

PROJECT INFORMATION

Project Director's Name*	Lydia Olander
Organization*	Duke University
Project Title*	Ecosystem Services Program Director, Nicholas Institute for Environmental Policy Solutions
Reporting Period*	Nov 15, 2020 - May 31, 2021

Note to Grantees: In sections 1 to 5, we ask you to highlight your accomplishments (including outputs and outcomes) through this grant award. These sections of the final grant report will be made available to the public.

1. GOALS AND ACCOMPLISHMENTS

1.1 Please restate the goals and objectives of your project.*

This project intends to advance standardized measures of restoration work through the development of ecosystem service logic models (ESLMs) to provide accountability and produce a transferable and scalable approach for measuring success and comparing restoration alternatives and outcomes across disparate Gulf projects.

Specifically the development of ESLMs in close partnership with local communities, experts and practitioners will:

- 1) Build a consistent framework for comparing restoration alternatives and streamlining metric identification and monitoring plans by synthesizing ESLMs built at 5 sites (one watershed in each State) across the Gulf for 2-3 prominent restoration actions (e.g., marsh restoration, oyster reef restoration). This ESLM framework will provide a shared evidence-base for how prominent restoration activities lead to ecosystem service, economic and social outcomes and a 'minimum set' of prioritized metrics for ecological, social and economic outcomes for each site and restoration action;
- 2) Foster consistency in metrics used across restoration activities and locations by using the site-specific ESLMs to create generalized ESLMs and priority metrics that apply across the Gulf;
- 3) Develop a transferable and malleable operational framework for integrating priority metrics into existing Gulf restoration monitoring systems; and
- 4) Ensure this process is replicable and constructive for practitioners by developing practical guidance and decision support resources for the generation and use of ESLMs in restoration project design and monitoring.

1.2 Describe the accomplishments of your project. You should include both the anticipated accomplishments that you outlined in your project proposal as well as any *unanticipated* accomplishments that have since occurred. Describe any activities you have conducted, programmatic progress made, or project benchmarks and milestones met.*

1) We built a social and economic monitoring framework for common coastal restoration project types in the Gulf of Mexico. This was done by synthesizing the outcomes of over 20 project types, rather than just 2 or 3 as stated in the proposal goal. The monitoring framework consists of ecosystem service logic models for all restoration project types, a database of metrics that can be used to monitor social and economic outcomes of those project types, and a suite of core metrics that are common across project types.

2) The framework described in #1 (above) paves the way for consistency in metrics by creating a common set of metrics that work across the Gulf region and across restoration actions. We have been in discussions with restoration funders (e.g. RESTORE) to think about how they might suggest these standard metrics to grantees. We have also shared these resources with many different Gulf restoration programs (state, estuary, NOAA, NFWF, etc...) and have integrated the tool into a new training being led by the NOAA office of Coastal Management through its NERRS (funded separately).

3) The logic models developed provide a way to show how ecological goals can link to the social and economic outcomes and metrics developed by this project which can be used by any program or project to integrate the ecological and socio-economic monitoring. We have mapped the GEMS metrics to RESTORE parameters to make it easy to see how their existing monitoring framework links to ours. We also worked to align our language (e.g. using the term 'core metrics') with other monitoring frameworks in the Gulf, like the NRDA Monitoring and Assessment Manual.

4) We developed an online tool that hosts the monitoring framework, as well as a series of users guides for practitioners and funders that explain how these user groups might find the GEMS resources helpful. We conducted a series of targeted webinars at the end of the project presenting the project resources to those who plan, monitor, and fund restoration projects in the Gulf. In addition, through other funded projects, we have a "how to" guide available on our website for anyone who would like to build their own logic model and the NOAA OCM course mentioned above will train participants how to develop their own models and adapt them for different uses including development of metrics. We also have a workshop facilitation guide that provides ideas for how to facilitate the development of metrics in a workshop setting.

2. Outputs

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

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** denotes required fields*

2. OUTPUTS

Outputs are tangible or measurable deliverables, products, data, or publications produced during the project period.

2.1. Please indicate the number of students (K-12, undergraduate, or graduate), postdoctoral scholars, citizen scientists, or other trainees involved in the project. *

Please enter 0 if none were involved.

K-12 students	0
Undergraduate students	0
Graduate students	6
Postdoctoral scholars	0
Citizen Scientists	0
Other Trainees	0

2.2. Has your project generated any data and/or information products? *

Generation of data includes transformations of existing data sets and generation of data from existing resources (e.g., maps and images). Information products include publications, models, software, code, curricula, and digital resources.

(Check all that apply.)

Responses Selected:

Information Products

2.3. Briefly describe how you fulfilled the approved Data Management Plan and, if applicable, any changes from the approved plan. *

Data and other information products were shared in the ways that we proposed in the project proposal:

- a. The majority of data captured through this research was stored in Excel and csv formats. The ESLMs were created and stored in Lucidchart, and then exported to PDF format and created in an online editable format through draw.io, which are available on our website.
- d. No proprietary datasets were used, and no confidential data was collected.
- g. This project produced workshop summaries, guidance documents, and ESLMs, which are all freely available on our website.

Short term data management was conducted as stated in the project proposal:

- a. Researchers used computers to capture and store data and other information products
- b. Software used by project personnel to capture, store, and process data and other information products included Microsoft Excel and Word.
- c. No data was integrated or aggregated. Version control for shared files was managed through tools such as Google Docs and Box.
- d. Data collected by the project team was not confidential, and therefore did not have to be encrypted.

Metadata

- a. The project did not create any datasets that require metadata.

Data Sharing

- a. All data and information products created by the project are publicly available on our website.

Long term management

- a. All data and information products are publicly available. Information products are currently stored within the Duke University Data Repository and will be loaded into GRIIDC once GRIIDC completes their current website upgrade that will allow hosting of information products.
- b. Data/ information products are being stored in non-proprietary format and will be stored by researchers for a minimum of 5 year post project.

If your project has produced publications, websites or data portals, GIS applications, models or simulations, software packages or digital tools, code, curricula, or other interactive media, please download the Excel worksheet entitled [GRP Information Management Reporting](#). Use the “Information Products Report” tab in the worksheet to create an inventory of these products and to verify deposit in a curation facility. Upon completion, please upload the worksheet to your task list. If you need guidance on how to complete the Information Products Report, please e-mail gulfgrants@nas.edu. A member of GRP’s data management staff will reach out to you.

2.4. Aside from data and information products, what other tangible or measurable deliverables or products (e.g., workshops, trainings, and outreach events) were produced during the project period? *

Upon completion of this form, you may upload supplemental material that represent the tangible or measurable deliverables or products to complement this narrative report.

9 workshops held throughout the course of the project. These workshops were used to get feedback on ESLMs, brainstorm metrics that could be used to measure social and economic outcomes, and pressure test those metrics with experts from around the Gulf

- a. 5 state workshops in 2018
- b. 1 regional workshop in 2018
- c. 1 regional workshop in 2020
- d. 2 virtual topical workshops in 2020

Presentations on GEMS to many end-user groups: GOMA, GRP, Charlotte Harbor National Estuary Program (NEP), Tampa Bay Estuary Program, Pensacola Bay Estuary Program, the Social Coast Forum, NOAA- DARP

The project was rolled out and announced to the Gulf community through a series of webinars in Spring 2021 that targeted audiences who do planning, monitoring, and funding of restoration projects in the Gulf.

4. Information Products

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

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4. INFORMATION PRODUCTS

In this section, please provide a response to each question to complement the **Information Products Report** in the **GRP Information Products Management** Excel worksheet.

4.1. Please select the type(s) of information products that your project produced. *

Responses Selected:

1. Scholarly publications, reports or monographs, workshop summaries, or conference proceedings
2. Websites or data portals
6. Software packages or digital tools, or other interactive media
7. Other: Users guides

Scholarly publications, reports or monographs, workshop summaries, or conference proceedings *

Please provide a list of citations for project publication, reports and monographs, workshop summaries, and conference proceedings.

Olander, L., C. Shepard, H. Tallis, C. Shepard, D. Yoskowitz, K. Coffey, et al. 2021. GEMS Phase II Report: Coastal Restoration. NI R 21-05. Durham, NC: Duke University. <https://nicholasinstitute.duke.edu/publications/gems-phase-ii-report-coastal-restoration>

Olander, L., D. Yoskowitz, H. Tallis, C. Shepard, K. Warnell, S. Mason, et al. 2020. GEMS Phase I Report: Oyster Reef Restoration. NI R 20-01. Durham, NC: Duke University. <https://nicholasinstitute.duke.edu/publications/gems-phase-i-report-oyster-reef-restoration>

Warnell, K., R. Karasik, S. Mason, A. Zhao, S. Sharma, C. Sandoval. 2018. Evidence Library for Oyster Reef Restoration in the Gulf of Mexico. <https://nicholasinstitute.duke.edu/sites/default/files/gems/GEMS-Evidence-Library.pdf>

GEMS. 2021. PRACTITIONER GUIDANCE FOR GEMS SOCIAL AND ECONOMIC METRICS: Oyster Reef Restoration <https://nicholasinstitute.duke.edu/sites/default/files/gems/GEMS-oysters-practioners-guide-final.pdf>

GEMS. 2021. PRACTITIONER GUIDANCE FOR GEMS SOCIAL AND ECONOMIC METRICS: Green Infrastructure for Stormwater Management. <https://nicholasinstitute.duke.edu/sites/default/files/gems/GEMS-green-infrastructure-practitioners-guide.pdf>

GEMS. 2021. PRACTITIONER GUIDANCE FOR GEMS SOCIAL AND ECONOMIC METRICS: Coastal Habitat Restoration <https://nicholasinstitute.duke.edu/sites/default/files/gems/gems-coastal-habitat-restoration-practioners-guide.pdf>

GEMS. 2021. CORE METRICS FOR INTEGRATING SOCIAL AND ECONOMIC OUTCOMES INTO PROJECT FUNDING, PROGRAM DESIGN, AND MONITORING <https://nicholasinstitute.duke.edu/sites/default/files/gems/gems-funders-guide.pdf>

Websites or data portals *

Please provide a list of project websites and data portals (including the website URL).

<https://nicholasinstitute.duke.edu/project/gems>

How long beyond the grant period will you maintain the project website/data portal and its contents? Please describe plans to archive the website/data portal and its contents after regular maintenance concludes.*

The website is part of our institutional website and will be maintained for at least 10 years and beyond that will be archived at Duke University.

Curricula for education and training, GIS applications, Models or simulations, Software packages or digital tools, or other interactive media, and Other *

If you produced any additional documentation to describe information products, please provide a list of this documentation (e.g., model or simulation documentation, software manuals, source code annotation).

Documentation related to the web tool and database of metrics created is provided within the website.

<https://nicholasinstitute.duke.edu/project/gems>

4.2. Beyond depositing information products in a repository, what other activities have you undertaken or will undertake to ensure that others (e.g., researchers, decision makers, and the public) can easily discover and access the listed information products? *

All information is available on our website and has been shared through webinars, and will also be included in a training we developed in partnership with NOAA's Office of Coastal Management.

4.3. Are any of the information products you produced confidential, proprietary, or subject to special license agreements? *

No

5. Project Outcomes

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5. PROJECT OUTCOMES

Outcomes refer to the **impact(s), consequence(s), result(s), or effect(s)** that occur from carrying out the activities or outputs of the project. Outcomes may be environmental, behavioral, health-related, or programmatic. Example outcomes include, but are not limited to: increased learning, knowledge, skills, and motivation; policy changes; actions taken by a group as a result of information generated by your project.

5.1. Please describe the outcomes achieved during your project and how they were assessed. For this question, we are interested in learning about the immediate short-term outcomes that have already occurred during or as a result of your project. Do not include long-term outcomes you foresee your work contributing to beyond the end of the project. *

- 1) Continued and forwarded discussions among the Gulf restoration community about the importance of social and economic monitoring.
- 2) A number of projects will be using ESLMs for design and proposal writing
- 3) A number of restoration programs, state and federal agencies are using our measurement protocols to explore how they might incorporate considerations of equity into their work.
- 4) The RESTORE Council team is linking the GEMS metrics into their metric framework.
- 5) NOAA restoration center and DARRP (NRDA) program are exploring how to use our metrics and protocols to improve how they incorporate onshore recreational and subsistence fishing into their restoration programs.

5.2. We're interested in hearing not just the results of your project but what are their implications for or contributions to:

- offshore energy system safety,
- environmental protection and stewardship, and/or
- health and community resilience

Please describe what you consider to be the most remarkable accomplishment or finding of your project. What can others learn from your accomplishment and finding? How do you see it fitting in with your greater field of study or community of practice? *

As we developed models for >20 different restoration approaches across the Gulf, we found that the socio-economic outcomes of these projects overlap quite a lot. The primary socio-economic effects of many restoration projects are similar enough that we were able to develop a small core list of metrics that are applicable to almost any restoration project funded in the Gulf. Our hope is that the primary outcome of this project is that both restoration funders and practitioners across the Gulf can use GEMS products to better target and understand the social and economic implications of their programs and projects. Initial exploration suggests that a similar approach can be used in other areas e.g., forest planning, design of agricultural best practice programs, etc... This could result in the development of a consistent and credible way for programs to target and track social and economic outcomes from natural resource management. Ecosystem services are seen as inherently local, yet there is a need for consistency in their application and measurement so that projects can be compared and success can be tracked over time. Our work in the Gulf shows that it is possible to build a consistent and credible approach.

6. Communication

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Note to Grantees: In Section 6, we seek input from you to help us evaluate the Gulf Research Program's funding strategy. This section will not be made available to the public.

6. Information to Inform GRP Evaluations

6.1. Sharing the difficulties you encountered helps us learn from your experience. Describe any challenges you encountered in your project and how you addressed or overcame them. Challenges are inherent to conducting any complex project. These may include (but are not limited to): unexpected staffing changes, changes in the community you are working in, appearance of a new technology or dataset in the field you are working in, challenges accessing a field site, policy or regulatory changes that affect the issue you are addressing, low recruitment rates, delays in setting up services, or other problems in implementing and conducting your project. *

1. COVID-19 Pandemic. This project is heavily centered on stakeholder engagement through workshops. With the pandemic we had to shift our strategy to virtual engagement to ensure that we could get the feedback we needed from stakeholders across the Gulf.
2. Also due to COVID-19 the project rollout had to be done virtually. The original project plan was for PIs to travel to all 5 Gulf states and meet with key stakeholders in each state to rollout the project products. Because travel was prohibited, all rollout had to be done virtually. While it was a challenge not to meet face-to-face with end users of these products, it did allow a wider audience to hear about the project.
3. Staff turnover and transitions: One of the staff leads left between year 1 and 2 of the project which left one of the partner institutions many months behind on their deliverables. One of the co-PIs had an institutional transition which required a transfer of funding, delaying her contributions by many months.

6.2. We like to hear about what you learned from your work and how you feel it affects future work or the work of others. Think back on your project strategies, methods, and activities, what worked and what did not? Is there anything you would do differently in the future? If so, tell us what and why. *

Stakeholder and expert engagement: We initially conducted in person workshops to gather input on our models and metrics. While these were great, this approach limited the type of experts and stakeholder that we engaged. A number of key points of view (e.g., recreational fishing guides, tribal representatives, economic development agency staff) were not available or interested in spending a day discussing coastal restoration. So, we added a new element to our project which required one to one phone interviews of these different stakeholders.

Equity and Resilience: In the original plans for this work, we envisioned that we would have unique metrics that could be used to track both equity and resilience. Throughout the course of the work we found that instead of separate metrics, it made more sense to think about how each of the metrics that we were suggesting to quantify the outcomes of restoration could be used to think about different facets of equity and resilience.

Targeted products: It became clear through the course of the project that we needed to target our work to different audiences. This led to the development of practitioners guides (for project developers and planners) and a funders guide (for program funders and managers), and to a series of webinars designed to reach these different audiences.

6.3. What are the next steps for this work, either for you and your project team or other researchers? Has this project led to other opportunities to work in this area? *

- 1) The GEMS webtool has been integrated into a training the Duke team co-developed with NOAA's Office of Coastal Management that will be rolling out next year.
- 2) The project led to the co-development of a proposal to NOAA Restore with the NOAA Restoration Center and DARRP program to work on better inclusion of social impacts to onshore recreational and subsistence fishing
- 3) The GEMS metrics have been linked to the RESTORE Council's monitoring framework providing them a pathway for voluntarily incorporating these metrics into their program.

6.4. Have you developed new collaborations or partnerships (formal or informal) as a result of this work? If yes, please describe the new collaborations or partnerships. *

- 1) NOAA Restoration Center and DARRP project under NOAA Restore program.
- 2) GEMS integrated into the GOMA work plan

6.5. What, if any, positive changes in policy or practice do you foresee as a result of your work? *

By engaging so many different stakeholders around the Gulf in this process, we really hope to capture metrics that are associated with the outcomes of restoration that are most important to people across the Gulf. If these restoration outcomes are tracked, then we can eventually be smarter about which types of restoration we want to prioritize to help people achieve the goals that matter most to their communities.

6.6. If you could make one recommendation to the Gulf Research Program for how best to build on the work you conducted in this project, what would it be? *

Invest in a) developing methodologies and institutionalizing program scale surveys that capture key social and economic outcomes like recreational fishing economic impact (jobs, revenue etc...) and subsistence harvest, b) piloting the GEMS metrics with restoration programs/projects in the Gulf with a particular focus on improving consideration of equity in restoration program and project design and monitoring.

7. Communication and Dissemination

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

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Note to Grantees: In Section 7, we ask you to help us communicate the importance, progress, and accomplishments of your work. Information provided in this section will be used by the Gulf Research Program to highlight its funded projects in print and electronic informational and promotional materials. The intended audience for the information provided in this section is different and should be thought of as a general audience. When you return to the dashboard, you may upload images that represent and illustrate the work of your project.

7.1. Please describe the most exciting or surprising thing you have learned while working on this project in a way that is understandable by a general audience. *

As we developed models for >20 different restoration approaches across the Gulf, we found that the socio-economic outcomes of these projects overlap quite a lot. The primary socio-economic effects of many restoration projects are similar enough that we were able to develop a small core list of metrics that are applicable to almost any restoration project funded in the Gulf.

In the original plans for this work, we envisioned that we would have unique metrics that could be used to track both equity and resilience. Throughout the course of the work we found that instead of separate metrics, it made more sense to think about how each of the metrics that we were suggesting to quantify the outcomes of restoration could be used to think about different facets of equity and resilience.

7.2. Do you have any stories that capture the impact of this project? (optional)

If so, please share one or two. Examples of what we are interested in include stories of people/communities that the project has helped; lives that have changed; work that led to policy change, such as legislation or regulation; and research breakthroughs.

We have heard many personal stories about how natural resources affect people's lives and livelihoods. These stories range from charter fishermen not knowing whether their way of life will continue to exist because of declining fish populations, and communities losing parts of their cultural identity because oyster harvesting or other traditional practices no longer occur in their area. Using the GEMS metrics we will be able to incorporate outcomes that matter most to people, and monitor restoration performance in ways that resonate with both local communities and decision makers.

7.3. Have any communications, outreach, or dissemination activities occurred in relation to your project?*

Please describe:

- Any press releases issued (other than that issued by the National Academies of Sciences, Engineering, and Medicine) about the project.
- Any media coverage or news stories about the project.
- Any social media accounts, websites, listservs, or other communication vehicles used to communicate information about this project. Please include relevant web addresses if available.

All three partner institutions (Nicholas Institute for Environmental Policy Solutions, Harte Research Institute at Texas A&M Corpus Christie, and The Nature Conservancy) sent out press releases about this project. We have released rollout information about the project through the National Ecosystems Services Partnership newsletter, the GOMA newsletter, and the Coastal States Organization newsletter. The Nicholas Institute and Harte Research Institute facebook and twitter accounts have both posted multiple times about this project. We have also created a project website, found here: <https://nicholasinstitute.duke.edu/focal-areas/gems>. In Spring 2021 The project was rolled out and announced to the Gulf community through a series of webinars that targeted audiences who do planning, monitoring, and funding of restoration projects in the Gulf. We have plans to present GEMS again through a webinar in fall 2021 to the GOMA Human Benefits of Nature group, and a presentation of the GEMS online tools through a GOMA tool time webinar. Additionally, project leads from all 3 partner institutions continue to present on the GEMS project at conferences and at smaller, more localized meetings such as that of a particular National Estuary Program.