Duke
NICHOLAS INSTITUTE
FOR ENVIRONMENTAL POLICY SOLUTIONS

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

NC COASTAL RESERVE & NATIONAL ESTUARINE RESEARCH RESERVE

Ecosystem Services Resources for Oyster Reef Restoration at the North Carolina NERR

Sara Mason, Rachel Karasik, and Lydia Olander

Ecosystem Services Resources for Oyster Reef Restoration at the North Carolina NERR

CONTENTS

Author Affiliations
Sara Mason is a Policy Associate at the Nicholas Institute for Environmental Policy Solutions.

Rachel Karasik is a Policy Associate at the Nicholas Institute for Environmental Policy Solutions.

Lydia Olander is Director of the Ecosystem Services Program at the Nicholas Institute for Environmental Policy Solutions.

Citation
Mason, S. , R. Karasik, and L. OLander. 2020. Ecosystem Services Resources for Oyster Reef Restoration at the North Carolina NERR. NI R 20-04. Durham, NC: Duke University

Acknowledgements
This work was sponsored by the National Estuarine Research Reserve System Science Collaborative, which supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is funded by the national Oceanic and Atmospheric Administration and managed by the University of Michigan Water Center (NAI4NOS4190145). We would also like to thank our partners at the North Carolina National Estuarine Research Reserve, Brandon Puckett and Whitney Jenkins, without whom this work would not have been possible.

Cover photo: Natalie Rodriguez

Publication Number: NI R 20-04

Summary

The NERRS Is Interested in Incorporating Ecosystem Services into Research, Management, and Decision-Making

Ecosystem services are the benefits that flow from nature to people, and an ecosystem services approach to coastal management is defined by the consideration of these benefits in decision-making. The National Estuarine Research Reserve System (NERRS) has acknowledged that using an ecosystem services lens for research, management, and decision-making is important to reflect the numerous social, economic, and environmental benefits that estuarine systems provide.

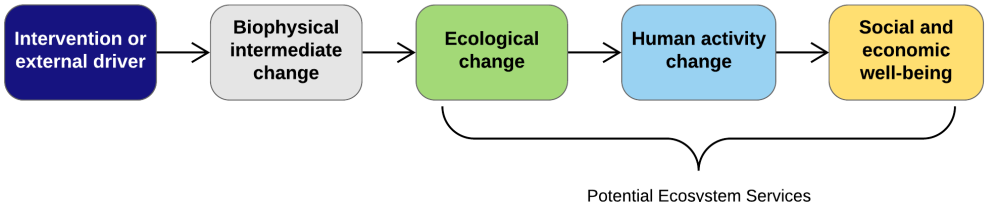
While ecosystem services are at the forefront of many NERRS activities, there is not yet a standard approach for integrating a broad suite of ecosystem services into the management decision-making process. Using a common approach to describe and monitor ecosystem services across the Reserve System could enable more efficient knowledge transfer, data sharing, and tracking of trends in ecosystem services provision across sites.

This case study describes the use of Ecosystem Services Conceptual Models (ESCMs) as a framework for considering the ecosystem services provided by oyster reef restoration projects at NERR sites across North Carolina. The oyster reef model was used to assess research gaps and inform ecosystem service metric selection. The model (and associated metrics) could likely be used at other sites as a template for consideration of the ecosystem services effects of oyster reef restoration.

CONCEPTUAL MODELS AS A WAY TO SYSTEMATICALLY THINK ABOUT ECOSYSTEM SERVICES

Ecosystem Services Conceptual Models represent a possible entry point for beginning to incorporate a suite of ecosystem services considerations into a program or project. These models illustrate the way that a management intervention or external driver cascades through an ecological system and results in changes to ecosystem service and other human welfare impacts (Figure 1). Generalized ESCMs can be developed for a broad category of management or an ecosystem type, and specified ESCMs are versions of these generalized models, but developed to describe a specific context and intervention. Generalized models will usually be higher level and less specific to enhance transferability, while site-specific models are often more detailed and precisely tailored to the conditions and processes of a particular location. For further information on ESCMs, see a primer here.

Figure 1. Structure of an Ecosystem Services Conceptual Model.



Ecosystem services are the handoff between ecological and social systems and can be measured as changes in ecologically linked human activity (e.g., # of people recreating at a site due to restoration; # of homes at risk of flooding due to loss of a wetland) or socioeconomic activity (e.g., jobs or revenue generated from an increase in fishing or recreational activity).

CASE STUDY: ECOSYSTEM SERVICES FOR OYSTER REEF RESTORATION AT NORTH CAROLINA NERR SITES

This case study describes a project that built a new generalized oyster reef ESCM in partnership with the North Carolina NERR, performed a literature review to substantiate the model, identified associated ecosystem services metrics, and developed educational and outreach materials based on the model.

North Carolina NERR

There are four research reserve sites in North Carolina totaling 10,000 acres of protected area. In addition to oyster reefs, NERRS sites protect and manage tidal flats, salt marshes, shrub thicket, maritime forest, and sand dunes that support osprey, black skimmers, summer flounder, spotted sea trout, red drum, and least tern populations. (North Carolina NERR Management Plan).

BOX 1. POSSIBLE USES FOR ESCMS

ESCMs have multiple uses, which are summarized below. Where possible, we have linked to an example of ESCMs being used in each of the ways listed.

ESCMs can:

- **Be adapted to different contexts.** General coastal habitat models can be adapted to any site where the habitat exists.
- **Act as a foundation for socioecological systems thinking.** Building and working with these models can help managers and researchers move beyond examining ecological outcomes of habitat management to mapping out impacts to people and what they care about. By clearly illustrating connections between different ecological and social aspects of a system, these models can help spur thinking about the variety of partners and expertise needed to fully understand the impacts that a particular management action or external driver will have.
- **Identify services and beneficiary groups.** By extending these models all the way out to ecosystem services and social outcomes you can start to think about how different groups will be impacted by ecological changes resulting from management decisions. (Link to beneficiary case).
- **Act as a pathway for consistency in ecosystem service assessment.** Ecosystem services tend to be context-specific because they are unique to the communities/groups/stakeholders receiving benefits from a particular ecosystem, but there is still a need for consistency in how they are considered across contexts so that comparisons can be made. These models can act as a consistent framework to identify central themes or outcomes across different contexts.
- **Jump-start ecosystem services and/or socioeconomic metric selection.** Since ESCMs help to identify the full suite of socioeconomic outcomes linked to an intervention, they are a useful starting place for selecting common metrics that would allow for easier comparison between ecosystem services outcomes of different projects. (Link to metrics web page).
- **Create a foundation for ecosystem service quantification and valuation.** These models can act as a framework for thinking about necessary data and analytical models for quantifying the range of outcomes relevant to a particular site. (See a journal article discussing an example of this).
- **Become an evidence framework.** By considering available evidence for each link in the chain, we have an easy way of mapping what is known about these ecosystems, the expected direction and magnitude of changes, and to where there are gaps in evidence suggesting research or monitoring priorities. (E.g., an evidence library for a general salt marsh model).
- **Act as a communication tool.** You don't need to understand what the term 'ecosystem services' means to read and react to one of these models. They act as a visual summary of the socio-ecological system and can be a good way to engage some stakeholder groups and start conversations about how ecological and human systems interact. (Link to communications examples).

Project Process

Our process is outlined below in Table 1. We typically use an iterative and interactive process to incorporate feedback from multiple experts on the usefulness of ESCMs and associated products from those who we hope would use them most.

Table 1. North Carolina NERR Process Summary

Project Step	Details
Draft ESCM created	We performed a limited literature review to develop a draft ESCM. This gave participants at our model-building workshop something to respond to.
Potential metrics collected	A basic literature review was conducted to develop a list of metrics that had previously been used to measure ecosystem services. These metrics were meant to serve as a catalyst for deeper discussion with stakeholders about what they perceive to be appropriate metrics at the site.
Workshop hosted	We hosted a one-day workshop at the Rachel Carson Reserve in Beaufort, NC, with representatives from the NERR, the NC Coastal Federation, the Nature Conservancy (TNC), University of North Carolina Wilmington, the NC Division of Marine Fisheries, and the Albemarle Pamlico Sound National Estuary Partnership. We updated the general ESCM based on their feedback. We also selected a set of ecosystem services metrics that seemed most important and feasible for use on the oyster restoration sites.
Experts consulted	We consulted two different types of experts to provide feedback and advice on the workshop-constructed models. 1. Habitat experts: we discussed the model with oyster restoration experts who did not attend the workshop to ensure what was created aligns with their knowledge of oyster reef systems. 2. Social experts: these are people closely tied to the intersection between habitat change and social outcomes. This includes seafood distributors, community development officials, restoration contractors and tourism officials. We wanted input on how they view habitat restoration (or change) and the outcomes most important to them. This was done to ensure we had incorporated the proper nuance in our model for the connections between the ecological and social system.
Models updated	Models were updated based on expert feedback and were redistributed to workshop participants for input and approval.
Metric assessment	The metric lists generated at our workshop represent what participants thought would be feasible and applicable to measure. These suggested metrics were ranked against a set of criteria relating to feasibility and applicability to better identify which metrics could be adopted into the NERRS framework and perhaps be useful across other NERRS sites.

Project Step	Details
Development of education and communication materials	Our communications research assistant worked with NC NERR site staff and stakeholders to develop a number of mixed-media education and communication materials built off ECSMs and priorities identified by the NERR.
Development of facilitation guide	A multiphase facilitation guide for coastal managers hoping to develop ECSMs, metrics, and related content was developed because the individual processes and workshops were useful to participants.

Project Resources

We created a set of resources from our project work at the NC NERR. These resources are summarized in Table 2, and more detail on each item can be found in the sections below.

Table 2. NC NERR Outputs

Output	Details	Link
ES Conceptual Models	An ecosystem services conceptual model was created for oyster reef restoration on a site in the NC NERR.	Oyster Reef model
NC Oyster Reef Evidence Library	This document describes the available evidence for every link (arrow) in the NC oyster reef conceptual model.	NC oyster reef evidence library
Metrics Assessment	Ecosystem services metrics for prioritized model outcomes were selected at the workshop and then assessed using metric criteria.	Metrics list, with notation of how each metric scored against our criteria
Education and outreach materials	Ecosystem services education and outreach materials based on the model content were created for the NC NERR.	Oyster Reef Education Materials
Social Interview findings	Interviews with experts on the socioeconomic outcomes of restoration were interviewed and responses were summarized.	Social interviews write-up findings/summary

Models

A general ESCM was designed for oyster reef restoration North Carolina based on a stakeholder engagement processes, literature reviews, and expert elicitation. The general model includes significant ecological, human activity, and socioeconomic outcomes linked to restoration of that habitat type. Model images can be viewed below, and examined online here.

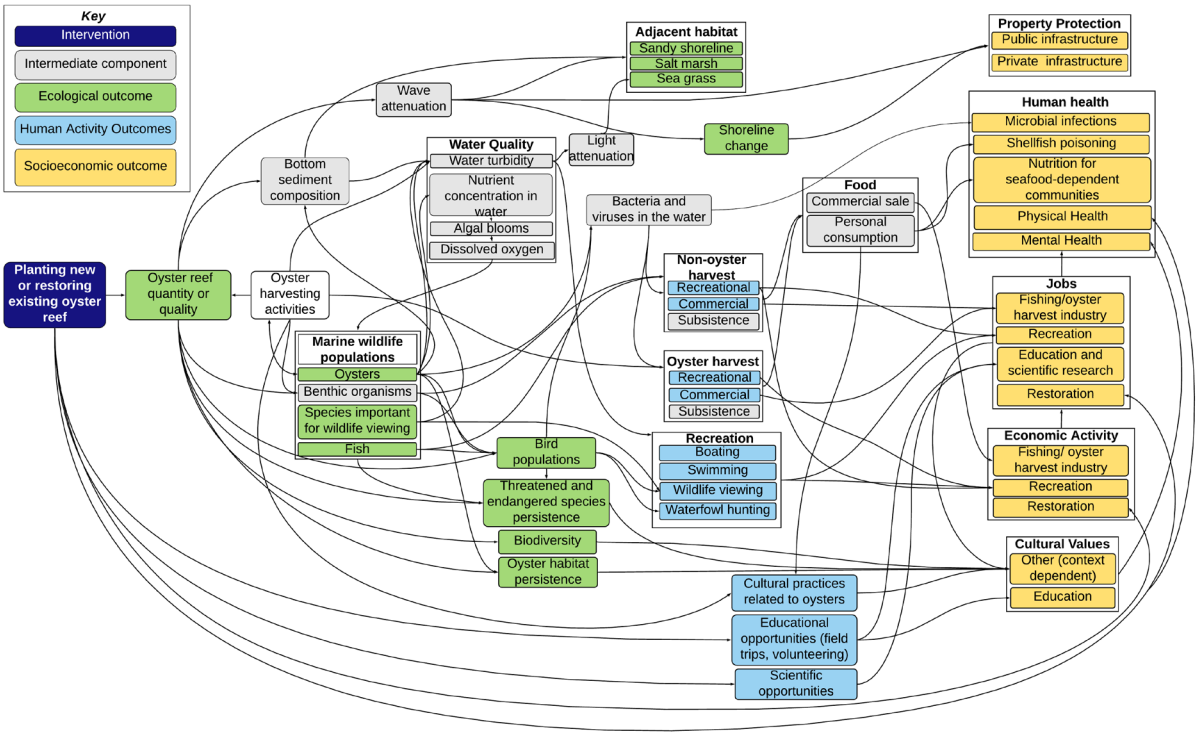
Attendees at the North Carolina model-building workshop and in subsequent stakeholder conversations raised important points about what was included in the model. Notes about the model and the model-building process are provided below:

- Education and science opportunities provided by restoration sites will link back to increased restoration elsewhere. With increased awareness about the need for and benefit of habitat restoration, there will (hopefully) be increased demand for healthy habitats by the public and policy makers. This important linkage is not shown in the current model because it is such a long-term outcome.
- Going through the model building process was viewed by researchers as a way to systematically think about research gaps. Seeing the entire socioecological system summarized in one place helped the group examine where there are local gaps in knowledge about how different parts of the system interact and connect.

There are also important aspects of the model that need to be considered by those who attempt to adapt and apply these models to other sites, as they may indicate alterations that need to be made. These considerations are outlined below:

- While attendees acknowledged that water quality concerns resulting from point and nonpoint source pollutants upstream could not be ameliorated with oyster reef restoration alone, they acknowledged that water quality as an ecosystem services outcome was incredibly important for all stakeholders. Water quality outcomes such as nutrient concentration, algae blooms, and dissolved oxygen are retained in this model, but participants agreed that oyster reef restoration projects alone were unlikely to result in significant changes to these metrics, except perhaps at an extremely localized level. Those adapting this model to another site should consider whether effects of a particular oyster restoration project would impact these types of outcomes, and if not should remove those outcomes from their version of the model.
- In the North Carolina context, oyster reefs are relatively rare given the significant decline in this habitat over the past centuries. This means that the marginal benefit of a single restoration site is significant and the existence value benefits, especially to those who associate oyster reefs with the identity of the NC coast, are quite high.

Figure 3. The North Carolina Generalized Oyster Reef ESCM



North Carolina Oyster Reef Evidence Library

Evidence libraries are resources that document the known evidence about each link (arrow) in an Ecosystem Services Conceptual Model. These links represent relationships between different aspects of the system that are illustrated in the ESCM. A description of the evidence for a particular relationship is referred to as an evidence library entry. The collection of entries for an entire ESCM makes up the evidence library.

Each evidence library entry contains:

- **A description of the relationship** between the two focal nodes (boxes). This starts as an assumption, but it can become an evidence-based description through development of the library and assessment of evidence;
- **A summary** of the evidence found relating to the assumption;
- **A list of other factors** that may result in variation (location, timing, external drivers, and so on). in direction or magnitude of effect described in the assumption;
- **A summary of confidence** in the assumption given available evidence;
- **A list of evidence resources.**

Evidence libraries can be used:

- To identify knowledge gaps (i.e., identify links where there is limited evidence available);
- To determine what is known about the direction and magnitude of hypothesized relationships;
- To provide best available science summaries for each link, as a way to keep people in the future from starting research from scratch;
- To understand which outcomes are strongly linked to the intervention.

Find the North Carolina Oyster Reef Evidence Library here.

Metrics for Oyster Reef Restoration in North Carolina

ESCMs are a useful starting place for understanding the ecosystem services outcomes from interventions like restoration. They can be a jumping off place for integrating ecosystem services into management in many ways, including the development of metrics used to monitor the outcomes of restoration projects. One of the benefits of monitoring ecosystem services is that these metrics can resonate with stakeholders who aren't normally interested in environmental data. Ecosystem services data record information about how natural systems affect people and it is important to select metrics that represent those outcomes that people care about. There are multiple ways to observe and measure ecosystem services or socioeconomic outcomes, and it is a significant challenge to select metrics that are meaningful, but also feasible to measure.

Using a set of metrics extracted from a literature review as a starting point, workshop participants were asked to identify a minimum of three metrics that could be used to measure each dominant ecosystem services outcome for oyster reef restoration projects in North Carolina. Some of the identified metrics are already being measured or are considered feasible to measure. Other metrics were viewed by our stakeholders as less feasible, idealized metrics, and we chose to identify these metrics as "dream" metrics to document what our stakeholders would most like to measure, even if it might not be feasible at this time.

Metric Assessment

In order to rank and compare the metrics developed at our workshop we assessed the metrics through a set of six criteria (described in Table 3 below) that would comprehensively relay the feasibility and relevance of each metric.

Table 3. Metric Criteria and How Each Criterion Was Scored

Criteria	Score 1	Score 2	Score 3
Metric has been measured elsewhere	There is no clear or published method for measuring this metric	Measurement of this metric has not taken place at a NERR but there are publications that include clear guidelines on how to measure the metric in relevant contexts	Measurement of this metric has taken place in similar contexts and a replicable method within NERR sites exists
Ease and cost of data collection	Very difficult and/or costly	Somewhat difficult and/or costly	Relatively easy and/or cheap
Metric captures the ecosystem services outcome of interest	Important aspects of outcome are not captured	Metric captures some important aspects of the outcome	Metric captures the outcome fully or directly
Changes in the metric can be attributed to a restoration project	Attribution is difficult/impossible	Attribution might be possible	Change in metric is likely directly attributable to restoration
Changes in the metric could be detected within a typical project lifecycle	No, unlikely to see this change within 5 years	Might see minor changes within 5 years	Yes, likely to see this change within 5 years
Data on this metric would resonate with important stakeholders	No, data on this metric will not resonate well with people outside the academic community	Somewhat, select stakeholders will be able to connect with this metric	Yes, the metric connects easily to things that people care about

For each criterion, scores of 1 through 3 were assigned, with 1 being the least suitable and 3 being the most suitable, based on the authors' knowledge of the metric and the methods described in the literature review. When they are summed, the six individual metric criteria scores range from 6 to 18, with higher scores representing more suitable metrics. It is important to note that this metrics feasibility assessment, while an effort to standardize and qualify the potential metrics, is still somewhat subjective and relies on the literature review and knowledge of the authors of this report. A sample of assessed metrics are shown below in Tables 4–6, and the full metrics list can be found here with a breakdown of how each metric scored on the six criteria. Metrics with "**" represent "dream" metrics.

It is important to note that these metrics are focused on sampling for a single restoration site and as a result the ecosystem services metrics tend to measure ecological outcomes that are providing a service to people in the area or human activities that indicate use of a service, rather than socioeconomic metrics like jobs or revenue which tend to require larger scale impacts and quantification.

Top-Scoring Metrics

There are four metrics developed from the North Carolina workshop that scored 15 and 16 out of 18 total possible points. Three are ecological metrics, while one is a measure of human activity indicating social links to ecosystems (ecosystem services). Though we prefer to select ecosystem services metrics that move beyond ecological measures, ecological metrics likely scored high as they tend to be more attributable and easier to measure.

Table 4. Top-Scoring Oyster Reef Metrics

Metric	Outcome from ECSM	Total score	Brief description of methods
Habitat extent/size of the site	Habitat Persistence	16	Field surveys of site size
Size-class distribution	Oyster Populations and Oyster Habitat Persistence	16	Random sampling of restored oyster sites on a restored site where oyster samples are categorized by size
Abundance/presence of a particular fish species at a reef	Fish Populations	15	Visual survey conducted before, during, and after restoration
****Change in availability of wild oysters for celebrations/holidays - via survey**	Cultural Values	15	Market analysis of oysters including a section on seasonality and seasonal availability based on existing data

Dream Metrics

The workshop group identified "dream" metrics for outcomes based on their personal and professional expertise. These are the metrics that stakeholders felt best captured the ecosystem services outcome of interest in a meaningful way, but that were considered difficult to monitor due to difficulty or cost of collecting the requisite data. We recognize that in many cases the ease and cost of collecting data on a particular metric is the ultimate deciding factor in whether a metric gets monitored, indicating that many of these metrics are unlikely to be used in the near future.

Table 5. Dream Metrics and Their Metric Assessment Scores

Metric	Outcome from ECSM	Total score	Brief description of methods
****Adult recruitment to fishing grounds from the project site**	Fish Populations	11	Sample fish in restored areas and measure their recruitment
****Catch per unit effort of trip (CPUE), combined with an associated satisfaction survey**	Recreational Oyster Harvest	10	Determine CPUE by measuring number of fish hooked and landed/hr on restored and nonrestored sites; then use a satisfaction survey to determine if satisfaction related to recreational to oyster harvest has changed
****Change in availability of wild oysters for celebrations/ holidays - via survey**	Cultural Values	15	Market analysis of oysters including a section on seasonality and seasonal availability based on existing data
****Oyster landings on reefs with known population connection to a restored reef site**	Commercial Oyster Harvest	10	Use NOAA database to get data on oyster landings in metric tons, pounds and dockside value for a county with large restoration areas
****Quality of recreational fishing (satisfaction survey)**	Recreational Non-Oyster Harvest	13	Survey of angler use of and satisfaction with restored area
****Tourism dollars generated by tourists travelling to the region to fish recreationally**	Recreational Non-Oyster Harvest	12	ENOW (a NOAA resource) includes publicly available and annually updated data on tourism in coastal states in the U.S.; attributing changes to any one restoration project is difficult to impossible
****Willingness to pay for a certain habitat type**	Habitat Persistence	11	Willingness to pay study where each respondent is asked their willingness to pay for one of four oyster reef restoration projects of different sizes

Crossover Priorities

An identical ESCM workshop focused on oyster reefs was also conducted at the Rookery Bay NERR in southwestern Florida during this project. Table 6 displays those metrics that were prioritized in both locations, representing metrics that are relevant for multiple habitat types. In total, six metrics corresponding to four ecosystem services outcomes overlapped between the two sites. They included one dream metric and their feasibility scores ranged from 10–16. The higher-ranking metrics tended to be those that correspond to ecological outcomes while the lower scoring ones were indicators seeking to assess changes in social or economic outcomes related to the ecosystem changes. This is likely for two reasons: there are already a number of ecological and biological metrics institutionalized in habitat monitoring, and social and economic outcomes such as property value are more difficult to attribute to an individual habitat restoration project.

Table 6. Crossover Metrics That Were Prioritized at Both Rookery Bay and the NC NERR Workshops

Metric	Outcome from ECSM	Total score (6–18)	Brief description of methods
Density of a particular fish species (# of fish species per unit area)	Fish Populations and Habitat Persistence	13	Direct observation of fishes in a given area and/or fish counts via hydroacoustic surveys
Number of species of particular importance found at the site (FL); Abundance/presence of a particular fish species at a reef (NC)	Fish Populations	15	Visual survey performed before, during, and after restoration
Habitat extent/size of the site	Habitat Persistence	16	Field surveys of site size
Habitat extent/size of the site	Habitat Persistence	14	Remote sensing to measure site size.
**Willingness to pay for a certain habitat type	Habitat Persistence	11	Willingness to pay study utilizing a survey
Changes in property value of residential properties due to the project	Property Protection	10	Online housing prices in X distance radius of site
Property value of homes/commercial buildings with the site in view	Aesthetics and Property Protection	11	Online housing prices in X distance radius of site

Education Materials

Members of the North Carolina NERR staff and targeted community members interviewed expressed interest in using ESCMs for stakeholder engagement and outreach regarding oyster reef restoration. In response, we worked with the NC NERR communications team to develop ecosystem services-based education and outreach material. Infographics, stakeholder presentations, middle-school education material, and abbreviated project summary products were then developed to fit these needs (Table 7).

Table 7. Summary of Education and Outreach Material Created for North Carolina

General Outreach Material	Middle School Education Material
Stakeholder ES PowerPoint presentations	ES PowerPoint Lesson
Twitter infographic	Oyster Reef Rally PowerPoint game
Simplified ESCM (for communication purposes)	ES Bingo and ES Sorting (printable activities)
ESCM Fact Sheet	

Figure 6. Example of an Infographic Created to Describe the Ecosystem Services of Oysters in North Carolina.

Social Interviews Regarding Oyster Reef Restoration

In addition to engagement with natural resource and habitat experts, we conducted interviews with people impacted by oyster reef restoration in North Carolina, but not directly involved in restoration on the NERRS project sites. This was done to determine if the final set of ecosystem services outcomes aligns well with these stakeholders' perceptions of what the important impacts of restoration are. We conducted seven semi-structured phone interviews and two in-person interviews. The people with whom we spoke represented the tourism, seafood distribution, aquaculture, and restoration industries as well as community and economic development officials. Interviewees indicated that the final list of ecosystem services outcomes developed at the workshop correctly reflected their understanding of important restoration impacts. Similarly to our workshop, a prevalent sentiment across stakeholder groups was that water quality is the

Box 2. Ecosystem Services Workshop Facilitation Guide

We have heard multiple times that the process of hosting and taking part in a workshop to develop ESCMs and think about ecosystem services metrics was a valuable experience for both NERR staff and partners in attendance. The process of adapting models is a good way to start thinking more intentionally about ecosystem services at reserves, and it promotes thinking about the socioecological system more holistically. Model discussion is helpful for identifying gaps in knowledge, starting to normalize ecosystem services thinking across different stakeholders, and thinking very specifically about how NERR management decisions affect different stakeholder groups.

We have documented our workshop process in a facilitation guide that would allow any coastal manager to take one of our draft models and work with a stakeholder group to develop a specified model that fits their site's context. Find the guide here.

best indicator for overall coastal health, along with skepticism that habitat restoration will have a significant impact on water quality. See a full write up of the social interviews here.

POSSIBLE NEXT STEPS FOR NORTH CAROLINA

Using an ESCM framework represents a relatively easy entry point to more fully and consistently incorporate the consideration of ecosystem services into coastal decision-making. The oyster reef model developed for sites in North Carolina can be used and adapted for any oyster reef restoration they consider in the future. The NERR can also use its familiarity with these models and their uses to adapt ESCMs for other habitats that may be a focus of work.

The Oyster Restoration and Protection Plan for North Carolina is currently undergoing an update. There are discussions about making the new version more service based (e.g., focusing priorities on fishery production potential rather than area of habitat). Several authors of the upcoming plan attended our workshop, and hopefully the conversations we fostered and information provided here can help play some small part in future conversations about making the updated plan more service-oriented.

There are also ways to build upon these initial models. Additional information and value can be gained by building additional layers of information on the ESCMs, such as collecting data on a subset of the metrics developed during this project. These ESCMs can also be the basis for understanding research gaps and monitoring priorities, identifying affected communities (see example beneficiaries case), and developing predictive models for examining alternative scenarios. All of these could be built using the framework of the oyster reef model developed for NC NERRS.

In addition, if the ESCMs and associated products (metrics, evidence assessments, predictive models) are shared as a consistent and common set of models, tools, and resources and adopted by the NERR network more broadly; there is potential for shared knowledge to advance these products across the network, and for more meaningful cross comparison and interconnections on ecosystem services across the Reserve System.

Nicholas Institute for Environmental Policy Solutions

The Nicholas Institute for Environmental Policy Solutions at Duke University is a nonpartisan institute founded in 2005 to help decision makers in government, the private sector, and the nonprofit community address critical environmental challenges. The Nicholas Institute responds to the demand for high-quality and timely data and acts as an "honest broker" in policy debates by convening and fostering open, ongoing dialogue between stakeholders on all sides of the issues and providing policy-relevant analysis based on academic research. The Nicholas Institute's leadership and staff leverage the broad expertise of Duke University as well as public and private partners worldwide. Since its inception, the Nicholas Institute has earned a distinguished reputation for its innovative approach to developing multilateral, nonpartisan, and economically viable solutions to pressing environmental challenges.

Contact

Nicholas Institute
Duke University
P.O. Box 90335
Durham, NC 27708

1201 Pennsylvania
Avenue NW
Suite 500
Washington, DC 20004

919.613.8709
nicholasinstitute@duke.edu