

Wetlands are Green, (and Good as Gold!)



Jerry Kauffman

Feb 29, 2012

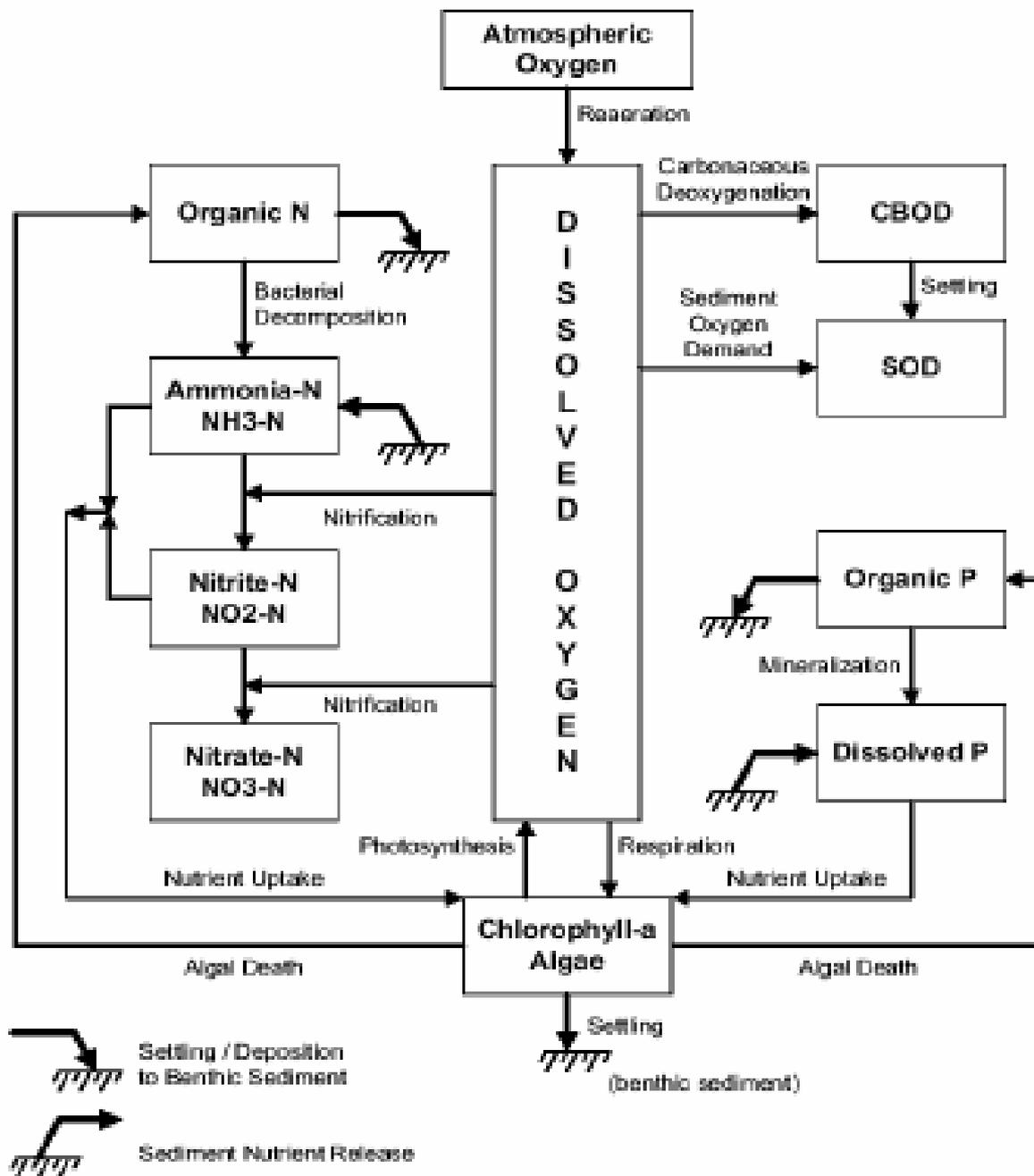
Coastal Delaware

- 1st State to sign the Constitution
- 1 Congressman
- 2nd smallest State
- 3 counties

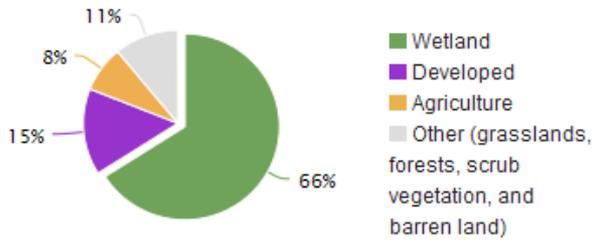
- 3 States on a peninsula
- Lowest State in the U.S.
- 500-yr floodplain covers 2/5 of State
- Wetlands cover 1/3 of State

Wetlands

- Hydrology
- Hydric Soils
- Hydrophytic Vegetation

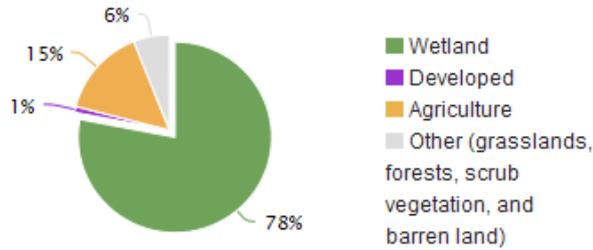


What Is in New Castle County's Floodplain?



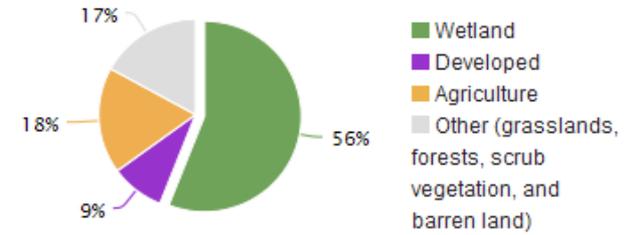
[Learn more about New Castle County's flood exposure.](#)

What Is in Kent County's Floodplain?



[Learn more about Kent County's flood exposure.](#)

What Is in Sussex County's Floodplain?



[Learn more about Sussex County's flood exposure.](#)

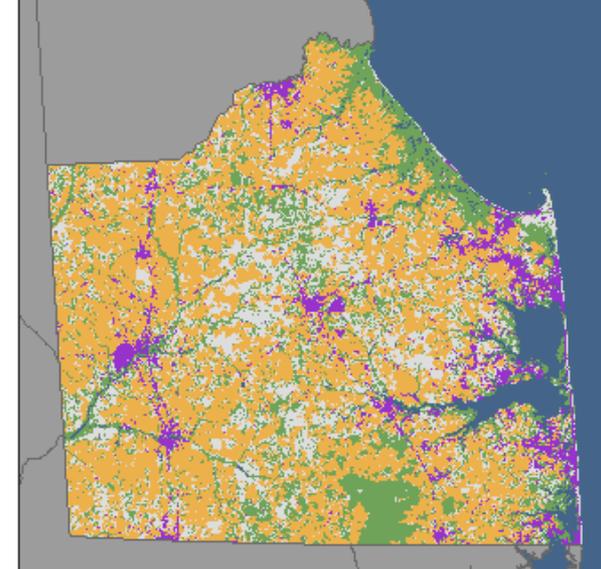
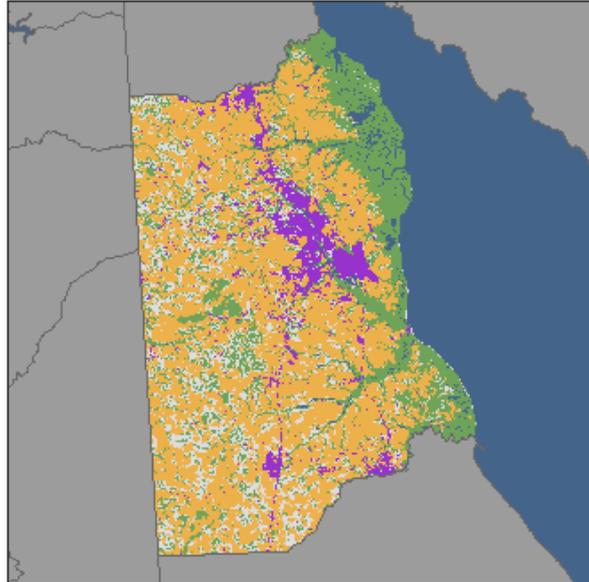
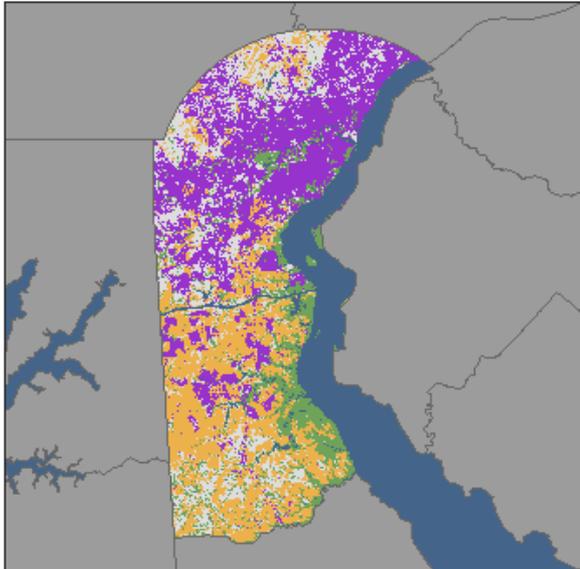
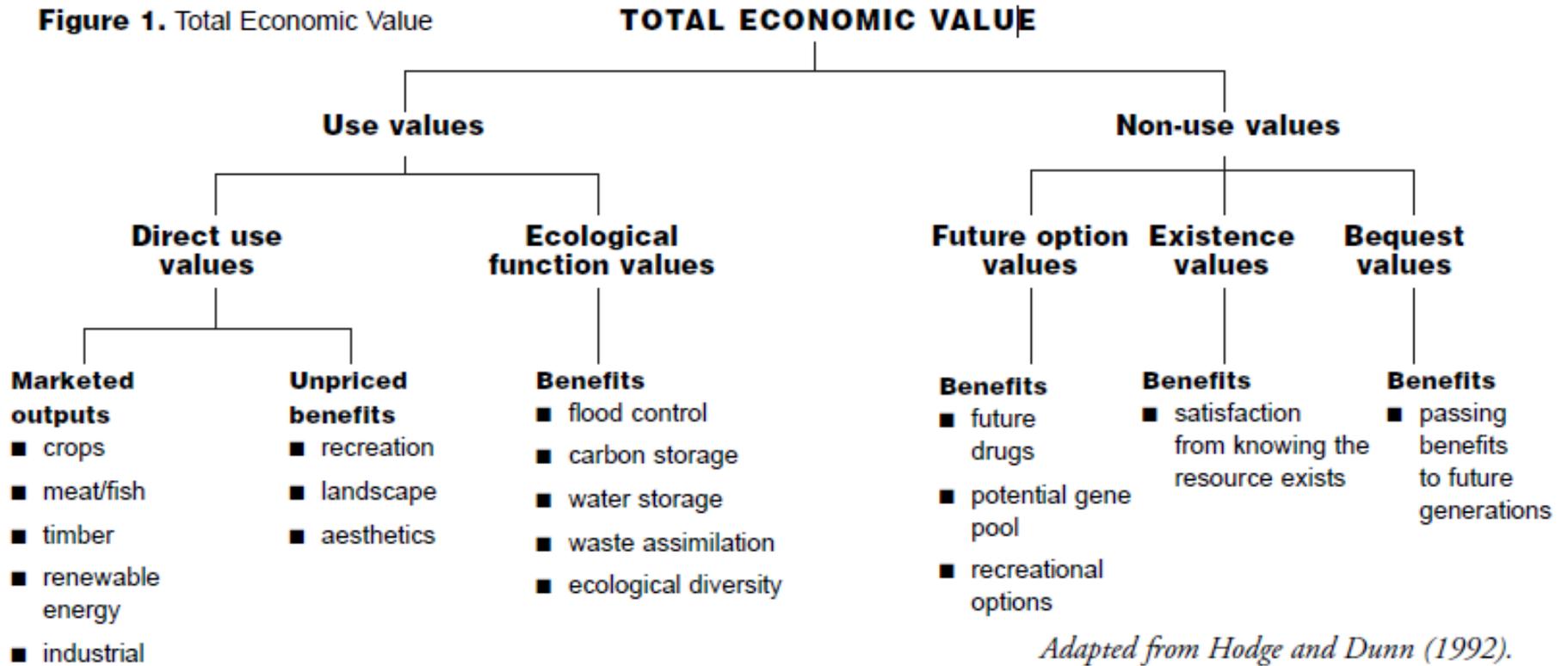


Figure 1. Total Economic Value



Ecosystems Services

(Daily and Allison 2002)

- Provide food and wine.
- Cleanse the Earth's air and water.
- Nature's assets have been thought of as free.
- Property owners not compensated for services that nature provides to society.
- Owners of wetlands are not paid for seafood provided by these ecosystems.

Ecosystem Capital (Goldberg 2007)

- Economics has dismissed externalities.
- Negative externalities harm people who do not receive compensation, such as water pollution.
- Internalization of externalities through river basin organizations sets up system of fair pricing/payment.
- Economic valuation of watersheds is efficient way to make cost-effective decisions by policy makers.
- Create a market to fund watershed services

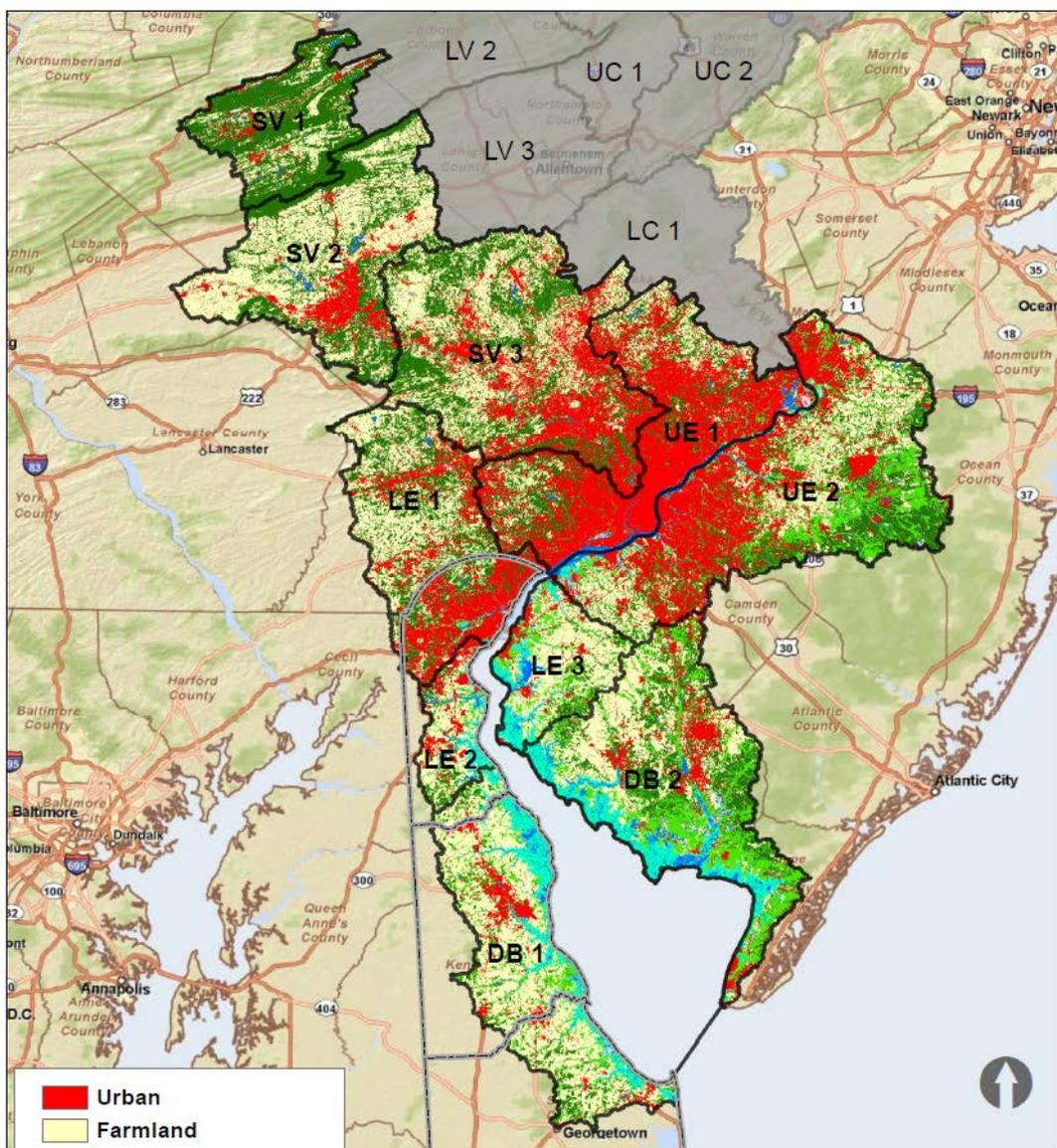
Nature's Pricing System (Odum 1998)

- The pricing system is basis of the supply & demand economy
- Is incomplete in protecting the natural environment
- Accounting of external values previously though to be free (air and water) needed to provide total valuation of nature.
- “Life support” value of estuary marshlands on the Delaware River/Bay are priced at **\$4,100/ac/yr**
- Commercial/sport fisheries, oyster aquaculture, nutrient removal, and wastewater treatment services
- “... we cannot continue to make nature (and society) pay all this price. It is prudent to preserve enough nature to do a reasonable amount of waste treatment work ... and this capacity needs to be figured into the economic value of natural environments.”

Ecosystems Services

(Searle and Cox 2009)

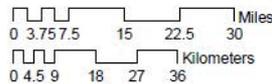
- *Nature's Services* published in 1997
- Ecosystem services publications grew 1,108%
- 1997: 255 publications
- 2007: 3,080 publications



Wetlands:

- kidneys of the Bay
- 15% of the estuary
- fish factories

Land Cover
in the
Watersheds of the
Delaware Estuary



Map produced by the
University of Delaware,
Water Resources Agency,
August, 2010.

Ecosystems area (acres) in the Delaware Estuary Watershed, 2005

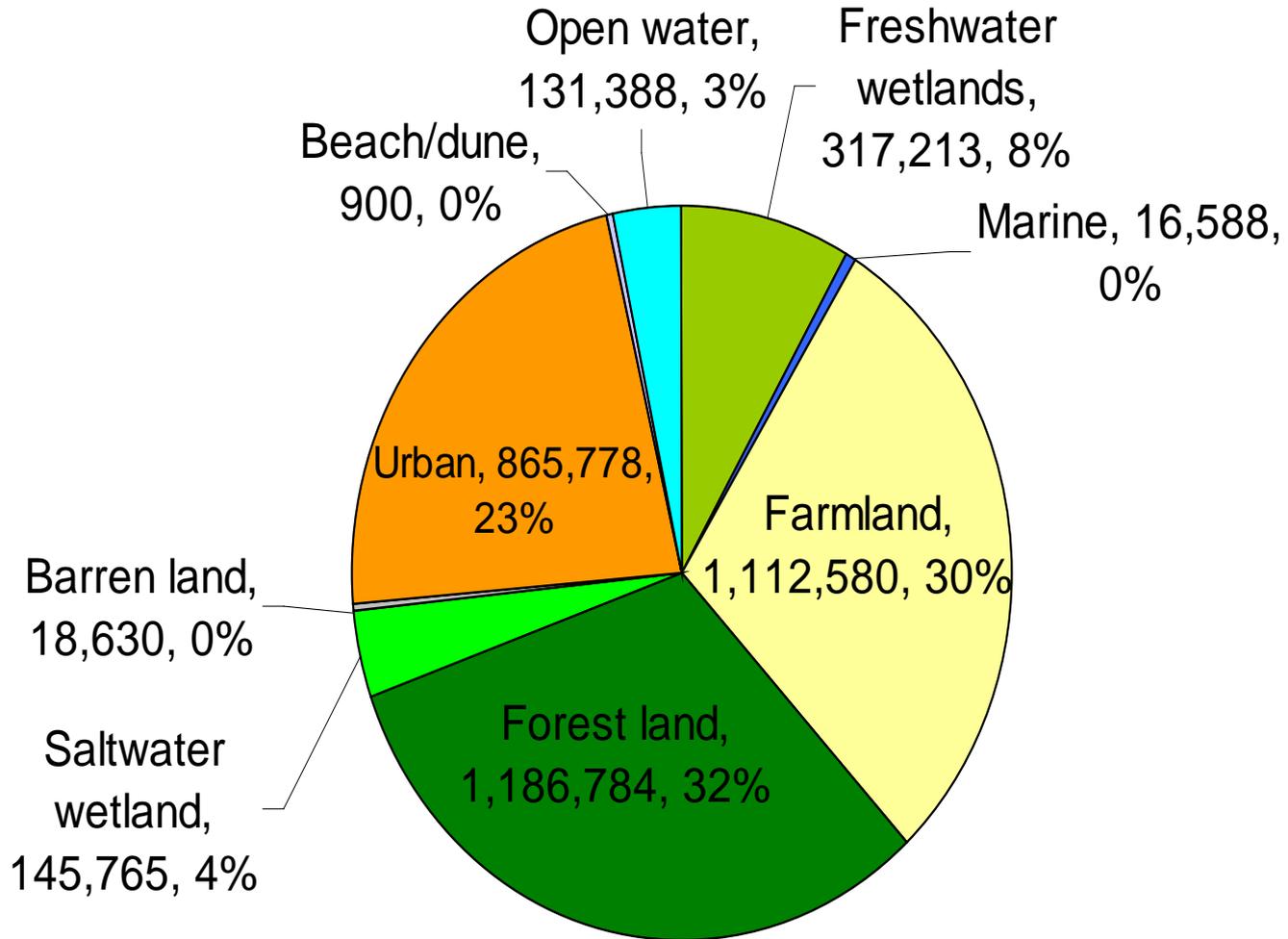


Table 32. Ecosystem services values for Cecil County (Weber 2007)

Ecosystem Service	Riparian Forest Wetlands (\$/ac/yr)	Nonriparian Wetlands (\$/ac/yr)	Tidal Marsh (\$/ac/yr)
Carbon sequestration	65	65	65
Clean air	191	191	
Soil and peat formation	946	450	1,351
<u>Stormwater/flood control</u>	32,000	32,000	1,430
Water supply	8,630	8,630	
Clean water	1,925	1,100	11,000
Erosion/sediment control	3,418	151	12,700
Water temperature regulation	4,450		
Pest control	50	50	
Pollination	75	75	
Recreation, fish, wildlife habitat	534	534	544
Community services savings	439	439	439
Increase in property values	42		
Total	52,765	43,685	28,146

Table 35. Comparison of ecosystem goods and services values

Ecosystem	Cecil Co. Md. 2006 (\$/ac/yr)	NJDEP 2004 (\$/ac/yr)	Wilderness Soc. 2001 (\$/ac/yr)	Peconic Est. 1995 (\$/ac/yr)	US Wildlife 2008 (\$/ac/yr)	Mass Aud.2003 (\$/ac/yr)
Freshwater wetland	43,685	11,802			6,268	15,452
Marine		8,670				
Saltwater wetland	28,146	6,269		\$6,560		12,580
Open freshwater		1,686			217	983
Riparian buffer	52,765	3,500				

Table E2. Ecosystem goods and services value of the Delaware Estuary watershed

Ecosystem	Area (ac)	\$/ac/yr 2010 ¹	\$/yr 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
Total	3,795,626		12,061,000,000	391,999,000,000

1. NJDEP 2004. 2. USDA 2009

Ecosystem Services Value in the Delaware Estuary Watershed

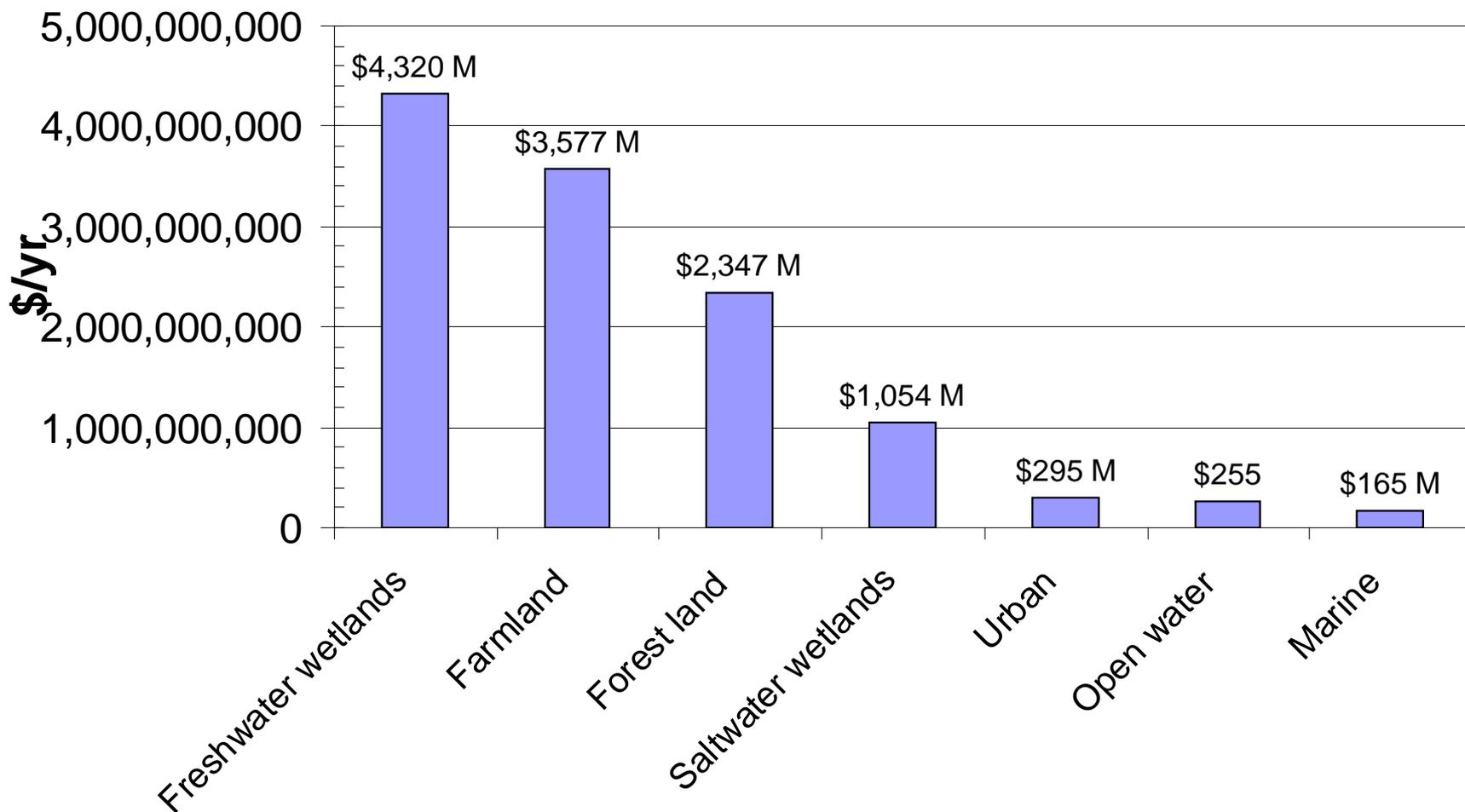


Table 1. Fishery jobs, wages, and business output supported by coastal wetlands
(NOAA Coastal Services Center, 2011)

Fishing	Delaware	New Jersey
Jobs	557	3,662
Business Output (\$ million)	\$14.5	\$107.5
Self-employed Revenue (\$ million)	\$17.6	\$168.6

Delaware Estuary Wetlands (DeLorme and Wood 1976)

- Wastewater treatment cost for 90% BOD removal: \$95 million/year
- Natural recycling capacity of wetlands reduces 3.5 lb/acre/day of BOD per day to treat remaining 10%.
- 463,000 acres of wetlands in Del. Estuary watershed
- Can treat 590 million lb of waste/year
- Wetlands removal costs: \$2.00/lb BOD/year
- Wetlands replacement value: \$1.18 billion/year

Delaware Estuary Value

(Greeley-Polhemus Group 1993)

- 123,000 jobs
- \$4.3 billion wages
- \$24 billion sales
- \$25 million sport fishing non-market value
- \$1 million in commercial fish landings
- Wetlands replacement value \$638 million.

Bombay Hook National Wildlife Refuge

- USFWS (Carver and Caudill 2007)
- 16,000 acres
- 4th most visited refuge
- 271,000 recreational visits (2006)
- 80% visitors from other states
- 6th most valuable refuge
- \$20.2 million to economy, food, lodging, equip., travel
- \$13.4 million from bird watching alone
- 198 jobs with \$5.5 million income
- FY06 annual budget \$804,000, benefits \$20.2 million
- Benefit-cost ratio of 23:1.

Delaware Estuary Species¹	Pounds²	Value² (\$2000)
Bass, Striped	752,882	\$1,717,372
Bluefish	1,423,282	\$508,128
Carp, Common	10,488	\$27,670
Catfish, Channel	6,922	\$3,929
Crab, Blue	8,436,188	\$10,800,297
Crab, Horseshoe	229,602	\$48,978
Drum, Black	39,230	\$22,311
Eel, American	298,940	\$625,511
Flounder, Summer	1,702,977	\$3,999,988
Herring, <u>Blueback</u>	1,434	\$609
Herring, Atlantic	6,039,473	\$563,083
Menhaden, Atlantic	37,720,009	\$3,200,359
Oyster, Eastern	524,160	\$2,721,300
Perch, White	88,060	\$84,500
Perch, Yellow	20,527	\$71,847
Shad, American	130,426	\$119,423
Shellfish	30,130	\$76,119
Snails (Conchs)	30,250	\$59,016
Weakfish	189,110	\$261,228
<u>Whelk, Chan'd/Knob</u>	277,217	\$511,172
Total	57,951,307	\$25,422,840

1. Dove and Nyman 1995. 2. NMFS, Nat'l. Ocean Economics Program 2007

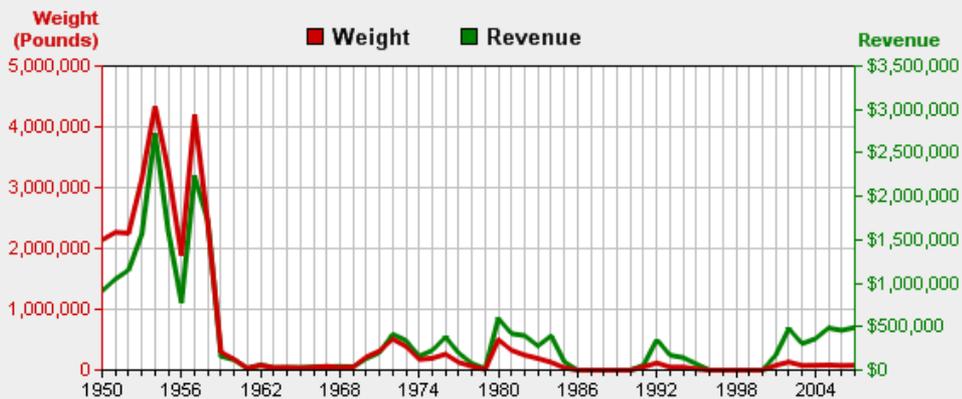
Delaware 'bass, striped' Harvests



Delaware 'crab, blue' Harvests



Delaware 'oyster, eastern' Harvests



New Jersey 'crab, blue' Harvests



New Jersey 'oyster, eastern' Harvests

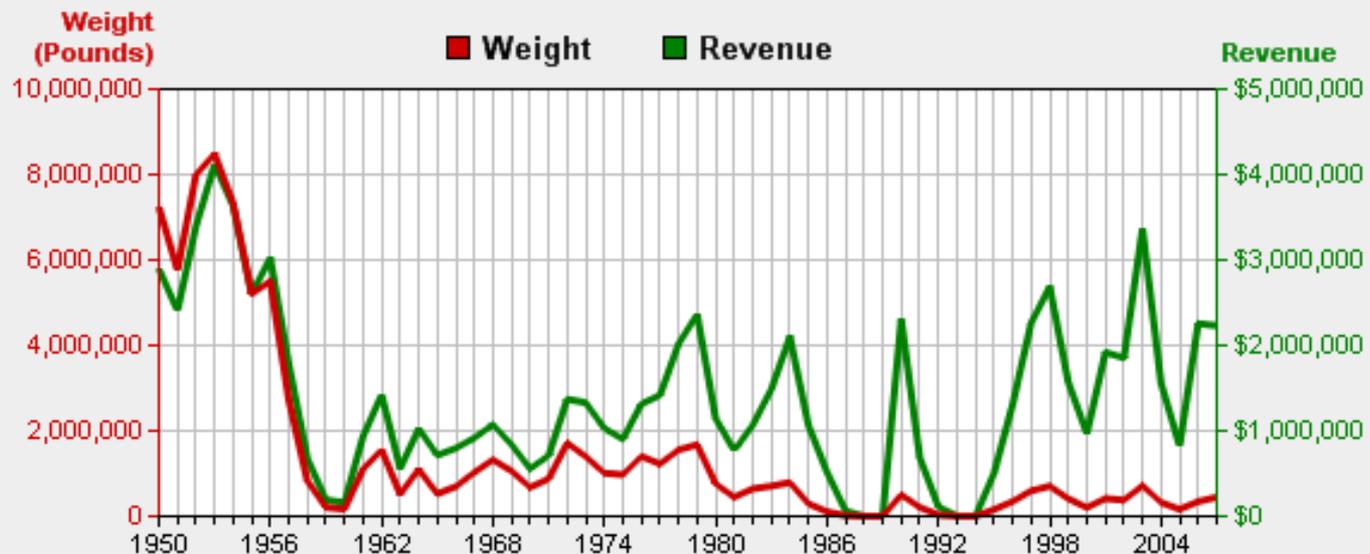


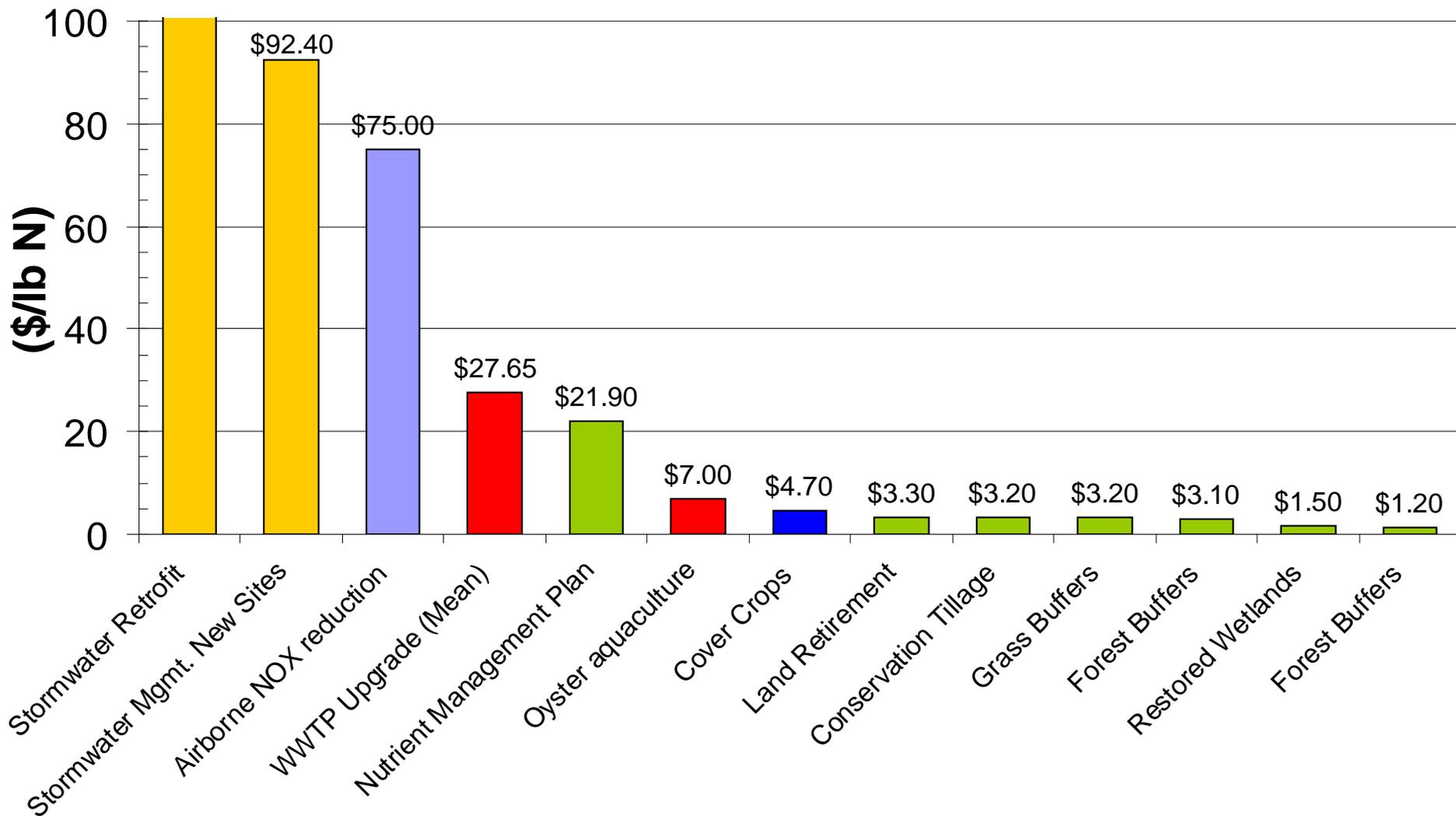
Table 22. Value of fishing, hunting, and wildlife recreation in Delaware Estuary watershed
(USFWS 2008, in \$2006)

Recreation Activity	DE in estuary ² (\$M)	NJ in estuary ² (\$M)	PA in estuary ² (\$M)	Del. Estuary (\$M)
Fishing	48.4	195.6	90.4	334.3
Trip Related	24.3	122.5	20.9	167.7
Equipment/other	24.1	73.1	69.5	166.7
Hunting	20.7	37.9	112.6	171.2
Trip Related	6.8	18.9	19.2	44.9
Equipment/other	13.9	19.1	93.4	126.4
Wildlife/Birding	65.4	139.7	101.0	306.1
Trip Related	6.6	38.0	22.8	67.3
Equipment/other	58.9	101.7	78.2	238.8
Total	134.4	373.3	304.0	811.7

Bird Watching

- Delaware Estuary one of most important feeding grounds in North America.
- 1 million shorebirds feed on horseshoe crab eggs during the spring migration.
- In 1988, 90,000 bird watchers spent \$5.5 million in greater Cape May (\$61 per viewer).

Per-Pound Costs of Reducing Nitrogen Pollution in the Chesapeake Bay Region



Fauna Factories

