
    - Marginal private cost is *constant* for a fixed amount of disposal
    - Marginal social cost of disposal *increases* with the level of disposal
  - Without market intervention, the level of scrap will be at m_1 and $m_1 > m^*$, the efficient amount of scrap
  - With refundable deposit, MC rises to MC + per-unit refund
  - Efficient amount of recycling occurs at the point where MC = MSC = MCR



- Refundable Deposits
  - Deposit is paid when bottle is purchased and refunded when bottle returned
  - Deposit gives household incentive to recycle more
  - Deposit increases private cost of disposal
  - Supply of glass comes from new glass and recycled glass
    - Increasing deposit increases supply of recycled glass and lowers price of glass



Supply of glass (S) = supply of virgin glass (Sv) + supply of recycled glass (Sr)

Without refund, the price of glass is P and Sr = m_1

With refund, Sr increases to S'r, and S increases to S'

Price falls to P' and the amount of recycled glass increases to m*

Externalities and Property Rights

- Property Rights
  - Legal rules describing what people or firms may do with their property
    - The firm had a property right to use the river to dump waste
    - The residents downstream had a property right to clean water

- Bargaining and Economic Efficiency
  - Economic efficiency can be achieved without government intervention when the externality affects relatively few parties and when property rights are well specified

- Profits Under Alternative Emissions Choices
  - Factory pays for the filter
  - Fishermen pay for the treatment plant

	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

- Efficient solution
  - Maximizes the joint profit of the factory and the fishermen
  - Buy the filter and do not build the treatment plant

- Bargaining with Alternative Property Rights

	Right to Dump ($)	Right to Clean Water ($)
No Cooperation		
Profit of factory		
Profit of fishermen		
Cooperation		
Profit of factory		
Profit of fishermen		

- The Coase Theorem
  - When parties can bargain without cost and to their mutual advantage, the resulting outcome will be efficient, regardless of how the property rights are specified

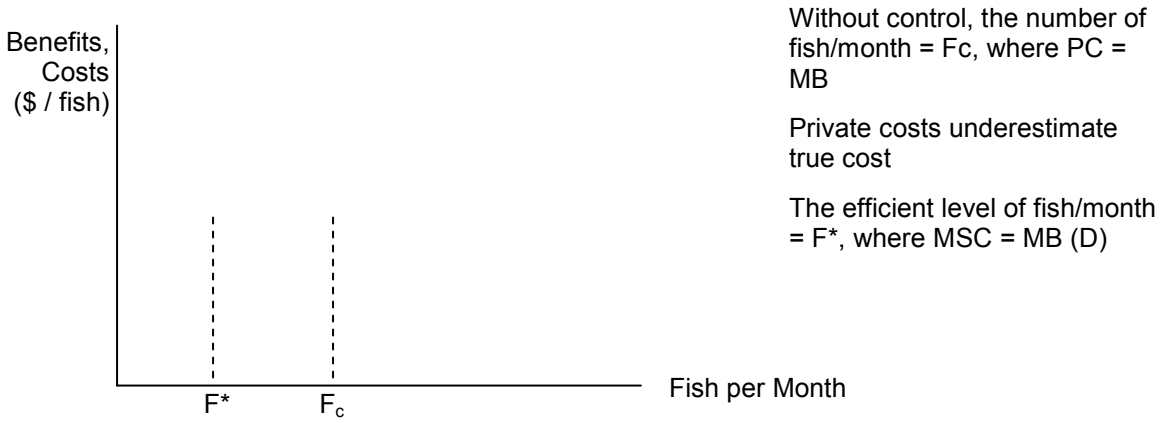
- Costly Bargaining – The Role of Strategic Behavior
  - Bargaining requires clearly defined rules and property rights
    - If property rights were not clear, other party might not be willing to pay as much and bargaining process would break down
    - One party might incorrectly assume the other party will eventually break down and accept less
    - Problems also arise when there are many parties involved

- A Legal Solution – Suing for Damages
  - In many situations involving externalities, one party is harmed (victim)
  - They can recover monetary damages equal to harm suffered
  - A suit for damages is different from effluent fee since the victim, not the government, is paid
  - Example
    - Fishermen have the right to clean water
    - Factory has two options
      - No filter, pay damages $\Rightarrow$ Profit = \$100 (\$500 – \$400)
      - *Filter, no damages $\Rightarrow$ Profit = \$300 (\$500 – \$200)*
  - Example
    - Factory has the right to emit effluent
    - Fishermen have three options
      - Put in treatment plant $\Rightarrow$ Profit = \$200
      - *Filter and pay damages $\Rightarrow$ Profit = \$300 (\$500 – \$200)*
      - No plant, no filter $\Rightarrow$ Profit = \$100
  - A suit for damages results in an efficient outcome when information is complete

Common Property Resources

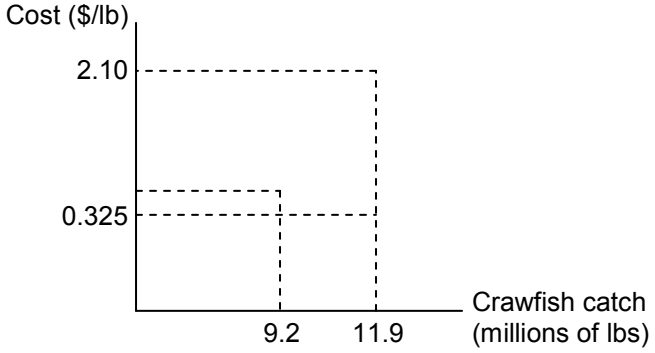
- Characteristics
  - Everyone has free access
  - Likely to be overutilized
  - Examples
    - Air and water
    - Fish and animal populations
    - Minerals

- Consider a lake where people fish
  - Each fisherperson takes fish up to the point where the marginal benefit to them equals the marginal cost
  - There is no reason that any one fisherperson take into account how their taking fish affects others experience
  - Private cost underestimates the true cost to society
    - More fishing reduces the stock of fish
    - Less is available to others and too low of a stock will completely deplete the fish
    - Too many fish are caught



- Solution
  - Private ownership
  - Owner will set fee for use of resource equal to the MC of depleting the stock
  - Fishermen will no longer find it profitable to catch more than the efficient amount of fish
  - In case that private ownership is not possible, the government steps in

- Crawfish Fishing in Louisiana: An Example
  - As a common property resource, too many crawfish have been trapped causing the population to fall below efficient level
    - F = crawfish catch in millions of pounds/yr
    - C = cost in dollars/pound
  - Demand: $C = 0.401 – 0.0064F$
  - MSC: $C = –5.645 + 0.6509F$
  - PC: $C = –0.357 + 0.0573F$
  - Efficient Catch
    - D = MSC
    - 9.2 million pounds



Quick Quiz

1. Which of the following describes an externality and which does not? Explain the difference.
   a. A policy of restricted coffee exports in Brazil causes the U.S. price of coffee to rise, which in turn also causes the price of tea to rise.
   b. An advertising blimp distracts a motorist who then hits a telephone pole.

2. A beekeeper lives adjacent to an apple orchard. The orchard owner benefits from the bees because each hive pollinates about one acre of apple trees. The orchard owner pays nothing for this service, however, because the bees come to the orchard without his having to do anything. Because there are not enough bees to pollinate the entire orchard, the orchard owner must complete the pollination by artificial means, at a cost of $10 per acre of trees. Beekeeping has a marginal cost of MC = 10 + 5Q, where Q is the number of beehives. Each hive yields $40 worth of honey.
   a. How many beehives will the beekeeper maintain?
   b. Is this the economically efficient number of hives?
   c. What changes would lead to the more efficient operation?

3. The market for paper is characterized by the following demand and supply curves: $Q_D = 160{,}000 - 2000P$ and $Q_S = 40{,}000 + 2000P$, where Q_D is the quantity demanded in 100-pound lots, Q_S is the quantity supplied in 100-pound lots, and P is the price per 100-pound lot. Currently there is no attempt to regulate the dumping of effluent into streams and rivers by the paper mills. As a result, dumping is widespread. The marginal external cost (*MEC*) associated with the production of paper is given by the curve $MEC = 0.0006Q_S$.
   a. Calculate the output and price of paper if it is produced under competitive conditions and no attempt is made to monitor or regulate the dumping of effluent.
   b. Determine the socially efficient price and output of paper.
   c. Explain why the answers you calculated in parts (a) and (b) differ.