REVEALED PREFERENCE METHODS

LESSON OBJECTIVES

01

Explain and apply Travel Cost Method

02

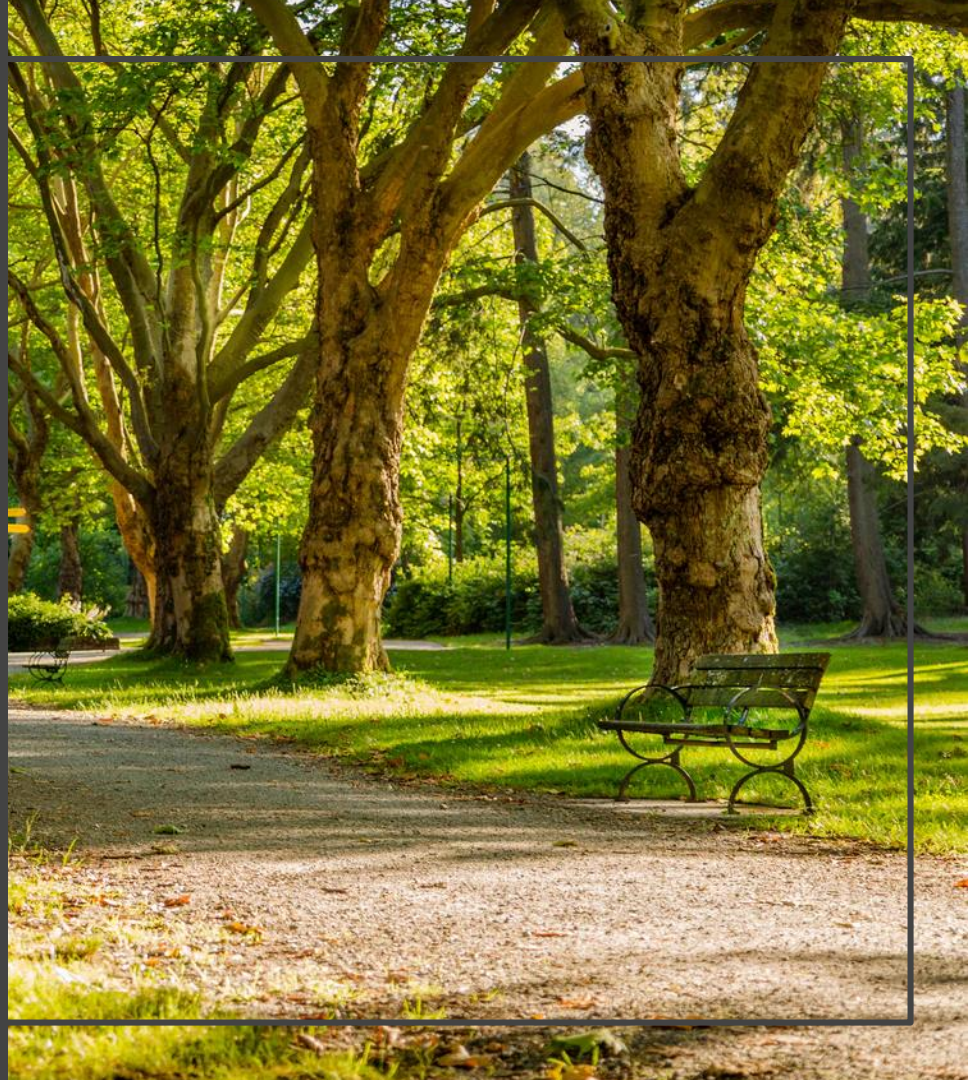
Explain and apply Averting Behavior Models

03

Explain and apply Hedonic Models

QUESTION OF THE DAY

Why are houses near parks more expensive?



TAXONOMY OF METHODS:

	Observed/Revealed Values	Stated/Hypothetical Values
Direct Method (Directly observe value)	Market prices	Contingent Valuation
Indirect Method (have to infer value)	Travel Cost Models Hedonic Models Averting Behavior Models	Choice Experiments

REVEALED PREFERENCE METHOD

Observe behavior indirectly, in related markets, to infer willingness to pay.

01

TRAVEL COST METHOD

HOUSEHOLD PRODUCTION MODELS

Combination of environmental good and market goods in household production function produces utility-yielding good or service

Example:
Travel + park = recreational day

Idea:
If the cost of market inputs are known, then we can infer the value of the environmental good

HOUSEHOLD PRODUCTION FUNCTION MODELS

There are a variety of non-market valuation methods based on household production function models.

We will consider:

- Travel cost methods
- Averting behavior models

TRAVEL COST METHOD (HOTELLING-CLAWSON-KNETSCH)

A history:

In 1947, the director of the National Park Service sent a letters to several top economists asking how to value the national parks

Harold Hotelling (UNC) responded, proposing the travel cost method

Method is primarily applied to recreational values

TRAVEL COST METHOD

Concept:

Imagine if they put a fence around Piedmont Park and charged an admission fee.

Result:

Can observe a price (cost of admission) and a quantity (number of people who visit)

TRAVEL COST METHOD

Concept: Infer value through opportunity costs of using the environmental good or service

Visiting a park takes time and money. We can measure this.

The “value” of a trip is reflected in the full cost paid to undertake the trip

The better the park, the more I am willing to pay.
The closer I am, the more frequently I will visit.

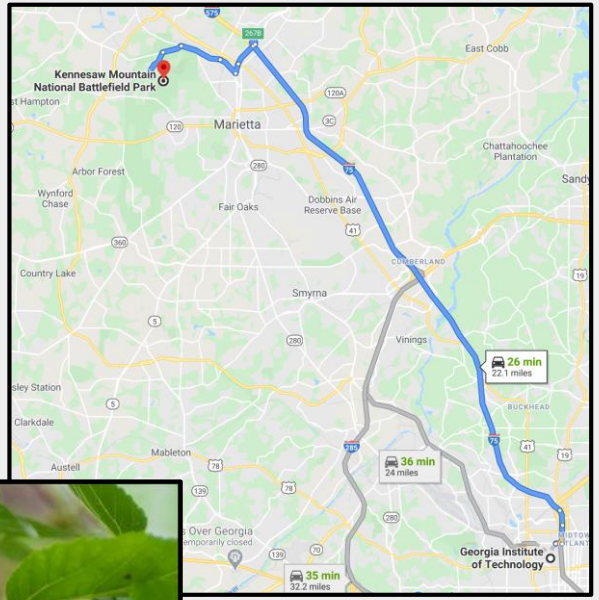
WHAT COMPRISES THE FULL PRICE (OR THE FULL COST)?

Examples:

- Admission fees
- Equipment costs
- Travel costs:
  - Fuel/airfare/car depreciation
  - Hotel/lodging
  - Food costs
- Value of time spent traveling

EXAMPLE: RECREATION AT KENNESAW MOUNTAIN

EX: RECREATION AT KENNESAW MOUNTAIN



EX: RECREATION AT KENNESAW MOUNTAIN

20 miles from campus (30 minute drive)
Opportunity cost of time (wage rate) = $20/hour
Car operating costs = $0.50/mile
Entrance fee = $5
Total travel cost?
= 0.5 hour x $20/hour + 20 miles x 0.50/mile + $5 = **$25**

ESTIMATING DEMAND

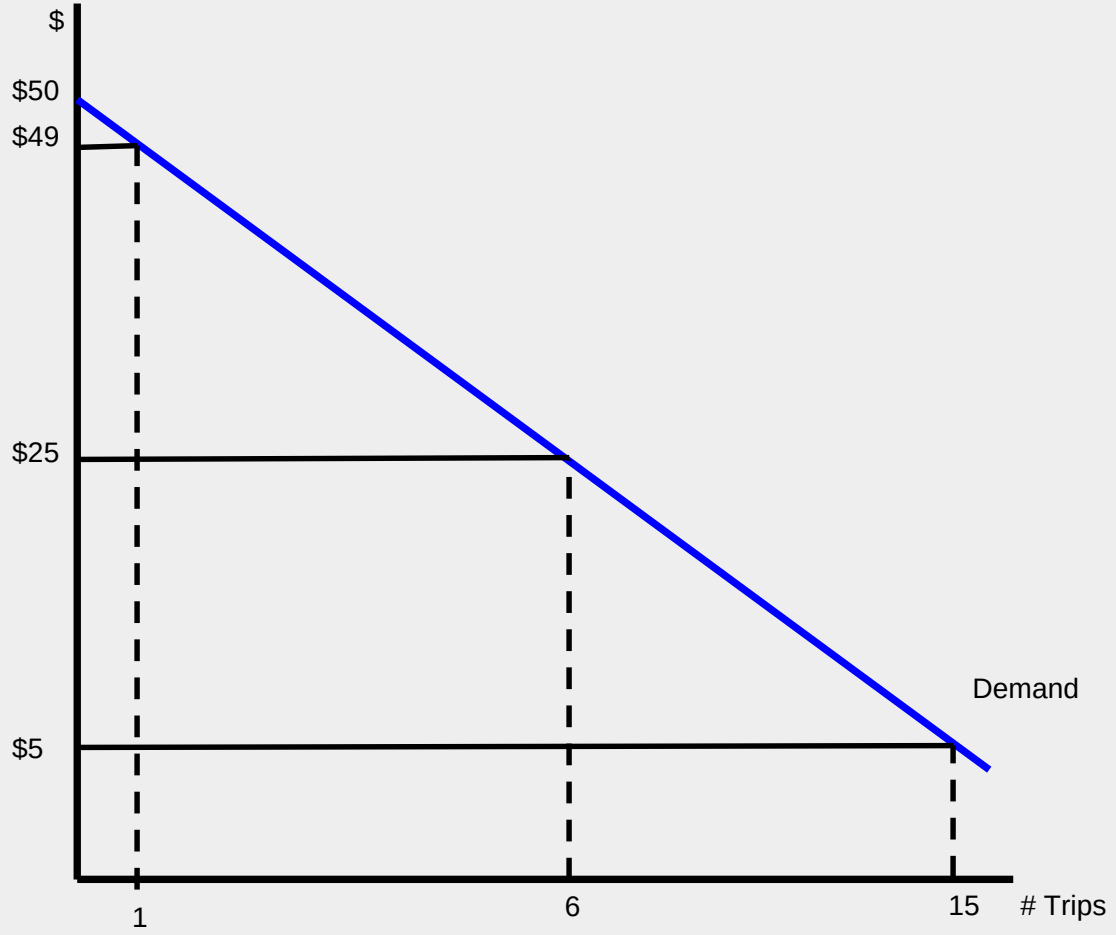
People live different distances from the mountain

Closer -> lower cost
Farther -> higher cost

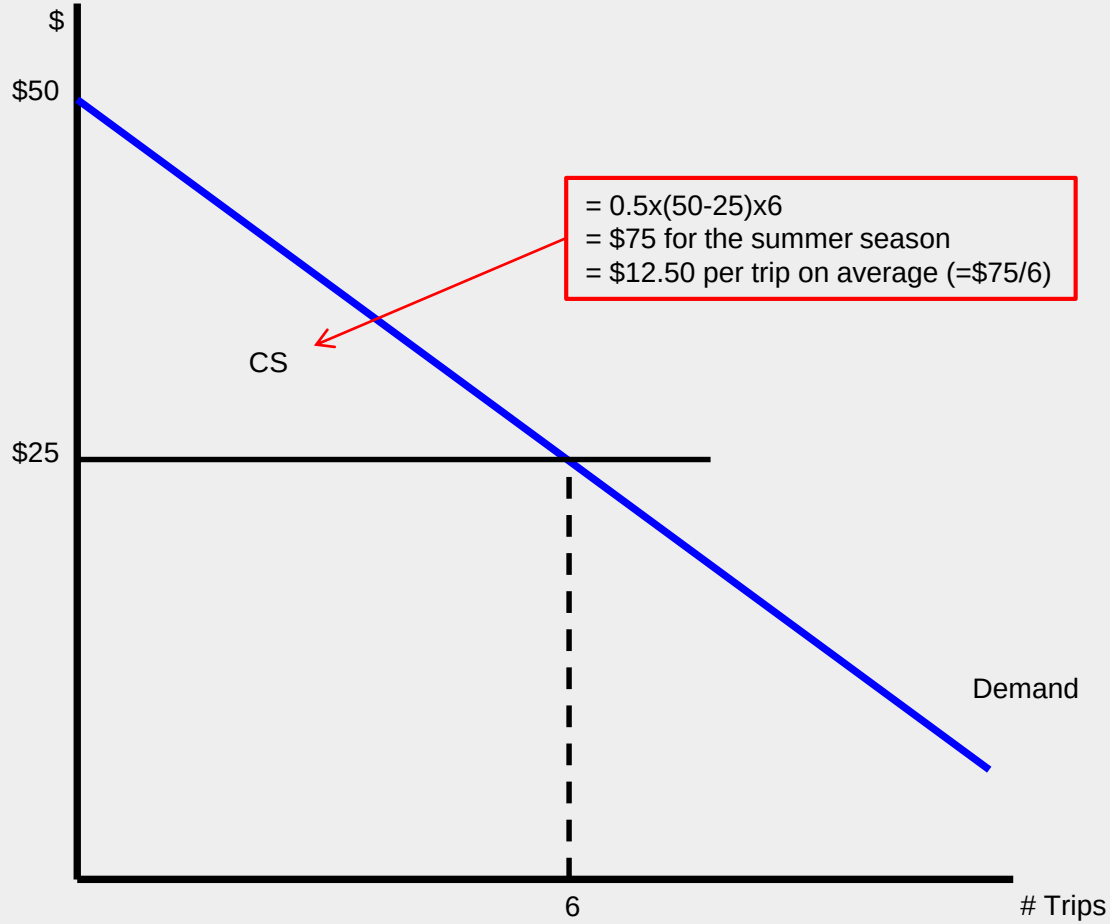
Survey random sample of visitors, we observe prices (costs) of trips and quantity of trips

Say $25 per trip is the average cost for a day-trip and we observe an average of 6 trips per season at this cost.

This information allows us to compute the net benefit (consumer surplus) associated with visiting Kennesaw Mountain (for the average trip)



What is the value per trip (for the average trip)?



EX: RECREATION AT KENNESAW MOUNTAIN

In 2017 there were an estimated 2.59 million trips to Kennesaw Mountain

We estimated a value of $12.50 in net benefits for the average trip.

What is the total value from recreation at Kennesaw Mountain?
$12.50x2.59 million = $32.375 million

One component of the value of Kennesaw Mountain is the recreational value it provides.

What are other values?

VALUE OF A CHANGE IN QUALITY?

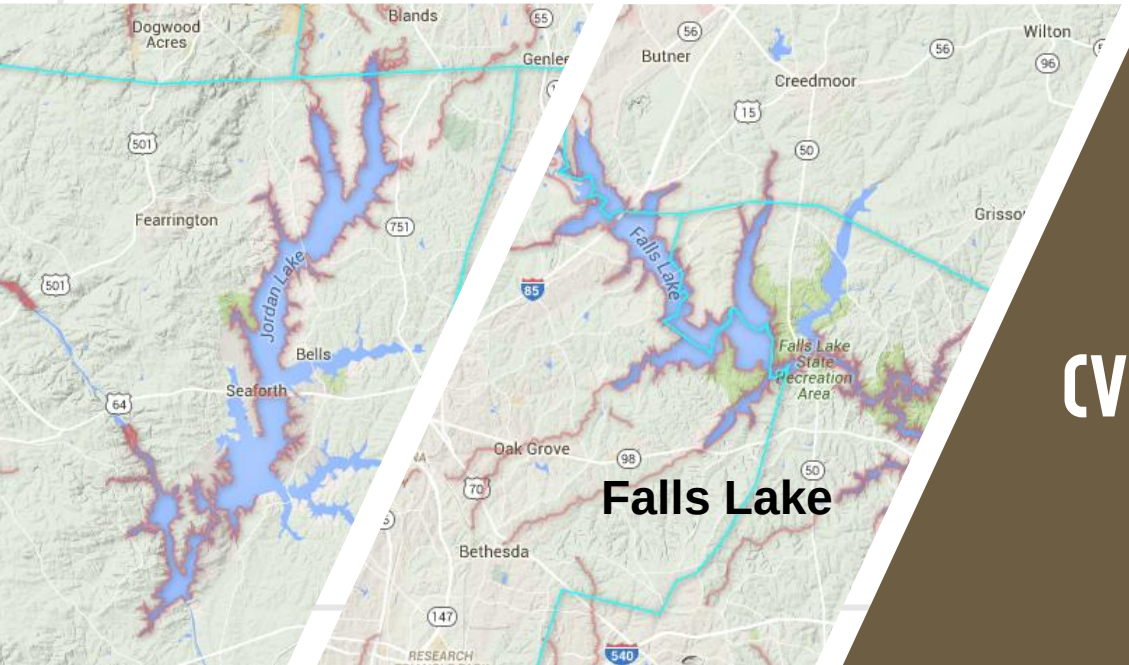
We can use the Travel Cost Method to measure the value associated with a resource.

A second measure of interest is the value associated with a change in quality.

Quality is affected by:

- Environmental conditions
- Congestion

The value of a change in quality is given by the change in consumer surplus.

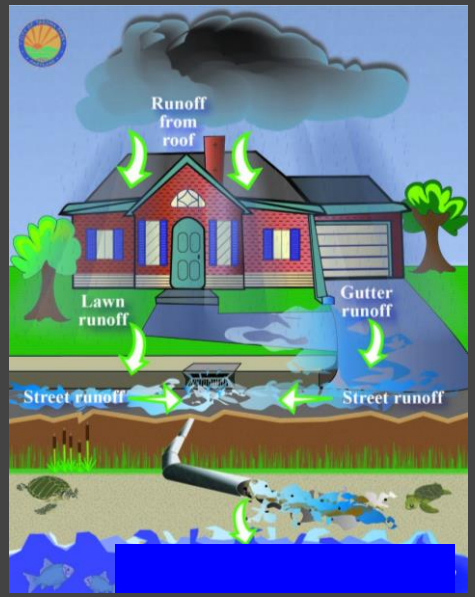


Falls Lake

EX. 2: FALLS LAKE (VON HAEFEN ET AL. STUDY)

CULPRITS?

Stormwater runoff



CULPRITS?

- Development

- Agriculture

- Wastewater Treatment

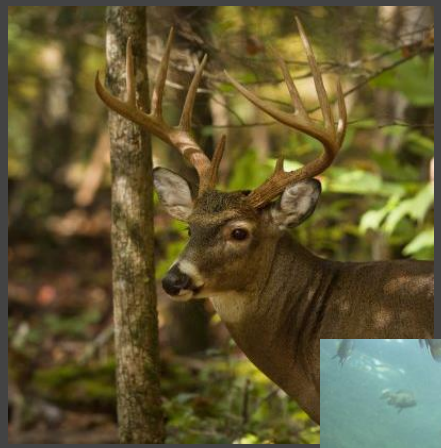
2010 FALLS LAKE NUTRIENT MANAGEMENT STRATEGY

Proposed rules:

- reduce nitrogen 40%
- reduce phosphorus 77%
- restore lake over 25 years

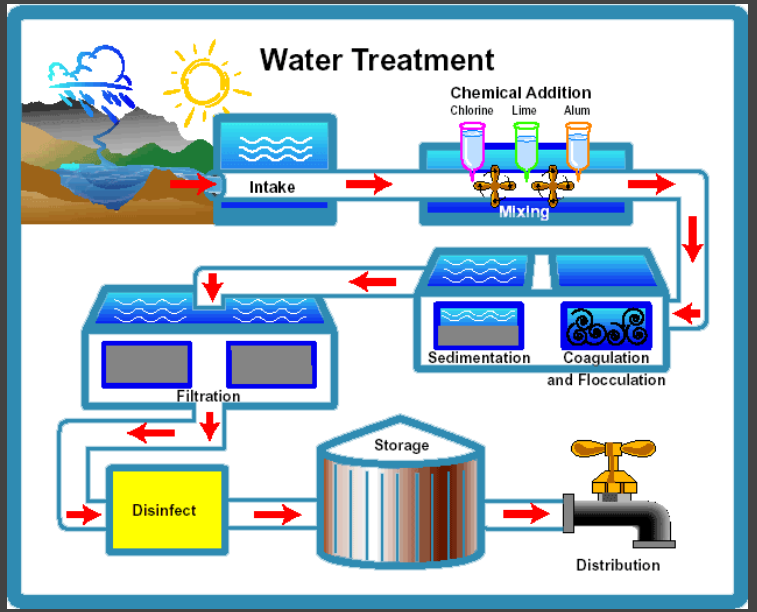
BENEFITS

Habitat



BENEFITS

Drinking water



BENEFITS

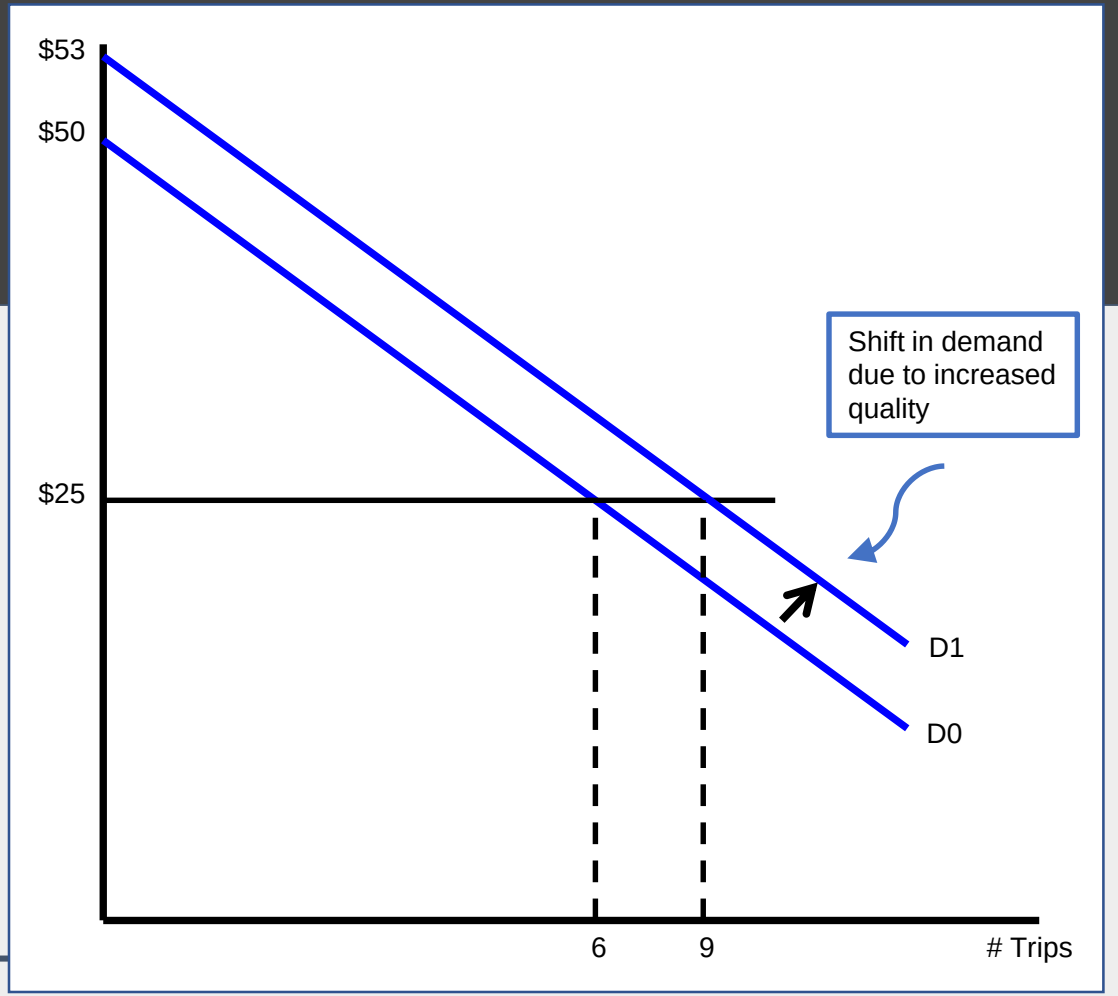
Recreation
- Boating
- Fishing
- Swimming
- Canoeing
- Hiking
- Birding

ATTENDANCE ACTIVITY

You survey travelers to Falls Lake both before (D0) and after (D1) the clean up.

Using the results of your survey, as shown in the graph, what is the estimated value of the clean up?

- Assume the travel cost is constant at $25.
- Assume constant 1 million visitors



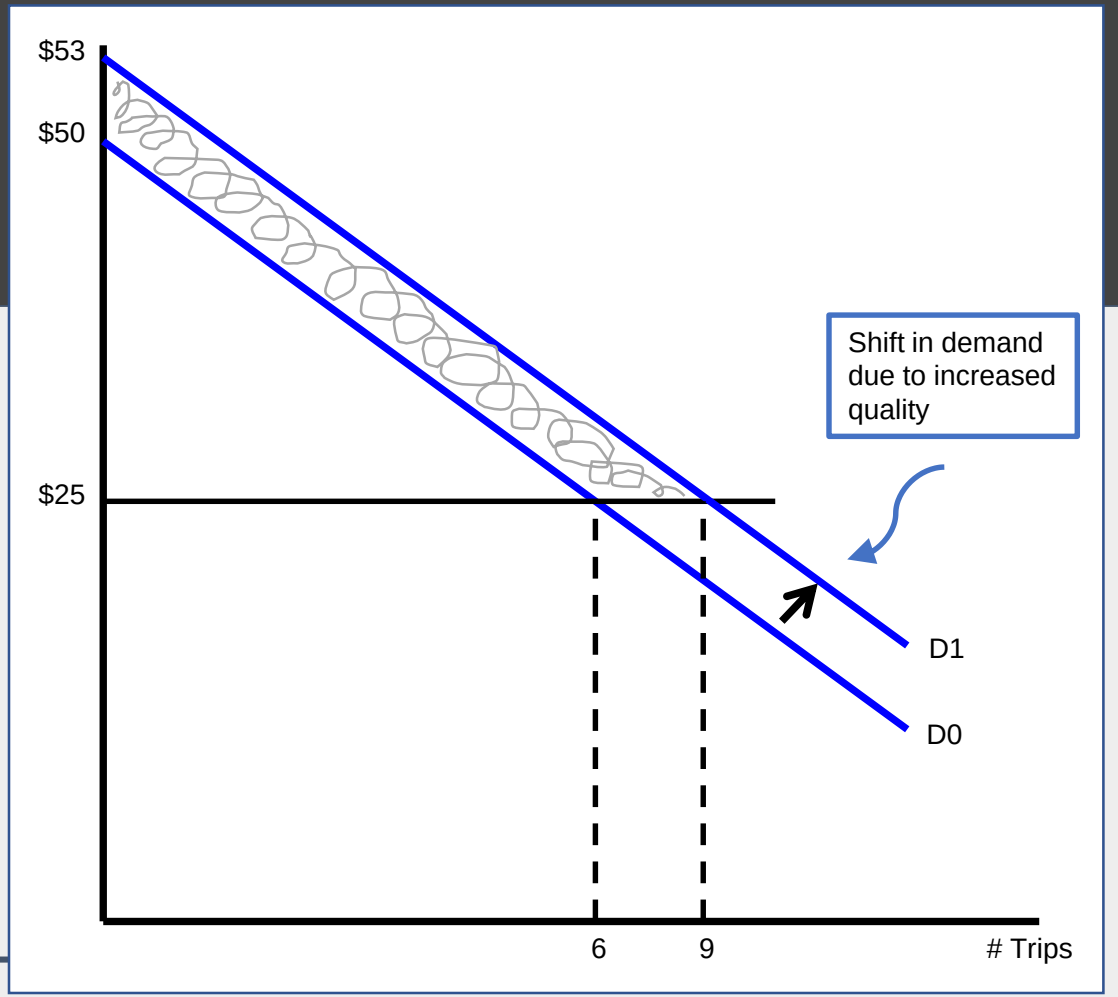
ATTENDANCE ACTIVITY

You survey travelers to Jordan Lake both before (D0) and after (D1) the clean up.

Using the results of your survey, as shown in the graph, what is the estimated value of the clean up?

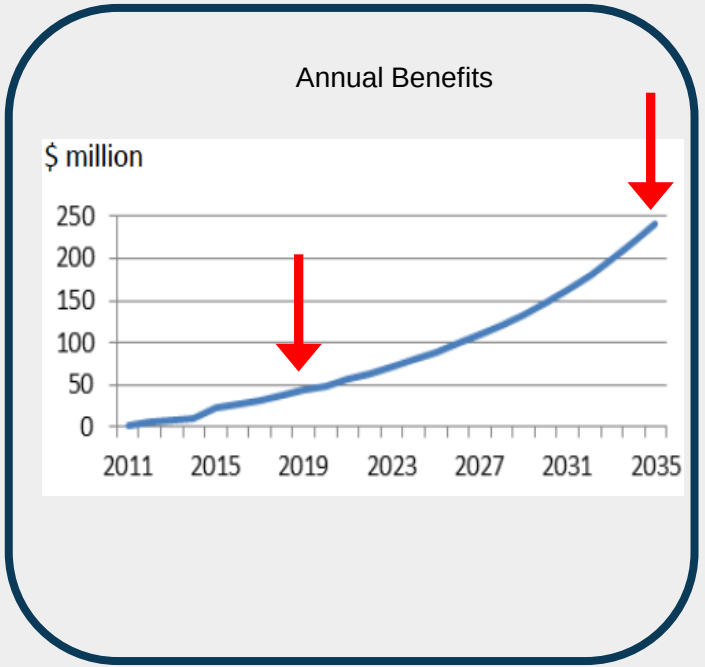
- Assume the travel cost is constant at $25.
- Assume constant 1 million visitors

0.5x9x($53-$25)-0.5x6x($50-$25)
= $51 or $51/9 = $5.67/trip
$51x1 million = $51 million



ECONOMIC BENEFITS OF ENHANCED RECREATION IF FALLS LAKE IS RESTORED

- $50 million per year by end of 10 years
- Over $200 million per year when rule is fully implemented



TRAVEL COST METHOD OVERVIEW

TRAVEL COST METHOD IN PRACTICE

Travel cost models (or a more sophisticated variant) are still commonly used for valuing recreation sites.

Value of time traveling tends to be a big source of variation in the travel cost:

What is the opportunity cost of time?
- Is working the next best alternative?
- Is there disutility from working that isn't present with travel?

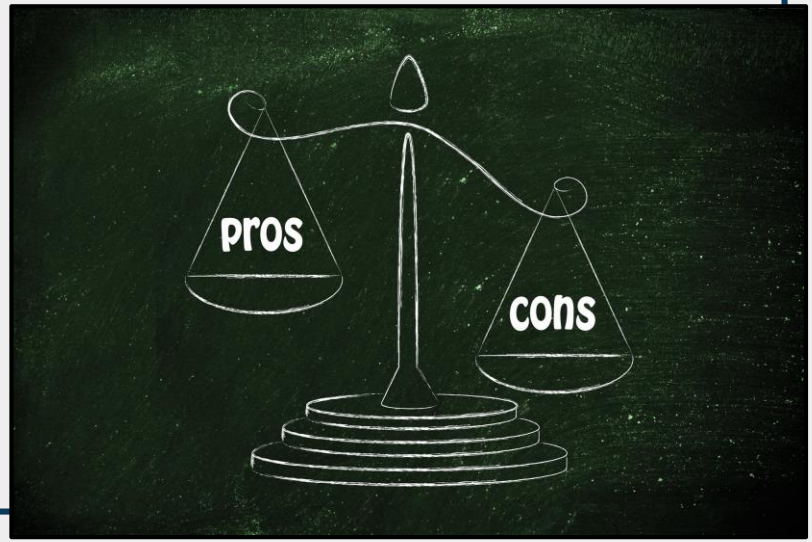
Other factors matter:
- Income, education, age, etc.
- Economists use statistical techniques (multivariate regression) to correct this

Multi-purpose trips

TRAVEL COST METHOD: PROS

Provide a great introduction to revealed preference

- Simple to use
- Easy to interpret

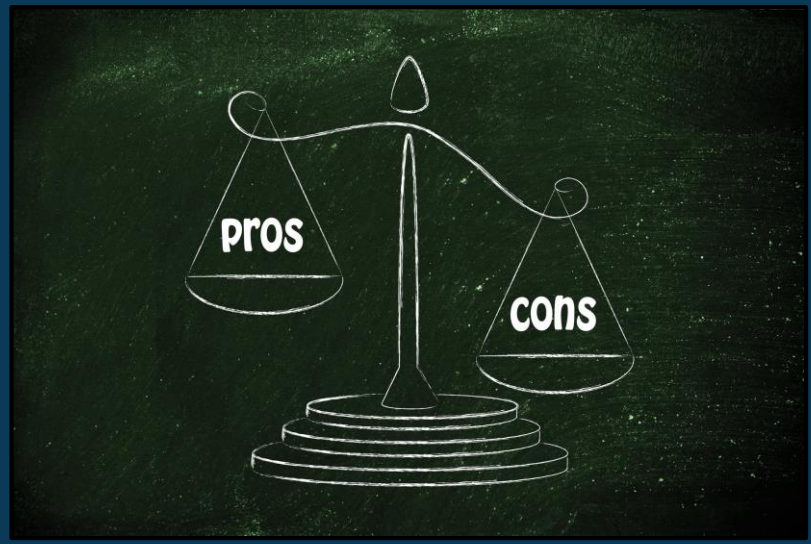


TRAVEL COST METHOD: CONS

Travel Cost can only measure use-values.

Often analysis is before the policy (before quality change).

- How to estimate the change in trips that would result from a change in quality that hasn't occurred?
  - → Can use surveys
  - → Can use data from a variety of sites with different quality



02

AVERTING BEHAVIOR MODELS

AVERTING BEHAVIOR MODELS: MOTIVATING EXAMPLE

You learn that your local drinking water has become contaminated and that by drinking it you can incur some health risks.

What do you do in response?

Go out and buy bottled drinking water.

At what cost? Average of $24-$48/household.

Can use these averting expenditures to measure cost of reducing risk.

AVERTING BEHAVIOR MODELS

People will exhibit averting behavior to avoid or lessen exposure to environmental bads (externalities)

Can use those costs to capture their WTP

PROBLEMS WITH AVERTING BEHAVIOR MODELS

1. Difficult to separate risk-reduction benefits from other benefits of the product or activity
   Ex. bottled water may taste better, be convenient, etc.

2. Difficult to separate risk-reduction benefits from other negative benefits of the product or activity
   Ex. bicycle helmets are uncomfortable

3. Imperfect Information
   Ex. continue drinking bottled water once source is cleaned

03

HEDONIC METHODS

HEDONIC METHOD: A MOTIVATING EXAMPLE

Consider two identical houses

- One in an area with clean air (House A)
- One in an area with polluted air (House B)

If both houses were for sale for $100,000, which would you buy?

Imagine there are many A's and B's. What will happen to the prices for these houses in the housing market?

- Prices will adjust until individuals are sufficiently compensated to move to house type B

Say prices end up at A = $105,000 and B = $75,000

- the "implicit price" or "hedonic price" of clean air is $30,000.

House A

House B

HEDONIC METHOD

Use observed market prices to infer the *implicit* prices for environmental amenities.

Common applications:

- Hedonic Property Method
- Hedonic Wage Method

BASICS OF HEDONIC PROPERTY METHOD

In practice, it is hard to find identical houses, so what do economists do?

Use statistical (regression) models to relate prices to characteristics of houses.

House Sales Price =
f(# bedrooms, # baths, sqft, lot size, fireplace?, pool?, school district quality, average income of neighbors, proximity to highway, proximity to park, distance from landfill)

HEDONIC PROPERTY METHOD EXAMPLE

National wildlife refuges provide 150 million acres of protected open space

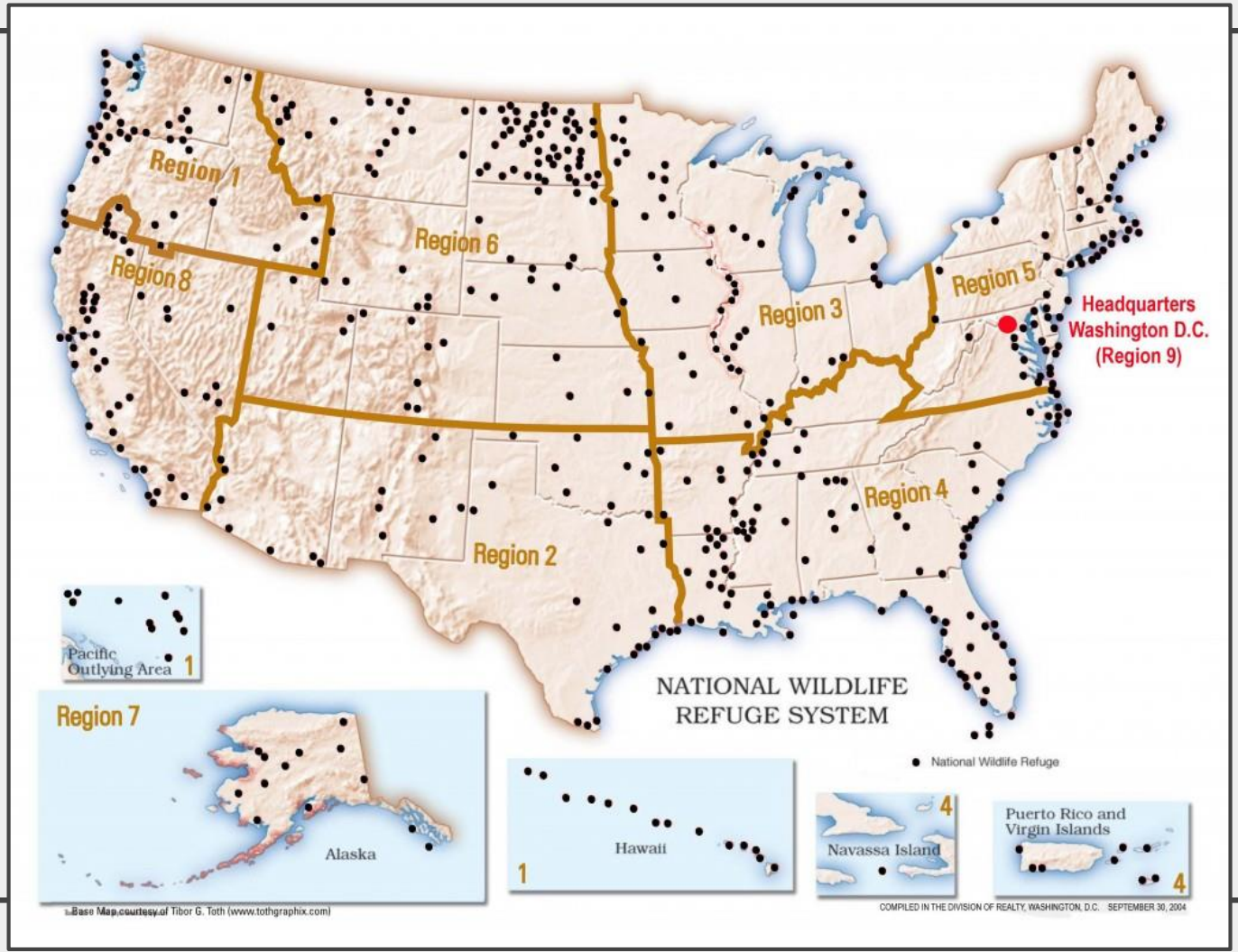
- Habitat for more than 1,300 species of plants and animals

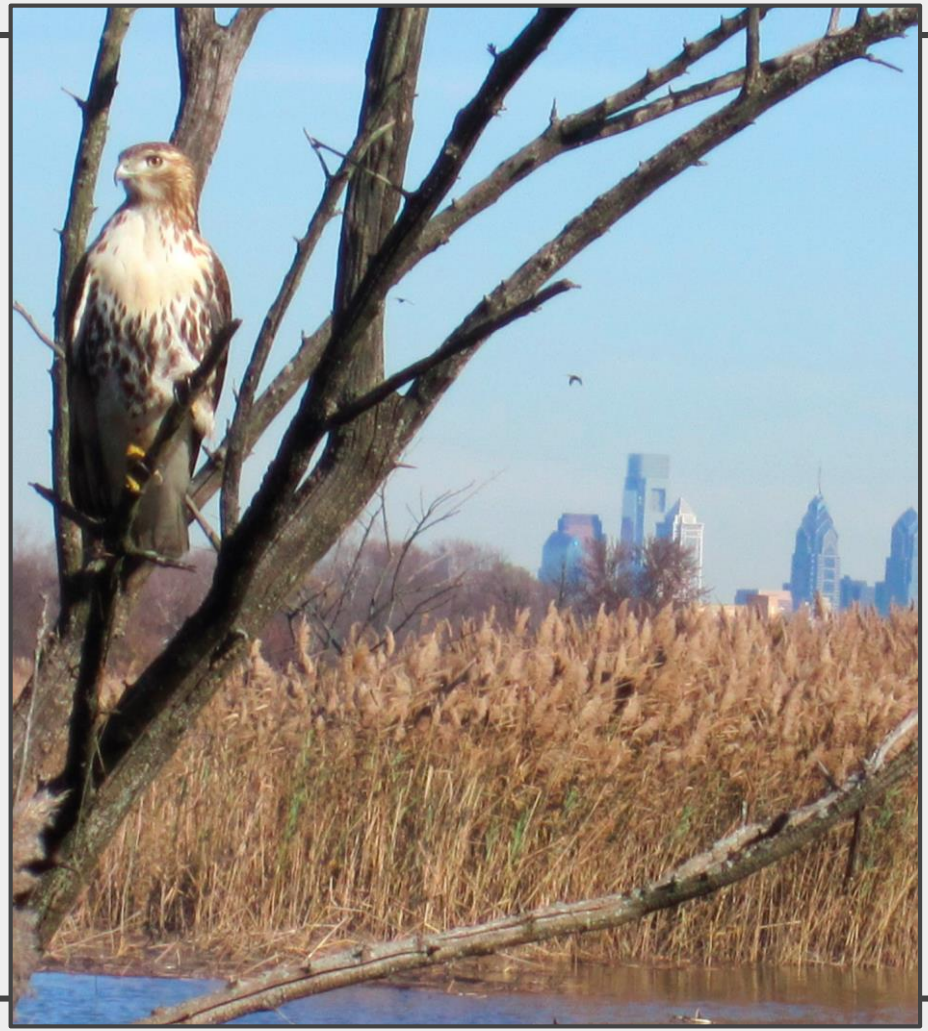
How do people value the permanently protected open space provided by national wildlife refuges.

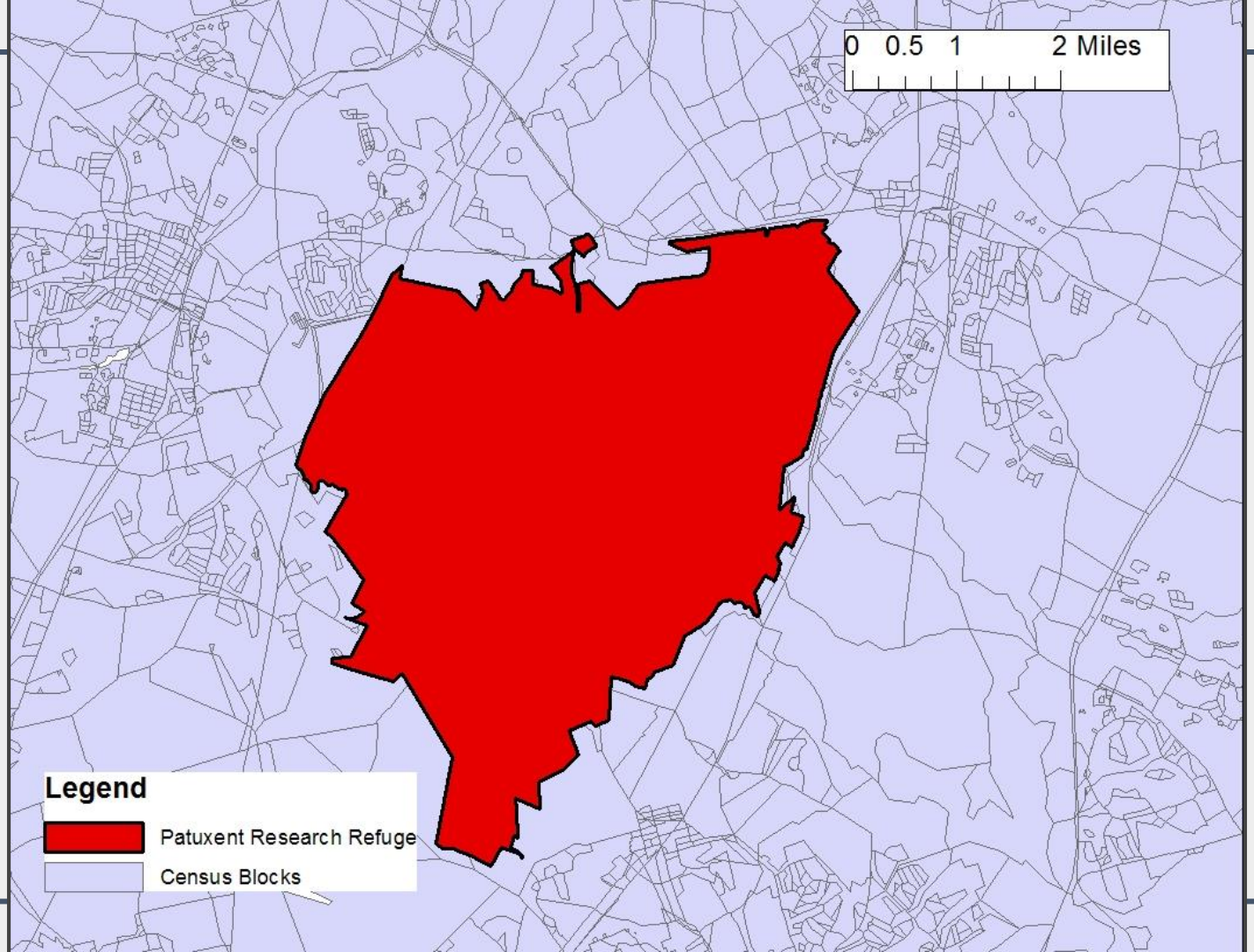
Examine property values near refuges within 2 miles of urban areas.

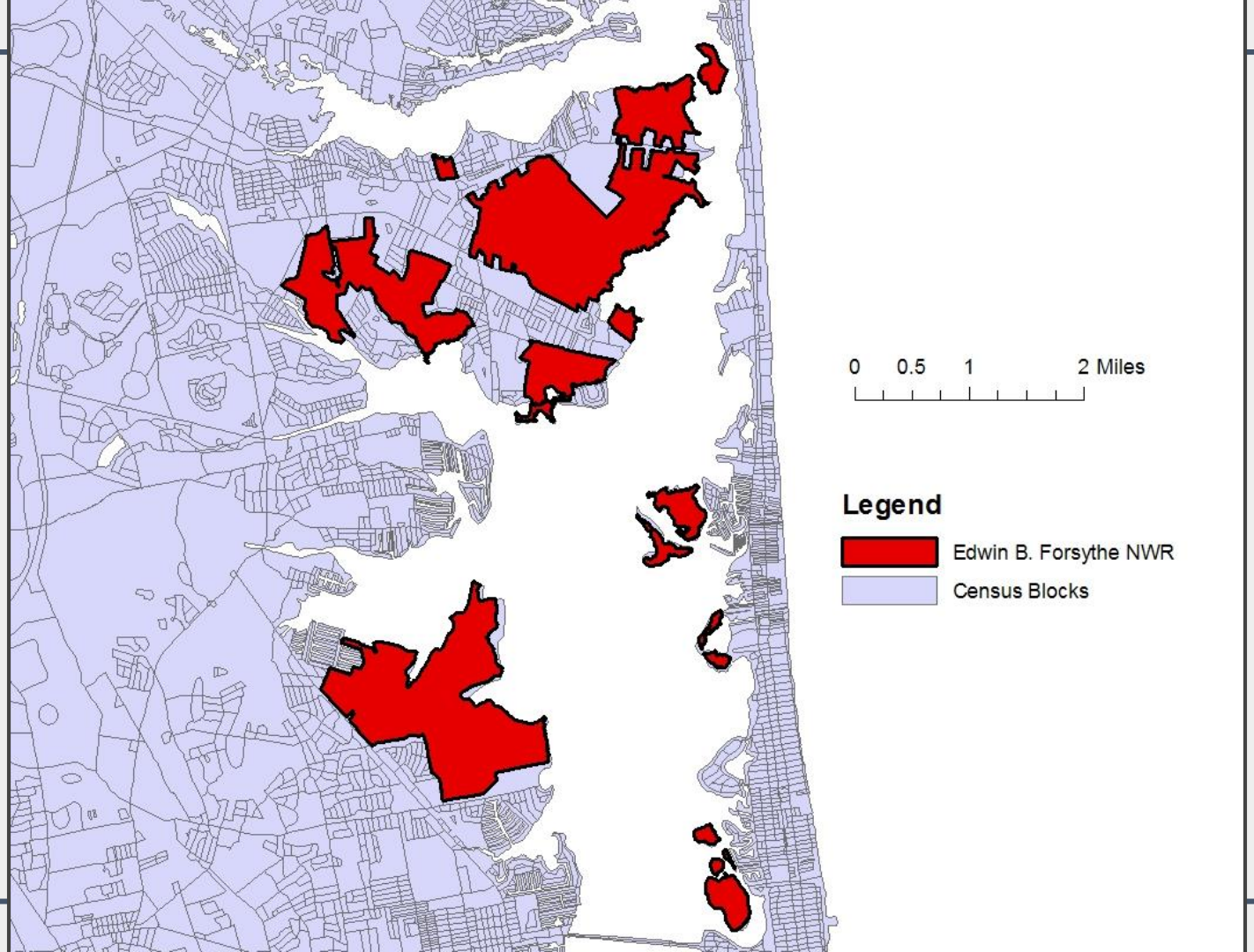
AMENITY VALUES OF NATIONAL WILDLIFE REFUGES

Taylor et al. (2012)


Region 1
Region 8
Region 6
Region 3
Region 5
Region 4
Region 2
Headquarters
Washington D.C.
(Region 9)
Pacific
Outlying Area
1
Region 7
Alaska
Hawaii
1
4
Navassa Island
Puerto Rico and
Virgin Islands
4
NATIONAL WILDLIFE
REFUGE SYSTEM
National Wildlife Refuge
Base Map courtesy of Tibor G. Toth (www.tothgraphix.com)
COMPILED IN THE DIVISION OF REALTY, WASHINGTON, D.C. SEPTEMBER 30, 2004




0 0.5 1 2 Miles
Legend
Patuxent Research Refuge
Census Blocks


0 0.5 1 2 Miles
Legend
Edwin B. Forsythe NWR
Census Blocks

STATISTICAL MODEL:

Price of house

Distance to refuge

Controls to help compare "identical" WLRs

Controls to help compare "identical" houses

$$\ln P_i = \alpha + \beta_1 D\_refuge_i + \beta_2 D\_refuge_i^2 + RC\eta + H_i\delta + N_b\gamma + G_b\theta + LC_{bg}\mu + \tau_{tr} + \varepsilon_i,$$

where the natural log of housing price for the *i*th house is assumed to be a function of its distance to the boundary of the nearest refuge (*D_refuge*), a vector of refuge characteristics (*RC*), a vector of housing characteristics describing the *i*th house (H_i), a vector of neighborhood characteristics measured at the block level (N_b), a vector of geographic descriptors of the census block in which the house is located (G_b), a vector of variables that describe the land cover of the block-group in which the house is located (LC_{bg}), and a vector of census tract fixed effects (τ_{tr}). The coefficients α, β, η, δ, γ, θ, and μ are to be estimated, and ε_i is an error term.[8] The covariates included in each vector were

ESTIMATES FOR THREE MODELS

(3 WAYS TO DESCRIBE DISTANCE)

Increasing distance from refuge decreases price

But effect wanes as distance increases

Houses within 0.5 miles sell for more than houses further away

Panel B: southeast region	Model 1	Model 2	Model 3
Distance	−0.221***		
	(0.045)		
Distance, squared	0.057***		
	(0.012)		
D0.5		0.101***	0.077***
		(0.035)	(0.023)
D1.0		0.038	
		(0.029)	
D1.5		−0.035	
		(0.025)	
D2.0		−0.034	
		(0.021)	
D2.5		−0.023	
		(0.018)	
R-squared	0.612	0.612	0.611
Observations	6970	6970	6970
Number of refuges	16	16	16

AGGREGATE VALUES

Marginal and total capitalized values (2010 $).

Panel A: regional impacts

	Marginal value (95% conf. interval)	Total capitalized value (millions) (95% conf. interval)
Northeast	$16,114 (5255–26,972)	$120.6 (31.2–159.3)
Southeast	$27,447 (17,023–37,871)	$153.8 (95.6–212.1)

Summing over the total number of houses within 0.5 miles of the refuges studied equals $120.6 million

Being within 0.5 miles of a refuge in the North increases property values $16,114 on average

	Average value per refuge[c] (millions)	Range[d] (millions)
Northeast	$11	$0.3/$42.1
Southeast	$11	

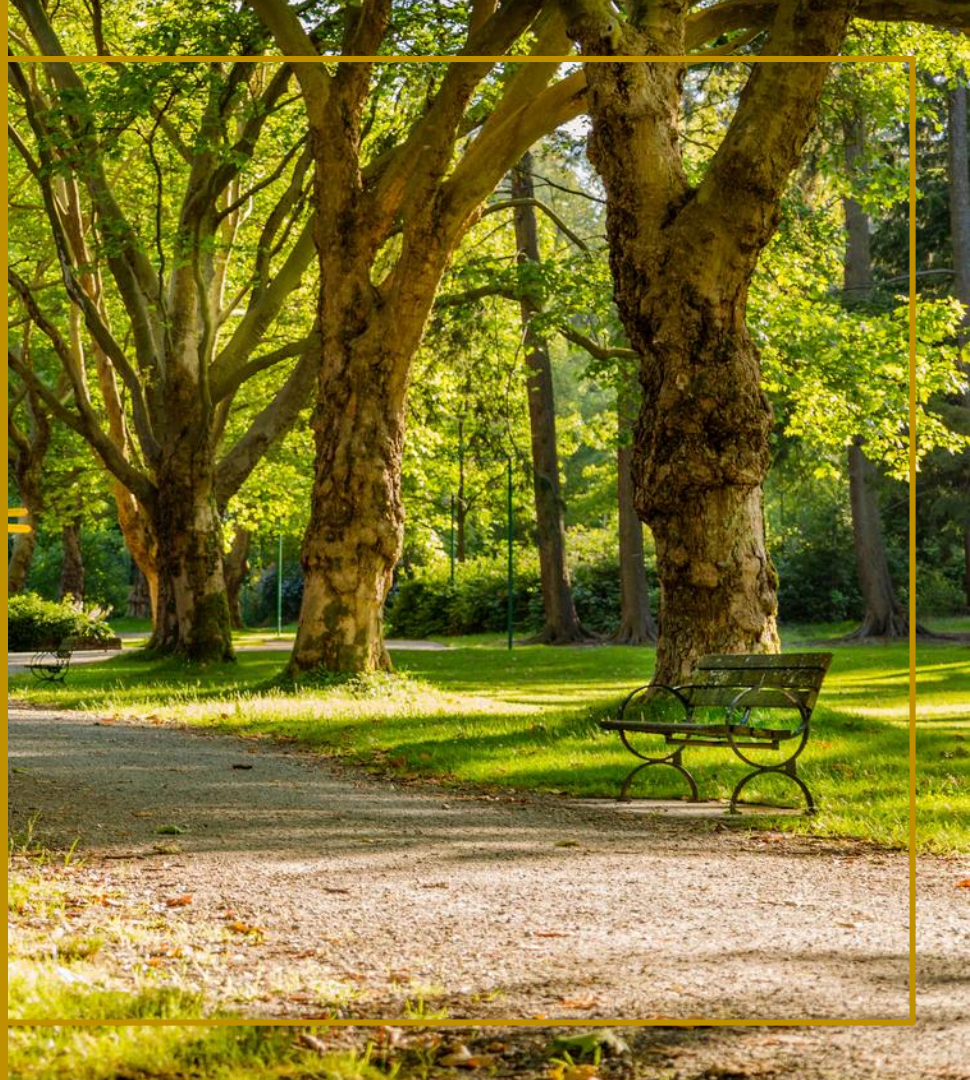
Average amount of property value increase around each refuge as a result of the refuge being there (and not being developed)

QUESTION OF THE DAY

Why are houses near parks more expensive?

People value the amenities provided by parks

What else is true of houses near parks?



PROBLEMS WITH THE HEDONIC METHOD

Often other amenities are correlated with environmental amenities

- Eg. House with better air quality is also in a better school district

These correlations can bias the results

- If other good amenties are correlated with environmental quality, does that lead to over or underestimate of value?

ATTENDANCE ACTIVITY

Think of an environmental policy.

Choose a method from the three we discussed today.

In your own words, first briefly describe how the method measures value. Then, describe how the method could be used to evaluate the benefits of your hypothetical policy.

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