

The Economic Value of Narragansett Bay

A Review of Economic Studies

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The Value of Ecosystem Services for Narragansett Bay

Goals

- **To review the studies** estimating values of ecosystem services for estuaries, continental shelf, forests, grasslands, wetlands, lakes and rivers, cropland, the ecosystems present in Narragansett Bay.
- **To identify gaps in information** about values of the Bay's natural resources, not only among the types of ecosystem services studied, but also between the two concepts of economic value.

The Economic Value of Natural Resources

■ The Income Concept

- Value added;
- Gross Product Originating (GPO)

Provides finite measure, but does not really describe utility.

■ The Gains From Trade Concept

- Willingness to pay; Consumer surplus;
- Willingness to sell; Producer Surplus;

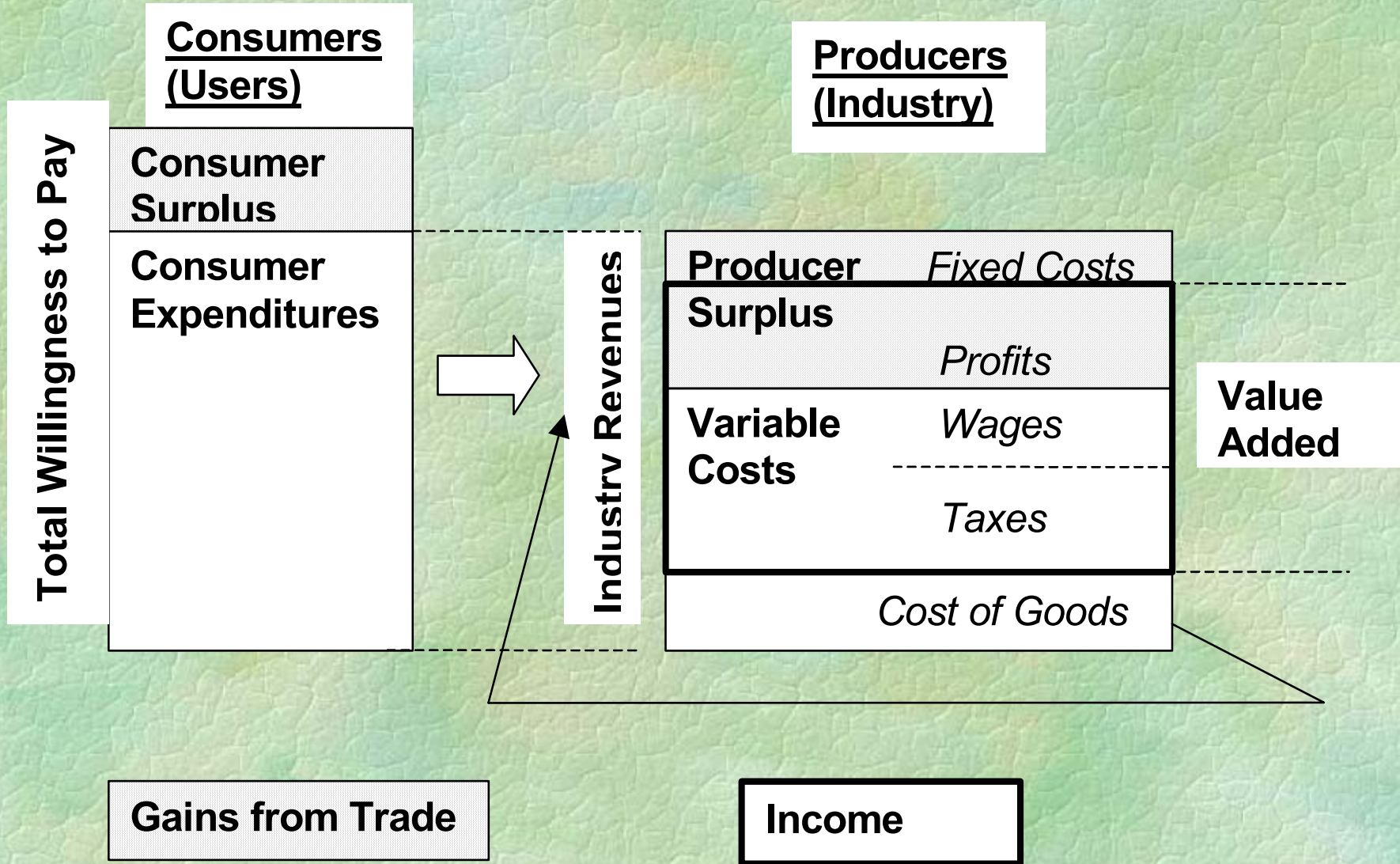
Provides a dollar measure of satisfaction received from natural resources, but is not necessarily finite and is difficult to measure.

■ Other Economic Measures

- Revenues Expenditures
- Wages Employment

Easy to obtain, but not accurate measures of value.

Value Concepts and Economic Measures



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Figure 1. Economic Value Concepts and Measures

The Value of Ecosystem Services for Narragansett Bay

- Constanza et al. (1997)
 - \$/hectare estimates of the values of different ecosystem types and their services
 - Major Problem : different data sources and estimation methods
 - Can be applied to assess economic value for a specific region if global values reflect local values

Narragansett Bay ecosystem services: \$2.1 billion (1994 dollars)

Table 1. Marine and Coastal Ecosystem Services and Functions

No.	Ecosystem Service	Ecosystem Function	Economic Activities
1	Gas Regulation	Regulation of atmospheric chemical composition	Air pollution
2	Climate Regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at local levels	
3	Disturbance Regulation	Capacitance, damping, and integrity of ecosystem response to environmental fluctuations	
4	Water Regulation	Regulation of hydrological flows	Irrigation
5	Water Supply	Storage and retention of water	Public water supply
6	Erosion Control and Sediment Retention	Retention of soil within an ecosystem	Public erosion control
7	Soil Formation	Soil formation processes	
8	Nutrient Cycling	Storage, internal cycling, processing and acquisition of nutrients	
9	Waste Treatment	Recovery of mobile nutrients and removal of breakdown of excess or xenic nutrients and compounds	Public waste treatment
10	Pollination	Movement of floral gametes	
11	Biological Control	Trophic-dynamic regulations of populations	
12	Refugia	Habitat for resident and transient populations	Habitat protection
13	Food Production	That portion of gross primary production extractable as food	Harvesting sectors: Agriculture, Commercial Fisheries
14	Raw Materials	That portion of gross primary production extractable raw materials	Harvesting and extraction sectors: Forestry, Mining
15	Genetic Resources	Sources of unique biological materials and products	
16	Recreation	Providing opportunities for recreational activities	Resource dependent recreational and tourism activities
17	Cultural	Providing opportunities and inputs for non-commercial uses	Resource dependent Government, NGO, and non-market activities
18	Commercial and Industrial	Providing inputs for commercial and industrial uses	Resource dependent Manufacturing, Wholesaling, Retailing, Services, etc.

Note: Adapted from Constanza et al. (1997), pp. 254

Table 2. Estimates of Narragansett Bay Ecosystem Values¹

Ecosystem Service	Global values by ecosystem service (\$/acre) ²							
	Estuaries	Shelf	Forest	Grass/Range	Wetlands	Lakes/Rivers	Cropland	Urban
Gas Regulation				2.8	53.8			
Climate Regulation			57.1	0.0				
Disturbance Regulation	229.5		0.8		1836.9			
Water Regulation			0.8	1.2	6.1	2203.6		
Water Supply			1.2		1537.8	856.7		
Erosion Control			38.9	11.7				
Soil Formation			4.0	0.4				
Nutrient Cycling	8539.1	579.1	146.1					
Waste Treatment			35.2	35.2	1690.4	269.1		
Pollination				10.1			5.7	
Biological Control	31.6	15.8	0.8	9.3			9.7	
Habitat/Refugia	56.9				123.0			
Food Production	210.8	27.5	17.4	27.1	103.6	16.6	21.9	
Raw Materials	10.1	0.8	55.8		42.9			
Genetic Resources			6.5	0.0				
Recreation	154.2		26.7	0.8	232.3	93.1		
Cultural	11.7	28.3	0.8		356.5			
Area (acres)³	100,208	500,000	318,995	5,636	102,249	18,756	50,112	191,572
Total Value (\$/year x 1000)	926,312.7	325,750.0	125,077.9	555.7	611,786.4	64,503.8	1,869.2	0.0

Note: Blank cells = not available; Shaded cells = service does not occur or is negligible

¹ Estimates refer only to the Rhode Island portion of Narragansett Bay, not the entire watershed

² Calculated from the \$/hectare estimates of Constanza et al. (1997) based on conversion factor of 2.471 acres/hectare.

All values are in 1994 U.S. dollars.

³ Source: Tyrrell and Harrison (2000)

The Value of Ecosystem Services for Narragansett Bay

Most of the studies found for Rhode Island and Narragansett Bay address only the ecosystem services directly linked to economic activities:

- **raw materials**
- **food production**
- **recreation services**
- **cultural services**
- **commercial and industrial services**

The Value of Ecosystem Services for Narragansett Bay

Table 3. Raw Materials Services Values of Narragansett Bay

Study	Geographic Scope	Basis for Valuation	Year	Value Estimates
Tyrrell and Harrison (2000)	Rhode Island	Resource dependent value added for forestry and mining industrial sectors	1997	\$22,000,000
Keller, Tosches, and Mycroft (2001)	Rhode Island	Annual average wages for the timber industry	2000	\$60,000,000

Table 4. Food Production Services Values of Narragansett Bay

Study	Geographic Scope	Basis for Valuation	Year	Value Estimates
Tyrrell, Devitt and Smith (1994)	Rhode Island	Revenues from commercial fish catch	1993	\$23,878,000
Save the Bay (2002)	Rhode Island	Revenues generated by commercial fish landings	1994	\$77,000,000
RIDEM, Division of Fish and Wildlife (2002)	Rhode Island	Revenues generated by the Rhode Island's seafood industry	1996	\$700,000,000
DeAlteris, Gibson, and Skrobe (2000)	Rhode Island	Value of commercial fishery landings	2000	\$73,000,000
National Marine Fisheries Services (2000)	RI and MA ports	Commercial fishery landings value of Narragansett Bay's ports	2000	Point Judith, RI: \$41,400,000 New Bedford, MA: \$146,300,000
Tyrrell and Hamison (2000)	Rhode Island	Annual resource-dependent contributions to the Gross State Product (value added) in agriculture and fisheries	1997	\$135,000,000
Colgan and Kite-Powell (2001)	Rhode Island	Gross Product Originating (GPO) and wages from living resources industries (fisheries and living marine resources)	1997	GPO: \$103,237,998 Wages: \$19,117,279
Rhode Island Senate Policy Office (2002)	Rhode Island	Average annual wages from fisheries and aquaculture industries	1999	Finfish: \$44,015 Shellfish: \$29,707
Scott et al. (2000)	Rhode Island	Farm gate value of aquaculture harvest	1999	\$213,861

Table 5. Recreation Services Values of Narragansett Bay

Study	Geographic Scope	Basis for Valuation	Year	Value Estimates
Tyrrell, Devitt and Smith (1994)	Rhode Island	Revenues, average annual wages and expenditures of Bay-related tourism industry	1993	Revenues: \$390,748,000 Wages: \$83,651,000 Expenditures: \$990,946
Colt, Tyrrell, and Lee (2000) Tyrrell and Harrison (2000)	Rhode Island	Revenues attributable to travelers and tourists Revenues from ocean-related events (\$/event) Total annual willingness to pay for recreation Total annual willingness to pay for Bay-related outdoor recreation activities	1998	\$2,500,000,000 \$1,000,000 \$6,700,000,000 \$2,000,000,000
Warziniack and Creason (2001)	Narragansett Bay Estuary	Revenues from tourism industry	1998	\$2,115,000,000
Colgan and Kite-Powell (2001)	Rhode Island	Gross Product Originating (GPO) and wages from tourism and recreation (on both water and land)	1997	GPO: \$140,051,675 Wages: \$51,570,360
Tyrrell, Devitt and Smith (1994)	Rhode Island	Expenditures of recreational fishing trips	1993	\$62,000,000
DeAlteris, Gibson, and Skrobe (2000)	Rhode Island	Revenues from recreational fishing trips	1998	\$150,000,000
Rhode Island Department of Environmental Management, Division of Fish and Wildlife (2002)	Rhode Island	Revenues generated by recreational industries' tackle shops, marinas, and charter boats	2000	\$150,000,000
Rhode Island Department of Environmental Management, Office of Strategic Planning and Policy (2001)	Rhode Island	Park generated revenues Revenues from non-resident beach fees Revenues from spending at stores and vendors near the East Bay Bike Path	1999 1996	\$3,150,000 \$875,277 \$2,200,000

Table 6. Cultural Services Values of Narragansett Bay

Study	Geographic Scope	Basis for Valuation	Year	Value Estimates
Tyrrell, Devitt and Smith (1994)	Rhode Island	Expenditures for research and regulation of the Bay	1993	\$38,161,317
Rhode Island Senate Policy Office (2002)	Rhode Island	Naval Undersea Warfare Center (NUWC) research budget	1998	\$637,000,000
		University of Rhode Island, Graduate School of Oceanography research budget	1999	\$22,423,129
Colgan and Kite-Powell (2001)	Rhode Island	Gross Product Originating (GPO) and wages from government industries (related to research, defense, ocean management)	1997	GPO: \$118,623,873 Wages: \$105,992,618

Table 7. Industrial and Commercial Services Values of Narragansett Bay

Study	Geographic Scope	Basis for Valuation	Year	Value Estimates
Tyrrell and Harrison (2000)	Rhode Island	Annual resource-dependent contributions to the Gross State Product (value added) for construction, manufacturing, transportation, trade, FIRE, and services industrial sectors	1997	\$1,724,000,000
Colgan and Kite-Powell (2001)	Rhode Island	Gross Product Originating (GPO) and wages from construction and rehabilitation (piers, wharves, dredging, beach restoration) Gross Product Originating (GPO) and wages from transportation (ocean transportation of goods and passengers)	1997	GPO: \$5,964,790 Wages: \$3,950,192 GPO: \$57,645,043 Wages: \$46,329,748
Tyrrell, Devitt and Smith (1994)	Rhode Island	Average annual wages of Bay-related industry	1993	\$167,431,800
Rhode Island Senate Policy Office (2002)	Rhode Island	Average annual wages from processors of canned and cured seafood industries Average annual wages from processors of fresh or frozen seafood industries	1999	\$37,460 \$25,134

Economic Value of Narragansett Bay (RI)

- **Rough Ecosystem Services (Mixed Concepts):**
\$2.1 billion/ Year
- **Value Added Concept**
\$2.3 billion/Year
- **Consumer Surplus Concept (Recreation Only)**
\$6.7 Billion/ Year

Future Work

- To include and estimate more **non-market economic values** of natural resources Narragansett Bay;
- To cover the **broader geographical scope** of the entire Narragansett Bay watershed
- To study and measure economic value **other ecosystem services** that are not directly related to specific economic activities;
- To **reconcile value concepts** and measures

The End