

The Economic Value of the Brandywine Creek Watershed

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The Importance of Valuation

- Nature provides us with commodities and services that we would otherwise have to replace or recreate ourselves.
 - Often undervalued by society, perceived as “free”
 - Free = easy to exploit or take for granted
 - The price: the costs of replacing or replicating after overusing, abusing, or destroying them

Better Shopping

Green areas = increased patronage (Joye et al., 2010)



Decreased medical costs

- Less sick days = increased productivity (US EPA, 2011)



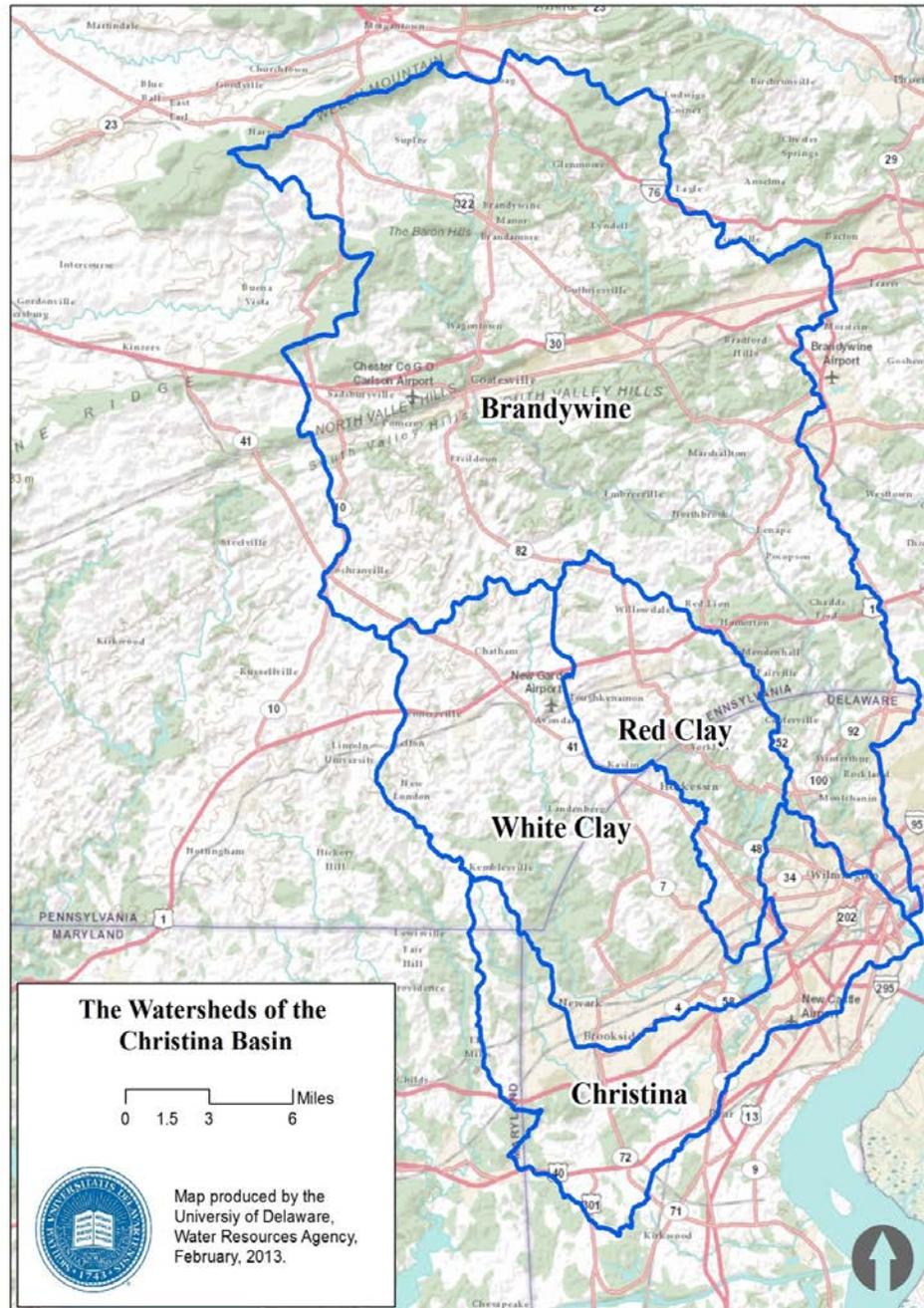
Safe drinking water

- Cost avoidance: \$8.0 - \$10.0 billion construction costs
\$1 million daily in O&M costs



Ashokan Reservoir





Map produced by the University of Delaware, Water Resources Agency, February, 2013.

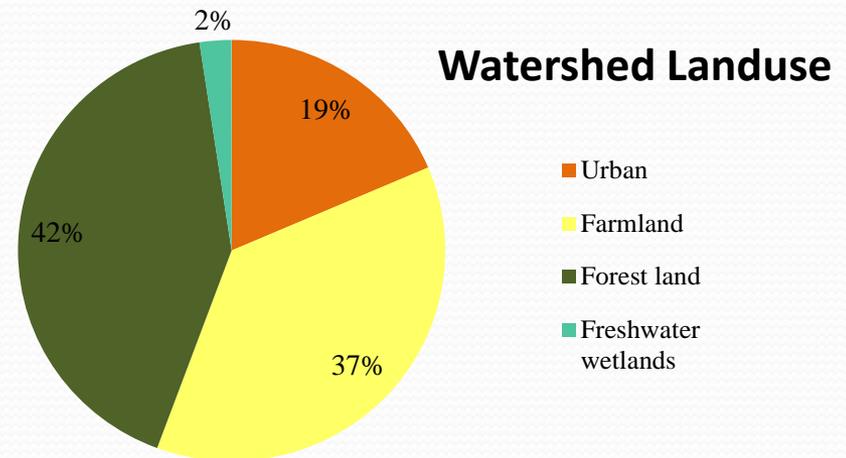


Agenda

- Characterization and history
- Valuation Techniques
 - Annual Economic Value
 - Market and non-market value of water quality, water supply, fish/wildlife, recreation, agriculture, forests, and benefits of public parks
 - Ecosystem Services
 - Value provided by wetlands, beaches, open water, forests, and farms
 - Jobs and Wages
 - Jobs and wages directly and indirectly associated with the watershed
- Final Calculations

The Brandywine Watershed

- 324 sq mi within the Christina Basin
 - Spans Chester County, PA and New Castle County, DE
 - Home to over 245,000 people (PA: 201,496; DE: 44,087)
- Dominant land uses:
agriculture and forest land
- Wilmington's sole source
of public drinking water



A Cultural and Economic Engine

- Lenni Lenape
- Colonial Era
 - Kalmar Nyckel, 1638
 - Quakers: mill dams and trade
 - Battle of the Brandywine at Chadds Ford, PA
- Post-Colonial
 - E.I. du Pont de Nemours & Company
- Today
 - Historical and natural treasure
 - 32,000 acres (15% of watershed) protected

Economic Value

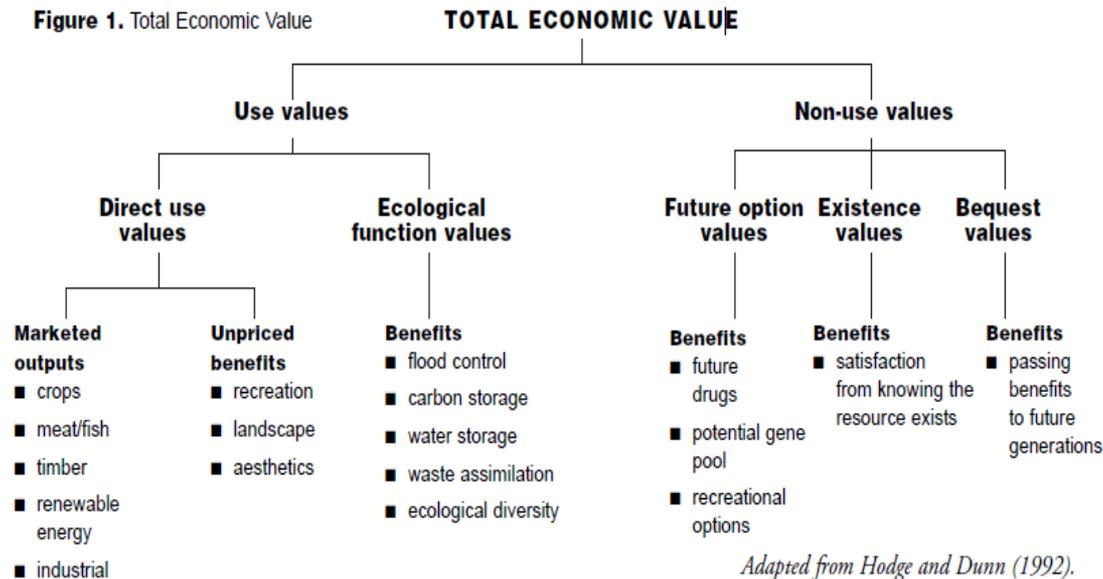
Use Values

- Direct use values
- Ecological function values

Non-Use Values

- Future option values
- Existence values
- Bequest values

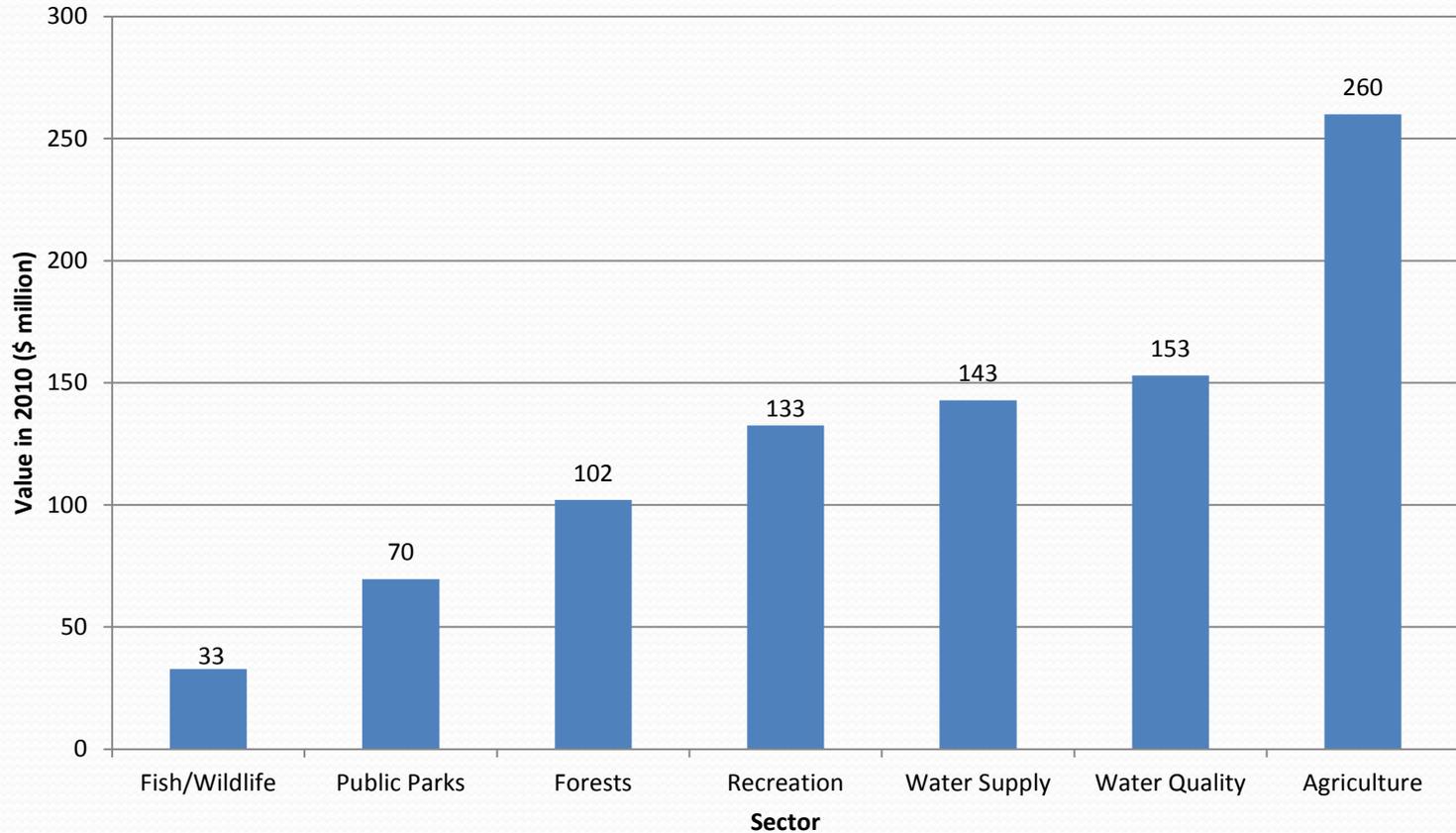
Figure 1. Total Economic Value



Use Values of the Brandywine Creek Watershed

- Water Quality
 - Willingness to pay for boatable, fishable, swimmable standards
 - Increased property values
 - Water and wastewater treatment
- Water Supply
 - Drinking water, reservoir storage, irrigation and industrial supply
- Fish/Wildlife
 - Fishing, hunting, and wildlife/bird-watching
- Recreation
 - State parks and outdoor activities
- Agriculture
 - Values of crops, poultry, and livestock
- Forests
 - Carbon storage and sequestration, air pollution removal, energy savings
- Public Parks
 - Health benefits, air pollution, stormwater and air pollution control

Economic Value of Brandywine Creek Watershed by Sector in 2010 Dollars



Over \$890 million

Ecosystem Services

- Air and water filtration, nutrient recycling, crop pollination, stormwater control, fish and wildlife recreation, soil conservation, etc.

Ecosystem	Cecil Co., Md. 2006 (\$/ac/yr)	NJDEP 2007 (\$/ac/yr)	Wilderness Society 2001 (\$/ac/yr)	Peconic Estuary 1995 (\$/ac/yr)	U.S. Wildlife 2008 (\$/ac/yr)	Mass. Audubon 2003 (\$/ac/yr)	USDA Census ¹ 2007 (\$/ac/yr)
Freshwater wetland	43,685	11,802			6,268	15,452	
Marine		8,670					
Farmland		6,229		9,979		1,387	3,315 ¹
Forest land	12,033	1,714	641		845	984	
Saltwater wetland	28,146	6,269		6,560		12,580	
Undeveloped				2,080			
Urban		296					
Beach/dune		42,149					
Open freshwater		1,686			217	983	
Riparian buffer	52,765	3,500					
Shellfish areas				4,555			

Service values in the watershed

Ecosystem	Area (acres)	\$/acre/yr	Present Value (\$)	Net Present Value* (\$)
Freshwater wetlands	4,009	13,621	54,600,951	1,774,530,897
Marine	34	10,006	343,552	11,165,455
Farmland	76,777	4,124	318,045,787	10,336,488,092
Forest land	86,679	1,978	171,461,731	5,572,506,255
Saltwater wetland	43	7,235	313,934	10,202,852
Barren land	525	0	0	0
Urban	38,361	342	13,104,693	425,902,536
Beach/dune	14	48,644	665,605	21,632,156
Open water	1,014	1,946	1,972,881	64,118,646
Total	207,456	2,702	560,509,135	18,216,546,889

*Net Present Value = The present value multiplied by the life of the good/service (say, 100 years), discounted by a rate (3%) due to inflation based on the Consumer Price Index (CPI).

Jobs and Wages

- Direct and indirect jobs and wages based on US Census North American Industry Classification Codes (NAICS)
 - For every direct job, there are 1.2 indirect jobs produced
- National Ocean Economic Program
 - Marine construction, living resources, mineral extraction, ship/boat building, tourism/recreation, transportation
- Farm jobs
 - USDA 2007 Census of Agriculture provided total jobs and average salary by county
- Fishing/Hunting/Wildlife Recreation
 - Value and multiplier estimates based on US Fish and Wildlife National Survey of Fishing, Hunting, and Wildlife Associated Recreation
- Outdoor Recreation
 - Cycling, camping, hunting, hiking, etc.
- Watershed Organization Jobs
 - Average salary \$61,700 (Bureau of Labor Statistics)
- Water supply and wastewater utility Jobs
 - Average salaries \$55,407 and \$40,000, respectively

Jobs in the watershed

Sector	Jobs	Wages (\$)
Direct Watershed-Related	23,208	1,205,450,000
Indirect Watershed-Related	27,850	964,360,000
Coastal	781	15,615,496
Farm	3,453	136,431,483
Fishing/Hunting/Birding	1,121	36,810,167
Outdoor Recreation	1,299	42,663,057
Watershed Organizations	124	5,952,000
Water Supply Utilities	175	9,723,929
Wastewater Utilities	58	2,322,400
Total	> 50,000	> \$2 billion

Results

Method	Value	Other (method specific)
Economic Value	\$890 million annually	
Ecosystem Goods and Services	\$560 million annually	NPV: \$18.3 billion over 100-year period
Jobs and Wages	\$2 billion annually	Over 50,000 jobs



The Brandywine Creek watershed contributes at least
\$560 million to \$2 billion annually
to the Pennsylvania and Delaware economies.



<http://www.wra.udel.edu/watershed-economics/>