Valuation of Environmental Benefits

· two types of benefits provided by environmental resources:
  -- use benefits
  --nonuse (existence) benefits

· Benefits which are not reflected in market prices are known as "nonmarket benefits."

· measurement of nonmarket benefits
  • **Willingness to Pay** to preserve natural resource systems
  • **Willingness to Accept** for preservation of resources
  • The effect of **Uncertainty and Risk Aversion**

<u>methodologies to value nonmarket benefits:</u>

· **Market Values** can be used for valuing environmental resources that are traded directly in markets.
· *imputed Market Values* for environmental resources attached to goods which are traded in markets; this is often refered to as the **technique of Hedonic Pricing**.
· **Travel Cost Models,** which infer resource values based on the opportunity cost of time and travel to visit areas such as Yosemite Park.
· **Engineering and Agronomical Cost Methods,** which calculate value based on the cost of restoring a developed natural resource
· **Interviewing Technique** or Contingent Valuation Method (CVM) elicits nonmarket values by asking people directly to state their valuation of a resource.

Types of Benefits

Use Benefits: utility arising from direct or indirect *physical use* of a resource

- **Consumptive Use Benefits**: private benefits that are derived from resource consumption
  --farming, fishing, mining
- **Nonconsumptive Use Benefits** are generally public good benefits
  --swimming, hiking, camping

Nonuse Benefits: utility that is derived from environmental resources without physically interaction with the resource

- **Option Value Benefits**: a benefit which is derived from maintaining the option to utilize future, unknown benefits by avoiding or delaying irreversible actions.
- **Vicarious Consumption Benefits**: utility derived from the consumption of environmental resources by *other* individuals.
- **Stewardship Benefits**: moral benefits that we derive from knowing that we are doing our parts as stewards of the worlds' resources

  Bequest Benefits: utility derived from passing an environmental resource on to future generations.

  Existence Value, or Inherent Benefits: utility derived from the knowledge of the mere existence of environmental resources.

Concepts in Benefits Measurement

- **Willingness to pay (WTP)**: is the *maximum* total amount of money an individual would give up in exchange for all the benefits associated with an environmental resource.

- **Willingness to accept (WTA):** is the *minimum* total amount of money an individual would accept to *forego* all the benefits associated with an environmental resource.

WTP < WTA,

Since, **WTP is bounded by an individuals' *budget constraint***.

Uncertainty, Expected Benefits and Risk Aversion

- uncertainty refers to the existence of several possible outcomes for a given decision

The Expected Benefit/Cost of a course of action is the sum of the benefits/costs associated with each possible outcome, multiplied by the probability that the outcome will occur if the course of action is chosen.

Uncertainty and Risk Aversion (cont.)

Example: Dept of Fish and Wildlife is considering a project that improves fish habitat. The alternative courses of action are

(1) don't do the project (i.e., take no action), or
(2) do the project.

- outcome under No Action is certain and equal to "Status Quo Benefit"
- outcome from doing Project is uncertain, but with three possible outcomes

Probability:	Possible Outcome Under the Project:
1/2	Status Quo Benefit + $6M.
1/4	Status Quo Benefit + $3M.
1/4	Status Quo Benefit + $9M

Expected Benefits associated with each course of action would be:

- Expected Benefit of No Action = Status Quo Benefit
- Expected Benefit with Project:
  = Status Quo Benefit + 1/2 · $6M + 1/4 · $3M + 1/4 · $9M
  = Status Quo Benefit + $6M.

If the effect of uncertainty is to make the Dept. WTP *less* than the Expected Benefit of the project to undergo construction, then we say that the Dept. is **Risk Averse**.

- That is, a Risk Averse Dept. is WTP < $6M.

The difference between the Expected Benefits of the project and the most the Dept. would be willing to pay is called the **Risk Premium**.

If the Dept. WTP = $5M, => Risk Premium = $1M.

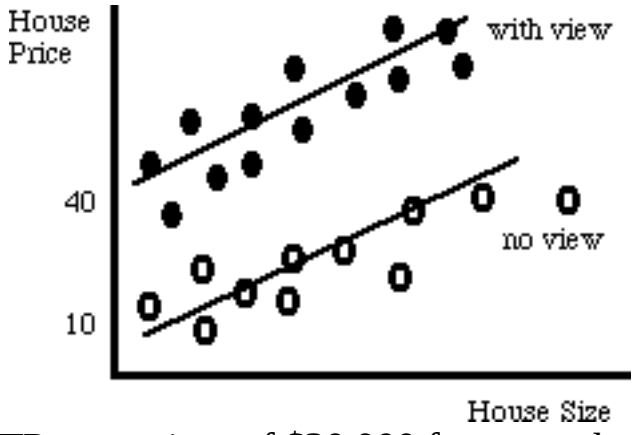
Hedonic Pricing

- Natural resources can be thought of as bundles of characteristics
- price of a resource reflects combinations of characteristics
- Hedonic Pricing measures the marginal value of a characteristic.
- *For example*, say we wish to estimate the aesthetic benefit of a beautiful view of the Pacific Ocean in Big Sur. This aesthetic value may be capitalized into the relative price of oceanside property compared with other non-oceanside property.

House Price = $\alpha + \beta_1$(Dist.) + β_2(House Size) + β_3(Lot Size) + β_4(View)

- where parameters β_1, β_2, β_3, and β_4 represent:
  - β_1 = the marginal value of a unit of distance
  - β_2 = the marginal value of a unit of house size
  - β_3 = the marginal value of a unit of lot size
  - β_4 = the marginal value of having a scenic view

- We can then use statistical regression analysis to estimate the marginal values for the parameters that give our hypothesized equation the best fit to the data.
- Suppose the results of our analysis are:
  β_1 = -20; β_2 = 80; β_3 = 10; β_4 = 30



- people are WTP a premium of $30,000 for an aesthetic view

Travel Cost Methods

- the value of a recreational facility, say, boating at a lake, can be measured by the opportunity cost of time and travel cost spent on the way to the lake, as well as on physical expenses such as gasoline.

- *Example*: There is one lake in a region, say Lake Tahoe. It attracts 40,000 visitors/month. Each spend 5 hours boating and 2 hours traveling. The opportunity cost of time is $8/hr for every individual. Gas and car use cost $6/travel hour per visitor. Entry cost is $2/visit. Thus, the total travel cost is:

  $$40{,}000 * [8 * 7 + 6 * 2 + 2] = 40{,}000 * 70 = \$2{,}800{,}000.$$

- The $2.8 million per month is an estimate of a lower bound on WTP for recreational benefits from the lake. It is a lower bound, because anyone that finds it optimal to spend time at the lake must receive at least enough benefit to cover the travel cost of getting to the lake, but might receive considerably more.

- The travel cost method may be used in assessing the lost recreational value resulting from closure of the lake, if, say, an oil spill or excessive pollution from agricultural runoff causes the lake to close due to public health concerns.

- If there are other substitute lakes, for example, Mono Lake, travel cost methods become more complex. If there are three lakes, A, B, and C, closure of A will cause some people to use B and C. However, B and C will be more congested and the benefits of using them will decline. Thus, we need to understand patterns of use of A, B, and C to assess their benefits and the impact of congestion on benefits.

Interviewing Techniques: the Contingent Valuation Method (CVM)

Currently, there is no other way to elicit nonmarket values besides asking people directly:

- How much would you be WTP for an amenity?
- How much would you be WTA to forego an amenity?
- How would you vote for a proposition involving an environmental or resource use choice?

In situations where people face such hypothetical costs and benefits, they may not have sufficient incentive to seriously consider their responses to survey questions.

Problems with Interviewing Techniques:

- **Strategic Bias**: Not telling the truth to advance a personal agenda
- **Framing Bias:** People's answers may vary according to the context in which a question is put.
- **Ill-formed Preferences:** People may not have well-formed preferences (e.g., WTP and WTA) for unfamiliar goods
- **Information Bias:** Failure to comprehend or to interpret questions correctly.