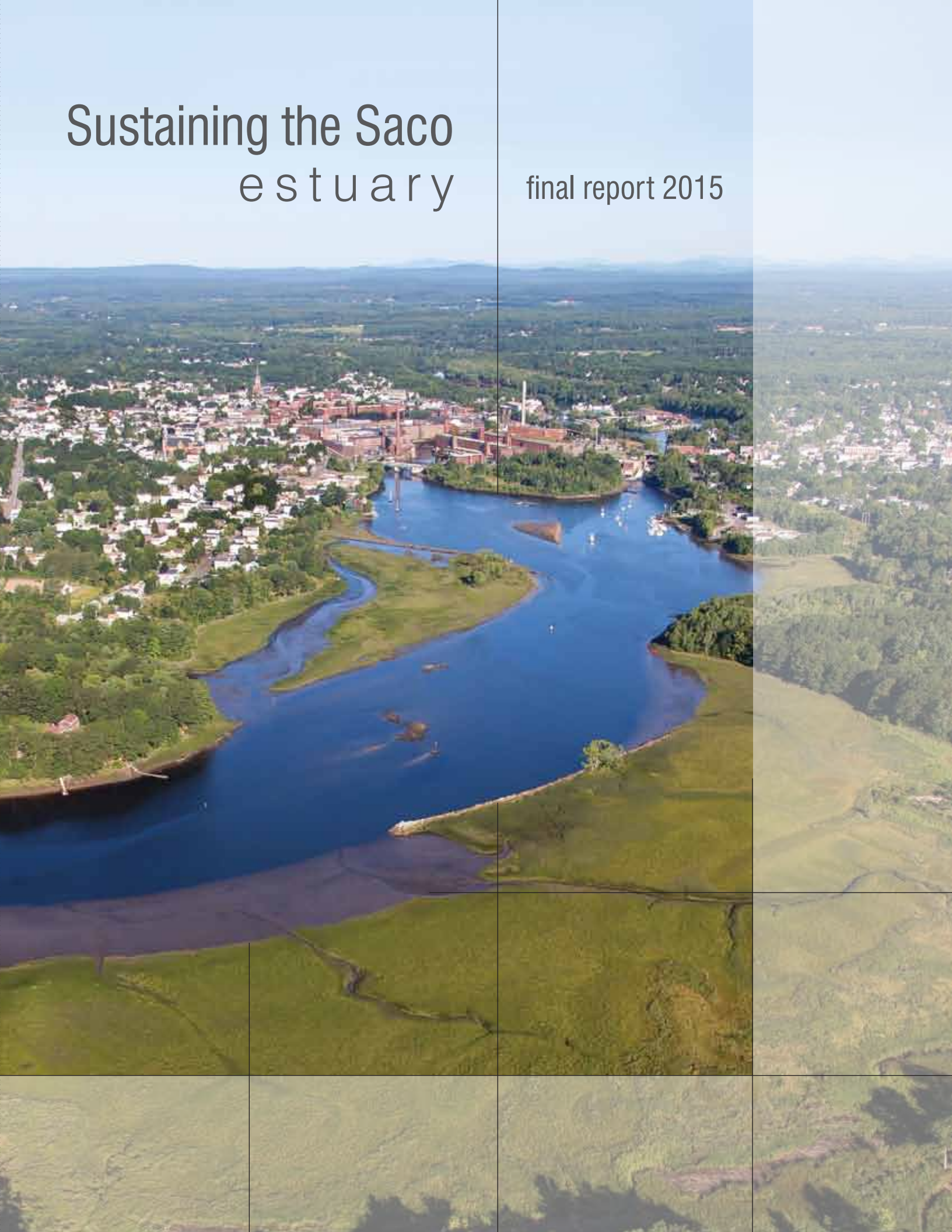


Sustaining the Saco e s t u a r y

final report 2015



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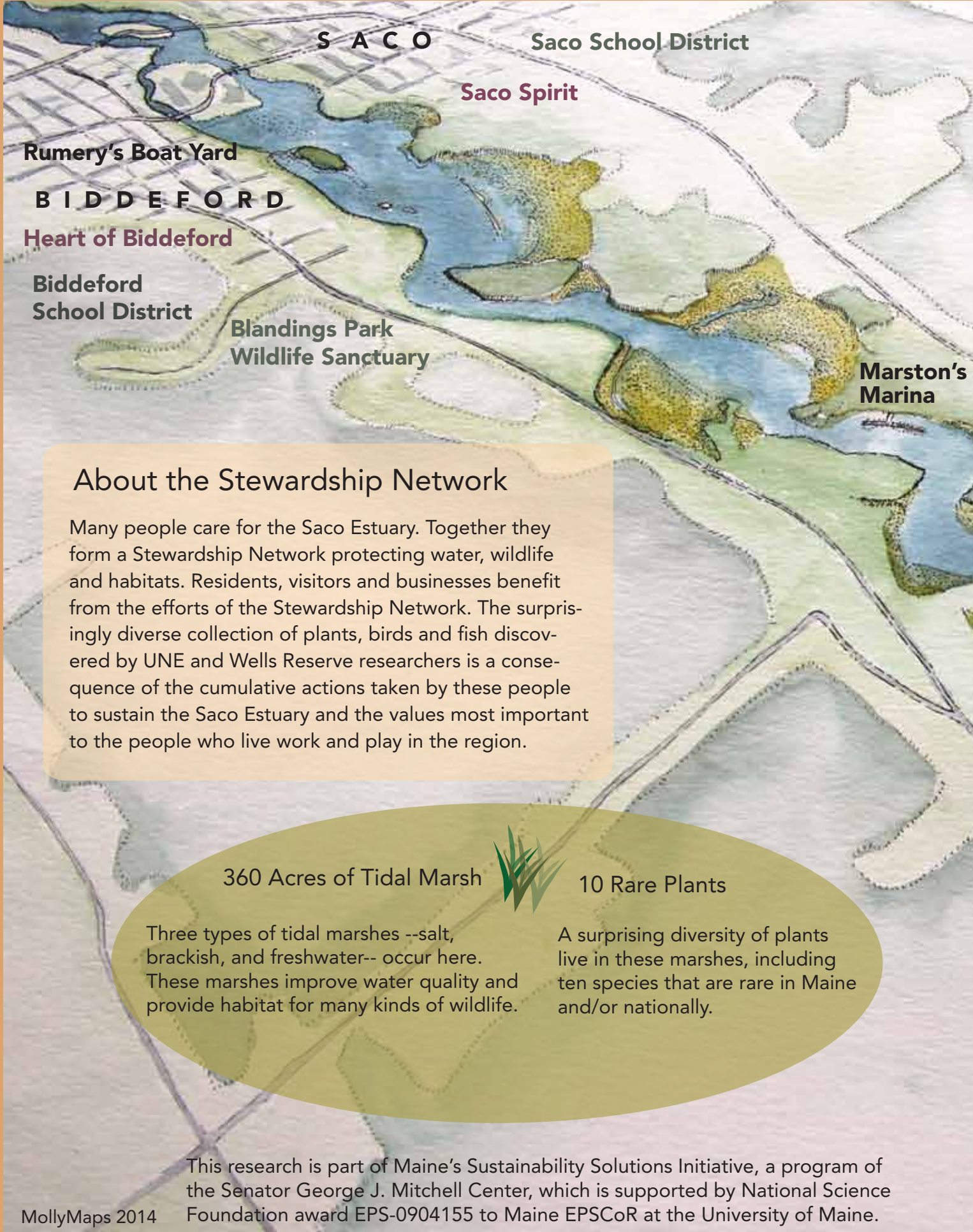
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This research is part of Maine's Sustainability Solutions Initiative, a program of the Senator George J. Mitchell Center, which is supported by National Science Foundation award EPS-0904155 to Maine EPSCoR at the University of Maine.

Report Editing and Design: Waterview Consulting

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S A C O

Saco School District

Saco Spirit

Rumery's Boat Yard

B I D D E F O R D

Heart of Biddeford

Biddeford School District

Blandings Park Wildlife Sanctuary

Marston's Marina

About the Stewardship Network

Many people care for the Saco Estuary. Together they form a Stewardship Network protecting water, wildlife and habitats. Residents, visitors and businesses benefit from the efforts of the Stewardship Network. The surprisingly diverse collection of plants, birds and fish discovered by UNE and Wells Reserve researchers is a consequence of the cumulative actions taken by these people to sustain the Saco Estuary and the values most important to the people who live work and play in the region.

360 Acres of Tidal Marsh



10 Rare Plants

Three types of tidal marshes --salt, brackish, and freshwater-- occur here. These marshes improve water quality and provide habitat for many kinds of wildlife.

A surprising diversity of plants live in these marshes, including ten species that are rare in Maine and/or nationally.

This research is part of Maine's Sustainability Solutions Initiative, a program of the Senator George J. Mitchell Center, which is supported by National Science Foundation award EPS-0904155 to Maine EPSCoR at the University of Maine.

MollyMaps 2014

A Stewardship Network Sustains the Saco Estuary

60 Fish Species



The Saco River estuary has the highest number of fish species --including adult and larval fish caught in the river and bay -- recorded in any Maine estuary.

133 Bird Species



Nearly half of all bird species in Maine have been observed using the Saco River estuary. Many of the species are not commonly associated with estuaries.

Saco Bay Tackle

Camp Ellis

University of New England

RECOGNIZING AND ENGAGING
THE STEWARDSHIP NETWORKACTIVELY WORKING TO
SUSTAIN THE SACO ESTUARY

BY CHRISTINE B. FEURT

What was the novel approach scientists used to learn about the ecological health of the Saco Estuary?

In 2009, scientists at the University of New England (UNE) and the Wells National Estuarine Research Reserve (Wells NERR) gathered to develop a unique research strategy for learning about the health of the Saco Estuary. The research strategy contained elements of traditional ecological research. This included studies to learn how physical attributes of the watershed such as water quality, flow of pollutants from the land, and local land use interact to affect the plants and animals using the estuary. A novel approach used for the first time at UNE made the research strategy unique. This novel approach integrated natural science research with social science approaches and deliberate engagement with the people whose actions contribute to the ecosystem health of the estuary.

Researchers were interested in understanding the *social-ecological system* associated with the Saco Estuary. The social-ecological system is more than water, tidal wetlands and fish. The social-ecological system includes all of the ways people interact with and depend upon the natural system. How do people use the estuary for livelihoods and recreation? How do businesses depend upon the health of the estuary? What are the mechanisms used by governments, businesses, and organizations to understand, protect and balance trade-offs that affect the ecological, social and economic values of the estuary that contribute to human well-being?

This new approach called *sustainability science* integrates the diverse disciplines of researchers with the work of stakeholder groups who are part of the social-ecological systems they are studying (Clark and Dickson, 2003). The initial goal of the Saco Estuary Project was to assess the ecosystem health of the Saco Estuary. The results of this research, detailed in this report, provide a baseline assessment of the condition of this previously understudied social-ecological system. This baseline assessment contributes to a longer-term goal to sustain and restore the structure and function of the estuary and support the efforts of government, businesses and local

organizations that value the estuary and depend upon the natural services it provides. Scientists and resource managers call these natural services that flow from healthy ecosystems *ecosystem services*. Drinking water, flood protection, pollution control, commercially viable fisheries and recreation are all examples of the ecosystem services that flow from the Saco River.

What groups, businesses and organizations care about and contribute to the ecosystem health of the Saco Estuary?

During the first year of the Saco Estuary Project an assessment of groups working to sustain the natural benefits or ecosystem services of the Saco revealed the complex architecture of what came to be called the *Stewardship Network* for the Saco Estuary. The Stewardship Network operating in the region includes municipal, state and federal governments, volunteer municipal boards making land use decisions, water supply organizations, land trusts, businesses, property owners and organizations that are uniquely focused on the region, such as the Saco River Salmon Club and the Saco River Corridor Commission. Each member of the Stewardship Network focuses on a unique suite of interests, approaches and responsibilities that contribute to sustaining valued qualities of the estuary. Together this network accomplishes some of the most important objectives of community-based ecosystem management to sustain ecosystem services (Meffe et al, 2002; Feurt, 2008).

The work of the Stewardship Network is accomplished in many ways. Examples of this work include the development of the Biddeford Open Space Plan by the Biddeford Conservation Commission and Open Space Committee. Using information about natural habitats and current land cover, and knowledge about the locations of special places valued by local community members, this group identified mapped and prioritized areas to be conserved and protected in Biddeford. The work of local planning boards, zoning boards and code enforcement officers contributes to the protection of shoreline buffers important for flood protection, water quality and critical habitat. The work of the Saco River Corridor Commission is unique in the State of Maine — providing increased protection for the shorelines of the main stem of the Saco River. The work of this group helps to ensure that drinking water quality, flood protection and habitat ecosystem services from the river are safeguarded.

People understand and value the lands and water that contribute to community wellbeing. Undergraduate researchers at UNE conducted an assessment of the work of the Stewardship Network and asked participants in a community workshop to identify valued qualities of the Saco Estuary and its watershed.

The members of the Stewardship Network participating in the Saco Estuary Project are listed below in alphabetical order. Representatives from these groups attended workshops, interacted with student researchers, advised scientists on the project and remained enthusiastically committed to the goals of the project—to sustain the structure and function of the ecological systems of the Saco Estuary. The ecological condition of the estuary is a reflection in part of the collective work of these groups.

The Saco Estuary Stewardship Network (2009–2014)

Biddeford Pool Land Trust	Maine Department of Inland Fisheries and Wildlife
Biddeford-Saco Chamber of Commerce and Industry	Maine Department of Marine Resources
Biddeford Saco Water (Maine Water)	Maine Department of Transportation
Blanding’s Park Wildlife Sanctuary	Maine Drinking Water Program
City Of Biddeford	Maine Geological Survey
Biddeford Code Enforcement	Maine Natural Areas Program
Biddeford Conservation Commission	Marston’s Marina
Biddeford Engineering, Stormwater Management and Public Works	Rumery’s Boat Yard
Biddeford Open Space Committee	Saco Bay Trails
Biddeford Planning Department and Planning Board	Saco Farmer’s Market
Biddeford Shellfish Commission	Saco Valley Land Trust
Biddeford Wastewater Treatment Facility	Saco Bay Tackle Company
City of Saco	Saco River Corridor Commission
Saco Code Enforcement	Saco River Salmon Club
Saco Conservation Commission	Southern Maine Planning and Development Commission
Saco Engineering and Public Works	The Nature Conservancy of Maine
Saco Planning Department and Planning Board	Thornton Academy
Saco Wastewater Treatment Facility	University of New England
Coastal Waters Commission	USDA Natural Resource Conservation Service
Cumberland County Soil and Water Conservation District	US Fish and Wildlife Service, Gulf of Maine Office
Friends of Wood Island Lighthouse	US Fish and Wildlife Service, Rachel Carson National Wildlife Refuge
Heart of Biddeford	US Environmental Protection Agency Boston Office
Maine Coastal Program	Wells National Estuarine Research Reserve
Maine Department of Environmental Protection	

Members of the Stewardship Network bring diverse expertise, knowledge and skills to the work they do that contributes to sustaining the ecosystem services of the Saco Estuary. Knowledge in the network includes engineering practices, stormwater management, sustainable business practices, pollution prevention, land conservation and land use planning. This work is motivated and inspired by a sense of place, awareness of local culture and a commitment to maintaining local heritage for future generations (Feurt, 2012). Each member of the Stewardship Network contributes to sustaining the ecosystem services of the Saco in different ways. This includes development of ordinances and regulations and their enforcement, land use planning and management, environmental monitoring and research, habitat conservation and restoration, education and community outreach, engineering, wastewater and public works, and drinking water provision. All elements of this *Kaleidoscope of Expertise* contribute to sustaining and restoring the qualities of the estuary that are important to the wellbeing of local residents (Feurt 2007; 2008; 2012). Figure 1 illustrates the *Kaleidoscope of Expertise* of the Stewardship Network for the Saco Estuary. Table 1 shows examples of each type of group represented by the *Kaleidoscope of Expertise*.



FIGURE 1 The Kaleidoscope of Expertise. Collaborative learning engages the stewardship network to sustain ecosystem services of the Saco Estuary.

Photo credit: Blue Marble by NASA, public domain.

How was Collaborative Learning used to build a bridge connecting knowledge to action?

One challenge that emerged early in the Saco Estuary Project was finding a way to link the scientific discoveries of the researchers with the work of the Stewardship Network. Sustainability science has adopted the term *knowledge to action* to capture the concept of bridging knowledge to decision-making across boundaries separating science and policy, between disciplines, across geographic scales and levels of management (Cash et al. 2003). Linking knowledge to action in sustainability science requires effective interactions among stakeholders and scientists. The research team used an approach called Collaborative Learning.

The Collaborative Learning approach facilitates the movement of knowledge to action in social-ecological systems like the Saco Estuary. As a robust approach with theoretical roots in alternative dispute resolution, soft systems methodologies and adult learning, Collaborative Learning is especially suited to meet the challenges of boundary work that links knowledge to action. Collaborative Learning includes principles and

TABLE 1 Saco Estuary Stakeholder Assessment: Categories of Expertise

Planning and Land Use	Regulations and Enforcement	Engineering Stormwater and Public Works	Citizen and Business Stewardship	Education and Outreach	Scientific Research and Monitoring	Drinking/Source Water Protection	Land Conservation
Saco Planning Board	Saco River Corridor Commission	UNE Waste Water Treatment	Heart of Biddeford	UNE	Wells National Estuarine Research Reserve	Biddeford-Saco Water/ Maine Water	Saco Valley Land Trust
Biddeford Planning Board	Maine Department of Environmental Protection	Biddeford Waste Water Treatment	Saco Bay Trails	Wells NERR	UNE	Maine Drinking Water Program	Biddeford Pool Land Trust
Saco Conservation Commission	Saco and Biddeford Code Enforcement	Saco Wastewater Treatment	Saco River Salmon Club	Biddeford and Saco Public and Private Schools	Biddeford Shellfish Conservation Committee		Friends of Wood Island Lighthouse
Biddeford Conservation Commission		Engineering and Public Works Biddeford and Saco	Marston's Marina				Blanding's Park Wildlife Sanctuary
Biddeford Open Space Committee			Rumery's Boat Yard				Rachel Carson National Wildlife Refuge
Coastal Waters Commission			Biddeford and Saco Chamber of Commerce and Industry				

Credit: Table developed by Samantha Mills, UNE Sustainability Intern 2013.

adaptable practices to enable diverse groups of stakeholders to share knowledge of a natural resource-based system and work together to improve and sustain that system despite differing perspectives (Daniels and Walker 2001; 2012).

A local adaptation of the Collaborative Learning methodology developed through the Coastal Training Program of the Wells NERR provided the framework for work with stakeholders in the Saco Estuary region (Feurt 2007; 2008; 2012). Nationally,

the Coastal Training Program develops and implements trainings, skill building and stakeholder engagement activities to improve the application of science to decisions affecting the ecosystem health of estuaries of the National Estuarine Research Reserve System (NOAA 2010). Locally, the Collaborative Learning approach developed in southern Maine integrated community-based ecosystem management (Meffe et al., 2002) and Collaborative Learning as a strategy to build ongoing partnerships among stakeholders and scientists to accomplish environmental objectives for sustaining ecosystem services. Ten years of collaboration with municipalities, watershed groups, land trusts and state and federal government resulted in ongoing partnerships that developed and implemented watershed plans and conservation plans (Feurt 2008; Feurt et al. 2010; and Salmon Falls Watershed Collaborative 2011). In the Saco Estuary Project, we adapted the Collaborative Learning methodology to bridge the interdisciplinary research of UNE and Wells NERR scientists with the on-the-ground management and policy work of the Stewardship Network.

The effectiveness of Collaborative Learning depends upon the resources and organizational capacity of the groups implementing the process. In practice, the method is resource intensive during the assessment phase and requires expert facilitation as well as buy-in from participants who must be committed to the learning and relationship building aspects that contribute to success. All of these elements came together during the five years of the Saco Estuary Project. A major contribution came from undergraduate researchers working in courses and internships sponsored by the UNE's Department of Environmental Studies - Center for Sustainable Communities under the guidance of Dr. Christine Feurt.

What do stakeholders in the social-ecological system of the Saco Estuary care about?

As part of the stakeholder assessment for the Saco Estuary Project, undergraduate researchers identified and characterized stakeholders interested in collaborating to develop indicators of ecosystem health for the Saco Estuary. Using the Collaborative Learning Guide for Ecosystem Management (Feurt 2008), a practitioner's guide to developing Collaborative Learning events, students in two Environmental Studies courses (*Ecosystem Management*, Fall 2009 and *Environmental Communication*, Spring 2010) conducted literature and internet reviews, attended stakeholder meetings and held informal meetings with diverse stakeholders to identify groups with interests and responsibilities for sustaining the ecosystem services of the Saco Estuary. Initially, twenty groups were identified including municipal staff of Biddeford and Saco, volunteer boards from the towns, land trusts, habitat and land conservation groups, and two groups with unique and strong ties to the Saco – the Saco River Salmon Club and the Saco River Corridor Commission.

Students in the Environmental Communication course created profiles of the stakeholder groups and developed a Collaborative Learning workshop, *Sustaining*

the Saco, held in 2010 to bring stakeholders together to meet with scientists on the project and to share their interests and concerns about the estuary. During class time students learned how to design a Collaborative Learning event and practiced skills of small group facilitation, active listening and note taking, all required for implementing a Collaborative Learning event.

Stakeholders from the groups identified by students were invited to a three-hour Collaborative Learning workshop on the UNE campus. Food was provided to create conditions supportive for busy people coming straight from work to attend the workshop. Dr. Feurt welcomed stakeholders and scientists. Student presentations introduced each aspect of the project and defined the meaning of the term *ecosystem services*. Stakeholders were then asked to engage with a team of students assigned to each of six breakout groups to discuss four questions designed to provide input to the project. Individual students facilitated the discussions, took notes on flip charts and typed notes into laptops as well as engaged in dialogue with stakeholders. Stakeholders provided input for the following questions:

- What do you value about the Saco Estuary and region?
- What are your concerns about sustaining ecosystem services of the Saco Estuary?
- How can UNE support community and regional efforts to sustain the Saco?
- Do you have anything else you would like to share with us this evening?

Students generated a stakeholder assessment using notes from their internet research and stakeholder meetings and the Collaborative Learning workshop. They used Grounded Theory Analysis to identify the diversity of stakeholder values linked to ecosystem services of the Saco Estuary. Grounded Theory Analysis (Corbin and Strauss 1990) is a qualitative method used to systematically analyze text such as meeting notes, policy and planning documents. Specific questions are used to query the text line by line and to develop coding themes consisting of key words and concepts. As patterns in the data emerge, quotes can be sorted according to themes to build theories to explain the data. Undergraduate researchers coded the initial data to build stakeholder profiles and to answer the four questions above. Subsequent coding of that data by Feurt for ecosystem services themes appears in Table 2.

This stakeholder assessment during the first year of the project contributed to development of the Stakeholder Network concept, built an understanding of stakeholder concerns and fostered the recognition that the stakeholders in the Stewardship Network were already actively engaged in sustaining ecosystem services. However, this Stewardship Network was not integrated internally, nor was it linked to the interdisciplinary research team as they began work on the Saco Estuary Project in 2009. The first *Sustaining the Saco* Workshop in 2010 helped UNE and Wells NERR researchers understand the work of the Stewardship Network and how to engage members of the Network for the duration of the project.

TABLE 2 Qualities of the Saco Estuary valued by stakeholders value according to type of ecosystem service

<p>ECOSYSTEM SERVICES Benefits that people obtain from ecosystems as categorized by the Millennium Ecosystem Assessment (2005)</p>	<p>Saco Estuary Stakeholder Values Identified from Collaborative Learning Workshop and Assessment conducted by UNE <i>Environmental Communication Class</i> Spring 2010</p>
<p>PROVISIONING SERVICES The products obtained from ecosystems, including, genetic resources, food and fiber, and fresh water.</p>	<ul style="list-style-type: none"> • People value the Saco River watershed as the water supply and source of safe drinking water for most of southern Maine • People value the role of regulations and laws to protect provisioning services (water quality) of the Saco Estuary • People value the commercial and recreational fishing that the Saco Estuary provides
<p>REGULATING SERVICES The benefits obtained from the regulation of ecosystem processes, including the regulation of climate, water, and some human diseases.</p>	<ul style="list-style-type: none"> • People value the role of natural areas like riparian buffers and wetlands to filter water as part of the water cycle • People value the role that natural areas play absorbing flood waters
<p>CULTURAL SERVICES The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including, knowledge systems, social relations, and aesthetic values.</p>	<ul style="list-style-type: none"> • People value the opportunities for recreation that the Saco Estuary provides • People value the undeveloped natural areas • People value access to the Saco Estuary • People value the aesthetics of the Saco Estuary • People value the potential of the Saco Estuary as a place for environmental education • People value the potential for research in the Saco Estuary to determine the location and condition of wildlife habitat • People value the quality of life the Saco Estuary provides to the community • People value the history of the Saco Estuary region to help identify their sense of place
<p>SUPPORTING SERVICES those services that are necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.</p>	<ul style="list-style-type: none"> • People value the potential that the resources of a healthy Saco Estuary have to support businesses/jobs for a stronger economy including a clean river and tidal wetlands supporting estuarine fish food webs. • People value conservation of natural areas and natural resources of the Saco Estuary to protect its biodiversity

ACKNOWLEDGEMENTS

The Stewardship Network whose collective actions sustain the Saco Estuary: Saco River Corridor Commission; Saco River Salmon Club; citizens of Biddeford and Saco; Biddeford-Saco Chamber of Commerce and Industry; Saco municipal government and volunteer boards; Biddeford municipal government and volunteer boards; Heart of Biddeford; Saco Valley Land Trust; Biddeford Pool Land Trust; Biddeford Pool Improvement Association; Blanding's Park Wildlife Sanctuary; Saco Coastal Waters Commission; Biddeford, Saco and University of New England (UNE) wastewater treatment facilities; Biddeford Saco Water/Maine Water; Rachel Carson National Wildlife Refuge; business owners located near and dependent on a healthy Saco Estuary; recreational users of the Saco Estuary; UNE students participating in the Environmental Studies courses "Sustaining Water" and "Environmental Communication" from 2009 to 2014 whose work engaged stakeholders in the Saco Estuary project; UNE undergraduate researchers working with the UNE Department of Environmental Studies Center for Sustainable Communities to identify, describe and engage the Stewardship Network and learn from them about actions that "Sustain the Saco"; The Wells National Estuarine Research Reserve.

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