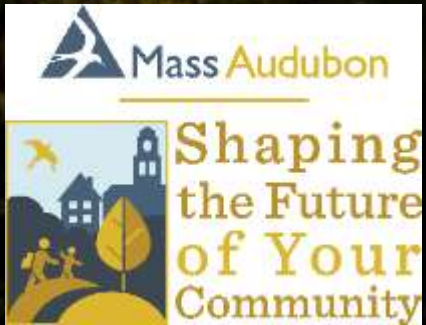


# Valuing Ecosystem Services in the Narragansett Bay Watershed

EPA Southeast New England Program for  
Coastal Watershed Resiliency



natural  
capital  
PROJECT



THE  
UNIVERSITY  
OF RHODE ISLAND  
GRADUATE SCHOOL  
OF OCEANOGRAPHY



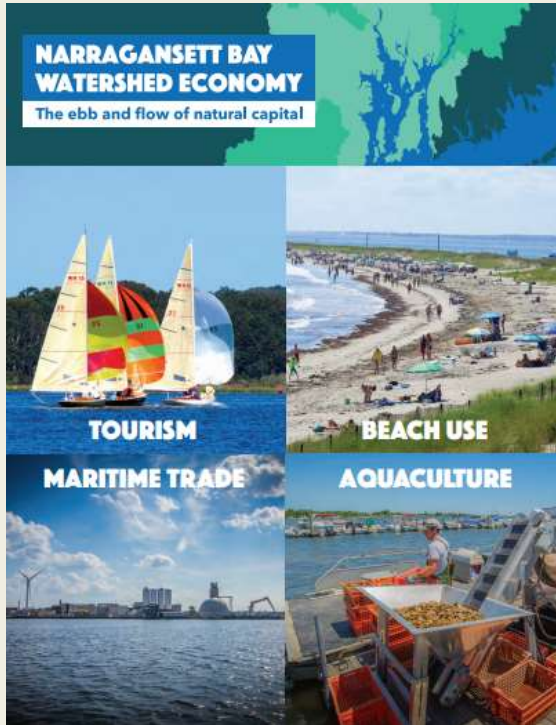




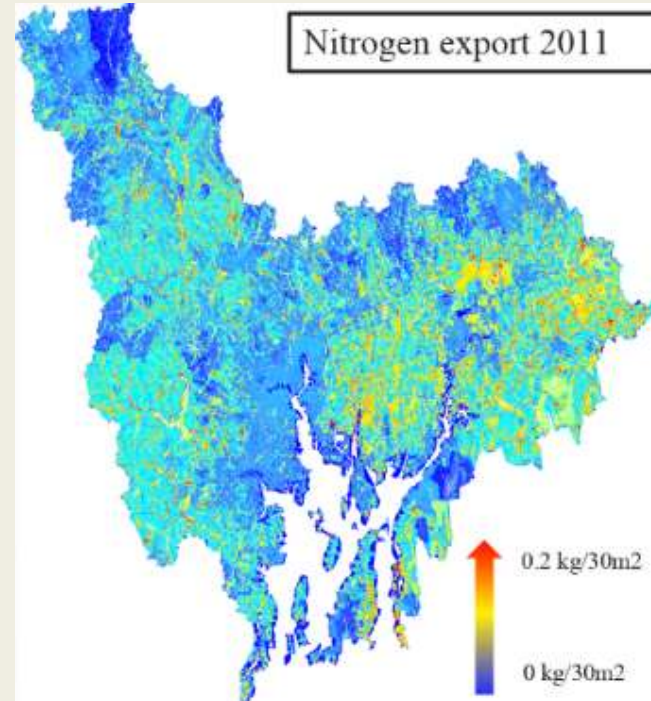
# The Narragansett Bay Watershed

- Home to ~2 million people
- 60% MA, 40% RI
- Dramatic reductions in pollution by wastewater treatment facilities – now other challenges
  - NBEP *State of the Narragansett Bay and its Watershed* report

# Project Elements & Roles



Valuation of economic sectors  
[nbweconomy.org](http://nbweconomy.org)



Modeling of land use changes, sediment/nutrient transport, wellbeing changes & value

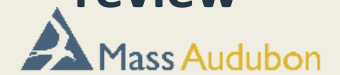


**SNEP Ecosystem Service Valuation Database**

In 2008, EPA's SNEP Watershed Assessment Group (WAG) and Mass Audubon developed a database of ecosystem service valuations (ESV) studies. The database includes 83 studies from 1990 to 2008, for Massachusetts and Rhode Island (see the SNEP page). We included 28 studies that included a total of 55 ecosystem service values that are included in the table below. In addition to the table, the database provides a link to the study.

Ecosystem Service Valued	Coastal or Inland	Habitat or Land Use Type	Geographic Region	Value	Methodology
Carbon Sequestration	Coastal and Inland	Wetlands	Atlantic, MA	\$590,000 for 2012-2020	Benefit Transfer
Carbon Sequestration	Coastal and Inland	Forest and Wetlands	The Long Island Sound Basin	\$19.2 - \$130.8/yr	Benefit Transfer
Carbon Sequestration	Coastal	A watershed database of 12 ecosystem types	Basin, MA	\$10-100 \$	Benefit Transfer
Commercial Fishing, Food Production, and Water	Coastal and Inland	Green Space	Tri-County, MA	\$15 \$/yr	Translational
Cultural Value, Food Production, and Greenhouse Gas Emissions	Inland	Farmland	All of RI	CI coefficients	Change Impact
Fishing/Commercial	Coastal	Ocean	Off the coast of MA and RI	\$14 million	Translational
Flood Reduction	Coastal and Inland	Wetlands	Atlantic, MA	\$3.2 \$/yr	Assessment, Cost
Flood Reduction	Coastal and Inland	Wetlands	Atlantic, MA	\$2.3 million/yr	Benefit Transfer
Flood Reduction	Coastal	Wetlands	Northwestern RI, including CI, RI and MA	\$623 \$	Assessed Cost
Flood Reduction	Inland	Farmland	All of RI	CI coefficients	Change Impact
Flood Reduction	Coastal	Ocean	MA state waters	\$67.8 \$/yr	Translational
Improved Water Quality	Inland	Forest	Wood-Panamaet Watershed	CI coefficients	Change Impact
Improved Water Quality	Inland	Wetlands	Blackstone River Watershed	\$180 to \$490 million/yr or \$11.2 to \$12.2 \$/acre/yr	Change Impact
Improved Water Quality	Coastal and Inland	Wetlands	Atlantic, MA	\$3.8 million/yr	Benefit Transfer
Improved Water Quality	Coastal and Inland	Wetlands	Northwestern	CI coefficients	Change Impact
Improved Water Quality	Coastal	Farmland, Water Shed	Providence, RI	CI coefficients	Change Impact
Improved Water Quality	Coastal	Wetlands	Narragansett	\$50-70 \$	Change Impact
Increased Property Values	Coastal and Inland	Wetlands	Atlantic, MA	\$10 \$	Benefit Transfer
Increased Property Values	Coastal and Inland	Green Space	Basin, MA	\$724 \$	Translational

Project organization, stakeholder outreach, materials, literature review





# NBW Economy Project



- Economic values of 13 sectors in NBW, most underpinned by natural resources
- Future threats for each industry, especially climate change

[nbweconomy.org](http://nbweconomy.org)



13 key industries



\$14+ billion in revenue and expenditure

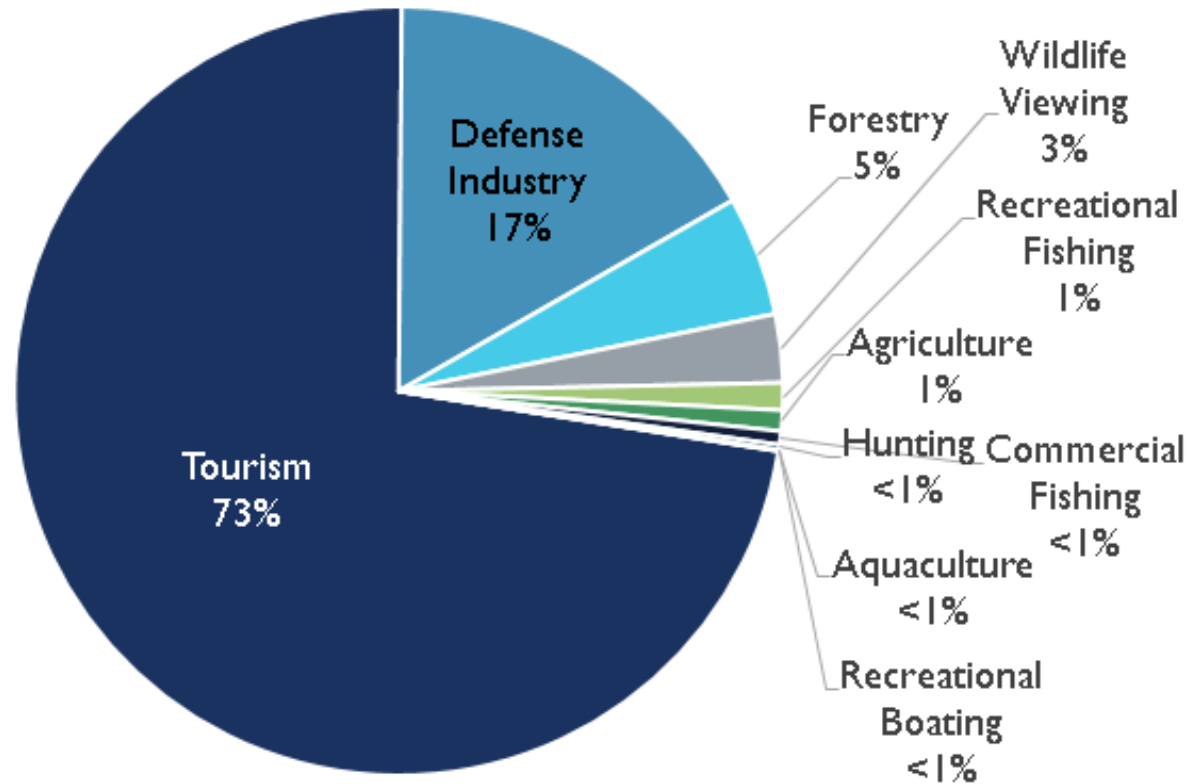


97,000+ full and part-time jobs

# NBW Economy Project

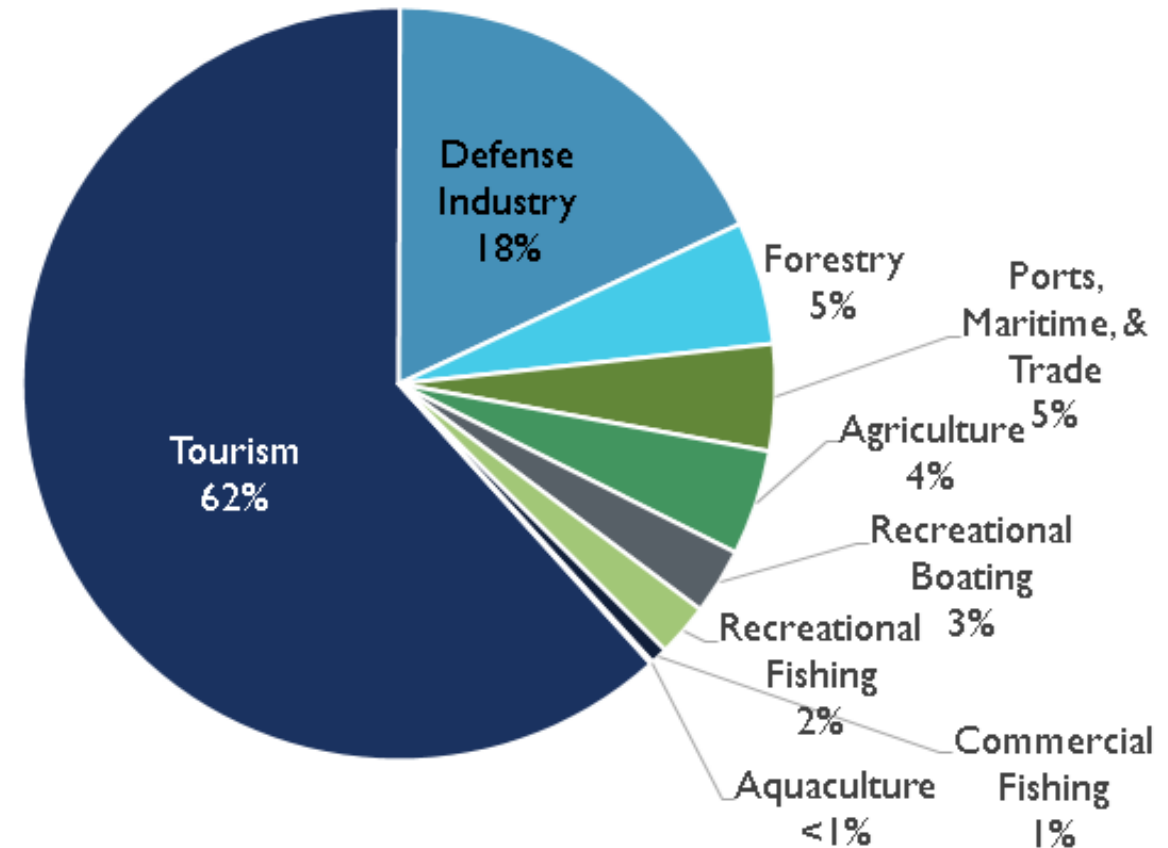


## Sector Revenue



Total annual revenue: \$13.8 billion (2016 US dollars)

## Sector Employment



Total annual employment: 97,298

# NBW Economy Project



## Example: Tourism

### In 2015 in the NBW:



24 million visitors to RI



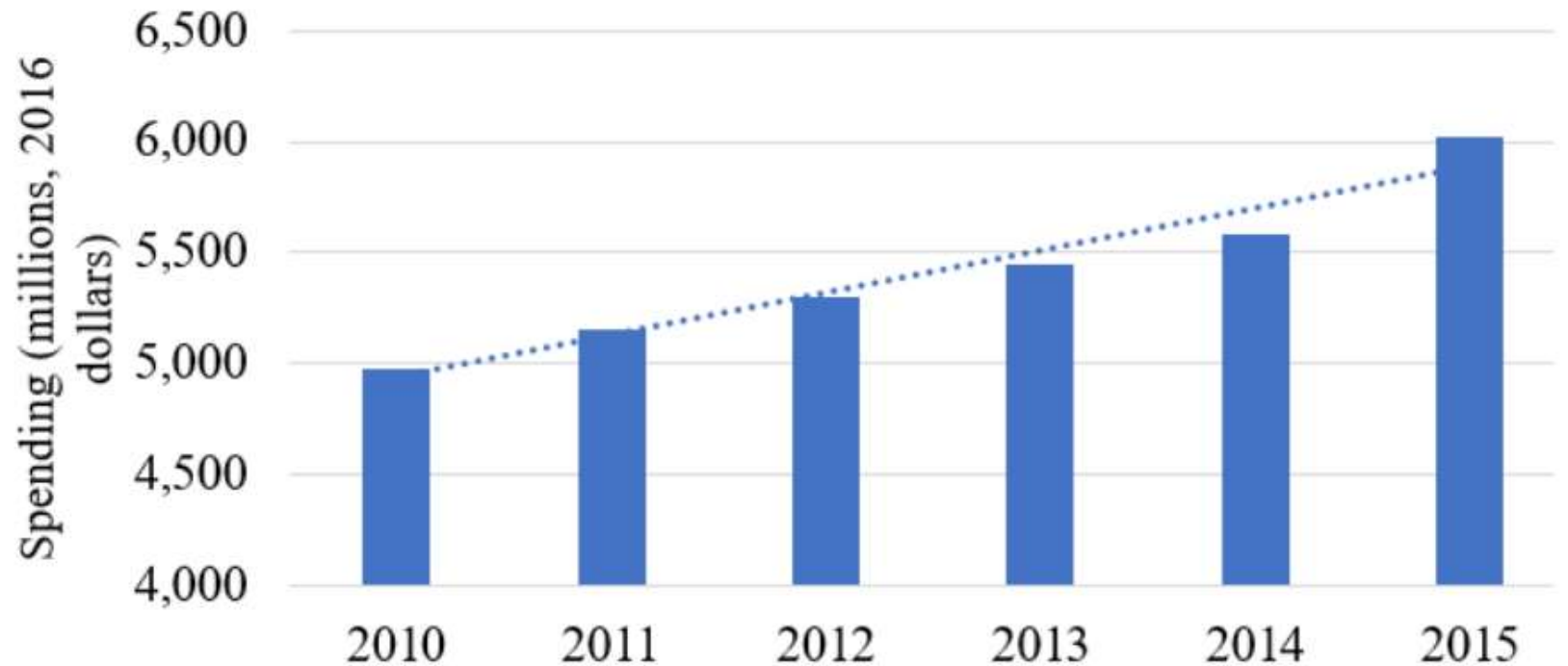
\$6 billion in revenue



91,000 jobs supported



Wages of over \$1.8 billion

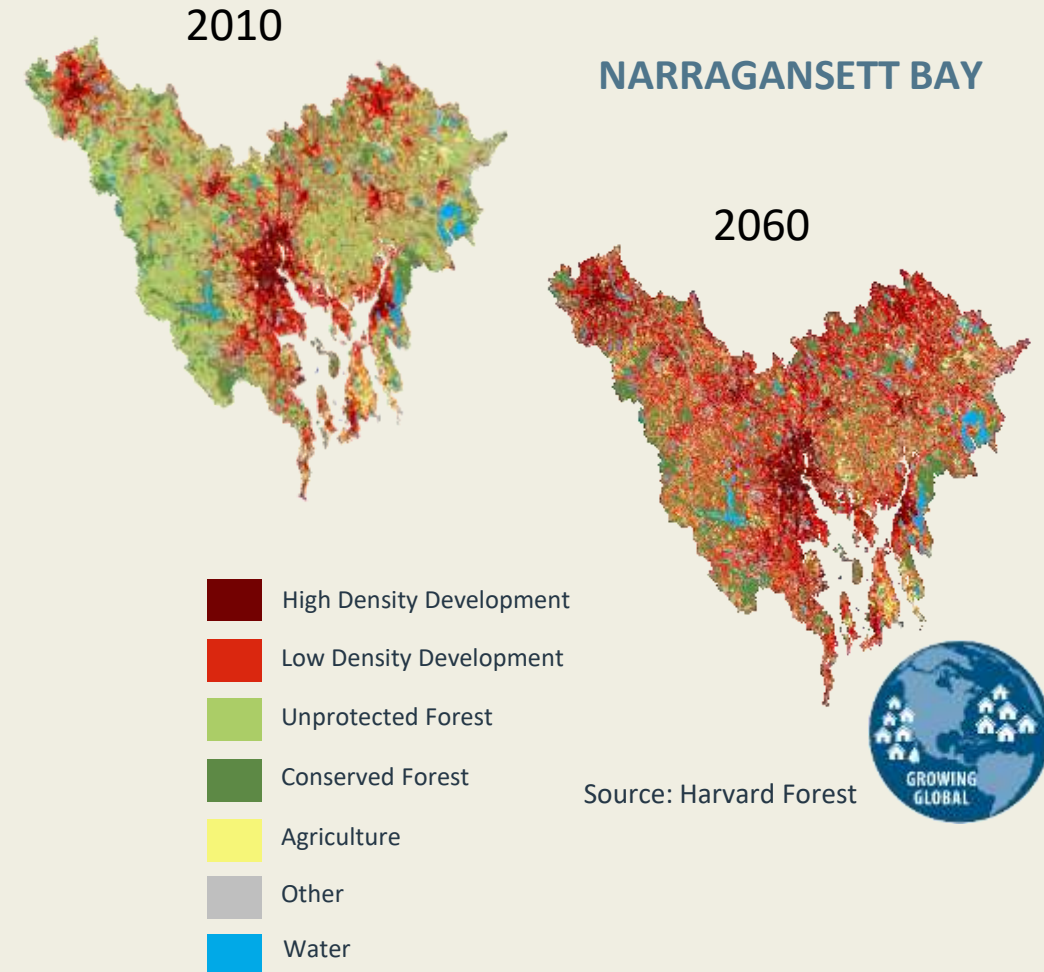


**Tourist Expenditure in RI 2010-2015**

Source: Tourism Economics, 2015

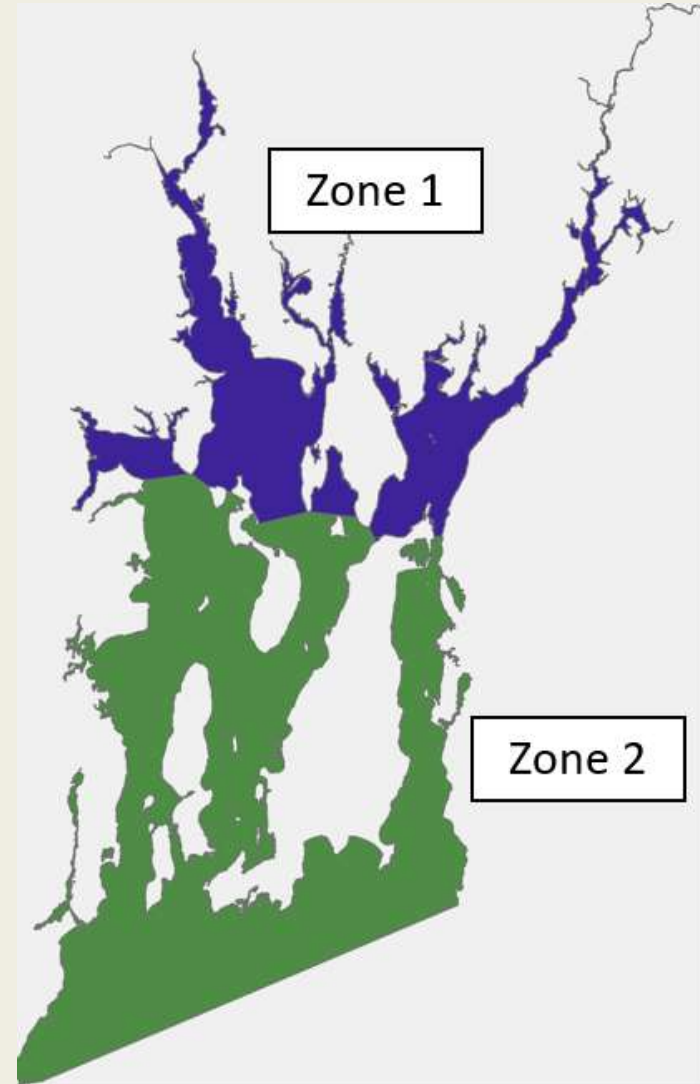
# Land Use and Water Quality Modeling

- Harvard Forest potential development scenarios – forest cover by 2060
  - "Connected Communities" - 46%
  - "Growing Globally" - 22%
- Used InVEST to model pollution retention benefits of land for water quality
  - If all natural areas are converted to development, significant changes in bacteria levels – no longer fishable/swimmable



# Land Use and Water Quality Modeling

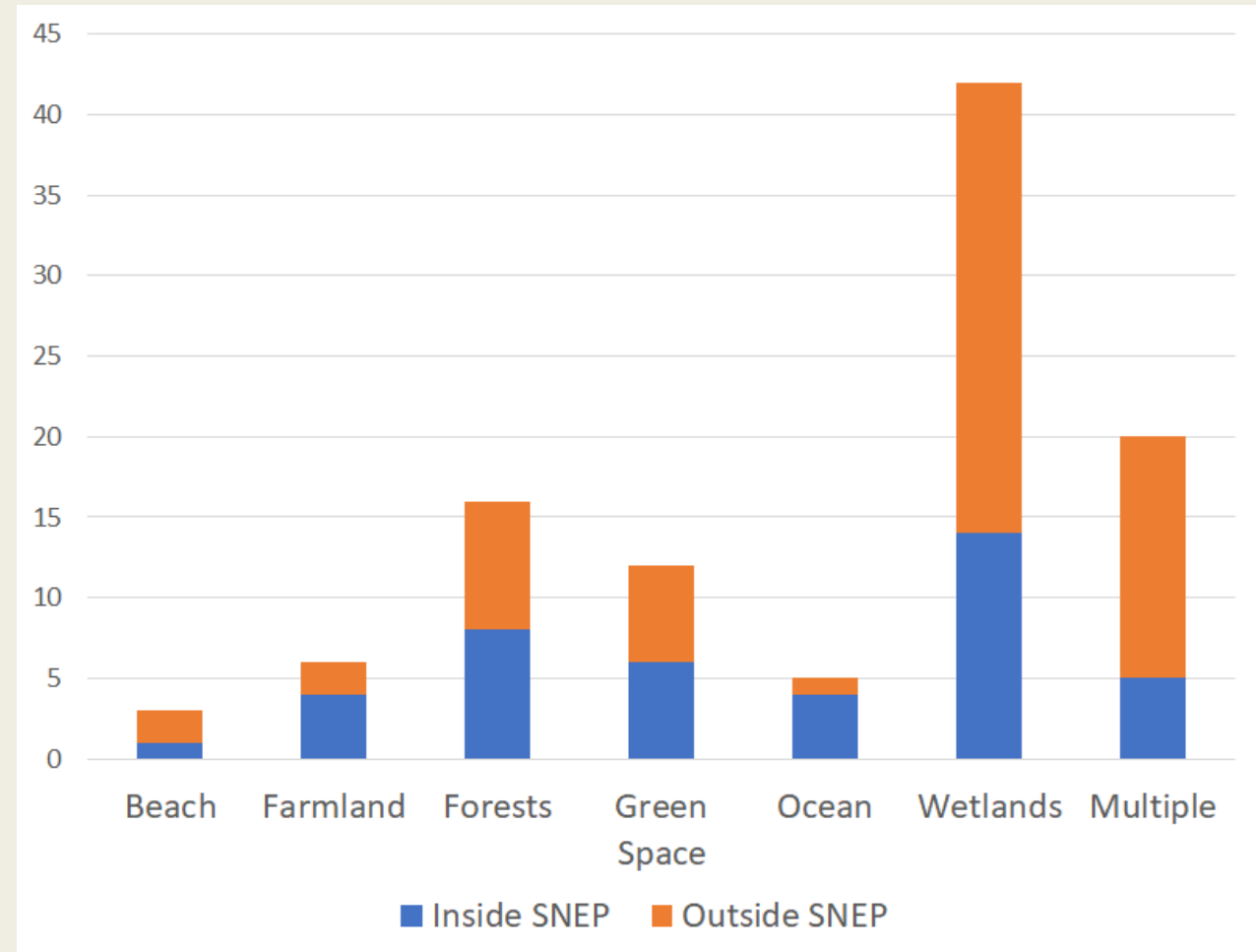
- Zone 1 & 2 – different oceanographic conditions
- Willingness to Pay (WTP) for maintaining water quality improvements in the Bay:
  - \$44 and \$59/year/household
  - \$30 and \$50 million total**





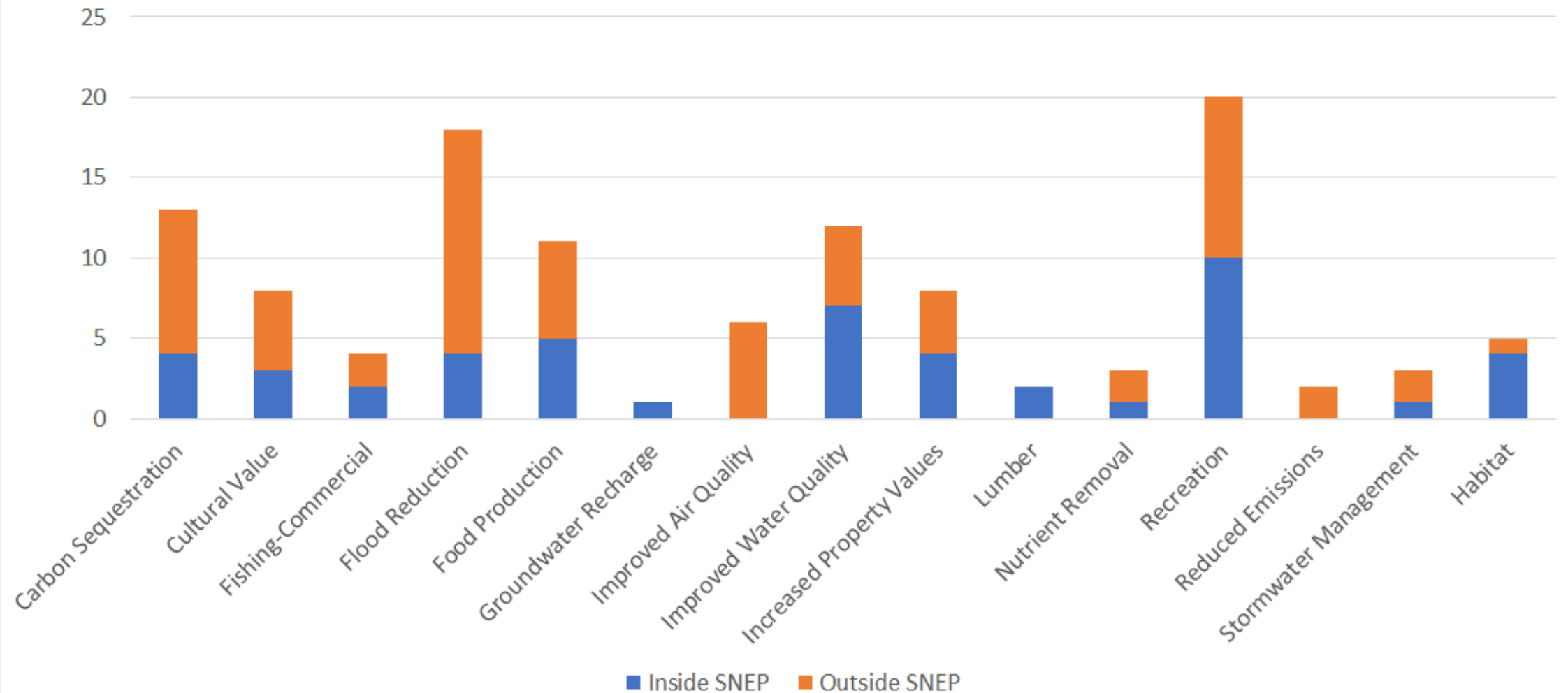
# Literature Review

Mass Audubon and ERG  
(Eastern Research Group)  
created a sortable database  
of 68 ecosystem service  
valuation studies



Type of Ecosystem Providing Service

# Literature Review



**Ecosystem Service Measured**

# Literature Review

## Five Ecosystem Services Fact Sheets

Forests | Grasslands and Farmland | Coastal |  
Wetlands & Waterways | Urban

Carbon Capture & Sequestration

Flood Mitigation

Air and Water Quality

Recreation

Food and Other Goods (ex: forestry)

Other Human Health (ex: heat mitigation)

Social and Cultural (ex: indigenous value)

Wildlife Value

### LID Fact Sheets



[massaudubon.org/lidfactsheets](http://massaudubon.org/lidfactsheets)



# Literature Review

## Wetlands & Waterways

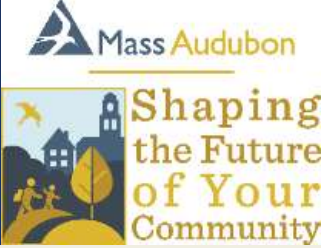
- Wetlands hold between 20 and 30% of global soil carbon despite occupying 5-8% of its land surface. Wetlands of the Eastern Mountains and Upper Midwest (includes New England) store the most carbon, accounting for nearly half of the wetland C in the US. *(Nahlik and Fennessy 2016)*
- Otter Creek floodplains and wetlands in Middlebury, VT: damage reductions of 54-78% across 10 flooding events. Annual value of flood mitigation services may be as high as \$450,000. *(Watson 2016)*

# Literature Review

## Wetlands & Waterways, cont.

- The Massachusetts Department of Ecological Restoration protects rivers, wetlands, and watersheds in MA. Their projects provide a 75% return on investment. Restoring the Muddy Creek Watershed in Chatham and Harwick, MA to remove 45.1% of nitrogen was about half the cost of equivalent sewerage (\$3.6 million vs. \$7.5 million).  
*(MA DER 2014)*

# Contact & Website



**Paige Dolci**

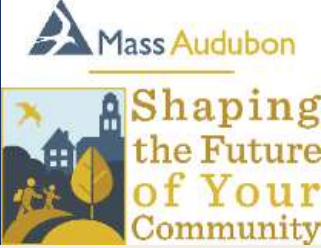
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**[massaudubon.org/shapingthefuture](https://massaudubon.org/shapingthefuture)**



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