

Methods Commonly Applied in NRDA to Quantify Restoration

“Scaling” Methods to Determine Appropriate Compensatory Restoration

- Value to Cost
 - estimating the value of the lost resources/services and spending recovered funds on restoration
- Value to Value
 - equating the value of the resource/service lost to those gained through the restoration actions
- Service to Service: e.g., HEA
 - equating the services lost from the release to the services provided from the restoration actions

Types of Resource Services

- Ecological Services
 - Bird nesting habitat
 - Fish spawning habitat
 - Food production for fish and birds
- Human Use Services
 - Fishing, boating, open space

Methods Commonly Applied in NRDA to Determine Appropriate Restoration

- Habitat Equivalency Analysis
- Economic Valuation Methods
 - Travel Cost Models
 - Stated Preference Techniques
 - Benefits Transfer

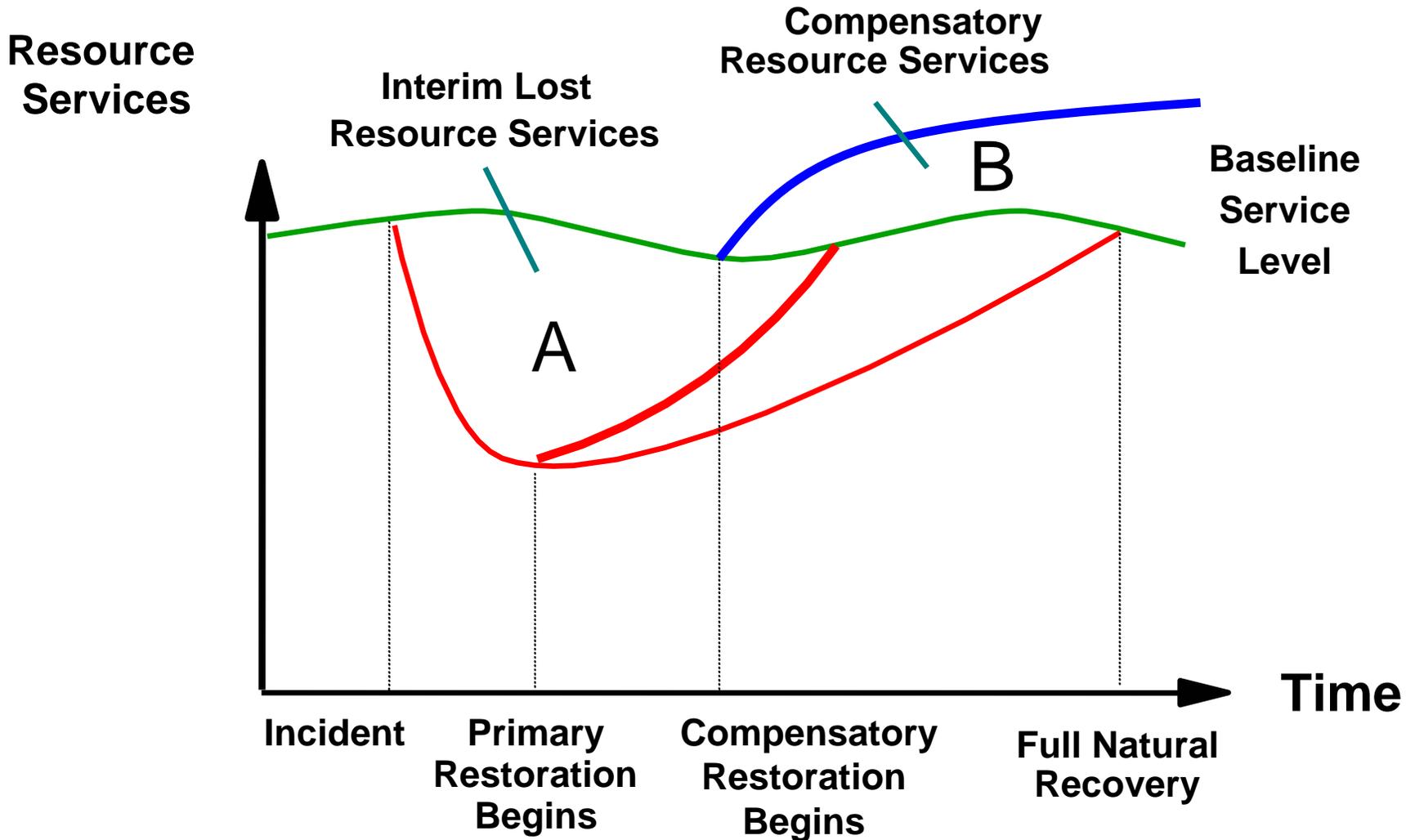
Habitat Equivalency Analysis: Two Central Concepts

- Equivalence in resource services: Ecological Metric
- Equivalence through time: Discounted Service Flows

Equivalence in Resource Services: Ecological Metric

- Acre of sea grass lost \leftrightarrow Acre of sea grass gained
- 100 birds killed \leftrightarrow 100 birds created \leftarrow 1 acre of marsh nesting habitat
- 10 acres sandy bottom lost \rightarrow 100 kg of bivalves lost \leftrightarrow 100 kg of bivalves gained \leftarrow creation of 0.5 acres oyster reef

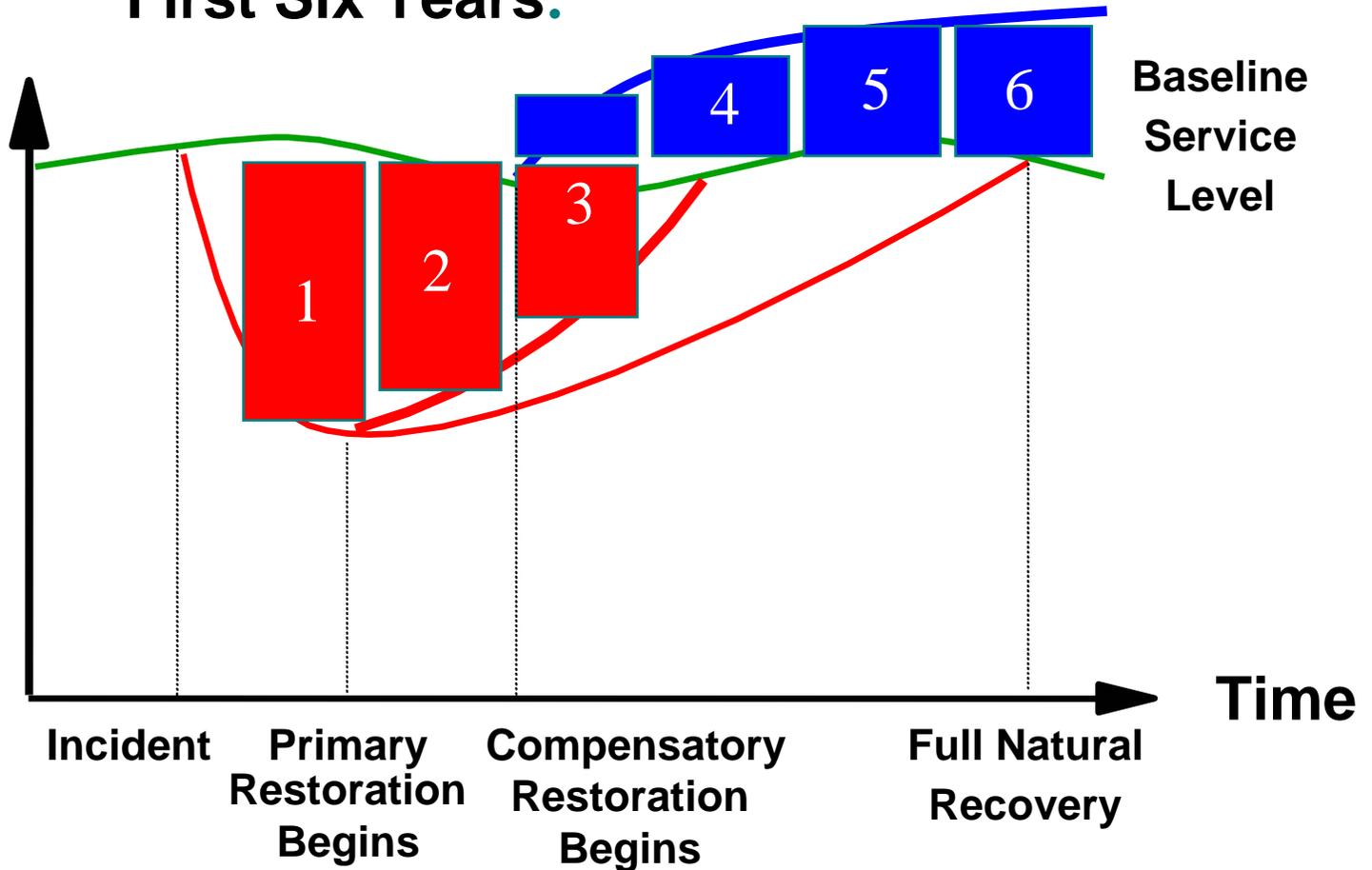
Habitat Service Flows



Equivalence Through Time

Resource
Services

First Six Years:



Discounted Service Flows

Year	Inverse Discount Factor	A		B		A+B Total Discounted Service Flows
		Interim Lost Resource Services		Compensatory Resource Services		
		Actual	Discounted	Actual	Discounted	
1	1.00	-5.0	-5.0			-5.0
2	1.03	-4.5	-4.4			-4.4
3	1.06	-3.5	-3.3	1.5	1.4	-1.9
4	1.09			2.0	1.8	1.8
5	1.13			2.5	2.2	2.2
6*	1.16			2.5	7.2	7.2
Total			-12.7		12.7	0.0

* Year six includes the terminal value.

Strengths of HEA

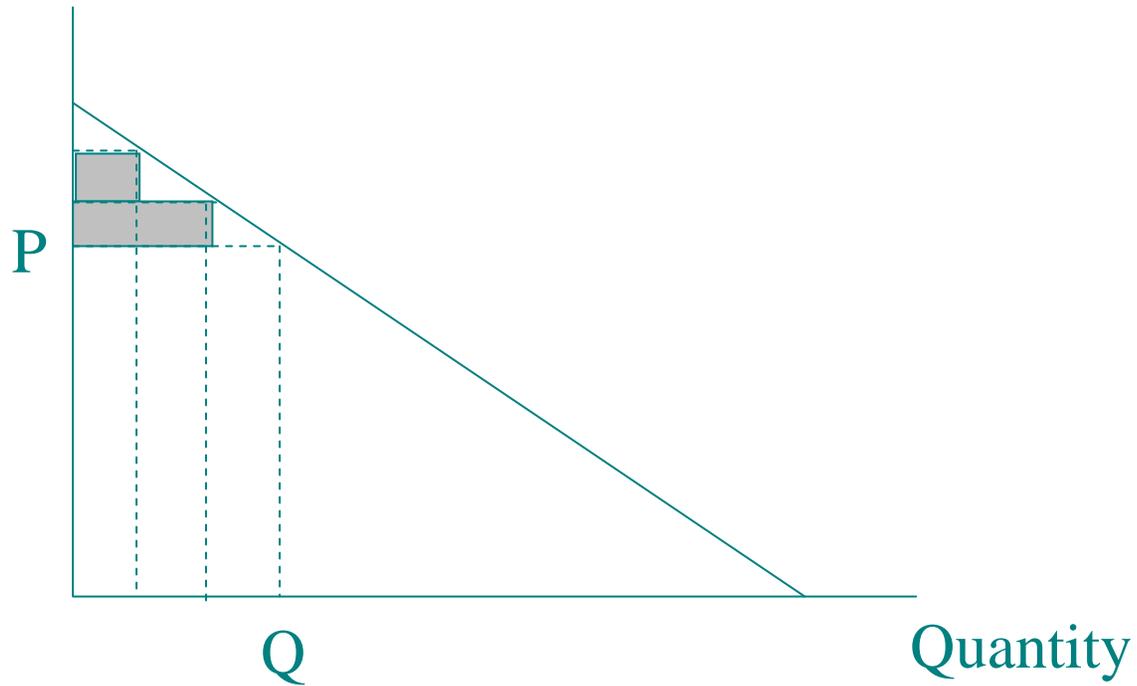
- Highly successful in achieving restoration settlements
- Upheld in court
- Framework for compromise

Travel Cost Models

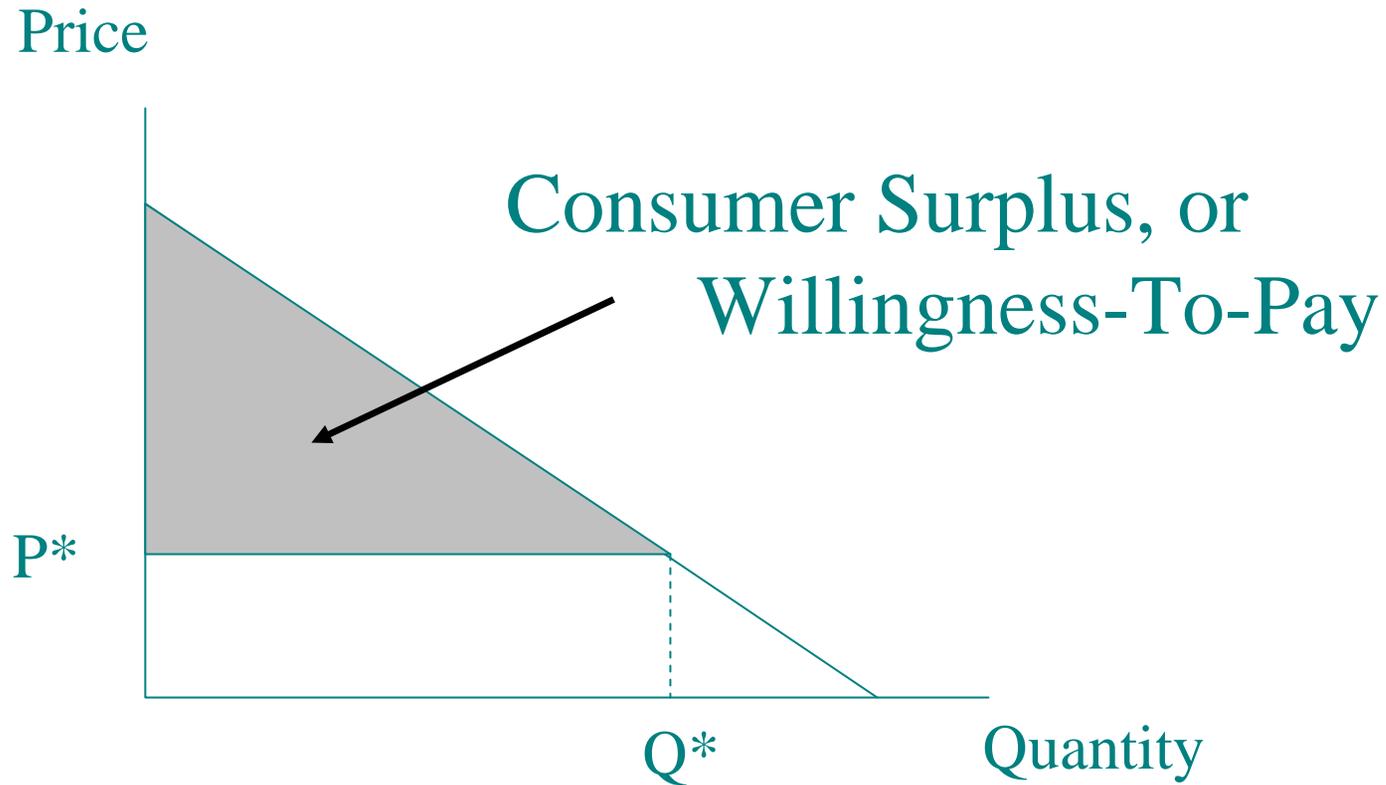
- Evaluates recreational services flows
- Exploits analogy to market behavior
- Price, Quantity, Consumer Surplus

Demand Curve Measures Value

Price



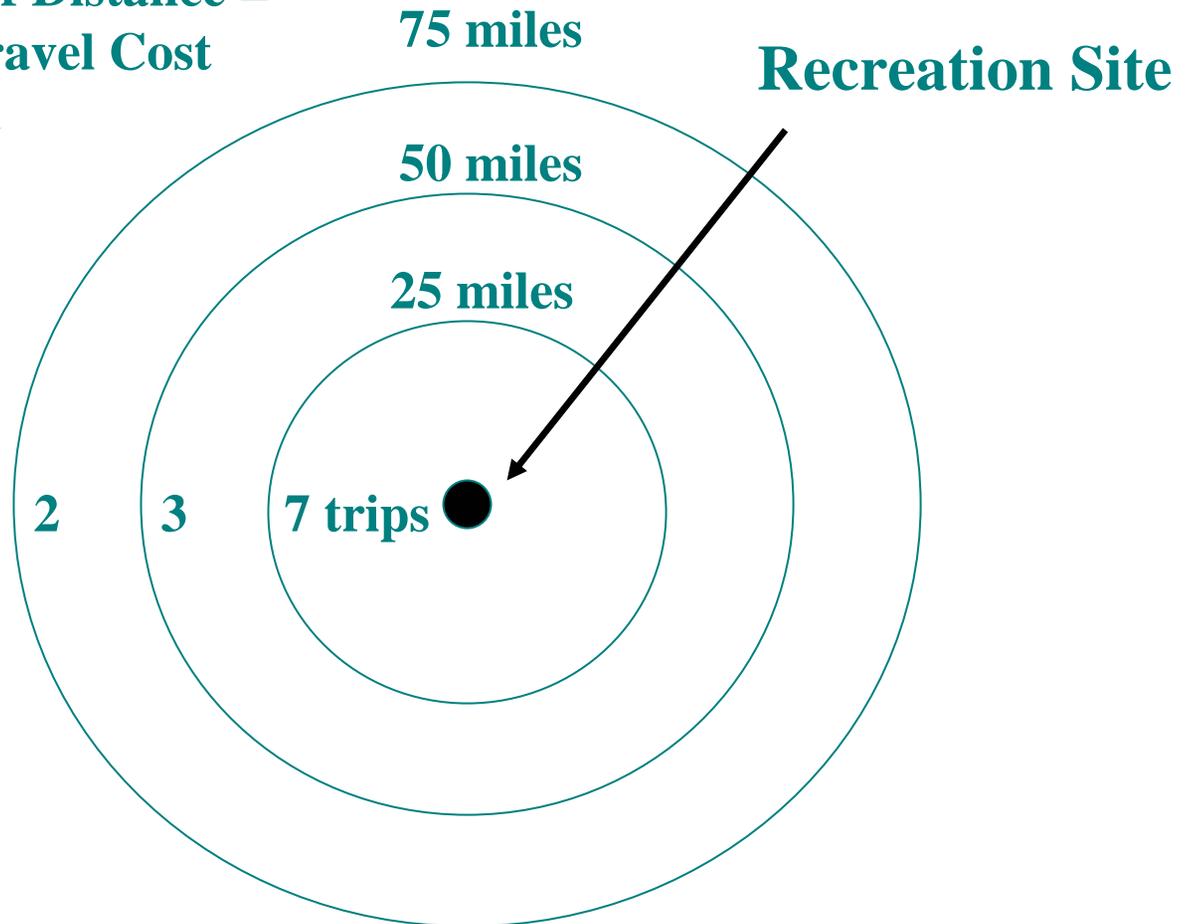
Total Consumer Surplus



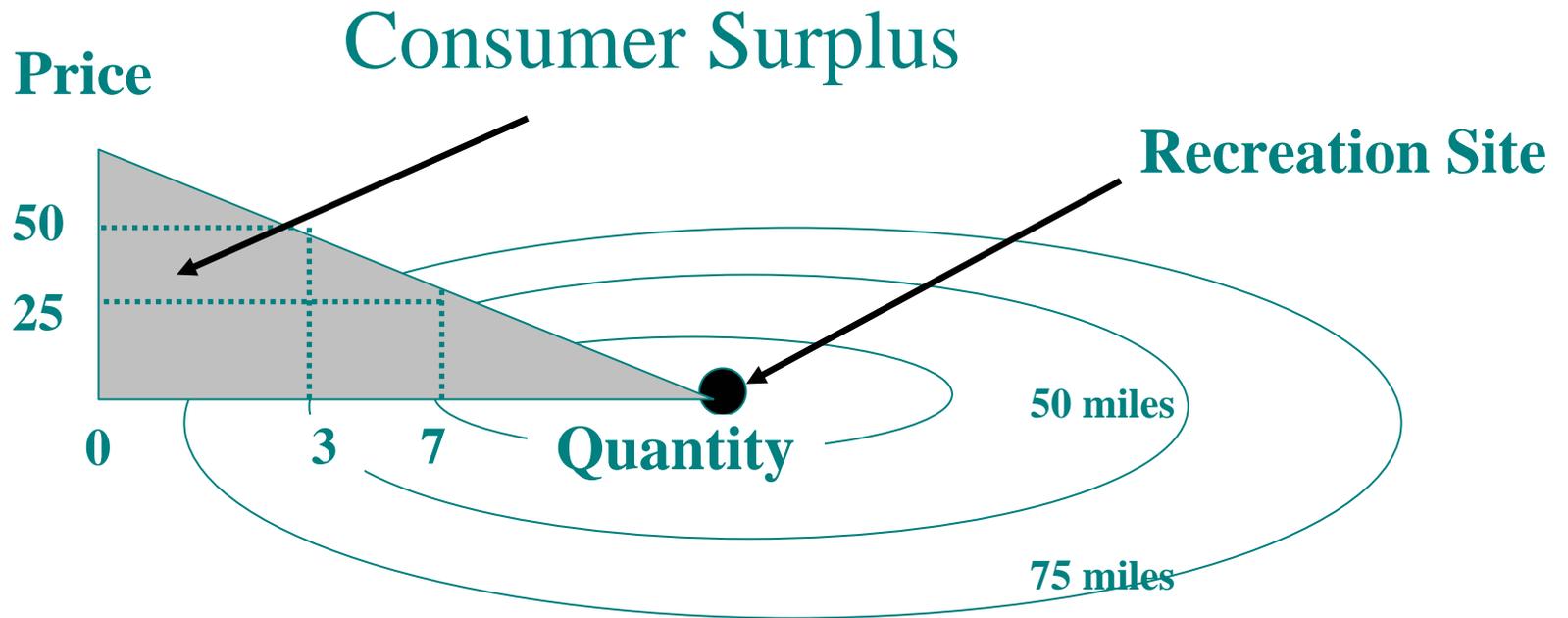
Travel Cost Valuation Method

**Price = A Function of Distance =
Out-of-Pocket Travel Cost
+ Time Cost**

**Quantity = Average
Trips per Person per
Season**



Travel Cost Demand Curve



Obtaining an Estimate of Value

- Estimate consumer surplus values for many sites
- Regress site values on site characteristics
- Estimate value of characteristics (e.g. urban environment, fish consumption advisories, fishing piers, bike paths)

Stated Preference Techniques

- Estimates demand curve using qualitative survey-response data
- Focuses on most important resource characteristics
- Commonly applied in market and non-market settings (e.g. product development and resource valuation)

Stated Choice Example (1)

EXAMPLE	Alternative A	Alternative B	Alternative C	Alternative D
Brand	McCain's	Old South	Generic	NONE OF THESE PRODUCTS
Grade	A	C	C	
Sweetness	Unsweetened	Sweetened	Sweetened	
Sale Offer	Package of 4	Unit	Unit	
Total Price/Package	\$3.75	\$1.75	\$1.00	
I Would Purchase.... (✓Check Only One)	<input type="checkbox"/> ↓	<input type="checkbox"/> ↓	<input type="checkbox"/> ↓	<input type="checkbox"/>
How Many of the Selected Product?	_____ packages of 4	_____ cans	_____ cans	

Stated Choice Example (2)

1. Assuming that the following areas were the **ONLY** areas available, which one would you choose on your next hunting trip, if either?

Features of Hunting Area	Site A	Site B	
Distance from home to hunting area	50 kilometres	50 kilometres	Neither Site A nor Site B I will NOT go moose hunting
Quality of road from home to hunting area	Mostly gravel or dirt, some paved	Mostly paved, some gravel or dirt	
Access within hunting area	Newer trails, cutlines or seismic lines, passable with a 2WD vehicle	Newer trails, cutlines or seismic lines passable with a 4WD truck	
Encounters with other hunters	No hunters, other than those in my hunting party, are encountered	Other hunters, on ATVs, are encountered	
Forestry activity	Some evidence of recent logging found in the area	No evidence of logging	
Moose population	Evidence of less than 1 moose per day	Evidence of less than 1 moose per day	

Check ONE and only one box

Please complete all 16 of the scenarios that follow. Missing any of these questions will not allow us to properly analyze your choices!

Obtaining an Estimate of Value

- Compares the value of resource losses and resource restoration to find the appropriate scale of restoration
- Combined with travel-cost model, or can stand alone

Benefits Transfer

- Valuation short-cuts using existing data
- Previous examples of above methods can be applied to new problems
- Explicit reliance on past studies to determine lost value
- Often used to supplement travel cost studies

Strengths of Economic Valuation Methods

- Supported by an extensive economics literature
- Upheld in court
- Flexibility in injury assessment and resource compensation

For Additional Information on NRDA Methods...

- Dunford, R.W. *et al.* "The Use of Habitat Equivalency Analysis in Natural Resource Damage Assessments." *Ecological Economics*, 2004.
- Penn and Tomasi. "Calculating Resource Restoration for an Oil Discharge in Lake Barre, Louisiana." *Environmental Management*, 2002.
- Hausman, J.A. *et al.* "Assessing Recreational Use Losses Due to Natural Resource Damage." *Journal of Public Economics*, 1995.
- Breffle, W.S., *et al.* "Combining Stated-Choice Questions with Observed Behavior to Value NRDA Compensable Damages," *The Handbook of Contingent Valuation*. (Forthcoming, original study at <http://www.stratusconsulting.com/staff/PDFs/TVereport.pdf>.)