

PRACTITIONER GUIDANCE FOR GEMS SOCIAL AND ECONOMIC METRICS

Coastal Habitat Restoration

Coastal habitats across the Gulf of Mexico—including salt marsh, oyster reefs, seagrass, mangrove forests, and sand dunes—have all declined over the last decades due to numerous development, climate, and disaster-related stressors. In the Gulf, [1,000 square miles of wetland were lost just in the years between 1996 and 2000](#); [seagrasses declined by 20–100% across Gulf estuaries from 1950–2000](#); and [85% of original Gulf oyster reefs are gone](#). Numerous funders have set up habitat restoration programs with wide-reaching goals including the restoration of healthy Gulf ecosystems and species, increased coastal resilience, and strengthening the economic and social systems tied to coastal habitats of the region. More than \$1.2 billion in funding related to the Deepwater Horizon oil spill has been spent on [153 habitat restoration and enhancement projects as of March 2021](#).



Monitoring Habitat Restoration Projects in the Gulf: Current Practice

The science and practice of habitat restoration has advanced tremendously, and multiple resources exist for planning, implementing, and monitoring the ecological restoration of coastal habitats. These resources include but are not limited to the [NRDA MAM Manual](#), [practitioner's handbooks](#) on oyster restoration monitoring, and a [NatureServe report](#) on ecological indicators for salt marsh, seagrass, oysters, and mangrove. A [recent inventory](#) of existing habitat monitoring programs in the Gulf of Mexico identified habitat structure (species composition of plants or submerged habitat-building animals, percent cover), species population information (abundance, size, density), and abiotic factors (substrate type, sediment classification, topography) as the most commonly measured parameters. While these metrics can provide information about the health and function of restored habitats, they do not help to assess the broader social and economic benefits that result from these resources. The GEMS project aims to fill this gap.

THE GEMS PROJECT

GEMS: Gulf of Mexico Ecosystem Services Logic Models & Socio-Economic Indicators

With support from the National Academies of Sciences, Engineering, and Medicine - Gulf Research Program, Duke University's Nicholas Institute for Environmental Policy Solutions, The Harte Research Institute at Texas A&M University-Corpus Christi, the Bridge Collaborative, and The Nature Conservancy have developed a standard set of conceptual models linking restoration investments to social and economic outcomes and identified related metrics that can be used to track restoration success. The metrics and models serve as a starting point and should be tailored to each project.

Restoration actions, outcomes, and metrics were collaboratively developed through workshops with state representatives, restoration funders, regional decision makers, and local experts from specific estuaries to ensure applicability of the outcomes and metrics across scales. The conceptual models and metrics were further informed by literature reviews, expert interviews, and feedback from a distinguished advisory council.

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Monitoring Social and Economic Outcomes: Recommendations from the GEMS Project

Although hundreds of millions of dollars will be spent on habitat restoration in the Gulf over the coming years, there is no shared platform to guide assessment and reporting of project progress and effectiveness for the broad set of social and economic goals (such as community resilience and economic revitalization) shared by the many institutions working in the Gulf. The GEMS project created a set of logic models to identify outcomes and metrics relevant across restoration projects, programs, and locations that can facilitate effective and consistent project planning and evaluation throughout the Gulf. For more information, see the [GEMS project website](#).

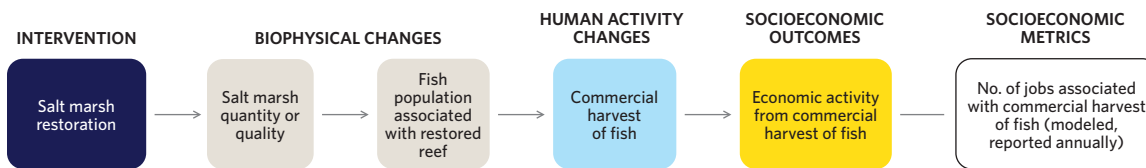
Identifying Social and Economic Outcomes for Project Justification and Monitoring

Practitioners developing projects or programs for habitat restoration can use the GEMS ecosystem services logic models (ESLMs) to identify specific social and economic outcomes of their project or program that link to a set of metrics which can be used for monitoring. For example, the flow chart below demonstrates a pathway resulting in socioeconomic outcomes that can be measured by metrics like number of jobs. This pathway is one part of a larger, more comprehensive ESLM. Chains of the ESLMs can also be used to tell stories about your project or program to explain how a sequence of events or activities leads to an economic or social benefit. [See more about developing value chain stories from Sea Grant](#).

HABITAT RESTORATION PROJECT TYPES

- Salt marsh
- Seagrass
- Mangrove
- Living shoreline
- Beach and dune
- Oyster reef
- Hydrologic connectivity

Ecosystem Service Logic Model

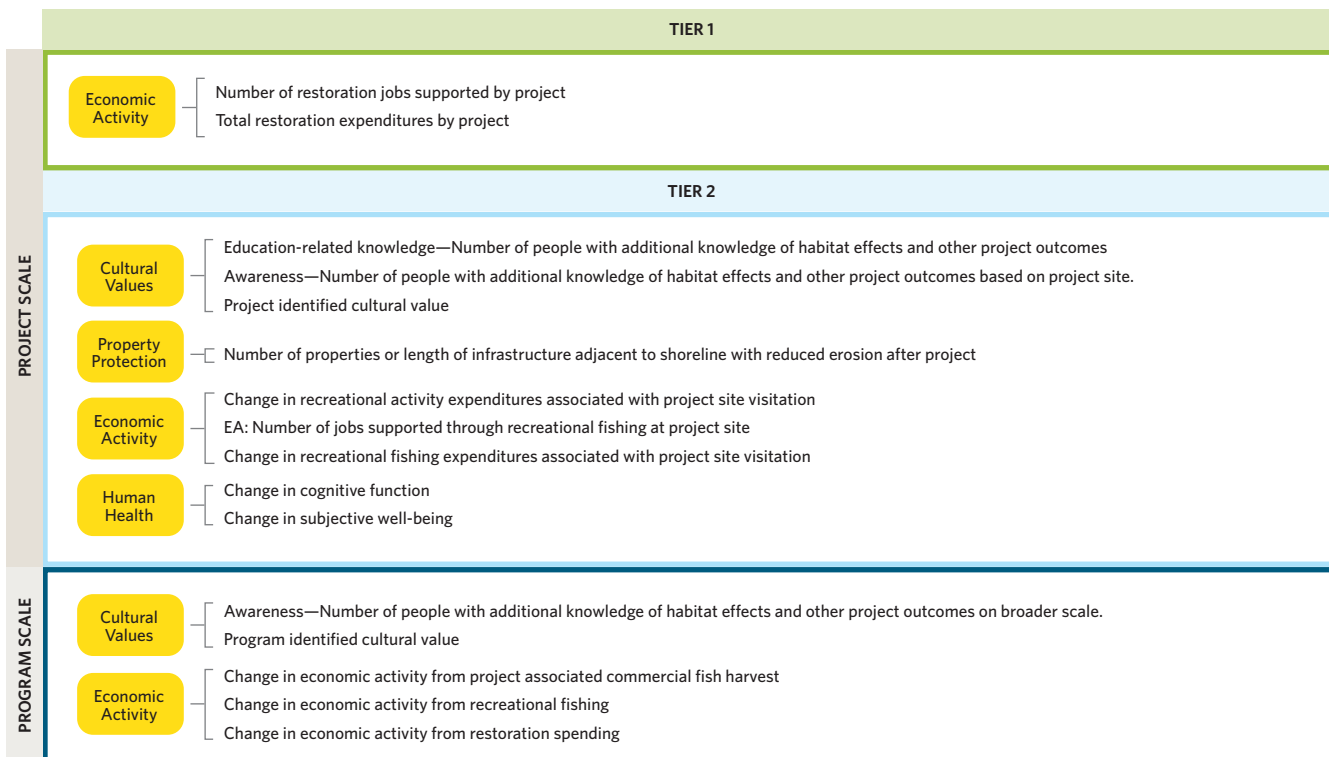


Visit the [GEMS website](#) to use ESLMs to identify the full suite of relevant social and economic outcomes for developing project justification or monitoring plans.

Recommended Social and Economic Metrics for Monitoring

The metrics below were selected by experts and practitioners in the Gulf of Mexico as core metrics relevant for monitoring the identified social and economic outcomes of habitat restoration. Core metrics are likely to show a significant change across multiple project types (more information on core metrics is available [here](#)). Similar to [NRDA's core parameters](#) for measuring biophysical and ecological outcomes, using core metrics allows for consistency, comparison, and rolling up results. Use this resource and the linked online database to identify the socioeconomic metrics that are relevant to your project goals.

Metrics are categorized by scale and tier. Project-scale metrics measure changes in outcomes due to one project, while program-scale metrics measure cumulative changes in outcomes for multiple projects. Tier 1 metrics require relatively few resources or specialized skills to measure, while tier 2 metrics may require bringing in partners/students with relevant skills and take more time to measure. Several socioeconomic outcomes of habitat restoration have metrics that are not fully established or required data are not readily available. These research and development (R&D) metrics are not shown here but are included in the full metrics list in the Appendix.



In Depth: GEMS Recommended Metrics

SEE BELOW FOR METRICS IDENTIFIED THROUGH STAKEHOLDER MEETINGS, LITERATURE REVIEW, AND EXPERT CONSULTATION. MEASUREMENT PROTOCOLS ARE ON THE [GEMS WEBSITE](#).

TIER 1, PROJECT SCALE METRICS

Number of restoration jobs supported by project: The number of jobs directly supported by the restoration project, including but not limited to project design, construction, project site maintenance, education, and monitoring, reported every year.

Total restoration expenditures by project: The total amount of money spent on the restoration project as reported in the project budget every year.

TIER 2, PROJECT SCALE METRICS

Education-related knowledge: Number of people with additional knowledge of habitat effects and other project outcomes: The number of people with additional knowledge of habitat effects and other project outcomes due to project-associated educational outreach, assessed using project-scale methodologies such as surveys, interviews, or focus groups.

Awareness: Number of people with additional knowledge of habitat effects and other project outcomes based on project site: The number of people with additional awareness of habitat effects and other project outcomes, due to proximity to the project, assessed using project-scale methodologies such as surveys, interviews, or focus groups.

Change in project-identified cultural value: Identification and evaluation of cultural ecosystem services (CES), which vary by community, for monitoring (e.g., Pascua et al. 2017). Where possible, project team can develop framework for pre- and post-restoration monitoring of CES.

Change in recreational activity expenditures associated with project site visitation: Estimate of total recreational activity expenditures due to the project compared to baseline of recreational activity expenditures in surrounding area, calculated as the number of recreational trips to the project site (estimated from random sampling counts as part of structured monitoring).

Number of jobs supported through recreational fishing at project site: The number of direct, indirect, and induced jobs associated with recreational fishers visiting the restored reef, based on fishing expenditures determined through a survey of recreational fishing anglers conducted by the restoration project.

Change in recreational fishing expenditures associated with project site visitation: Estimate of total recreational fishing expenditures due to the project compared to baseline of recreational fishing expenditures in surrounding area, calculated as the number of recreational fishing

trips to the project site (estimated from random sampling counts as part of structured monitoring) multiplied by the average trip expenditure (from [NOAA FEUS 2018 Report](#)).

Proportion of surveyed harvesters who say that food caught/harvested at the site is important for feeding their household: Estimate of proportion of surveyed harvesters who say that food harvested at project site is important for feeding their household and if that has changed since project installation.

Change in cognitive function: Change in performance on simple recall or other cognitive function tests pre- and post-recreation activity or time at project site.

Change in subjective well-being: Change in self-reported state of well-being. Survey of visitors pre- and post-time at project site.

Number of properties or length of infrastructure adjacent to shoreline with reduced erosion after project: Total amount of public infrastructure or private property (measured in number and type of properties, or length of road) that experiences decreased adjacent erosion rates due to the restoration project reported every year.

TIER 2, PROGRAM SCALE METRICS

Awareness: Number of people with additional knowledge of habitat effects and other project outcomes on broader scale: The number of people with additional awareness of habitat effects and other project outcomes, due to living or working in proximity to the project, assessed using program-scale methodologies such as surveys, interviews, or focus groups.

Change in program identified cultural value: Identification and evaluation of cultural ecosystem services (CES), which vary by community, for monitoring. Where possible, program team can develop framework for pre- and post-restoration monitoring of CES.

Change in economic activity from project associated commercial fish harvest: Jobs, labor income, gross state product, and total industry output modeled annually based on NOAA commercial harvest data and state data (e.g., [Florida commercial fisheries](#)) for relevant species.

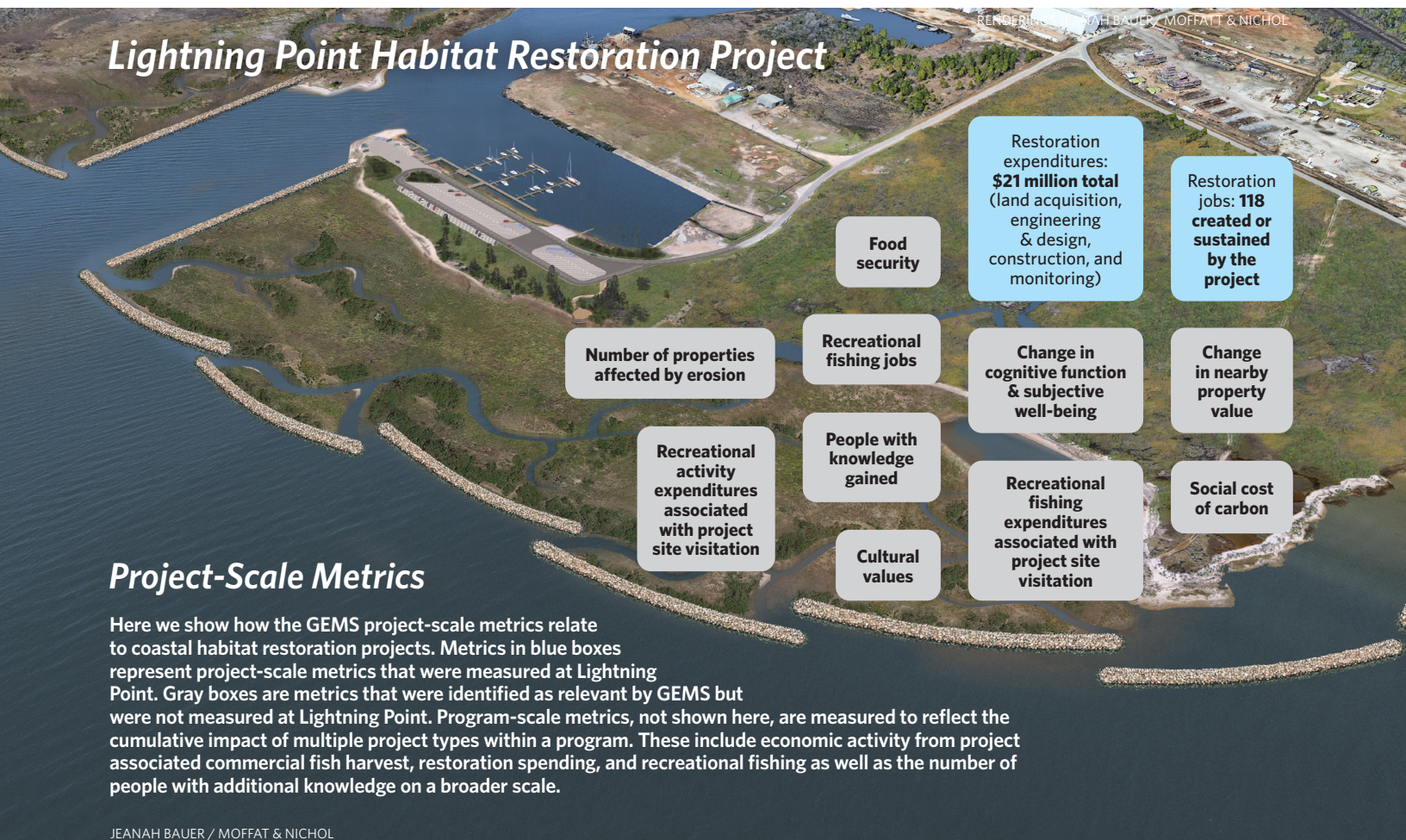
Change in economic activity from recreational fishing: Jobs, labor income, gross state product, and total industry output modeled annually at a county to regional level. Angler surveys will account for the difference in activity associated with a restoration project, which would then be used as input into the economic impact analysis (see [Texas Half Moon Reef example](#)).

Change in economic activity from restoration spending: Jobs, labor income, gross state product, and total industry output modeled based on project expenditures.

Applying the GEMS Metrics to a Habitat Restoration Project: Lightning Point

The [Lightning Point Shoreline Restoration project](#) is a shoreline protection and habitat restoration project in Bayou La Batre, Alabama. Known as the “Seafood Capitol of Alabama,” this city has strong connections to the Gulf through fishing, seafood processing, and shipbuilding. Lightning Point historically provided community access to the coast, but extensive shoreline loss has jeopardized that value in recent years. The Nature Conservancy partnered with the City of Bayou La Batre, Alabama, Department of Conservation and Natural Resources and Mobile County to install 1.5 miles of breakwaters for shoreline protection and create more than 40 acres of marsh, tidal creek, and upland habitat, using funds from the National Fish and Wildlife Foundation’s Gulf Environmental Benefit Funds. Alabama Power, the Gulf of Mexico Energy Security Act, and Partners for Environmental Progress contributed additional funds for recreational amenities at the site. Construction was completed in July 2020, and habitat monitoring will continue for several years as the newly planted areas mature.

The project will create a variety of benefits for the Bayou La Batre community. The breakwaters and marsh will reduce shoreline erosion and protect the developed areas farther inland from coastal storms. Walking paths, ADA-compliant access for fishing, and a pavilion provide opportunities for the local community and visitors to use Lightning Point for recreational activities. The restored habitats also attract a variety of birds, including the endangered least tern, that are valued by birders. Two newly constructed jetties connected to the larger living shoreline project limit the need for regular dredging to maintain access for the shrimping and shipbuilding industries, and the future potential utilization of dredged material for marsh sustainability can reduce costs for the Army Corps of Engineers. City Docks, a follow-up project at Lightning Point funded through RESTORE and currently in the planning stage, will include a low-impact parking area and sustainable retail and commercial waterfront development. While the project’s monitoring plan is focused on ecological metrics, TNC is also interested in understanding the socioeconomic returns on their investment in Lightning Point.



For more information, visit nicholasinstitute.duke.edu/project/gems

Appendix: Full Metrics List for Habitat Restoration Projects

This list includes all metrics that are likely to show a significant change from at least one of the habitat restoration project types. Additional details about these metrics, including measurement protocols for tier 1 and 2 project-scale metrics, are available on the GEMS website.

The relevant project types column lists the types of habitat restoration projects for which the metric is expected to show a significant change. Habitat restoration project types are salt marsh (SM), seagrass (SG), mangrove (MG), living shoreline (LS), beach and dune (BD), oyster reef (OR), and hydrologic connectivity (HC).

OUTCOME	METRIC	TIER	SCALE	RELEVANT PROJECT TYPES
Cultural Values				
Other	Change in project identified cultural value	2	Project	SM, SG, MG, BD, OR
Other	Change in program identified cultural value	2	Program	SM, SG, MG, BD, OR
Knowledge	Education-related knowledge: Number of people with additional knowledge of habitat effects and other project outcomes	2	Project	SM, SG, MG, LS, BD, OR
Knowledge	Awareness: Number of people with additional knowledge of habitat effects and other project outcomes based on project site	2	Project	SM, SG, MG, LS, BD, OR
Knowledge	Awareness: Number of people with additional knowledge of habitat effects and other project outcomes on broader scale	2	Program	SM, SG, MG, LS, BD, OR
Economic Activity				
Restoration/Intervention	Number of restoration jobs supported by project	1	Project	SM, SG, MG, LS, BD, OR, HC
Restoration/Intervention	Total restoration expenditures by project	1	Project	SM, SG, MG, LS, BD, OR, HC
Recreation and tourism	Change in recreational activity expenditures associated with project site visitation	2	Project	SM, SG, MG, BD, OR
Recreation and tourism	Number of jobs supported through recreational fishing at project site	2	Project	SM, SG, MG, BD, OR
Recreation and tourism	Change in recreational fishing expenditures associated with project site visitation	2	Project	SM, SG, MG, BD, OR
Recreation and tourism	Change in economic activity from recreational fishing	2	Program	SM, SG, MG, BD, OR
Restoration/Intervention	Change in economic activity from restoration spending	2	Program	SM, SG, MG, LS, BD, OR, HC
Recreation and tourism	Change in recreation and tourism associated economic activity associated with a closure period	R&D	Program	SM, SG
Finfish/Shellfish harvest	Number of aquaculture jobs supported by project	1	Project	OR
Finfish/Shellfish harvest	Change in economic activity from project associated commercial fish harvest	2	Program	SM, SG, MG, OR
Finfish/Shellfish harvest	Change in economic activity from project associated commercial aquaculture harvest	2	Program	SG, OR
Local businesses	Change in local business revenue from project disruption	2	Project	MG, BD, HC
Human Health				
Public safety (related to evacuations)	Change in number of days evacuation routes are closed	1	Project	MG
Food security for communities	Proportion of surveyed harvesters who say that food caught/harvested at the site is important for feeding their household	2	Project	SM, SG, MG, OR
Food security for communities	Proportion of protein or nutrition from food harvested at restoration site	R&D	Program	SM, SG, MG, OR
Mental health and psychological well-being	Change in cognitive function	2	Project	SM, SG, MG, BD, OR
Mental health and psychological well-being	Change in subjective well-being	2	Project	SM, SG, MG, BD, OR

Waterborne disease	Change in number of reported cases of waterborne diseases in counties near the project site	R&D	Project	SG
Property Protection & Value				
Property protection (erosion)	Number of properties or length of infrastructure adjacent to shoreline with reduced erosion after project	2	Project	SM, SG, MG, LS, OR
Property protection (flooding)	Modeled avoided flood damage and/or number of people with reduced flood frequency or depth	2	Project	SW
Property protection (flooding)	Change in property damage (per value of property) caused by flooding with the project in place (as opposed to without)	2	Project	SW
Property value	Change in property value across affected properties.	2	Project	SW, TW
Social Cost of Greenhouse Gas Emissions				
Social cost of greenhouse gas emissions	Change in economic costs resulting from carbon emissions	1	Project	SM, SG, MG
Social Disruption				
Social disruption due to project or flooding	Number of days of disrupted services due to project	1	Project	MG, BD, HC
Social disruption due to project or flooding	Change in number of critical facilities (roads, hospitals, schools) affected by stormwater flooding (with frequency and duration of closures if possible)	2	Project	SM, MG, BD