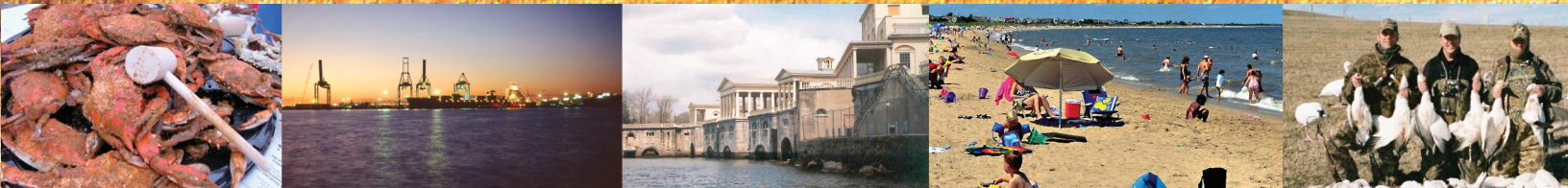


Economic Value of the Delaware Estuary Watershed

The Delaware Estuary watershed is the economic engine of the Delaware Valley

May 2011

prepared for



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What do Boeing, Sunoco, Campbell's Soup, DuPont, Wawa, Starbucks, Iron Hill Brewery, the Philadelphia Eagles, Salem Nuclear Power Plant, and the United States Navy have in common? They all depend on the waters of the Delaware Estuary to sustain their business.

The natural resources of the Delaware Estuary watershed provide tremendous economic value to our region. This report examines that value in three distinct ways:

- **Economic value directly related to the Delaware Estuary's water resources and habitats**

Using economic activity as a measure of value, the Delaware Estuary contributes over \$10 billion in annual economic activity from recreation, water quality and supply, hunting and fishing, forests, agriculture and parks.

- **Value of the goods and services provided by the Delaware Estuary's ecosystems**

Using ecosystem goods and services as a measure of value, the ecosystems of the Delaware Estuary (such as wetlands, forests, farms, and water) provide \$12 billion annually in goods and services in 2010 dollars, with a net present value of \$392 billion calculated over a 100-year period.

- **Employment related to the Delaware Estuary's water resources and habitats**

Using employment as a measure of value, the Delaware Estuary directly and indirectly supports over 500,000 jobs with over \$10 billion in wages annually. This does not include the thousands or even millions of jobs in companies and industries that rely on waters of the Delaware Estuary for their industrial and commercial processes.

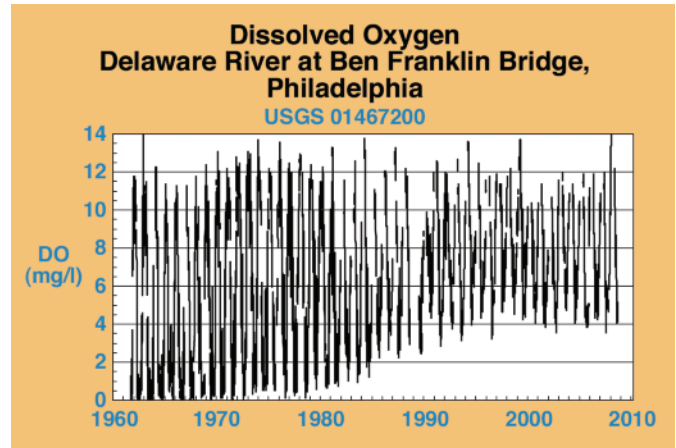


Note that the three economic categories above cannot be summed because there is a measure of overlap between certain values that could result in double counting. For example, the ecosystem values of forests for water-quality benefits are at least partially captured in the economic value of water supply. However, the above estimates clearly indicate the Delaware Estuary is an economic engine that contributes over \$10 billion annually to our region's economy.



The Delaware River Revival

The Delaware Estuary is recovering after decades of neglect. In 1961 President Kennedy signed the Delaware River Basin Compact as the first federal-state watershed accord. In 1996 Congress added the Delaware Estuary as the only tri-state watershed in the National Estuary Program. With these watershed programs, the Delaware River revival is underway as depicted on the chart of dissolved oxygen at the Ben Franklin Bridge at Philadelphia.

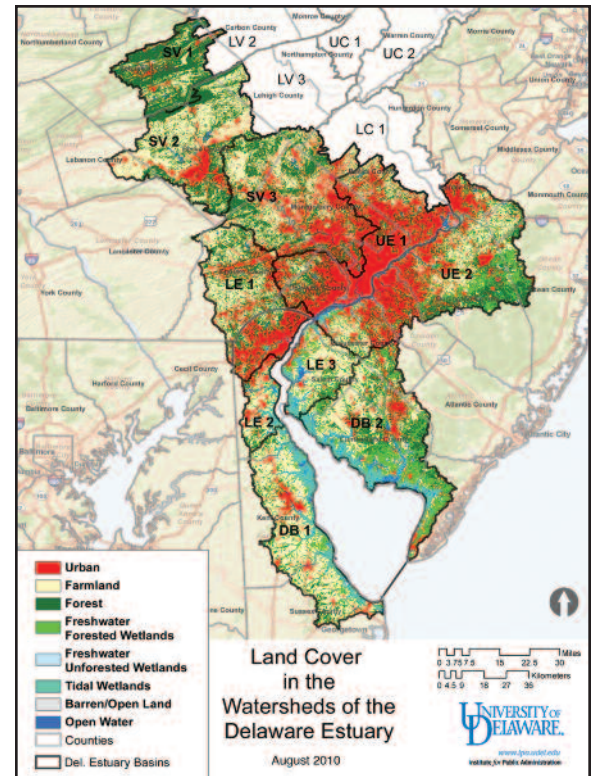


The Delaware Estuary Watershed

The Delaware Estuary watershed covers just 0.2% of the continental U.S., yet it supplies drinking water to 2% of the U.S. population. If the Delaware Estuary watershed were considered as a state, it would be the 13th most populous just after Virginia and ahead of Washington and Massachusetts.

The Delaware Estuary watershed occupies about 6,000 square miles, including:

- **Delaware** (50% of its land area and 72% of its population)
- **Maryland** (just 8 square miles, negligible population)
- **New Jersey** (26% of its land area and 19% of its population)
- **Pennsylvania** (7% of its land area and 35% of its population)



From 2000-2010, the population in the Delaware Estuary watershed grew by 5.1% or about 325,000. The population increased by 24% in Kent and Sussex Counties, Del., 12% in Gloucester Co., N.J., and 14% in Chester Co., Pa. Philadelphia gained population for the first time in half a century. Cape May Co., N.J., and Schuylkill Co., Pa., lost population. In 2010, 6,700,000 resided in the watershed's four-state area:

- **Delaware** (pop. 642,000)
- **Maryland** (pop. 2,300)
- **New Jersey** (pop. 1,645,000)
- **Pennsylvania** (pop. 4,410,000)



Annual Economic Value

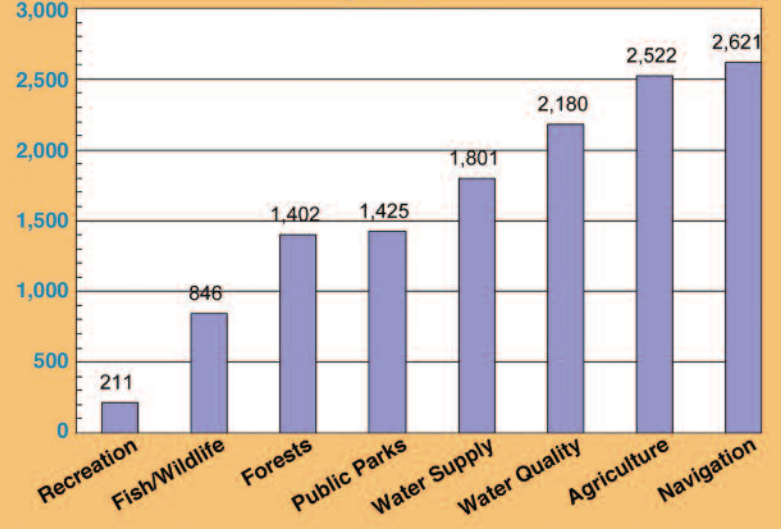
The Delaware Estuary watershed contributes over \$10 billion in annual market and non-market value. Market value is determined by the sale/purchase of watershed goods such as drinking water, fish, or hunting supplies. Non-market value is provided by ecosystems such as pollution removal by forests, public willingness to pay for water quality, forest carbon-storage benefits, and health benefits of parks.

Totals were rounded down to avoid double counting and ensure values are not overstated (see table).

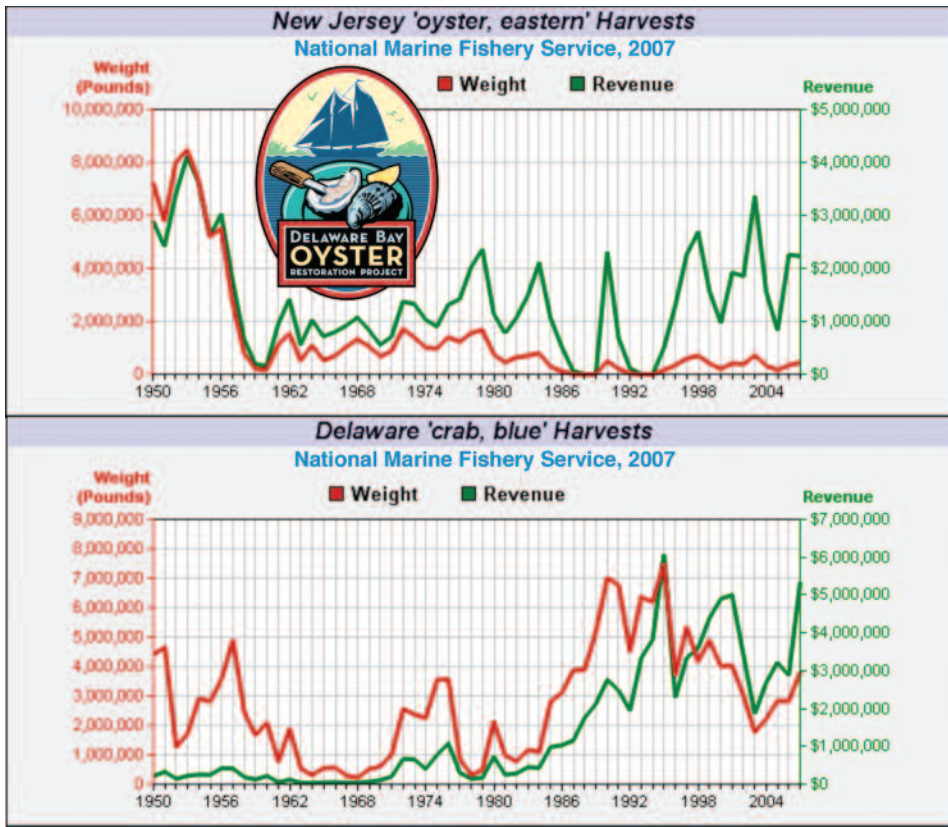
Ecosystem Services

The Delaware Estuary watershed is rich in natural resources and habitat, as measured by the economic value of ecosystem goods and services. Ecosystem goods are benefits provided by sale of watershed products, such as drinking water and fish. Ecosystem services are economic benefits provided to society by nature, such as water filtration, flood reduction, and carbon storage. The value of natural goods

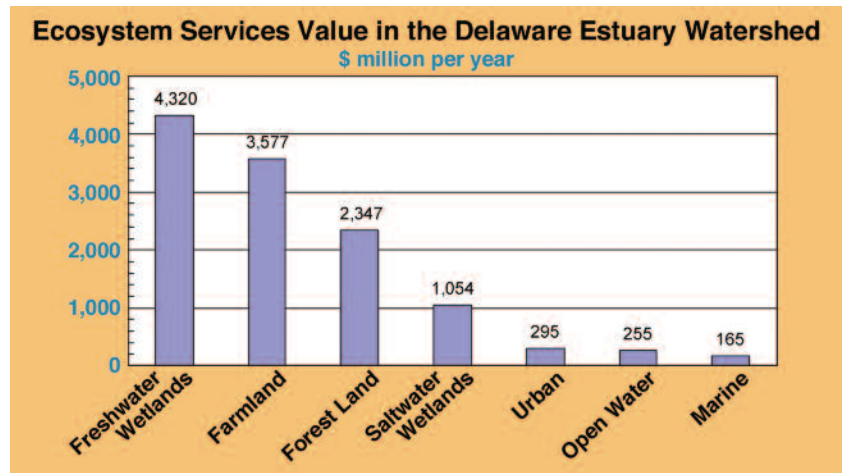
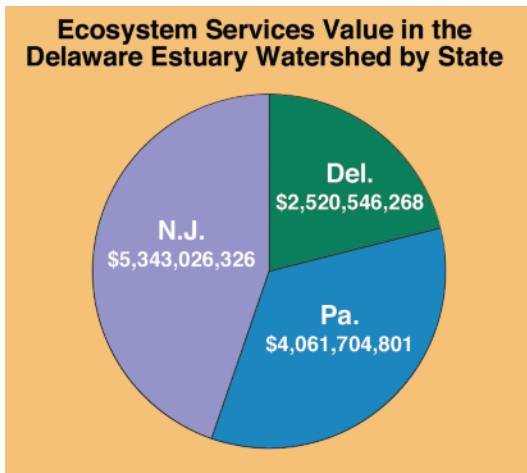
Annual Economic Value of the Delaware Estuary Watershed
\$ million



Annual Economic Value of the Delaware Estuary Watershed		\$million
Market Value		> \$8 billion
Water Quality		
Water Treatment by Forests (\$62/million gallons per day)		17
Wastewater Treatment (\$4.00/thousand gallons)		1,490
Increased Property Value (+8% over 20 years)		13
Water Supply		
Drinking Water Supply (\$4.78/thousand gallons)		1,333
Irrigation Water Supply (\$300/acre-foot)		30
Thermoelectric Power Water Supply (\$44/acre-foot)		298
Industrial Water Supply (\$200/acre-foot)		140
Fish/Wildlife		
Commercial Fish Landings (\$0.60/lb.)		34
Fishing (11-18 trips/angler, \$17-\$53/trip)		334
Hunting (16 trips/hunter, \$16-\$50/trip)		171
Wildlife/Bird-watching (8-13 trips/year, \$15-\$27/trip)		306
Agriculture		
Crop, poultry, livestock value (\$2,300/acre)		2,522
Maritime Transportation		
Navigation (\$15/acre-foot)		221
Port Activity		2,400
Non-Market Value		> \$2 billion
Recreation (Boating, Fishing, Swimming)		
Swimming (\$13.40/trip)		9
Boating (\$30/trip)		47
Fishing (\$62.79/trip)		52
Wildlife/bird watching (\$77.73/trip)		104
Water Quality		
Willingness to Pay for Clean Water (\$38/nonuser, \$121/user)		660
Forests		
Carbon Storage (\$827/acre)		981
Carbon Sequestration (\$29/acre)		34
Air-Pollution Removal (\$266/acre)		316
Building Energy Savings (\$56/acre)		66
Avoided Carbon Emissions (\$3/acre)		4
Public Parks		
Health Benefits (\$9,734/acre)		1,057
Community Cohesion (\$2,383/acre)		259
Stormwater Benefit (\$921/acre)		100
Air-Pollution Control (\$88/acre)		9



and services from ecosystems in the Delaware Estuary watershed is \$12 billion (in 2010 dollars) with net present value (NPV) of \$392 billion, using a discount rate of 3% over 100 years (see table at the bottom of this page). Ecosystem services by state: Delaware (\$2.5 billion, NPV \$81.9 billion), New Jersey (\$5.3 billion, NPV 173.6 billion), Pennsylvania (\$4.1 billion, NPV \$132.0 billion), and Maryland (negligible).



Ecosystem Goods and Services Value of the Delaware Estuary Watershed

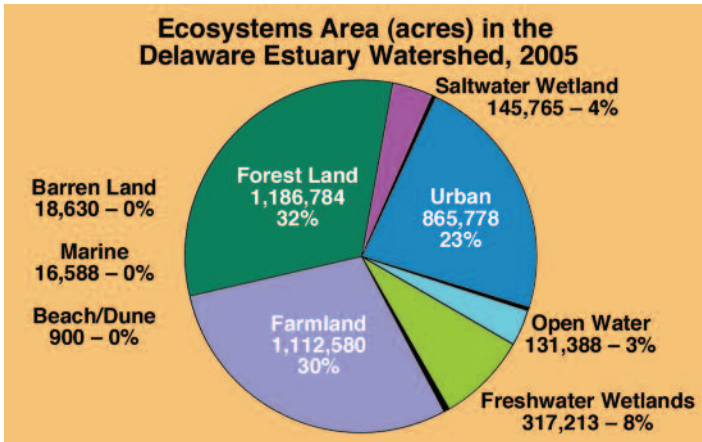
Ecosystem	Area (acres)	\$/acre/year 2010 ¹	\$/year 2010	NPV \$
Freshwater wetlands	317,213	13,621	4,320,647,087	140,421,030,319
Marine	16,588	10,006	165,982,947	5,394,445,767
Farmland	1,112,580	3,215 ²	3,577,486,604	116,268,314,632
Forest land	1,186,784	1,978	2,347,605,465	76,297,177,613
Saltwater wetland	145,765	7,235	1,054,617,851	34,275,080,170
Barren land	18,630	0	0	0
Urban	865,778	342	295,761,123	9,612,236,487
Beach/dune	900	48,644	43,758,633	1,422,155,566
Open water	131,388	1,946	255,655,983	8,308,819,443
Watershed Total	3,795,626		12,061,000,000	391,999,000,000

1. New Jersey Department of Environmental Protection, 2004. 2. USDA, 2009



Jobs and Wages

The Delaware Estuary watershed is a jobs engine that supports over 500,000 direct and indirect jobs with \$10 billion in annual wages in the coastal, farm, ecotourism, water/wastewater, recreation, and port industries. Totals were rounded down to avoid double counting and ensure values are not overstated (see table).



<i>Jobs and Wages Related to the Delaware Estuary Watershed</i>			
Sector	Jobs	Wages (\$million)	Data Source
Direct Basin-related	192,785	4,280	U.S. Bureau of Labor Statistics (2009)
Indirect Basin-related	231,342	3,420	U.S. Census Bureau (2009)
Coastal	44,658	947	National Coastal Economics Program (2009)
Farm	28,276	1,159	USDA Census of Agriculture (2007)
Fishing/Hunting/Birding	24,713	812	U.S. Fish and Wildlife Service (2008)
Water Supply Utilities	2,290	127	University of Delaware and DRBC (2010)
Wastewater Utilities	1,021	51	University of Delaware and DRBC (2010)
Watershed Organizations	150	8	University of Delaware and DRBC (2010)
Port Jobs	12,121	772	Economy League of Greater Philadelphia (2008)
Delaware Estuary watershed totals	> 500,000	> \$10 billion	

Jobs directly associated with the Delaware Estuary watershed (i.e., water/sewer construction, water utilities, fishing, recreation, tourism, and ports) employ 192,785 people with \$4.3 billion in wages:

- **Delaware** (15,737 jobs, \$340 million wages)
- **New Jersey** (52,007 jobs, \$1.1 billion wages)
- **Pennsylvania** (125,041 jobs, \$2.8 billion wages)

Jobs indirectly related to the waters of the Delaware Estuary watershed (based on multipliers of 2.2 for jobs and 1.8 for salaries) employ 231,342 people with \$3.4 billion in wages in:

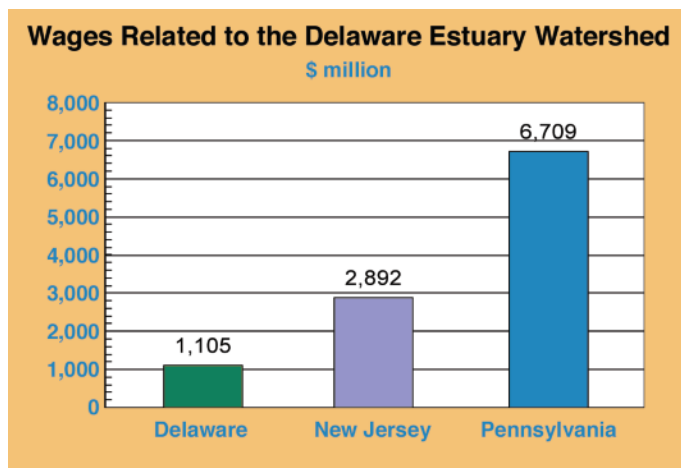
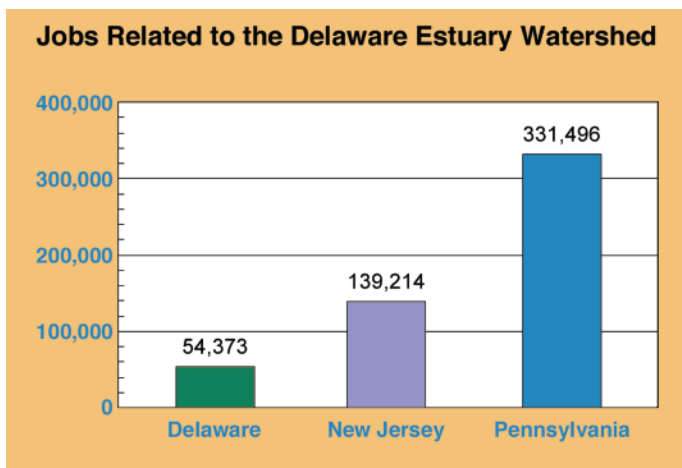
- **Delaware** (18,884 jobs, \$270 million wages)
- **New Jersey** (62,408 jobs, \$0.9 billion wages)
- **Pennsylvania** (150,049 jobs, \$2.2 billion in wages)

The National Coastal Economy Program (2009) reports coastal employment in the Delaware Estuary watershed provides 44,658 jobs representing \$947 million in wages in:

- **Delaware** (12,139 jobs, \$214 million wages)



- **New Jersey** (4,423 jobs, \$140 million wages)
- **Pennsylvania** (28,096 jobs, \$593 wages)



<i>Jobs and Wages in the Delaware Estuary Watershed by State</i>						
Sector	Del. Jobs	N.J. Jobs	Pa. Jobs	Del. Wages (\$M)	N.J. Wages (\$M)	Pa. Wages (\$M)
Direct Basin-related	15,737	52,007	125,041	340	1,100	2,800
Indirect Basin-related	18,884	62,408	150,049	270	900	2,200
Coastal	12,139	4,423	28,096	214	140	593
Farm	3,289	8,287	16,700	135	340	685
Fishing/Hunting/Birding	4,092	11,365	9,256	134	373	304
Water Supply Utilities	126	509	1,654	7	28	92
Wastewater Utilities	106	215	700	5	11	35
Delaware Estuary watershed totals	54,373	139,214	331,496	1,105	2,892	6,709

References

- Austin et al., 2007. The Benefits of Restoring the Great Lakes Ecosystem. The Brookings Institution.
- Bockstael et al., 1989. Measuring the Benefits of Improvements in Water Quality: the Chesapeake Bay. Marine Resource Economics. 6:1-18.
- Breunig, K., 2003. Changes in Land Use and Their Impact on Habitat, Biodiversity, and Ecosystem Services in Massachusetts.
- Economic League of Greater Philadelphia, 2008. Maritime Commerce in Greater Philadelphia: Assessing Industry Trends and Growth Opportunities for Delaware River Ports.
- National Ocean Economics Program, 2009. State of the U.S. Ocean and Coastal Economies.
- Frederick et al., 1996. Economic Value of Freshwater in the United States. Resources for the Future. Washington, D.C.
- Greeley-Polhemus Group, 1993. Final Report: Assessment of Selected Delaware Estuary Economic & Resource Values.
- Ingraham and Foster, 2008. The Value of Ecosystem Services Provided by the U.S. National Wildlife Refuge System in the Contiguous U.S. Ecological Economics. 67:608-818.
- Latham and Stapleford, 1987. Economic Impacts of the Delaware Estuary. Delaware Sea Grant College Program.
- Leggett and Bockstael, 2000. Evidence of the Effects of Water Quality on Residential Land Prices. Journal of Environmental Economics and Management. 39(2):121-144.
- NJDEP, 2007. Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources.
- Nowak et al., 2008. Urban Forest Assessment in Northern Delaware. Delaware Center for Horticulture, U.S. Forest Service.
- Trust for Public Land and American Water Works Association, 2004. Protecting the Source: Land Conservation and the Future of America's Drinking Water.
- Trust for Public Land, 2009. How Much Value Does the City of Wilmington Receive from its Park and Recreation System? U.S. Department of Agriculture, 2009. 2007 Census of Agriculture. Delaware State & County Data.
- U.S. Fish and Wildlife Service, 2008. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.
- U.S. EPA, 1973. Benefit of Water Pollution Control on Property Values. EPA-600/5-73-005, October 1973.
- U.S. EPA, 1995. Framework for Measuring the Economic Benefits of Groundwater. Office of Water. Washington, D.C.
- U.S. National Energy Technology Laboratory, 2009. Impact of Drought on U. S. Steam Electric Power Plant Cooling Water Intakes and Related Water Resource Management Issues. Washington, D.C. 191 pp.
- Weber, T., 2007. Ecosystem Services in Cecil County's Green Infrastructure. The Conservation Fund. Annapolis, Md.



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