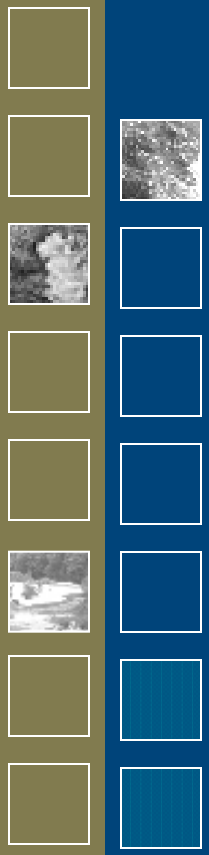
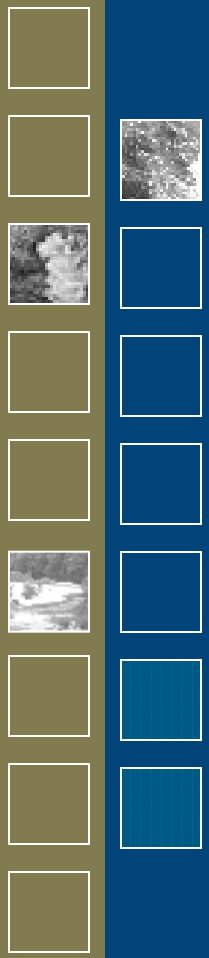


Natural Resource Damage Assessment

Stratus Consulting
Eric English, PhD
July 20, 2011



Damages Determination

Cleanup vs. Restoration

Incident

Cleanup

Restoration

Damages Definition

- First component: *Primary restoration*
- The cost of restoring resources to their baseline level of services
- Depends on the feasibility of on-site restoration

Compensatory Restoration

- Second component: *Compensatory restoration*
- Compensation for the “interim loss” that occurs when resources are not providing full services
  - Interim losses accrue until resources return to their baseline condition

Compensable Value

- Can be calculated as
  - The public's value for lost services that would have been provided by the injured resources
  - The cost of providing services of equivalent value

Damages – Three Components in Total

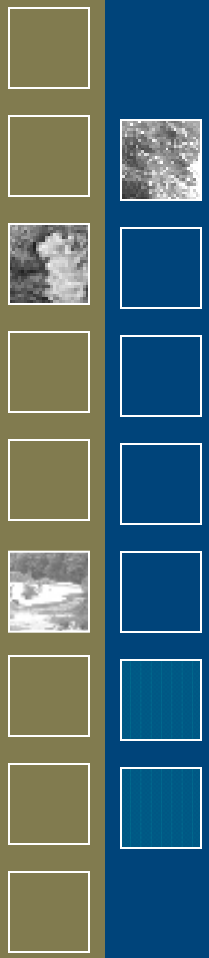
1. The cost of restoring natural resources sufficient to return services to baseline

   and

2. The cost (or value) of compensating for interim losses until baseline is reached

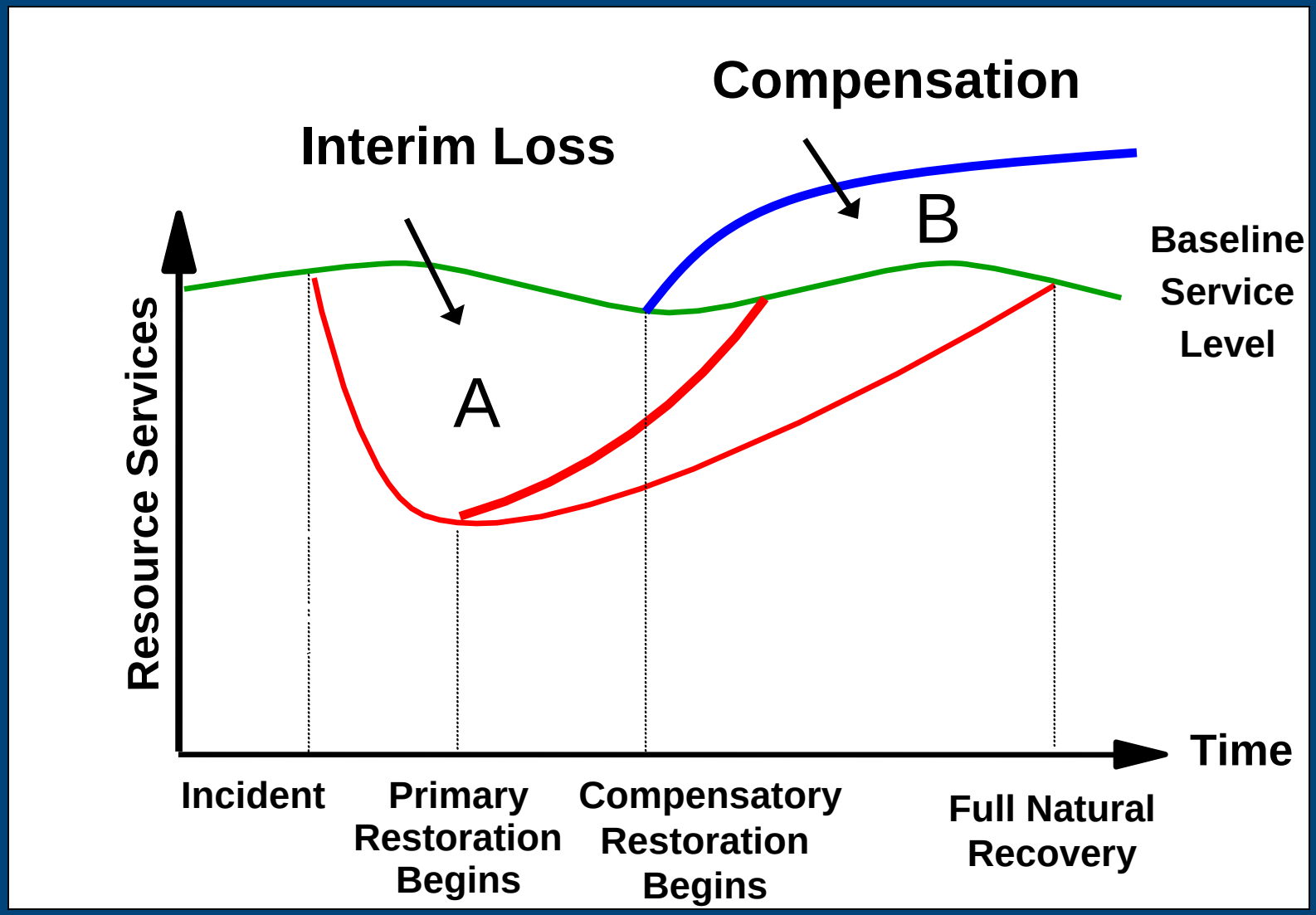
   and

3. The cost of reasonable (i.e., value justifies cost) assessment costs



Compensable Value

What is Compensable Value Addressing?



Value: Definition

- The rate at which individuals are willing to trade off one resource or service for another
- The trade-off can also be between resources and money

Compensable Value Determination

- Determine value of resource/service by
  - How much of other resources or services an individual is willing to forego

    -or-
  - How much money an individual is willing to give up to get a resource or service

Types of Values

- Active use
  - Recreation, hunting, boating, commercial (market value)
- Option
  - Not using now, may use later
- Nonuse (independent of use)
  - Existence/bequest
  - Ecological value of resource

Approaches to Determining Compensation

- Resource to resource
  - Restoration provides resources of same type, quality, value
- Service to service
  - Restoration provides services of the same type, quality, value

Approaches (cont.)

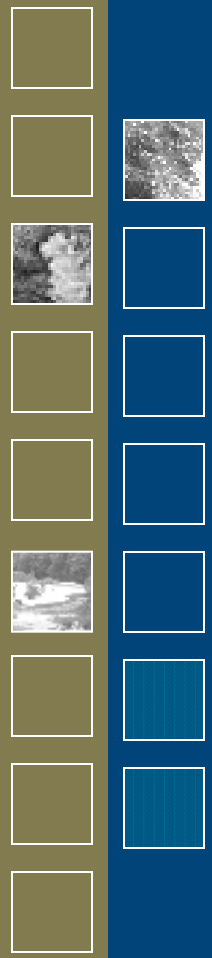
- Value to value
  - Restoration action provides services of comparable value
  - Does not meet criteria for service to service, e.g., out of kind
- Value to cost
  - Does not meet criteria for service to service
  - Valuation of replacement services cannot be done within reasonable timeframe and/or at reasonable cost

Difference between Scaling Methods

- What is the unit of measure to determine how much *compensatory* restoration is necessary?
  - Resource to resource
    - Natural resource quantities
  - Service to service
    - Natural resource services
  - Value to value
    - Value of the resources or services
  - Value to cost
    - Monetary value: $ loss ➔ settlement amount

Focus

- All of these approaches focus on determining how much compensatory restoration is necessary
- Each approach can be implemented using specific methods



Scaling Methods or "How Much Restoration is Necessary to Fully Compensate?"

Methods for Scaling

Resource to resource,
Service to service

- Habitat equivalency analysis (HEA)
- Conjoint

Value to value,
Value to cost

- Travel cost method
- Conjoint
- Contingent valuation
- Hedonic price models
- Market values
- Benefits transfer

Habitat Equivalency Analysis

- Equivalence across resources
  - Uses biological metrics to establish equivalence of resource losses and gains
- Equivalence across time
  - Economic discounting

Habitat Equivalency Analysis (cont.)

- Acre of marsh lost ⇐⇒ Acre of marsh gained
- 100 birds killed ⇐⇒ 100 birds created
  ⇐ 5 acres of marsh nesting habitat

Oil Release ➔ Runoff Control

Gallons released = gallons captured

Salmon Mortality ➔ Enhancement of Spawning Habitat

Gravel placement below dam: 10 yd^3 gravel = 130 ft^2 spawning habitat = 81 salmon fry/year

Conjoint (for resource-to-resource scaling)

- Uses public preference to establish equivalence of resource losses and gains
- Survey of the affected population describes environmental benefits of resource improvements
- Survey questions ask which environmental improvements are preferred

Conjoint (for resource-to-resource scaling) (cont.)

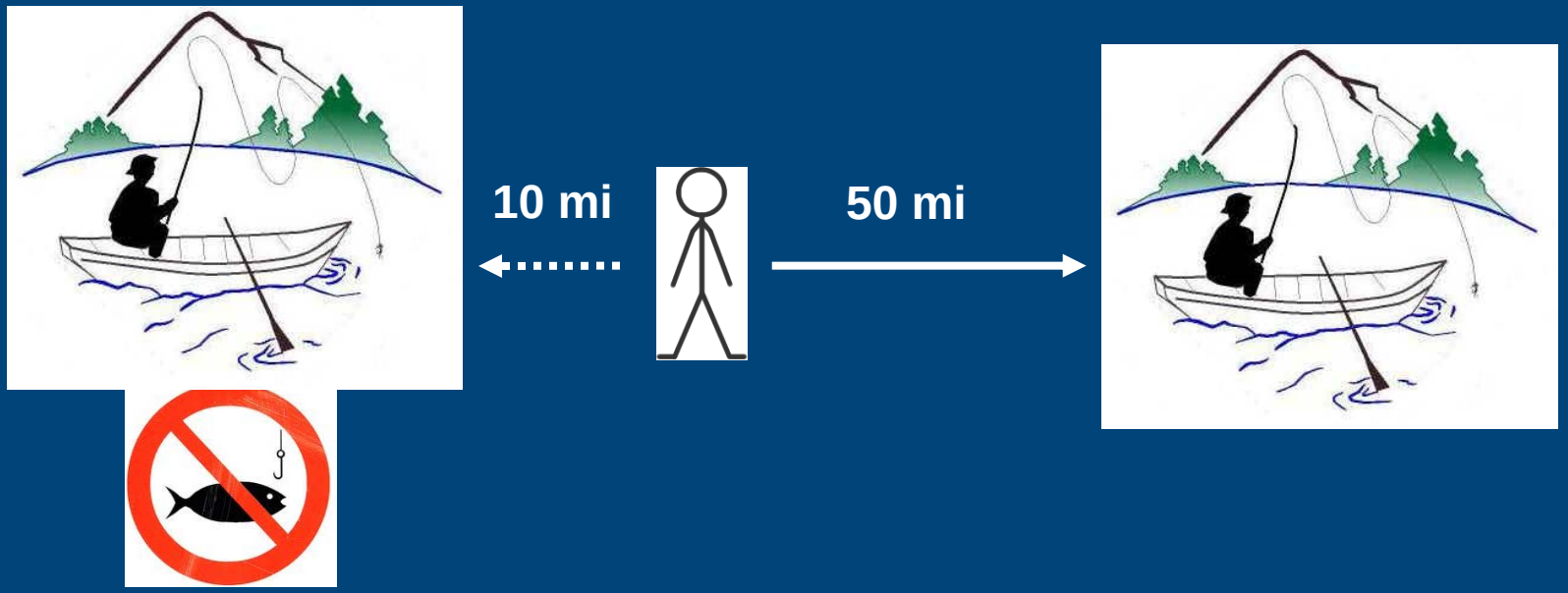
18 **If you had to choose, would you prefer Alternative A or Alternative B?** *Check one box at the bottom.*

	Alternative A ▼	Alternative B ▼
Wetlands Acres	63,800 acres (10% more)	60,900 acres (5% more)
PCBs Years until safe for nearly all fish and wildlife	20 years until safe (80% faster)	70 years until safe (30% faster)
Added cost to your household Each year for 10 years	$50 more	$25 more
Check (✔) the box for the alternative you prefer →	☐	☐

Travel Cost Method

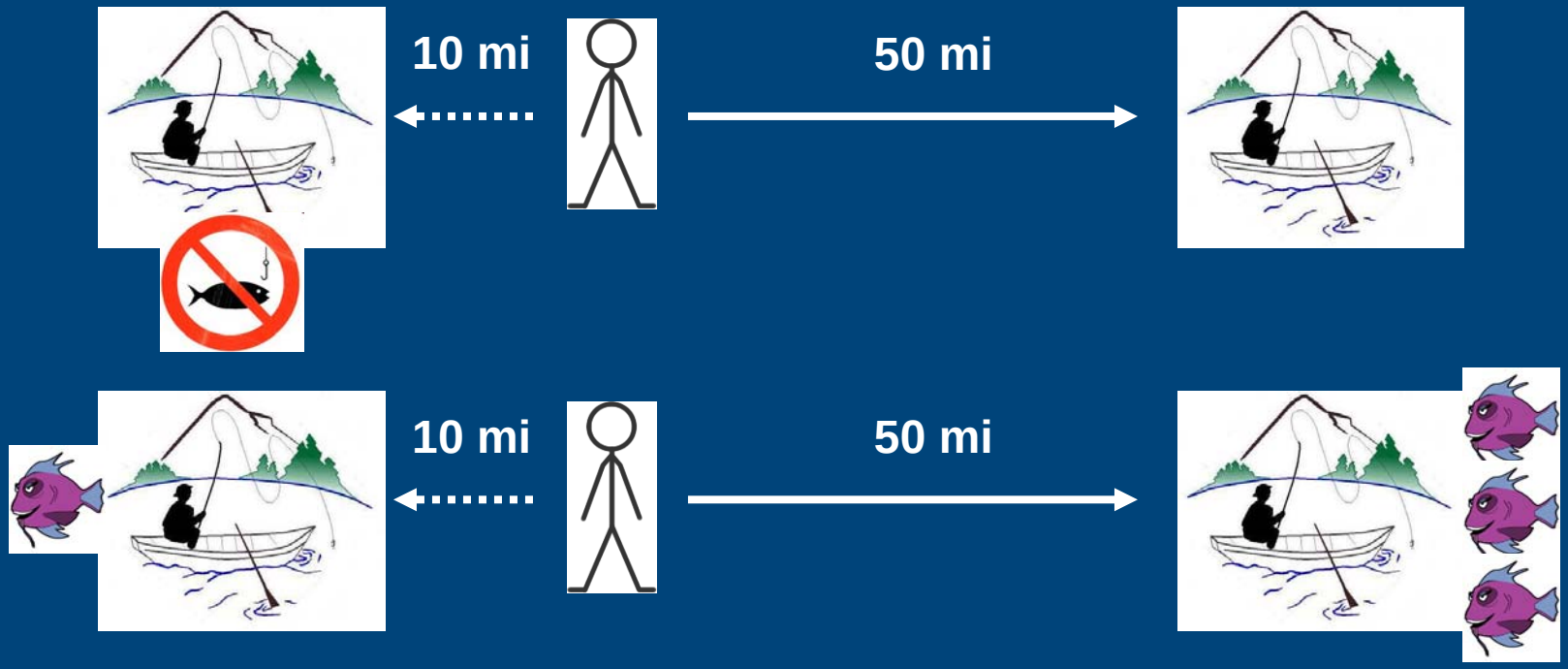
- Measures *use value*: “recreational use”
- Survey collects data on where people choose to recreate
- Willingness to travel = willingness to pay

Travel Cost Models



Value = 40 (50 miles – 10 miles)
x 2 (round trip)
x $0.65 ($0.35 gas/mi + $0.30 time value/mi)
= $52 per trip

Fish Consumption Restrictions ➔ Increase in Fish Populations



Value to user group: Increase in catch rates offsets chemical contamination

Conjoint (for value-to-cost scaling)

- Survey collects data on where people *would* choose to recreate, given *options constructed by the researcher*
- Flexibility to value conditions not present in observed choices
- Can be combined with travel cost methods

Conjoint (for value-to-cost scaling) (cont.)

If you were going to fish the waters of Green Bay, would you prefer to fish the waters of Green Bay under Alternative A or Alternative B? *Check one box in the last row*

	Alternative A ▼	Alternative B ▼
Smallmouth bass		
Average catch rate for a typical angler.....	2 hours per bass	2 hours per bass
Fish consumption advisory.....	No more than one meal per month	Unlimited consumption
Your share of the daily launch fee.....	Free	$3
Check the box for the alternative you prefer.....	❑	❑

Contingent Valuation

- Estimates use and nonuse value
- Asks respondents' willingness to pay for a single program, rather than a collection of attributes
- Simple choice format allows complex detail to be presented to respondents

Contingent Valuation (cont.)

Many species of fish and birds live off the South Coast. Four of these species are having problems producing young.

Two species of fish are having problems producing young in one place off the South Coast. These are White Croaker and Kelp Bass.

Two of the many species of birds living along the South Coast also have reproduction problems. They are Bald Eagles and Peregrine Falcons.

Many scientists have studied why these four species of fish and birds are having reproduction problems along the South Coast but not elsewhere along the California coast. They agree that these reproduction problems are caused by a deposit of two chemicals that are trapped in the sediment on the bottom of the ocean. These chemicals are DDT and PCBs.

Contingent Valuation (cont.)

Until recently, there was no way to speed up this natural process. However, a procedure has now been developed to cover chemical deposits like this. If the State does not implement this program, nature will do the same thing, but it will take longer, 50 years instead of 5. That is, an additional 45 years.

If an election were being held today and the total cost to your household would be a one time additional tax of $80, would you vote for the program to speed up recovery or would you vote against it?

FOR	1	(CODE SKIP RECORD AND GO TO W-2)
AGAINST	2	(CODE SKIP RECORD AND SKIP TO W-3)
NOT SURE	8	

Hedonic Price Models

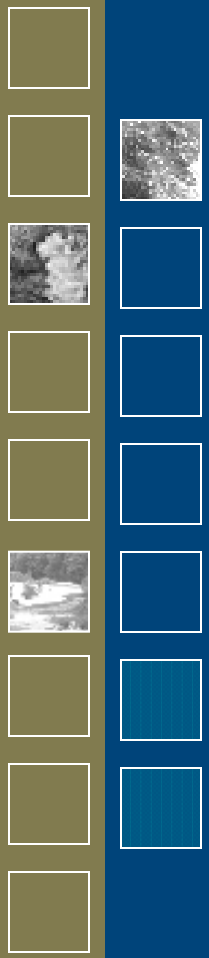
- Housing prices reflect the value of nearby attributes
- An important attribute could be the presence of contaminated sites
- Hedonic methods used in New Bedford Harbor CERCLA case; private claim in Buzzards Bay oil spill

Market Values

- Generally reserved for private claims
- In some cases there are market values for publicly provided goods
  - Water supply
- In some cases market values accrue to public resources
  - Commercial fishing, commercial navigation
  - Economic rent

Benefits Transfer

- Applying results of previous studies to value resource impacts
- Any of the above methods could be used in a benefits transfer study
- Relative to primary study, benefits transfer costs less but entails greater uncertainty

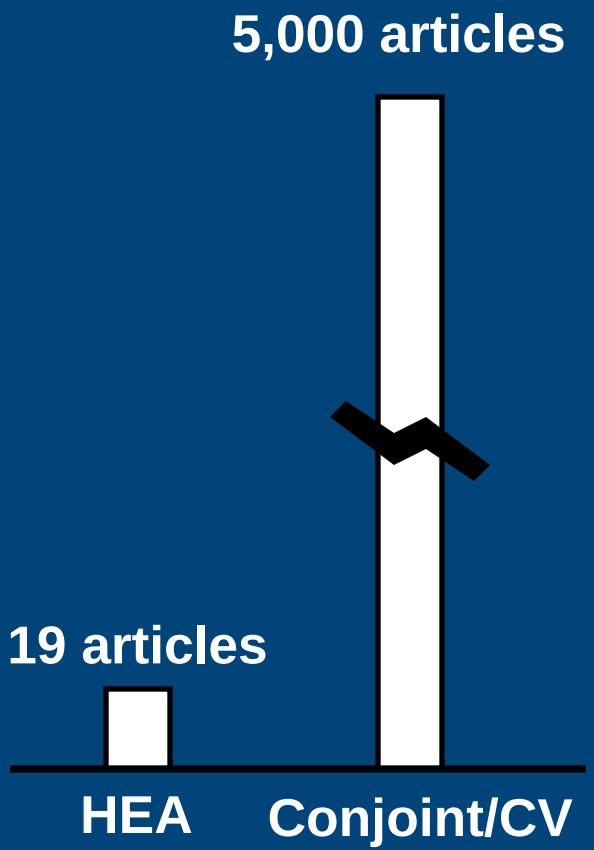


Some Considerations in Choosing a Method

HEA vs. Survey Methods (conjoint/CV)

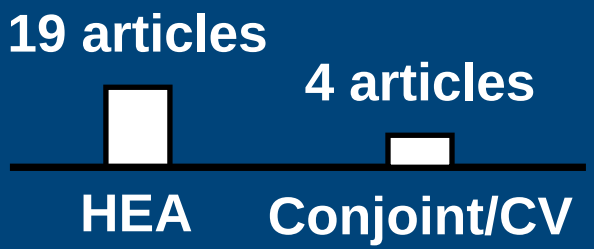
- Similarity of services lost (injury) and services gained (restoration)
- Literature support
- Cooperation vs. litigation

HEA Literature Support



- About 19 applied HEA studies have been published
- Compare this to more than 5,000 conjoint/CV studies valuing non-market environmental goods

Literature within Natural Resource Damage



- All HEA applications are NRD related
- Only the Exxon and Green Bay assessments have led to published stated-preference studies

Travel Cost Method vs. Conjoint

- Do real-world choices include representations of baseline conditions?
- Conjoint method can measure changes not reflected in real-world choices

Original Study vs. Benefits Transfer

- Availability of appropriate previous research
- Cost of original study
- Uncertainty in benefits transfer estimates

Assessment and Restoration in a Tribal Context

- Resources of importance to tribe
- Selecting restoration projects that provide services supporting tribal activities or traditions

Examples of Cultural Services from Natural Resources

- Direct use of the resources
  - Food, crafts, commerce
- Transmission of Traditional Ecological Knowledge
- Transmission of language skills to youth
- Ceremonial
- Historic meeting sites
  - Societal interchange

Considerations in a Tribal Context

- "Willingness to pay" implies tribes do not have a right to the resource
- Income may be a small part of total endowment
- Tribal elders vs. representative sample
- Methods may be based on group consensus about community priorities rather than individual willingness to pay