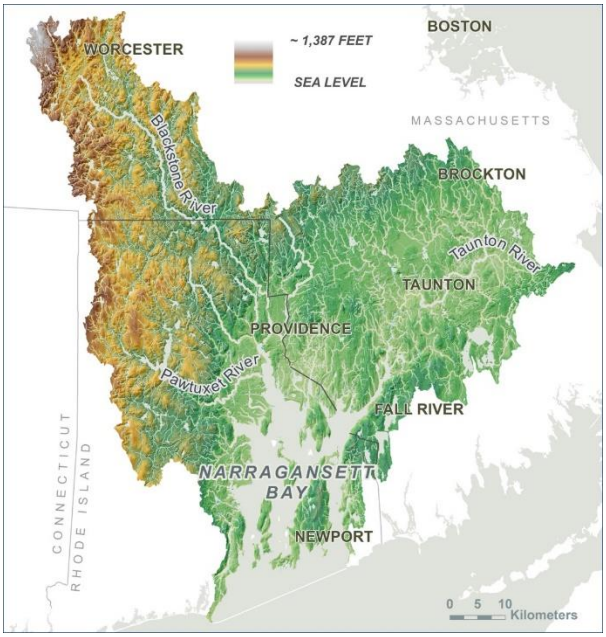
INTEGRATING ECOSYSTEM SERVICES into LAND-USE DECISION MAKING in the NARRAGANSETT BAY WATERSHED

Decision Support Modeling for Multi-attribute Water Quality in the Narragansett Bay Watershed – *Griffin et al. 2019*

Background

- **The Narragansett Bay Watershed**
  - 1,705 square miles
  - 2 million people
  - 60% in Massachusetts, 40% in Rhode Island
  - In recent decades, investments in wastewater pollution have cut nutrient pollution in the Bay in half.



Map by The Narragansett Bay Estuary Program (NBEP)

Methodology & Study Questions

This study by Stanford's Natural Capital Project developed a model to evaluate residents' willingness-to-pay for water quality improvements in the Narragansett Bay Watershed from 2001-2011. **Willingness-To-Pay (WTP)** is the maximum amount a person is willing to pay for a product or service like water quality. The model predicts willingness-to-pay using a **Water Quality Index (WQI)**, which measures the qualitative condition of the bay based on the presence of six key pollutants. The study broke the watershed down into two zones—the upper and lower bay (Figure 1)—based on different oceanographic conditions.

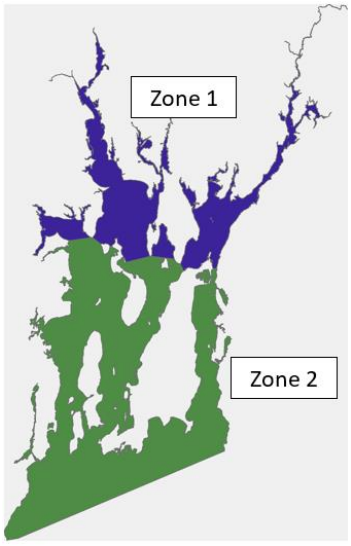


Figure 1. Griffin et al. 2019

Additional goals:

1. **To explore the effects of land use in the watershed on water quality.** We used Harvard Forest's potential future land use scenarios, as seen in *The New England Landscape Futures Project*. These four land use scenarios predict differences in development, timber harvest, agriculture, and land protection depending on drivers like socio-economic connectedness (whether the economy is globally or locally-oriented) and natural resource planning and innovation.
2. **To analyze the impact of dams on water quality in the Bay.** Stanford modeled what would happen to water quality if all of the watershed's dams were removed.
3. **To estimate the change in water quality index (WQI) if natural areas were converted to development.** Measuring water quality impacts from conversion of natural areas to development at the watershed level demonstrates where natural areas are playing a key role in protecting water quality.

(Over)

Major Findings

Wastewater treatment upgrades provide a high value to residents. Residents in the upper bay are willing to pay a total of **$51 million** and **$38 million** per year for recent wastewater treatment upgrades, in the upper bay and lower bay, respectively.

Additional findings:

1. **Future Scenarios:** The rapid, uncontrolled development scenario ("Growing Globally," Figure 2) was predicted to cause a significant increase in bacterial contamination in the Narragansett Bay Watershed. Large investments in wastewater treatment would be required to avoid the contamination.
2. **Dam removal:** A widespread network of dams helps maintain water quality in the Bay. Removing dams in the contributing watersheds of Zone 1 and Zone 2 would reduce water quality by 6.3 and 3.5 points on the index, respectively. However, it should be noted that dam removals have other potential benefits including reduced flood hazards and improved fish passage and aquatic habitat.
3. **Natural land conversion:** Converting natural lands to development across the sub-watersheds resulted in modest changes in water quality entering the Bay from all sub-watersheds. However, it should be noted that impacts within more localized inland waters may be more significant and this was not the focus of this particular modeling.

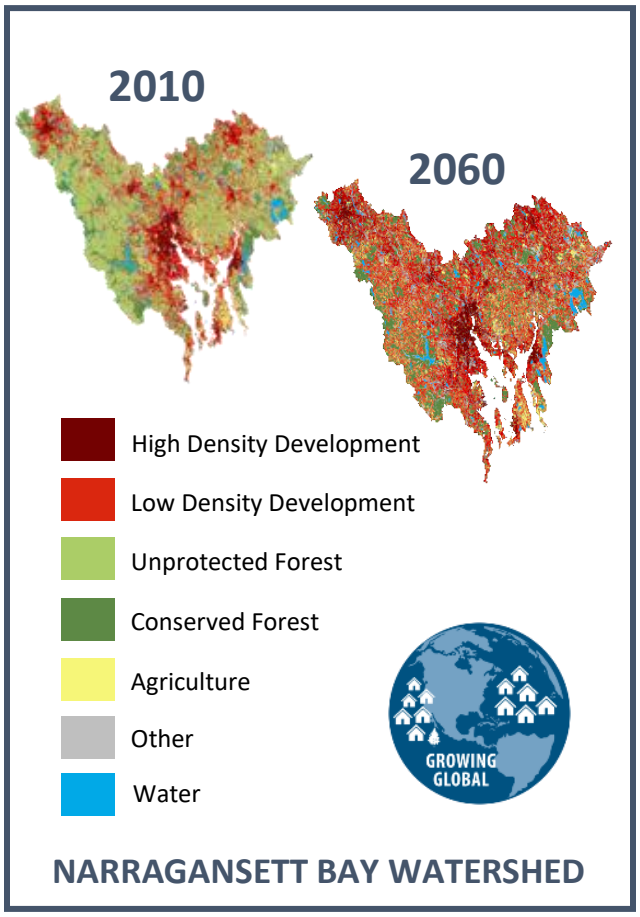


Figure 2. Harvard Forest, THE NEW ENGLAND LANDSCAPE FUTURES PROJECT, newenglandlandscapes.org

This modeling was part of a larger project that also includes information on economic valuation across 13 industry sectors and fact sheets on ecosystem services values.

Learn more at massaudubon.org/valueofnature

The Narragansett Bay Watershed Economy Project was conceived and partially supported by the Coastal Institute at the University of Rhode Island under the leadership of Dr. Emi Uchida. In addition, this project was supported, in part, under Assistance Agreement No. SE -00A00252 awarded by the U.S. Environmental Protection Agency (EPA) to Mass Audubon. The Lookout Foundation also provided funding to Mass Audubon. Additional project partners include the URI Graduate School of Oceanography, the URI Coastal Resources Center, the Natural Capital Project at Stanford University, and the George Perkins Marsh Institute at Clark University. The views expressed in this project are solely those of the authors. It has not been formally reviewed by EPA. Additional information is available at **www.nbweconomy.org**