Lecture # 2 -- Market Failures

I. The Invisible Hand

- The goal of today's lecture is to discuss why the free market may fail, and to discuss the consequences when that happens.
- To begin, we must consider how the market *should* function.
- Adam Smith, who coined the phrase "The Invisible Hand," was the first to notice that a free market of individuals acting in their own self interest leads to a socially-desirable result.
- Why does this occur:
    - Demand = Marginal Benefit (MB)
    - Supply = Marginal Cost (MC)
    - In equilibrium, P = MB = MC
        - No further beneficial transactions are possible.
        - Normally, a free market brings us to this point.
- However, there are times when private marginal benefits or costs are not equal to social marginal benefits or costs. When this occurs, the market is unable to allocate resources efficiency. We call this *market failure*.
    - The welfare lost because beneficial transactions do not occur is known as *deadweight loss*.

II. Market Failures in Environmental Economics

- Most of today's lecture dealt with the problems that various types of market failures cause. Of course, most of the course will focus on externalities. However, it is useful to be aware of other types of market failures and how they are relevant for environmental economics. We discussed three in class today.

A. Externalities

- An <u>externality</u> is an activity of one entity that affects the welfare of another and is not reflected in market prices.
    - A key feature of this definition is that the welfare of others is *not* reflected in market prices.
- To find the efficient level of activity, we need to know the *marginal social cost*.
    - <u>Marginal social cost</u> is the sum of marginal private costs and the marginal external costs, which represent the damage done by the externality.
    - Note that, without policy, the free market will not lead to an efficient solution.
        - Prices will reflect private costs, but not the additional external costs.
    - Individuals equate MPC and MB. Since MSC > MPC, over provision results.

B. Imperfect Information

- The market depends on perfect information, so that everyone knows all of the options available to them. If this is not possible, people may not make optimal choices.
    - Note that imperfect information is when different parties have different levels of information.
        - If no one realizes an activity is bad (e.g. Mercury pollution in Onondaga Lake in 1950s), imperfect information is not the problem.
            - It may be that the result is uncertain. Uncertainty is an important consideration for environmental policy, which we will discuss later in the course. However, if all sides have the same knowledge, even if uncertainty exists, imperfect information is not a problem.
- How is this relevant to environmental economics?
    - People may have imperfect information about things such as health risks or the dangers of pollution.
- What can be done?
    - Information can be provided by the government or by private individuals (e.g. "dolphin-friendly tuna").
    - The government may provide services that are not provided by the market because of imperfect information (e.g. insurance).

C. Public Goods

- Public goods have two key features:
    1. non-rival -- one person enjoying the good does not keep others from enjoying it
    2. non-excludable -- people cannot be kept from enjoying the good
        - Leads to *free-rider* problem.
- Because the goods are non-rival, efficiency requires that the sum of each individual's marginal benefit equal marginal cost.
- Underprovision results when public goods are provided by a free market.
- How is this relevant to environmental economics?
    - open spaces
    - forest services
- What can be done?
    - The government can provide public goods and finance them with taxes. This helps to alleviate the free-rider problem.
        - However, it still may be difficult to get people to reveal their true preferences for the good.

D. Open Access Resources

- Open Access Resources (also called common property resources) are resources or facilities that are open to uncontrolled access by individuals who wish to use the resource.
    - The goods are non-excludable but rival.
- The problem is a lack of property rights.
- Consider someone using a public grazing area.
    - Individuals equate MB = MC
    - The benefits are the value of using the grass.
    - There are two costs:
        - The cost of obtaining the resource
        - The opportunity cost of not being able to use the resource later
    - The user bears all of the first cost, but only part of the second cost, as it is shared by all users.
        - As a result, MPC < MSC
            - Thus, MB = MPC < MSC
            - This leads to over-utilization of the resource.
- Overcrowding at national parks is an example where non-excludability is a choice, rather than a feature of a good.
    - We will discuss different ways of controlling access and the tradeoffs with each.
        - Raising fees depends on ability to pay.
        - A reservation system with long waits may lock out local users or those who have traditionally used the land.
        - Should how the land will be used (e.g. the merit of the visitors desired use) matter?
- One important criterion for choosing the method depends on our ethics toward the resource. Why do we want public access to national parks in the first place?

- Fisheries provide a good example of open access resources.
    - Everyone shares the costs when fish are caught, as it makes it depletes the stock, making future fishing difficult.
        - Note the dynamic nature of the problem that, as we noted last class, makes natural resources unique.
    - This leads to overfishing.
    - Management options
        - Annual quotas
            - These restrict the number of fish that can be caught in a season
                - Leads to a "race to fish"
                    - Everyone wants to catch fish early, before others have caught them.
        - Technology restrictions
            - Only certain technologies can be used to catch fish
                - This makes fishing more difficult, but doesn't directly address the commons problem.
        - Individual Transferable Quotas (ITQ)
            - Used in Australia, New Zealand, Canada, Iceland, and Alaska
            - Divides an annual quota among fishermen as a long-term right
                - This provides incentives to manage the fishery properly
            - Shares can be traded
            - In a recent study, fisheries managed by ITQs were half as likely to collapse as other fisheries
                - The Alaskan halibut and king crab fisheries provide examples
                - Before ITQ, the fishing season lasted 3 days
                - Now, it lasts 8 months
                - Not only is it safer, but fish are sold fresh, and at higher prices, since there isn't a one-time glut on the market.
            - Challenges
                - Hard to use in international waters
                - Allocating shares is difficult
                    - Shares provide economic rent to those who receive them
    - Note that imperfect information must also be addressed to properly manage fisheries
        - Monitoring where fish come from has been difficult, but technology helps.
        - This not only helps regulators, but also provides information to consumers who may care about where their fish was caught.

III. Tragedy of the Commons

- In a well-known paper, Hardin's "The Tragedy of the Commons" (1968) relates the open access resource problem to the environment.
    - With pollution, people are putting something in to the commons, rather than taking something out.
        - Nonetheless, each individual's share of the cost is small.
    - Note that it is the lack of property rights that causes the problem.
        - For example, there are no property rights for air.
- Despite Hardin's concerns, there are examples of managed commons. Ostrom discusses what is necessary to keep a commons going
    - Begins with a theoretical framework to analyzing a socio-ecological system (SES)
    - An SES consists of four core-level subsystems:
        - Resource systems (e.g. a park, forest, water resource)
        - Resource units (e.g. trees and plants in the forest, quantity of water flow)
        - Governance systems
        - Users
    - Ostrom uses this framework to ask when a Tragedy of the Commons could be averted.
        - In general, a Tragedy of the Commons can be averted if the expected benefits of management are greater than the perceived costs of developing better rules and norms for most users and their leaders.
        - Ten second-level variables most frequently identified as important for this to occur:
            - Size of resource system
                - More difficult to self-organize when costs of defining boundaries and monitoring is high
                - Small sizes rarely have commons problems
                - Thus, medium sized resources most likely to self-organize
            - Productivity of system
                - Non-linear effect:
                    - No need to organize if already not productive
                    - Unlikely to see a need to organize if resource is very productive
                    - Need to perceive need to be motivated

- Predictability of system dynamics
    - Need to be able to predict what will happen once rules are in place
    - Forests generally more predictable than water resources
- Resource unit mobility
    - Can the units move across systems (e.g. wildlife versus trees)?
    - If so, less likely to self-organize
- Number of users
    - Relates to transaction costs, but depends on other variables
    - Larger groups may have higher transaction costs, but may also be better able to mobilize needed resources for management
- Leadership
    - Presence of local leaders makes self-organization more likely
- Norms/social capital
    - Users with shared values more likely to trust that agreements will be kept
    - Will have lower transaction costs to reach an agreement and lower monitoring costs.
- Knowledge of the SES
    - Costs of organizing lower if users share common knowledge
    - If population growing fast while resource regenerates slowly, users may not perceive limits of carrying capacity.
- Importance of resource to users
    - Higher value implies greater expected benefit
- Collective-choice rules
    - Do users have full autonomy at collective choice level to craft and enforce rules?
        - Leads to lower transaction costs

- Examples of how these matter
    - Successful commons often have elaborate conventions over who can use resources and when
        - What you take out must be proportional to what you put in
        - Usage must be compatible with health of the system
        - Everyone must have a say in the rules
        - Usually more focus on monitoring and conflict resolution than sanctions and punishment
    - Rules must match the attributed of the system
        - E.g. prohibiting harvest of female fish easy to monitor for lobster (eggs visibly attached to the belly), but not for gravid fish, where eggs are internal
    - Simple rules often problematic
        - Total allowable catch quotas in Canadian fisheries led to dumping of unwanted fish and misrepresentation of catches
        - Used transferable quotas defined over smaller sectors and on-board monitors to rectify
    - Will local users monitor?
        - Colonial powers in Africa, Asia, and Latin America didn't recognize local institutions, which led to overuse
- The *NY Times* article on groundwater in California provides an example where local residents successfully managed a common property resource (a groundwater aquifer). Consider how that relates to Ostrom's guidelines.