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Open-File Report 2022–1087

U.S. Department of the Interior
U.S. Geological Survey

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By Erin Seekamp, James Flocks, Courtney Hotchkiss, Linda York, Kelly Irick

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Abbreviations

Ala.	Alabama
APE	area of potential effect
DOI	U.S. Department of the Interior
Fla.	Florida
GINS	Gulf Islands National Seashore
GIS	geographic information system
IRB	institutional review board
Miss.	Mississippi
MsCIP	Mississippi Coastal Improvement Project
NHPA	National Historic Preservation Act
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
SAV	submerged aquatic vegetation
SD	standard deviation
USGS	U.S. Geological Survey

Gulf Islands National Seashore Regional Sediment Budget Research and Data Needs: Workshop Series Summary

By Erin Seekamp[1], James Flocks[2], Courtney Hotchkiss[1], Linda York[3], Kelly Irick[3]

Executive Summary

The National Park Service (NPS), in collaboration with the U.S. Geological Survey (USGS), recognizes the need to quantify the sediment budget of the barrier islands within the Gulf Islands National Seashore (GINS) to understand the coastal processes affecting island resiliency. To achieve this goal, identifying and quantifying the physical parameters that drive long-term change is necessary to model the processes that are both generative and terminal in island evolution and capture island response to long-term human alteration and climatic patterns. For example, measuring change across periods of storminess is more effective at assessing island resiliency than measuring change resulting from a single storm impact. Understanding changes to the physical environment over time is key to successfully predicting island responses to future storm impacts, human alteration, and sea-level rise and is necessary for effective decision making and management response. Yet, the diversity of factors affecting natural and cultural resources necessitates a strategic approach to data collection priorities that can inform sediment budget quantification and integrated resource management.

This study sought to advance sediment budget modeling efforts by conducting a "Needs Assessment Workshop" at the GINS. The purpose of the workshop was to identify and prioritize the specific research and data needs regarding the sediment budget at the GINS that can enhance the NPS efforts to conserve the islands' natural resources, cultural resources, and the facilities and infrastructure that support both conservation and visitor use of those resources. This effort explored two research questions: (1) "what research and data needs exist for the sediment budget at Gulf Islands National Seashore" (research question 1) and (2) "how can research to address these needs capitalize on regional partnerships to advance natural and cultural resource conservation at Gulf Islands National Seashore" (research question 2)? The workshop was conducted virtually in a two-part, two-day series.

The workshop series was organized by researchers from North Carolina State University in collaboration with NPS and USGS staff and was facilitated by National Oceanographic and Atmospheric Administration staff. The workshop series (two paired, sequential, partial-day workshops) addressed two target audiences: (1) NPS and USGS staff (April workshop) and (2) regional Federal, State, county, and nongovernmental organization staff, including NPS and USGS staff (May workshop). A total of four workshop sessions were held, comprising two sessions with each target audience.

The workshop series intended to identify sediment management research and data needs that could enhance natural and cultural resource stewardship at the GINS. One objective was to share information about regional sediment transport and management, available sediment management plans, and predictive modeling capabilities, including geomorphologic and hydrodynamic predictive models. This information was shared through a series of presentations by park managers and NPS and USGS researchers that identified park issues and available capabilities and data. The second objective was to elicit research and data needs, with a primary goal of assessing the importance and urgency of the identified needs. This assessment was partly determined by requesting that the workshop participants identify and prioritize research themes through polls, comments, and discussion.

The polls explicitly asked participants to qualitatively evaluate the importance (not at all, slightly, somewhat, very, or extremely) and urgency (not at all, slightly, somewhat, very, or extremely) of the thematically grouped research and data needs. These evaluations were plotted and shared during the workshop to visualize how the relative importance (x-axis) and relative urgency (y-axis) of each "need," relative to other needs, to identify the most necessary (importance) and time-sensitive (urgent) items, thereby allowing an enhanced, holistic understanding of the sediment budget at GINS. Results of the poll are published as a USGS data release (Forde and Flocks, 2023).

The assessment results revealed that the most important and urgent research and data needs included mapping (for example, elevation, habitat, and cultural resources), a regional sediment budget and management plan, and the dynamic modeling of sediment processes. During the workshop, these issues were visualized using scatter plots to demonstrate the relative importance and urgency of each theme, provide descriptive

[1]North Carolina State University.

[2]U.S. Geological Survey.

[3]National Park Service.

statistics, and elicit discussion. This format of iterative presentation, discussion, and prioritization allowed the project team to effectively accomplish their objective of identifying important and urgent research needs for natural and cultural resource stewardship at the GINS. Through the workshop, it was determined that expanded communication with the broader research community was needed to coordinate research activities and streamline potential funding opportunities and that research and policy should be integrated through a structured decision-making process.

At the conclusion of the workshop, an administered poll showed that the presentations effectively identified data and research needs and that the goals of the workshop were achieved. The results suggest that this type of needs-assessment workshop can effectively identify existing research capabilities and data, determine and prioritize research and data needs, and address how these efforts can use regional partnerships to aid natural and cultural resource conservation and management at National Parks.

Introduction

Barrier islands perform a vital function in protecting mainland communities from storms, serving as critical habitat for numerous endangered species, supporting recreation, preserving the physical evidence of past human occupation, and stimulating economic growth through tourism (Lorenzo-Trueba and Ashton, 2014). The barrier islands of Gulf Islands National Seashore (GINS) in the northern Gulf of Mexico provide natural value and recreational use to more than 5 million visitors per year (https://www.nps.gov/guis/learn/news/2019-visitation.htm). The park comprises 10 barrier islands extending over 250 kilometers from Florida to Mississippi. These islands contain abundant and diverse wildlife habitat that includes sandy beaches, seagrass beds, and forests. The submerged environment is composed of a dynamic coast bisected by inlets with large tidal deltas. This physical environment is controlled by natural processes such as a predominantly southeast wave climate that drives east to west sediment transport punctuated by intense storms that overwash the barrier islands and erode sand from the shoreface (Flocks and others, 2020). Tidal inlets between the islands act as sources and sinks of sediment over the long term.

The islands are in decline, with land areas severely reduced over the past century by storms, sea-level rise, and human alteration (such as shipping-channel maintenance) that also reduced sediment supply or altered sediment transport patterns. Over the past century, these influences caused a 24–64 percent loss in land area (Morton, 2007). In the Mississippi barrier islands, three persistent morphodynamic processes have been observed: (1) diminished down-drift sand transfer leading to higher net erosion rates, (2) island narrowing through island erosion on both the Gulf and Sound sides, and (3) island segmentation caused by storms. Some islands lost more than half of their area over the past century (Morton, 2008). Heavy damage was inflicted by hurricanes Ivan (2004) and Katrina (2005), which battered the islands with high winds and surge (Fritz and others, 2007).

The active littoral zone, or shoreface, of barrier islands is the most dynamic part of the system and typically reflects the highest amount of storm-related change. Shoreface sediments are eroded and placed on the island as overwash, removed offshore, or sequestered adjacent to neighboring tidal inlets as tidal deltas. Sand placed on the islands can be manipulated during poststorm recovery efforts, such as road clearing. Sediment deposited at tidal deltas may not return to the shoreface for long periods. However, not all tidal inlets are sediment sinks after stormy periods; rather, some act as sediment sources (Flocks and others, 2020). The dynamics that govern whether a tidal inlet acts as a source or sink, although not fully understood, are a complex interrelationship between morphologic and oceanographic conditions and fluctuations in the rate of decadal storminess. These processes regulate the sediment supplied to the island shoreface and influence island resiliency. This balance of sediment flux defines the sediment budget, a necessary metric for establishing base-level conditions, identifying erosion hotspots, and monitoring coastal management efforts.

Barrier islands are complex systems that evolve on varied time scales in response to natural and anthropogenic drivers. The elevated water levels and high-energy waves from a storm event can drastically change island morphology over hours to days, causing meters to tens of meters of shoreline loss, dune erosion, and breach formation across an island (Sallenger, 2000; Houser and others, 2008). Over extended periods, spatial variability in longshore transport driven by lower energy waves can move the shoreline onshore or offshore, while aeolian processes gradually build dunes that colonize with stabilizing vegetation (Cipriani and Stone, 2001). Sea-level rise can magnify the effect of individual storm events and alter patterns in alongshore transport, while decadal variability in storminess can alter the balance between erosive and accretionary processes (FitzGerald and others, 2008).

Sediment supply is a key element in governing how an island responds to changing environmental conditions across all time scales, with insufficient sediment at a given longshore location resulting in long-term erosion, lower dunes, more frequent inundation, and potential island drowning (Davis, 1994). An island's sediment budget is influenced by onshore and offshore factors, including natural features that interrupt or alter longshore transport, such as (1) capes or wide inlets, (2) bathymetry, which alters nearshore wave patterns, and (3) grain size, which governs rates of sediment transport. Anthropogenic modifications to the natural system also affect the sediment budget. Road maintenance and other infrastructure development can disturb dune evolution, and the dredging and maintenance of channels or inlets can artificially interrupt longshore transport and lead to sediment removal from the system (Morton, 2008; Byrnes and others, 2013). Estimating the sediment budget at an island, predicting how geomorphology evolves, and evaluating the associated effects on natural and

cultural resources require the identification and understanding of relevant physical drivers, which vary in importance from site to site.

This study seeks to advance future sediment-budget modeling efforts by identifying the most important (meaning necessary) and most urgent (meaning time-sensitive) research and data needs at the GINS and across the northern Gulf of Mexico. The study, designed to identify needed research and information, consisted of a series of virtual workshops that brought together National Park Service (NPS) staff and U.S. Geological Survey (USGS) researchers so that they could (1) identify park-specific research and data needs regarding sediment budgets at GINS that can enhance NPS efforts to conserve the islands' natural resources, cultural resources, and the facilities and infrastructure that support management and visitor use of those resources; and (2) leverage partnerships with regional researchers and management authorities to enhance a coordinated response to future data collection efforts. This workshop explored two questions: (1) "what research and data needs exist for the sediment transport budget at Gulf Islands National Seashore" (research question 1); and (2) "how can research to address these needs capitalize on regional partnerships to advance natural and cultural resource conservation at Gulf Islands National Seashore" (research question 2)?

Study Area

The GINS was selected as the study area for several reasons: (1) the GINS is comprised of many barrier islands subject to differing degrees of anthropogenic modifications to the natural system and are highly dynamic; (2) research efforts are already underway; (3) there is a demonstrated regional interest in funding efforts that support protecting natural and cultural resources from anthropogenic change (for example, the National Oceanographic and Atmospheric Administration [NOAA] RESTORE program, https://restoreactscienceprogram.noaa.gov); and (4) expressed interest on behalf of the NPS, by GINS managers and regional-level staff, to host this workshop series.

The GINS was established on January 8, 1971, for the purpose of preserving areas possessing outstanding natural, historical, and recreational values for public use and enjoyment (National Park Service, 2014). The GINS includes two administrative units, one in Florida and one in Mississippi (fig. 1), and comprises 139,175 acres of land. The Florida unit consists of two mainland sections and four barrier island sections in Florida's panhandle; the Mississippi unit consists of a mainland section and six barrier islands—noncontiguous barrier island systems divided by the State of Alabama. The 2014 GINS General Management Plan explains that management of the seashore is challenged by the increase in "intensity and frequency of storms in the Gulf of Mexico" (National Park Service, 2014, p. ii). This workshop series was developed to help GINS managers (1) identify sediment budget information needs for supporting the proper placement of dredge material in adjacent littoral zones so to protect and preserve the islands' natural processes and (2) provide baseline data to create, or maintain, existing channels or passes through, or adjacent to, the barrier islands.

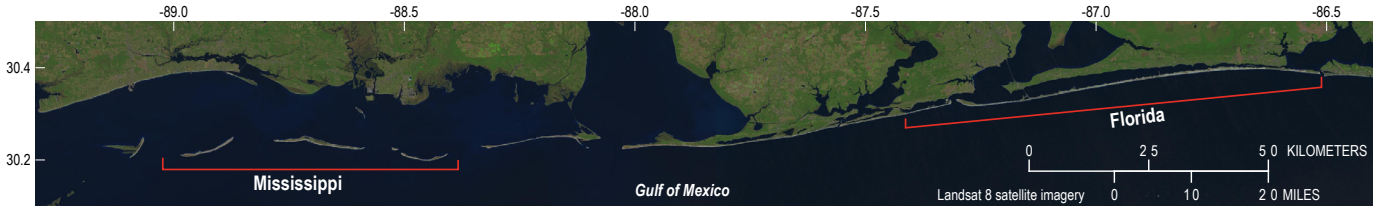

Figure 1. Index map of the Mississippi and Florida areas of the Gulf Islands National Seashore (GINS); northern Gulf of Mexico general GINS boundary shown by red brackets. Satellite imagery is Landsat 8.

Methods

Virtual Workshop Series

"The Gulf Islands Sediment Budget Needs Assessment Workshop" was held, virtually, on April 23 and 24 and May 27 and 28, 2020. The project team included researchers from North Carolina State University (Erin Seekamp and Courtney Hotchkiss), the National Park Service (Kelly Irick, Gulf Islands National Seashore; Linda York, Interior Region 2), and the U.S. Geological Survey (James Flocks, St. Petersburg Coastal and Marine Science Center). Additionally, two facilitators from the National Oceanic and Atmospheric Administration joined the project team (Caitlin Young, RESTORE Science Program; Kelly Samek, National Sea Grant Program). The April and May workshop agendas can be viewed in appendix 1 (figs. 1.1 and 1.2, respectively).

In the first part of the workshop, held on April 23rd (3 hours) and 24th (2 hours), NPS and USGS staff convened to identify and document research and data needs and priorities related to sediment transport budgets at the GINS. During the second part of the workshop, held on May 27th (4 hours) and 28th (4 hours), NPS and USGS staff met with governmental agencies and nongovernmental partners in the region to explore research and data needs and with partners outside of the region on priorities related to sediment transport budgets.

Workshop Participants

Workshop participants included the following: GINS administrative and management-level staff; regional and programmatic NPS staff working on sediment-transport related issues; USGS scientists doing research at GINS or within the region; regional Federal, State, and county agency staff addressing sediment or resource management projects within the region; and nongovernmental organizations researching sediment-transport budgets within the region. Participation was solicited in an invitational email, and the online registration form included the opportunity to recommend additional individuals as workshop participants. Twenty-four people participated in the April workshop (table 1), and 57 people participated in the May workshop (table 2).

Workshop Objectives

The objectives for the two workshops were (1) sharing current information, (2) identifying research and data needs, and (3) assessing perceptions about the most important and urgent research and data needs:

- Objective 1: Identify and share current information and knowledge on—
  - sediment budgets;
  - areas of sensitivity and concern in GINS;
  - NPS policy and administration;
  - natural and cultural resource management at GINS; and
  - completed U.S. Department of the Interior (DOI) geology, morphology, and hydrodynamic modeling studies.
- Objective 2: Identify research and data needs both regionally and specific to GINS on—
  - sediment transport and
  - resource management.
- Objective 3: Assess the importance and urgency of the identified research and data needs specific to—
  - GINS and
  - the northern Gulf of Mexico, regionally.

Table 1. Number of April workshop participants, their agency or organization affiliations, and the agency or organization subunit.

[DOI, U.S. Department of the Interior; NRSS, Natural Resource Stewardship and Science Directorate (of the National Park Service)]

Number of participants	Agency or organization	Subunit
7	National Park Service	Gulf Islands National Seashore
2	National Park Service	DOI Region 1
1	National Park Service	DOI Region 2
1	National Park Service	Multiple DOI Regions
3	National Park Service	NRSS, Geologic Resources Division
1	National Park Service	NRSS, Water Resources Division
2	National Park Service	NRSS, Environmental Quality Division
1	National Park Service	Gulf Coast Inventory & Monitoring Network
4	U.S. Geological Survey	St. Petersburg Coastal and Marine Science Center
1	U.S. Geological Survey	Wetland and Aquatic Research Center
1	Cherokee Nation Technologies	U.S. Geological Survey contractor

Table 2. Number of May workshop participants, their agency or organization affiliations, and the agency or organization subunit.

[—, not available or not applicable; DOI, U.S. Department of the Interior; NRSS, Natural Resource Stewardship and Science Directorate (of the National Park Service)]

Number of participants	Agency or organization	Subunit
5	Bureau of Ocean Energy Management	—
3	Escambia County Florida Natural Resources Management	—
3	Florida Department of Environmental Protection	—
2	Florida Fish and Wildlife Conservation Commission	—
2	Geological Survey of Alabama	—
2	Mississippi Department of Environmental Quality	—
1	Mississippi-Alabama Sea Grant	—
1	National Oceanic and Atmospheric Administration	National Centers for Coastal Ocean Science, Marine Spatial Ecology Division
2	National Park Service	DOI Region 2
2	National Park Service	DOI Region 1
2	National Park Service	Gulf Coast Inventory &Monitoring Network
7	National Park Service	Gulf Islands National Seashore
1	National Park Service	Multiple DOI Regions
2	National Park Service	NRSS, Environmental Quality Division
3	National Park Service	NRSS, Geologic Resources Division
1	National Park Service	NRSS, Water Resources Division
1	National Park Service	Southeast Archeological Center
2	Olsen Associated, Inc.[1]	—
2	The Water Institute of the Gulf	—
3	U.S. Army Corps of Engineers	—
4	U.S. Fish and Wildlife Service	—
1	U.S. Geological Survey	Contracted by the USGS
4	U.S. Geological Survey	St. Petersburg Coastal and Marine Science Center
1	U.S. Geological Survey	Wetland and Aquatic Research Center

[1]Olsen Associated, Inc.—the coastal engineering consultants working with Escambia County, Florida, on the Pensacola Inlet management plan.

Workshop Format and Data Collection

The April and May workshop series each occurred over a sequential two-day period. For day one of the April workshop (appendix 1, fig. 1.1), a set of presentations shared current management concerns and recent studies (Objective 1) that were, after the workshop, synthesized into a list of GINS-specific research and data needs (Objective 2). The session adjourned after a midworkshop evaluation. For day two of the April workshop, opening remarks were provided by the GINS superintendent about the critical research and data needs he identified in the earlier presentations, followed by a facilitated discussion refining the list of needs. An online elicitation survey questionnaire, which used an iterative sequence of elicitation (deliberation of results), was used to assess perceptions of the importance and urgency of the refined list of GINS-specific research and data needs (Objective 3). Survey responses were analyzed for mean scores and visualized on topical area scatterplots for the facilitated deliberations.

Following the final elicitation with the April workshop participants, the list of research and data needs was truncated to include only those qualitatively identified as “most important and urgent” by NPS and USGS staff for use in the May workshop (appendix 1, table 1.2). During day one of the May workshop (appendix 1, fig. 1.2), a set of presentations shared information about GINS and regional studies (Objective 1), and facilitators led a discussion to refine the list of regional research and data needs based on the information presented (Objective 2). This initial list of regional research and data needs (appendix 1, table 1.1) was evaluated, after day one of the workshop, in an online elicitation-survey questionnaire for perceptions of importance and urgency. For day two of the May workshop, a facilitated discussion of the survey results was used to further refine the regional research and data needs list. At the end of the May workshop, a final online-elicitation survey questionnaire was administered to collect perceptions of the “most important and urgent” regional research and data

needs (Objective 3) and evaluations of the workshop (appendix tables 4.1, 4.2). Results of the survey are published in Forde and Flocks (2023).

The survey questionnaires were structured using themes: cultural resources, natural resources, geomorphology and sediment, mapping and modeling, policy and management. Participants were asked to rate each research and data need relative to the other needs within the theme. The response scales for importance and urgency were presented as a side-by-side matrix and measured on scales labeled—"not at all (1)," "slightly (2)," somewhat (3)," "very (4)," and "extremely (5)." Participants were instructed to skip those survey items—that is, specific research and data needs—that they did not feel qualified to evaluate. Participants were asked to evaluate the April and May workshops by stating the extent to which they agreed or disagreed with a set of four belief statements:

- "I understood the meeting objectives and felt they were achieved."
- "The presentations were effectively designed and presented to help me understand the important points."
- "The meeting organizers and facilitators were interested and effective in helping me participate."
- "I was comfortable in the virtual setting and felt I had ample opportunity to participate."

The items were measured on a five-point scale from "strongly disagree (1)" to "strongly agree (5)," with "ambivalent (3)" as the mid-point and an "undecided" response option (coded separately for analysis).

Descriptive statistics were applied to the survey data, and open-ended questions were thematically analyzed and reviewed by the project team. Data were visualized using scatterplots to create an importance-urgency analysis of identified research and data needs. Specifically, participant responses were plotted and shared during the workshop to visualize how the relative importance (*x*-axis) and relative urgency (*y*-axis) of each need in relation to other yet similar (grouped thematically) needs to identify the most necessary (importance) and most time-sensitive (urgent) needs to enhance the understanding of a GINS sediment budget.

It is important to note that purposive sampling does not allow findings to be generalized and only represents the opinions of those who participated in the workshops and the online elicitations. As such, the findings should only be used as one of many information sources to guide future decisions about park-specific and regional research studies. Finally, workshop participants were encouraged to upload recent reports from sediment-related studies to the drive. A bibliographic list of all reports uploaded to the drive can be found in appendix 2.

Study protocols were reviewed and approved as exempt for human subjects research under the Code of Federal Regulations (45 CFR part 46.101 (d.1)(d.2)) by the Institutional Review Board (IRB) at North Carolina State University (IRB protocol no. 20863).

Results

National Park Service and U.S. Geological Survey: April Workshop Results

Of the April workshop participants, 20 people (6 GINS staff, 11 [other] NPS staff, 2 USGS staff, 1 undetermined) completed the final elicitation survey (83 percent response rate). In total, 58 GINS-specific research and data needs were identified and categorized into six thematic categories: specific geomorphology (22), natural resources (11), cultural resources (8), general geomorphology (8), management and policy (6), and mapping (3) (table 3). Participants determined that all of the research and data needs were at least "somewhat important" and at least "somewhat urgent" to address (appendix 3, table 3.1). The six most important research and data needs, in order of highest average result, included:

- Mapping: Barrier island habitat mapping and use, including the relation to natural and cultural resources and park assets (mean=4.63, standard deviation (SD)=0.52);
- Geomorphology (general): Regional sediment budget (mean=4.47, SD=0.77);
- Management and policy—sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on current cost estimates; for example, the cost for monitoring and ensuring that the postdredge handling of sediment keeps it in the littoral system) (mean=4.47, SD=0.84);
- Cultural resources: Conduct Section 110 archaeological surveys[4] of the Santa Rosa area (Santa Rosa Island, Florida [Fla.]), Perdido Key, Horn Island (Mississippi [Miss.]), and Cat Island (Miss.) of GINS (mean=4.44, SD=0.74);
- Geomorphology (specific)—regional sediment budget: Update or validate the previous budget to determine whether the system, in addition to individual islands, is losing sand and include a confirmation of westward sand transport, especially west of Ship Island, Miss. (mean=4.37; SD=0.76); and
- Geomorphology (specific)—modeling (dynamic models that incorporate changes in all habitats along the migrating barrier island system): A study of sand transport for Pensacola Pass and downdrift of the GINS shoreline (mean=4.37, SD =0.76).

The five "most urgent" research and data needs included—

[4]Section 110 of the National Historic Preservation Act (16 USC 470) calls on all Federal agencies to establish, in conjunction with the Secretary of the Interior, their own historic preservation programs for the identification, evaluation, and protection of historic properties (https://www.nps.gov/fpi/Section110.html).

- Geomorphology (general): Regional sediment budget (mean=4.32, SD=0.75);
- Geomorphology (specific)—Regional sediment budget: Update or validate the previous sediment budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport, especially west of Ship Island, Miss. (mean=4.32, SD=0.82);
- Geomorphology (specific)—modeling (dynamic models that incorporate changes in all habitats along the migrating barrier island system): A study of sand transport for Pensacola Pass and downdrift of the GINS shoreline (mean=4.21, SD=0.71);
- Management and Policy—sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on current cost estimates; for example, the cost for monitoring and ensuring that the postdredge handling of sediment keeps it in the littoral system) (mean=4.21, SD=0.71); and,
- Geomorphology (specific)—regional sediment budget: Updating or validating the previous sediment budget (mean=4.17, SD=0.98).

Specific to the "cultural resources" theme, Section 110 archeological surveys of the Santa Rosa area (Fla.), Perdido Key, Horn Island (Miss.), and Cat Island (Miss.) were reported as both the "most important" (mean=4.4, SD=0.74) and "most urgent" (mean 4.13, SD=0.88) research and data need (fig. 2). Other "cultural resources" research and data needs evaluated as "very important" and at least "somewhat urgent" included identifying the effects Pensacola Pass maintenance dredging and the placement of spoil have on cultural resources ("importance" mean=4.18, SD=0.81; "urgency" mean=3.76, SD=1.12), and completing cultural landscape inventories for Perdido Key and Cat Island, Miss. ("importance" mean=4.06, SD=0.96; "urgency" mean=3.63, SD=0.82).

Specific to the "natural resources" theme, the data needs reported as "most important" and "somewhat urgent" (fig. 3) included sea turtle surveying and nest monitoring ("importance" mean=4.31, SD=0.87; "urgency" mean=3.88, SD=1.02), shorebird hotspot surveying and monitoring ("importance" mean=4.13, SD=8.34; "urgency" mean=3.67, SD=1.11), and updating seagrass natural-resource data ("importance" mean=4.00, SD=1.03; "urgency" mean=3.63, SD=0.96). Other "natural resources" research and data needs that were determined "somewhat important" and "somewhat urgent" included impacts on benthic ecology ("importance" mean=3.75, SD=1.00; "urgency" mean=3.19, SD=0.83), water quality impact studies with the reestablishment of Navarre Pass ("importance" mean=3.63, SD=0.81; "urgency" mean=3.31, SD=0.70), and benthic invertebrate species study ("importance" mean 3.56, SD=0.96; "urgency" mean=3.13, SD=1.02).

Specific to the "geomorphology (general)" theme, the "most important" and "most urgent" research data needs (fig. 4) were regional sediment budgets ("importance" mean=4.47, SD=0.77; "urgency" mean=4.32, SD=0.75) and dredging ("importance" mean=4.17, SD=0.62; "urgency" mean=4.00, SD=0.84). Modeling was ranked as "most important" (mean=4.05, SD=0.91) and "somewhat urgent" (mean=3.89, SD=0.81).

Regarding the "geomorphology (specific)" theme, several research and data needs were considered to be of "high importance" (fig. 5). The "most important" and "most urgent" research and data needs reported were updating and validating the regional sediment budget to include the evaluation of sand transport ("importance" mean=4.37, SD=0.72; "urgency" mean=4.32, SD=0.82), the modeling of sand transport and downdrift of Pensacola Pass ("importance" mean=4.47, SD=0.72; "urgency" mean=4.21, SD=0.71), and updating the previous sediment budget ("importance" mean=4.17, SD=0.86; "urgency" mean=4.17, SD=0.99). Other specific geomorphology research and data needs determined to be "most important" and at least "somewhat urgent" included dredging effects on adjacent beaches ("importance" mean=4.21, SD=0.79; "urgency" mean=3.89, SD=0.94), predictive sediment transport and shoreline-change modeling along Santa Rosa Island, Fla. ("importance" mean=4.11, SD=0.81, "urgency" mean=3.89, SD=0.94), modeling the evolution and sediment placement at Petit Bois Island, Miss. ("importance" mean=4.06, SD=0.87; "urgency" mean=3.89, SD=0.96), identifying shoreline change along the Florida-Alabama-Mississippi coast ("importance" mean=4.05, SD=1.08; "urgency" mean=3.95, SD=0.91), studying shoreline change of downdrift erosion ("importance" mean=4.05, SD=0.85; "urgency" mean=3.68, SD=0.82), and restoration guidance on beach nourishment ("importance" mean=4.00, SD=0.88; "urgency" mean=3.74, SD=1.28).

Specific to the "mapping" theme, the "most important" and "somewhat urgent" research and data needs (fig. 6) reported included barrier island habitat mapping ("importance" mean=4.63, SD=0.52; "urgency" mean=3.75, SD=1.03) and updating regulatory and jurisdictional overlap depictions ("importance" means=4.00, SD=0.76; "urgency" means=3.50, SD=0.76). Another research and data need reported as "somewhat important" and "somewhat urgent" was developing or adopting standards for updating mapping information ("importance" mean=3.75, SD=0.71; "urgency" mean=3.00, SD=0.93).

Specific to the "management and policy theme," the "most important" and "most urgent" research needs (fig. 7) reported included a budget for a long-term natural sediment-transfer plan ("importance" mean=4.47, SD=0.84; "urgency" mean=4.21, SD=0.72) and structured decision making and prioritization ("importance" mean=4.32, SD=0.67; "urgency" mean=4.05, SD=0.78). Other research and data needs that were "somewhat important" and "somewhat urgent" included stakeholder prioritization ("importance" mean=3.78, SD=0.81; "urgency" mean=3.61, SD=0.98) and a coastal engineering inventory ("importance" mean=3.68, SD=0.67; and "urgency" mean=3.21, SD=0.98).

Table 3. Sediment budget research and data needs identified during the April workshop, grouped by theme. Each need description is preceded by an assigned label. The labels in this table are plotted, by theme, in figures 2–7.

[Fla., Florida; Miss., Mississippi; SAV, submerged aquatic vegetation; GINS, Gulf Islands National Seashore; NPS, National Park Service; MsCIP, Mississippi Coastal Improvement Project; GIS, geographic information system]

Label	Need description
	Cultural resources (fig. 2)
Adaptation	Identify benefits, disadvantages, and costs of adaptation.
Arch	Conduct Section 110 archaeological surveys of the Santa Rosa area (Fla.), Perdido Key, Horn Island (Miss.), and Cat Island (Miss.).
CC SLR	Assess potential impacts of climate change, including sea-level rise and storms.
CLI Horn	Depending on management strategies for the wilderness islands, complete a cultural landscape inventory for Horn Island, Miss.
CLI PK CI	Complete cultural landscape inventories for Perdido Key (and Cat Island, Miss.).
Dredge PensPass	Identify the effects Pensacola Pass maintenance dredging and the placement of spoil have on cultural resources.
Forts	Assess the effects of stewardship of Fort Massachusetts and Fort Pickens on the management of barrier islands, including adaptation strategies that could include the mitigation of coastal erosion and sediment management.
Paleo	Compile a paleontological resources inventory.
	Natural resources (fig. 3)
Benth_Food	Benthic ecology: Identify benthic invertebrate species present at GINS and which of those serve as important food sources (for shorebirds and fish). This includes intertidal areas.
Benth_Rest	Benthic ecology: How can restoration or other activities affect the benthic ecology and food webs?
CC_Phen Dist Impacts	Climate change and sea-level rise: Potential effects of climate change and phenology and distribution changes associated with species and species groups—what are likely distributions and population parameters in 20–50 years considering climate change projections for sea turtles, shorebirds, and others.
Fisheries	Fisheries: Pass and nearshore usage by migratory species of concern (for example, Gulf sturgeon).
HabRestInv	Inventory other types of habitat restoration projects being considered (not including sediment) that could affect the dynamics of the system.
Mammals	Marine mammals: How can restoration or other activities affect marine mammals?
Seagrass_Survey	Seagrass: Updated natural resources survey data (for example, SAV data are from 2012 and, as noted, have likely changed greatly) to assess potential impacts.
SeaTurtles	Sea turtles: Surveying and monitoring to determine how resources like nesting sea turtles could be affected by management of the barrier island system.
Shorebirds	Shorebirds: Surveying and monitoring to identify hotspots for Federally protected migratory shorebird use on barrier islands.
Water_Fresh_MS	Water resources: Freshwater sources on the barrier islands, including freshwater lenses that create freshwater wetlands; for example, West Petit Bois Island offshore of Mississippi.
Water_WQ Navarre	Water resources: Water quality and turbidity studies park-wide, including the effects on water quality and salinity if Navarre Pass is reestablished.
	Geomorphology (general) (fig. 4)
CC/SLR	Climate change and sea-level rise.
Dredge	Dredging.
Geol Fmwk	Detailed subsurface geologic framework.
Modeling	Modeling.
Reg Sed Budg	Regional sediment budget.
Restor	Restoration.
ShoreChg	Shoreline change.
Surf Sed	Surficial sediment characteristics.

Table 3. Sediment budget research and data needs identified during the April workshop, grouped by theme. Each need description is preceded by an assigned label. The labels in this table are plotted, by theme, in figures 2–7.—Continued

[Fla., Florida; Miss., Mississippi; SAV, submerged aquatic vegetation; GINS, Gulf Islands National Seashore; NPS, National Park Service; MsCIP, Mississippi Coastal Improvement Project; GIS, geographic information system]

Label	Need description
	Geomorphology (specific) (fig. 5)
CC_BenDisCost	Climate change and sea-level rise: Benefits, disadvantages, and costs of adaptation.
CC_Impacts	Climate change and sea-level rise: Potential effects of climate change, including sea-level rise and storms.
CC_Vuln Monit	Climate change and sea-level rise: Geomorphic monitoring, particularly to provide and update the exposure component of the Mississippi islands' vulnerability to sea-level rise and storms.
Dredg_Adj	Dredging: How park areas can be affected by dredging and renourishment activities at adjacent beaches.
Dredg_Circul	Dredging: How dredging affects circulation and sediment transport (navigation channel and borrow site activities).
Mod_Navarre	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: Current and predictive sediment transport and shoreline change models along Santa Rosa Island, Fla., to address the effects of a proposal to cut a channel through the island at the east end of Navarre Beach.
Mod_PensPass	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: Study of the sand transport for Pensacola Pass and downdrift of the GINS shoreline.
Mod_PetitBois	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: A study of the evolution of Petit Bois Island, Miss., and modeling sediment placement scenarios that replicate natural processes of sediment movement through Petit Bois Pass.
Mod_Storm	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: Understanding island elevation and temporal response to storm impacts (for example, dune profile response).
Rest_App_Nour	Restoration: Guidance on whether beach nourishment is appropriate in certain park areas and, if so, which areas.
Rest_Post Assess	Restoration: Postrestoration assessment where restoration (for example, Ship Island, Miss., after MsCIP) and littoral sediment placement (for example, Pensacola Pass dredge material placement on Perdido Key) activities occurred.
Rest_Sand_Inv	Restoration: Inventory available sand sources; for example, at or near Perdido Key and Pensacola Pass.
Sed_Dates	Regional sediment budget: Characterize prior placement and removal activities with dates, volumes, locations, and the composition of sediment.
Sed_Nat Chg	Regional sediment budget: Identify potential "natural" changes to the future sediment budget outside of dredging and nourishment activities (for example, Pensacola Pass, Gulfport ship channel).
Sed_Regional	Regional sediment budget: Update or validate the previous budget to determine whether the system, in addition to individual islands, is losing sand; include confirmation of westward sand transport, especially west of Ship Island, Miss.
Sed_update valid	Regional sediment budget: Updating and validating the previous budget.
Shor_Downdrift	Shoreline change: A better understanding of downdrift erosion extent and timing near inlets and breaches, both natural and artificial.
Shor_Eros Hot Spot	Shoreline change: Identify shoreline erosional hot spots and potential areas of breaching to inform the development and management of infrastructure along the Florida-Alabama-Mississippi coast.
Shor_Hist Cntxt	Shoreline change: Complete coastal change surfaces to align the current configuration of the islands within the historical context. Much is complete for Mississippi; Florida remains to be done.
Shor_Topobathy	Shoreline change: Consistent temporal and spatial coverage of topobathymetric changes.
Surf_Geo Fram	Detailed geologic framework (subsurface).
Surf_Seafloor	Surficial sediment characteristics, including seafloor texture and composition (see NPS geologic resources inventory in "Inventories 2.0" (DeVivo, 2019) for the subaerial [land-based] portion).

Table 3. Sediment budget research and data needs identified during the April workshop, grouped by theme. Each need description is preceded by an assigned label. The labels in this table are plotted, by theme, in figures 2–7.—Continued

[Fla., Florida; Miss., Mississippi; SAV, submerged aquatic vegetation; GINS, Gulf Islands National Seashore; NPS, National Park Service; MsCIP, Mississippi Coastal Improvement Project; GIS, geographic information system]

Label	Need description
	Mapping (fig. 6)
Habitat	Barrier island habitat mapping and use data, including the relation to natural and cultural resources and park assets.
Reg Jurisd	Update regulatory and jurisdictional overlap depictions. Current GIS data are based on Lands Resources Division files from 2007 and do not reflect the current shorelines.
Standards	Develop or adopt standards for updating information for mapping.
	Management and policy (fig. 7)
Cstl Eng Inv	Coastal engineering inventory.
GRI 2.0	NPS geologic resources inventory in "Inventories 2.0" (DeVivo, 2019).
Rest Assess	Restoration assessment.
SDM	Structured decision making and prioritization.
Sed Mgt Plan	Sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on today's cost estimates; for example, the cost for monitoring and to ensure the postdredge handling of sediment to keep it in the littoral system).
Stakeholder	Stakeholder prioritization.

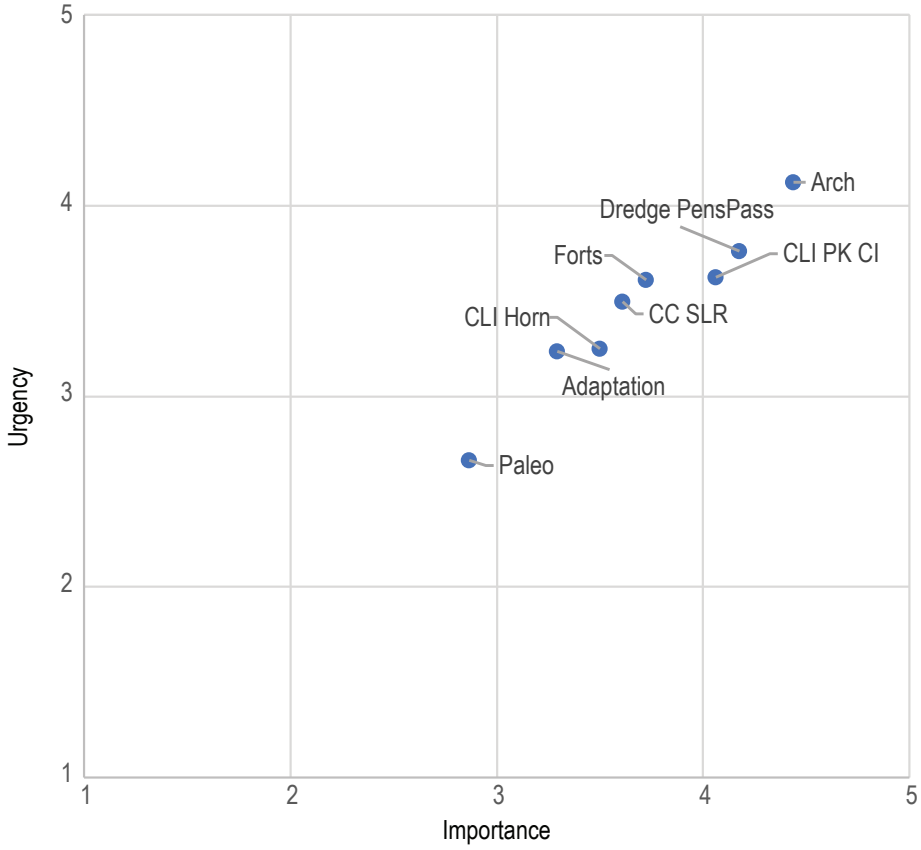

Figure 2. Scatterplot displaying April workshop participants' perceptions of the importance and urgency of "cultural resource" theme research and data needs. Table 3 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

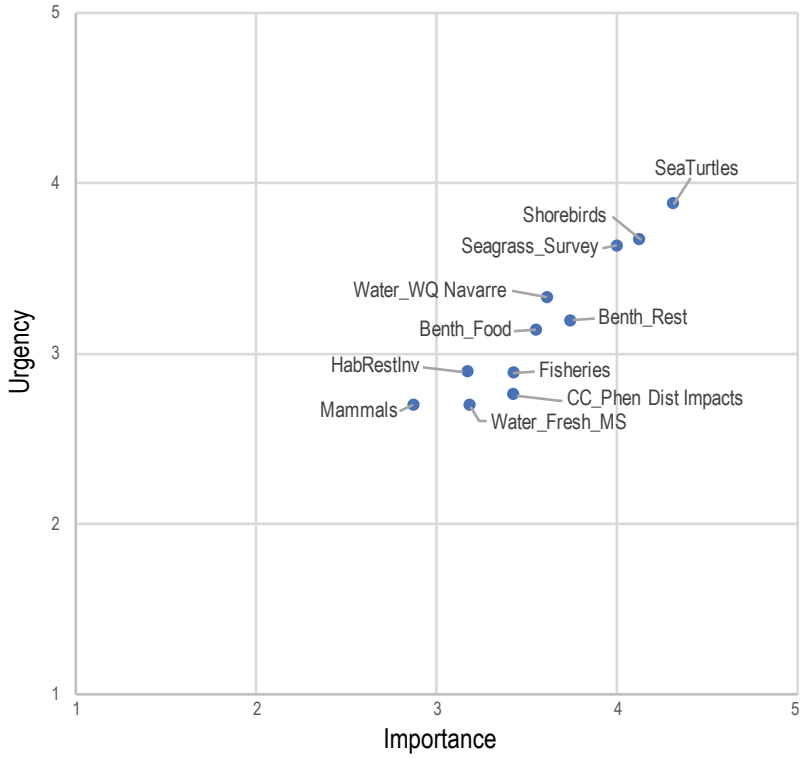

Figure 3. Scatterplot displaying April workshop participants' perceptions of the importance and urgency of "natural resource" themed research and data needs. Table 3 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

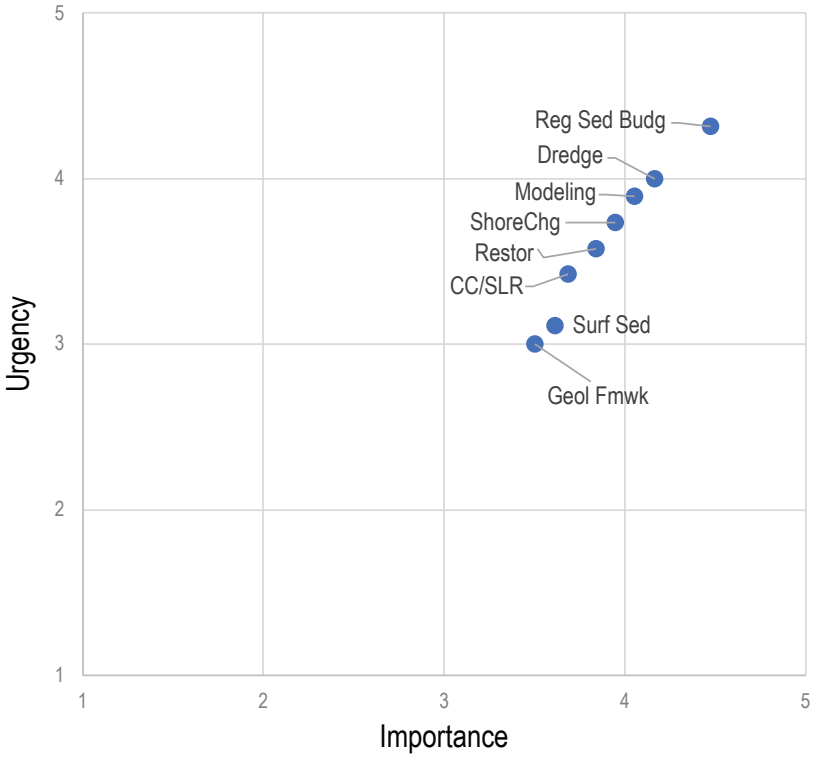

Figure 4. Scatterplot displaying April workshop participants' perceptions of the importance and urgency of "geomorphology (general)" themed research and data needs. Table 3 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

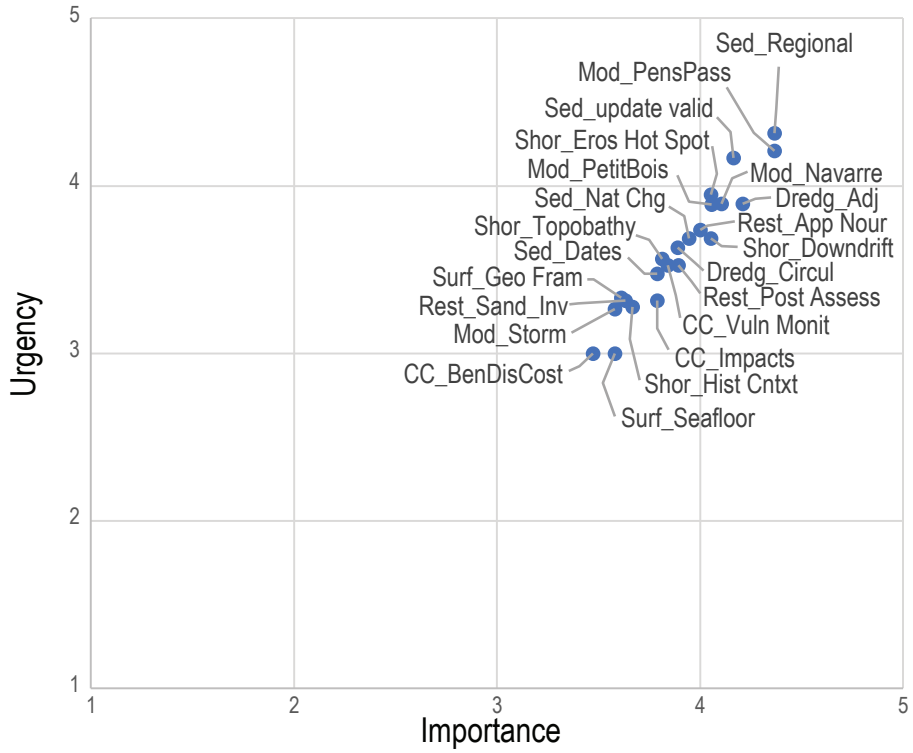

Figure 5. Scatterplot displaying April workshop participants' perceptions of the importance and urgency of "geomorphology (specific)" research and data needs. Table 3 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

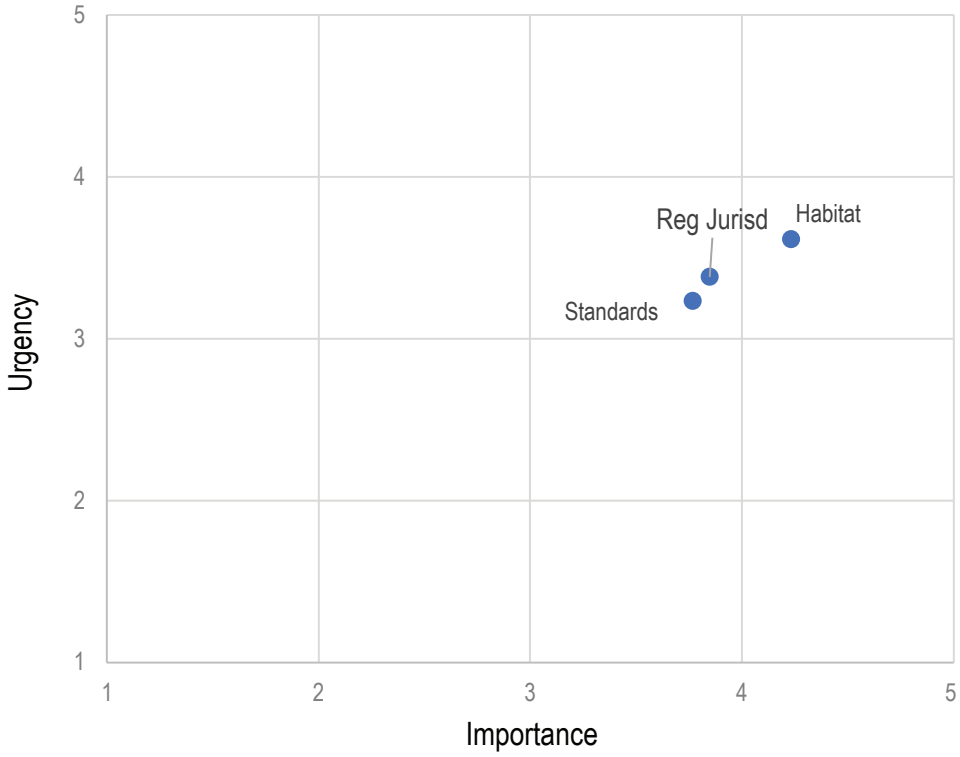

Figure 6. Scatterplot displaying April workshop participants' perceptions of the importance and urgency of "mapping" themed research and data needs. Table 3 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

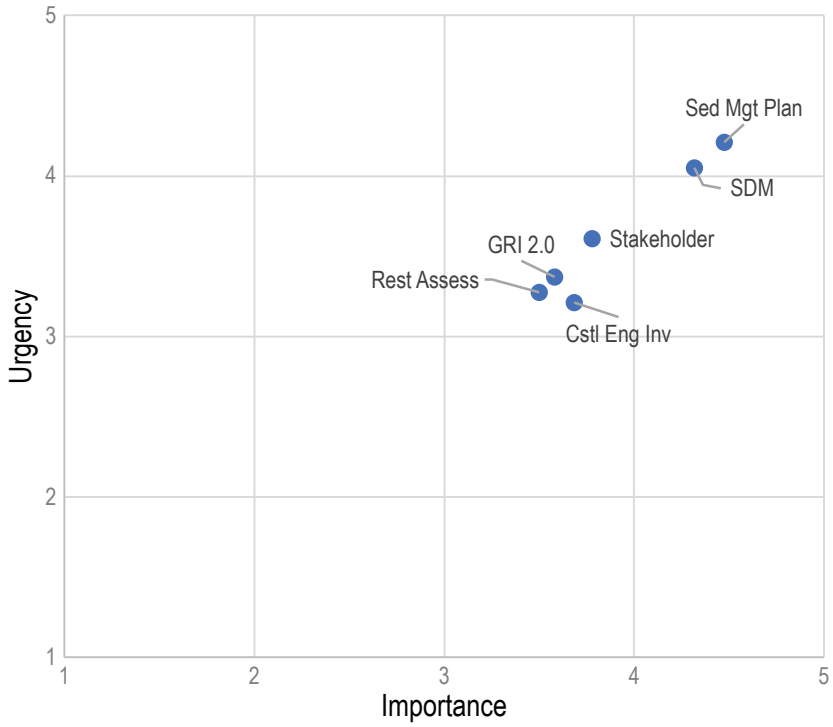

Figure 7. Scatterplot displaying April workshop participants' perceptions of the importance and urgency of "management and policy" themed research and data needs. Table 3 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

Regional Partners: May Workshop Results

Of the 57 people who participated in the May workshop, 23 people (5 GINS staff, 8 other NPS staff, 2 USGS staff, 3 Bureau of Ocean Energy Management staff, 1 Florida Department of Environmental Protection staff member, 1 Mississippi Department of Environmental Quality staff member, 1 Escambia County staff member, and 2 Water Institute of the Gulf staff) completed the final elicitation survey (40 percent response rate). In total, 37 regional research and data needs were identified and categorized into six thematic categories: management and policy (12), sediment (10), mapping and modeling (7), cultural resources (4), and natural resources (4) (table 4). Participants determined all research and data needs to be at least "somewhat important" and at least "somewhat urgent" (table 3.2). The five most important research and data needs reported included—

- Sediment transport: Dynamic modeling of natural and managed sediment transport volumes and directions affecting beaches, habitats, and cultural resources for the region (mean=4.40, SD=0.68);
- Mapping and modeling—elevation data: Elevation data (seafloor, inlet, ebb and flood shoals) and hydrographic surveys (mean=4.40, SD=0.68);
- Sediment transport: Update and validate the previous sediment budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport (especially west of Ship Island, Miss.) (mean=4.35; SD =0.67);
- Management and policy—comprehensive: Linking sediment management with cultural and natural resource priorities and recreational opportunities (mean=4.30; SD=0.73); and,
- Mapping and Modeling—inlet dynamics: Inlet studies with dynamic model inputs (mean=4.29, SD=0.72).

The five most urgent research and data needs reported included—

- Sediment transport: Update and validate the previous sediment budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport (especially west of Ship Island, Miss.) (mean=4.32, SD =0.58);
- Sediment transport: Dynamic modeling of natural and managed sediment transport volumes and directions affecting beaches, habitats, and cultural resources for the region (mean=4.21, SD=0.85);

- Natural resources—inventories and surveys: Evaluate barrier island (beach, nearshore, back-barrier) habitat mapping and use data (species of management concern and suitable habitat) (mean=4.15, SD=0.74);
- Mapping and modeling—shoal dynamics: Model nearshore morphologic processes (mean=4.06, SD=0.80); and
- Mapping and modeling—inlet dynamics: Inlet studies with dynamic model inputs (mean=4.05, SD=0.70).

Specific to the "cultural resources" theme, Section 106 archeological surveys[5] were reported as "most important" (mean=4.07, SD=0.88) and "most urgent" (mean=4.00, SD=1.04) (fig. 8). Other research and data needs included stewardship of Fort Massachusetts, Fort Pickens, and associated batteries ("importance" mean=3.88, SD=0.70; "urgency" mean=3.69, SD=0.87), Section 110 archeological surveys ("importance" mean=3.87, SD=0.91; "urgency" mean=3.50, SD=0.94), and a review of potential cultural landscapes within dredging areas of potential effect (importance mean=3.47, SD=0.74; urgency mean=3.14, SD=1.03).

Specific to the "natural resources" theme, all research and data needs were reported as "most important." Barrier island habitat mapping and use data were both the "most important" (mean=4.24, SD=0.62) and "most urgent" (mean=4.15, SD=0.74) data and research need (fig. 9). However, the research and data needs that ranked of "highest importance" were project design for limiting negative impacts on habitats and natural communities (mean=4.25, SD=0.79), but only "somewhat urgent" (mean=3.58, SD=0.84). The other needs that were "most important" and "somewhat urgent" included understanding the positive benefits of restoration nourishment ("importance" mean=4.15, SD=0.59; "urgency" mean=3.68, SD=1.00) and impacts to natural communities, specifically seagrass ("importance" mean=4.10, SD=0.79; "urgency" mean=3.63, SD=0.83).

Specific to the "sediment" theme, the "most important" and "most urgent" reported research and data needs (fig. 10) included dynamic modeling of natural and managed sediment transport ("importance" mean=4.40, SD=0.68; "urgency" mean=4.21, SD=0.85), validating the previous sediment budget to determine sand loss ("importance" mean=4.35, SD=0.67; "urgency" mean=4.32, SD=0.58), and shoreline changes and erosion on the Florida-Alabama-Mississippi coast ("importance" mean=4.15, SD=0.67; "urgency" mean=4.00, SD=0.58). Other research and data needs that were "most important" but "somewhat" urgent included conducting broader community research and raising awareness ("importance" mean=4.15, SD=0.81; "urgency" mean=3.70, SD=1.03), understanding sediment movement within the system ("importance" mean=4.14, SD=0.79; "urgency" mean=3.89, SD=0.81), long-term regional sediment needs ("importance" mean=4.10, SD=0.55; "urgency" mean=3.58, SD=0.90), and impact of sediment source and type ("importance" mean=4.05, SD=0.89; "urgency" mean=3.83, SD=0.98).

Specific to the "mapping and modeling" theme, the "most important" and "most urgent" reported research and data needs (fig. 11) included elevation data and hydraulic surveys ("importance" mean=4.40, SD=0.68; "urgency" mean=4.00, SD=0.88), inlet studies with dynamic model inputs ("importance" mean=4.29, SD=0.72; "urgency" mean=4.05, SD=0.70), and the modeling of nearshore morphologic processes ("importance" mean=4.14, SD=0.67; "urgency" mean=4.06, SD=0.80). Other research and data needs that were "most important" and "somewhat urgent" included water-level and tide-gage data ("importance" mean=4.20, SD=0.83; "urgency" mean=3.89, SD=0.83), nearshore wave and current data ("importance" mean=4.10, SD=0.72; "urgency" mean=3.83, SD=0.71), and modeling habitat hotspots ("importance" mean=4.05, SD=0.74; "urgency" mean=3.84, SD=0.96).

Specific to the "management and policy" theme, an inlet management plan for alleviating beach erosion at Pensacola pass was reported as the research and data need that was "most important" (mean=4.19, SD=0.93) and "most urgent" (mean=4.00, SD=0.79) (fig. 12). Other research and data needs that were "most important" and "somewhat urgent" were management plans linking sediment, resources, and recreation use ("importance" mean=4.30, SD=0.73; "urgency" mean=3.79, SD=1.03), dredging and nourishment impact plans ("importance" mean=4.19, SD=0.68; "urgency" mean=3.95, SD=0.76), and stakeholder transparency in science and policy management decisions ("importance" mean=4.15, SD=0.81; "urgency" mean=3.67, SD=0.84).

Workshop Evaluation Results

In general, workshop participants evaluated both the April and May workshops favorably, with May workshop participants holding slightly more favorable opinions than April workshop participants (table 5). Participant comments given after the workshop are shown in appendix 4. Opinions were measured as the strength of agreement or disagreement with a set of statements using a five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5), with "ambivalent" (3) as the midpoint. An "undecided" response option was included but not used by participants. Specifically, 43 participants agreed that they understood the meeting objectives and felt that the objectives were achieved (mean=4.14, SD=0.77), the presentations were effectively designed and presented to help them understand key points (mean=4.49, SD=0.70), the meeting organizers and facilitators were interested and effective in helping them participate (mean=4.60, SD=0.49), and they were comfortable in the virtual setting and felt they had ample opportunity to participate (mean=4.19, SD=0.88). The open-ended responses illustrated similarly favorable perceptions of the workshop and offered a few recommendations for future workshops (appendix tables 4.1, 4.2).

[5]Section 106 of the National Historic Preservation Act (54 USC § 306101) and its implementing regulations (36 CFR Part 800) require Federal agencies to consider the effects and specify any adverse effects of federally funded projects on historic properties (meaning listed, or eligible for listing, in the National Register of Historic Places), and provide other consulting parties, such as the State historic preservation office, and the public, an opportunity to comment on findings.

Table 4. Final list of research and data needs identified during the May workshop, grouped by theme. Each need description is preceded by an assigned label. The labels in this table are plotted, by theme, in figures 8–12.

[Ala., Alabama; Miss., Mississippi]

Label	Need description
	Cultural resources (fig. 8)
106 Surveys	Archeology inventory: Area of potential effect archeological surveys (terrestrial or maritime; including Fort McRee and cultural landscapes) (dredge, staging, placement, viewshed) (Section 106 surveys).
110 Surveys	Archeological inventory: General archeological surveys (including Fort McRee and cultural landscape inventories) of barrier islands (Section 110 surveys).
Cultural	Cultural landscapes: An understanding of the cultural landscapes within the area of potential effect (dredge, staging, placement, viewshed).
Fort Stewardship	Fort stewardship: Assess the effects of Fort Massachusetts, Fort Pickens, and associated batteries' stewardship (for example, adaptation strategies that could include the mitigation of coastal erosion and sediment management) on barrier island management.
	Natural resources (fig. 9)
Benefits	Project design impacts—positive: Understanding the benefits of restoration nourishment to natural communities (species of management concern and suitable habitat) (contributions of sand to a sand-starved system).
Design to Avoid Negative Impacts	Project design impacts: Design to limit negative effects on natural communities (species of management concern and suitable habitat) on the beach, in the nearshore, and in the back barrier (including ebb and flood shoals).
Habitat Mapping and Use	Inventories and surveys: Barrier island (beach, nearshore, back barrier) habitat mapping and use data (species of management concern and suitable habitat).
Negative Impacts	Project design impacts—negative: Impacts to natural communities (species of management concern and suitable habitat), especially how sediment affects seagrass.
	Sediment (fig. 10)
Existing Data	Existing data: Assessing the broader research community (for example, academics) to expand the awareness and use of existing data (for example, Perdido Key land loss; updates to "1999 Pensacola Pass Inlet management plan" study).
Location	Location: Identifying locations and types of sediment resources for coastal restoration (offshore, nearshore, upstream).
Source Availability	Source material (borrow): Suitability of available sediment sources to meet varying project needs (design).
Source Impact	Source material (borrow): Effect of sediment source and type on natural beach communities and functions, including nesting and foraging habitats (for example, marine turtles, migratory birds, beach mice).
Temporal	Temporal: Long-term sediment needs across the region.
Trans: Budget	Transport: Update or validate the previous sediment budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport (for example, west of Ship Island, Miss.).
Trans: Modeling	Transport: Dynamic modeling of natural and managed sediment transport volumes and directions affecting beaches, habitats, and cultural resources for the region.
Trans: Resilience	Transport: Understanding sediment movement within the system and the actions (for example, living shorelines) that can enhance coastal habitat resilience without moving sediment.
Trans: Shoreline Change	Transport—shoreline change: Identify erosional hot spots, areas of natural sediment supply, potential areas of breaching, and short-term erosion rates, both on the islands and offshore, to inform the development and management of infrastructure along the Florida-Alabama-Mississippi coast.
Watershed	Watershed changes: Linkages in land use, climate, and management in upstream watersheds affecting the location and type of sediment resources.

Table 4. Final list of research and data needs identified during the May workshop, grouped by theme. Each need description is preceded by an assigned label. The labels in this table are plotted, by theme, in figures 8–12.—Continued

[Ala., Alabama; Miss., Mississippi]

Label	Need description
	Mapping and modeling (fig. 11)
Elevation Data	Elevation data: Elevation data (seafloor, inlet, and ebb and flood shoals); hydrographic surveys.
Habitat Modeling	Habitat modeling: Modeling habitat hotspots (species of management concern), including the identification of disturbances that may be inhibiting the use of suitable habitat.
Inlet Dynamics	Inlet dynamics: Inlet studies with dynamic model inputs.
Shoals Dynamics	Shoal dynamics: Modeling of nearshore morphologic processes.
SLR and Subsidence	Sea-level rise and subsidence: Higher resolution models for sea-level rise and subsidence.
Water Levels Data	Water-level data: Water-level (and tide-) gage data (gage needed).
Wave and Currents Data	Nearshore wave and currents data: Nearshore wave and currents data (need for site-specific gages).
	Management and policy (fig. 12)
Capacity: Economics	Capacity: Economics of larger projects using sand dredged from offshore borrow areas or dredging the nearshore sand transport system (including inlet-bypassing shoals) versus smaller projects using upland sand (including the assessment of incremental beach management).
Capacity: Support Nav. Maint.	Capacity: Agency ability to support States and the needs for pass and navigational maintenance.
Comp.	Comprehensive: Linking sediment management with cultural and natural resource priorities and recreational opportunities.
Decision-Making	Decision making: Clear recommendations for decision makers (action versus inaction).
Inlet Mgt: Adj Dredge and Nourish	Inlet Management—dredging and nourishment: Identify how park areas can be affected by dredging and nourishment activities at adjacent beaches.
Inlet Mgt: Best Practices	Inlet Management—best practices: A Pensacola Pass inlet management plan that defines the beneficial use of sand that shoals in the inlet use to alleviate beach erosion along the adjacent shorelines while minimizing natural (such as listed species) and cultural (for example, Fort Pickens) resource impacts.
Inlet Mgt: Inlet Survey	Inlet management—inlet survey: Complete inlet survey (ebb and flood shoals) for each inlet, with two or more comparative surveys (updated inlet management plan).
Restoration Design	Restoration design: Barrier island maintenance and overlying slope and elevation design to mimic natural processes and support suitable habitat.
Sed Mgt Plan	Planning—sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on current cost estimates; for example, the cost of monitoring and ensuring that post-dredge handling of sediment keeps it in the littoral system).
Stakeholders: Jurisdiction	Stakeholders: Update regulatory and jurisdictional overlap depictions. Current GIS data are based on Lands Resources Division files from 2007 and do not reflect current shorelines.
Stakeholders: Multi-use	Stakeholders: Ensure that the sediment is used efficiently and avoid multi-use conflicts.
Stakeholders: Science and Policy	Stakeholders: Explicit integration of science and policy to enhance the transparency of stakeholder values and management decisions (for example, “Structured Decision Making” study at Dauphin Island, Ala.).

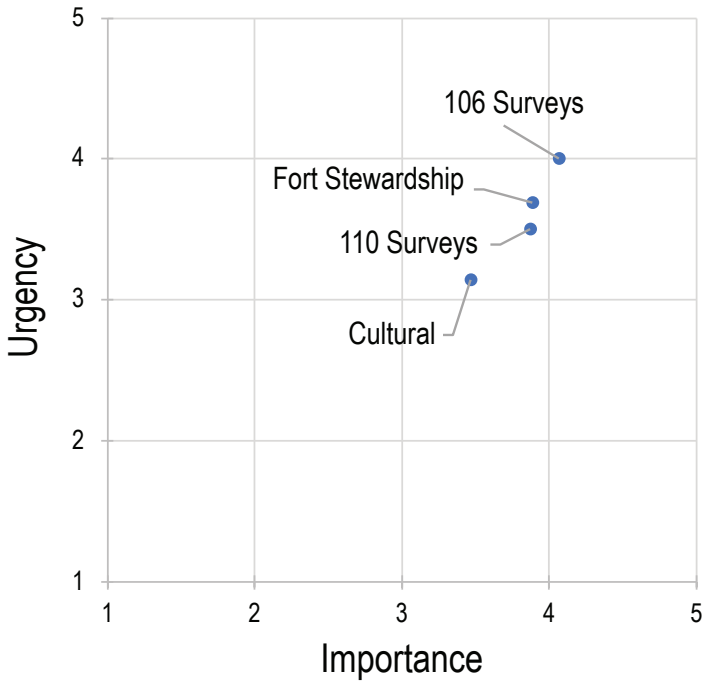

Figure 8. Scatterplot displaying May workshop participants' perceptions of the importance and urgency of "cultural resource" themed research and data needs. Table 4 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

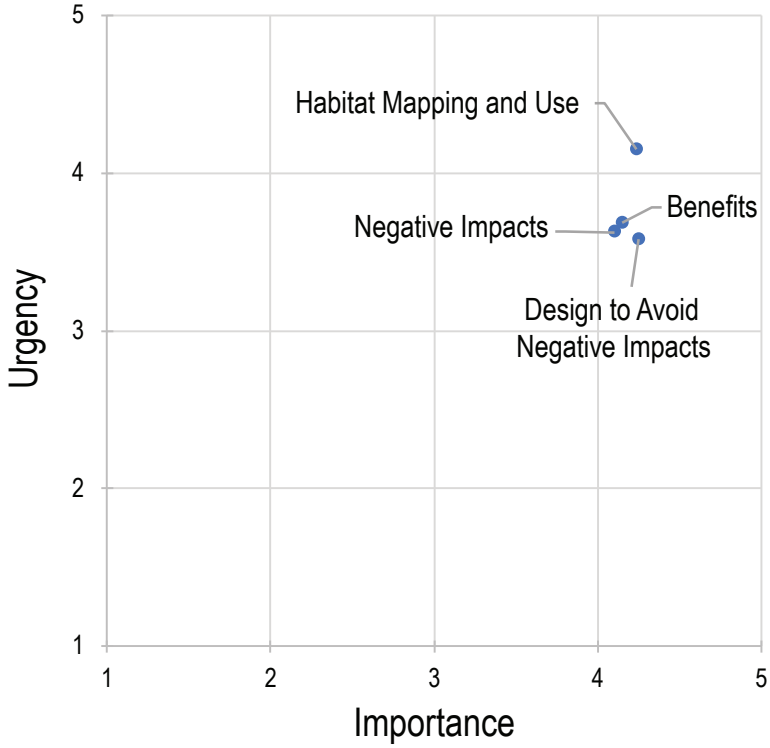

Figure 9. Scatterplot displaying May workshop participants' perceptions of the importance and urgency of "natural resource" themed research and data needs. Table 4 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

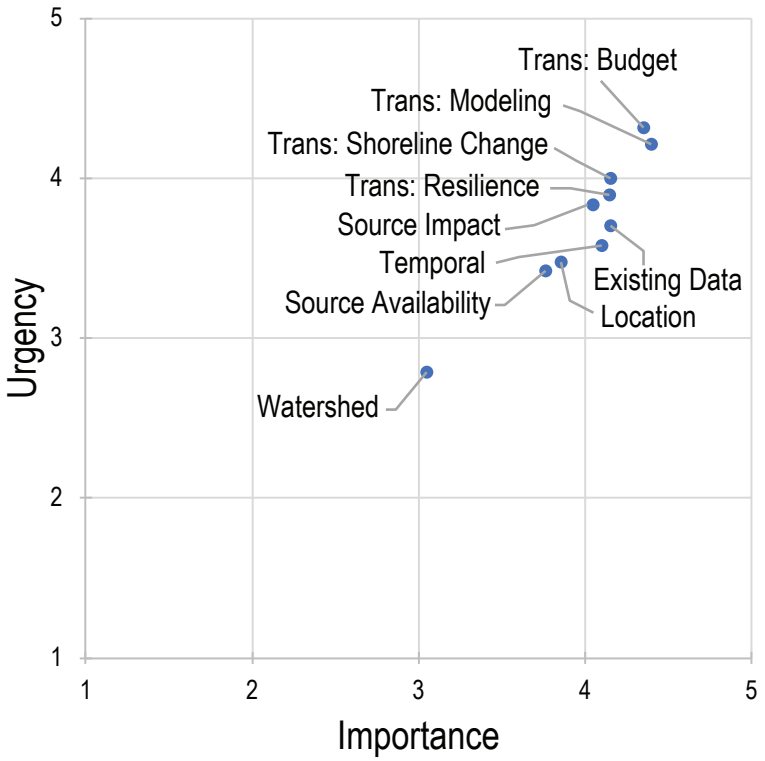

Figure 10. Scatterplot displaying May workshop participants' perceptions of the importance and urgency of "sediment" themed research and data needs. Table 4 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

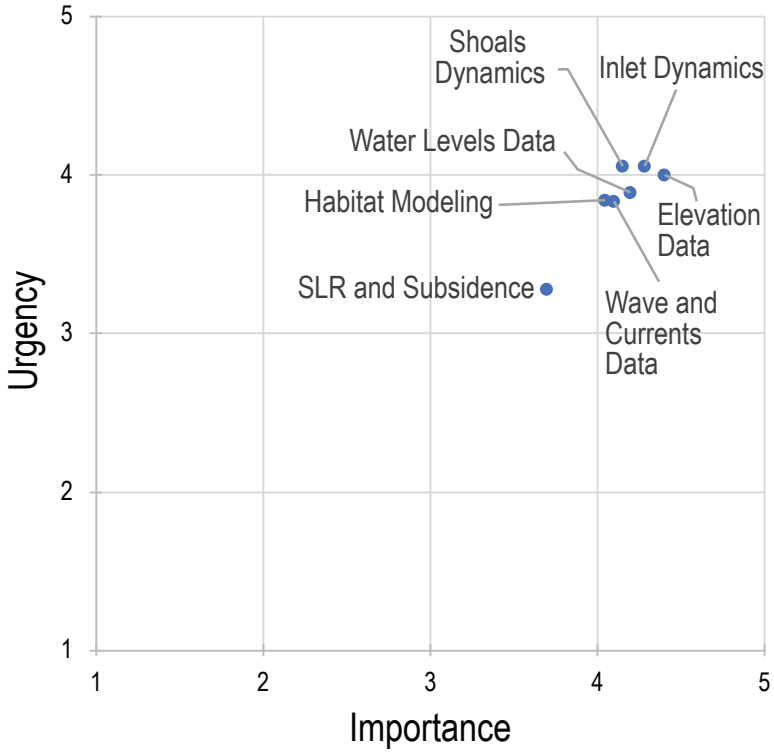

Figure 11. Scatterplot displaying May workshop participants' perceptions of the importance and urgency of "mapping and modeling" themed research and data needs. Table 4 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

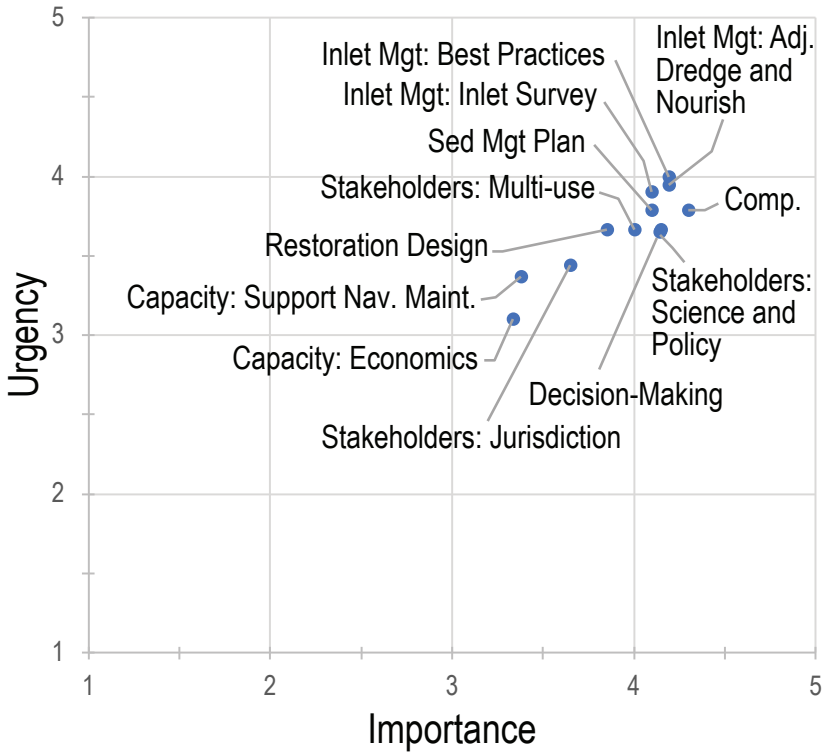

Figure 12. Scatterplot displaying May workshop participants' perceptions of the importance and urgency of "management and policy" themed research and data needs. Table 4 lists each label, by theme, and gives a complete description of each research or data need associated with that label.

Table 5. Descriptive statistics of participants' evaluations of the workshop where poll items were measured by strength of agreement or disagreement with a set of statements using a five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5), with "ambivalent" (3) as the midpoint.

[%, percent; SD, standard deviation]

Poll item	All participants		April workshop		May workshop	
	Number of responses=43		Number of responses=20		Number of responses=23	
	Response rate=53%		Response rate=83%		Response rate=40%	
	Mean	SD	Mean	SD	Mean	SD
I understood the meeting objectives and felt they were achieved.	4.1	0.77	4.1	0.64	4.2	0.89
The presentations were effectively designed and presented to help me understand the important points.	4.5	0.70	4.5	0.61	4.5	0.79
The meeting organizers and facilitators were interested and effective in helping me participate.	4.6	0.50	4.5	0.51	4.7	0.47
I was comfortable in the virtual setting and felt I had ample opportunity to participate.	4.2	0.88	4.1	0.95	4.3	0.82

Discussion

Many similar sediment budget research and information needs were identified as "very important" and at least "somewhat urgent" at the park level (GINS) and by managers and researchers working within the region (Florida panhandle and Alabama and Mississippi barrier islands). In particular, the findings suggest a need for developing a long-term, comprehensive sediment budget plan informed by the dynamic modeling of natural and managed sediment transport volumes and directions affecting beaches, habitats, and cultural resources. Expressed another way, the plan should link sediment management with cultural and natural resource priorities and recreational opportunities.

The "most important and urgent" research and data needs reported by participants as necessary for informing the desired plan included—

- barrier island habitat mapping and use data;
- Section 110 archeological surveys[6];
- elevation data (for example, seafloor, inlets, and ebb and flood shoals) and hydrographic surveys;
- inlet studies with dynamic model inputs and water-level and tide-gage data;
- shoreline change data (for example, erosional hot spots, natural sediment supply areas, potential breaching areas, and short-term erosional rates);
- the modeling of nearshore morphologic processes (for example, shoal dynamics); and
- costs associated with sediment management and monitoring (for example, postdredge handling of sediment placement) so that sand-transport assumptions are validated and adaptive management can be instituted to ensure sediment is kept in the littoral system. More generally, additional research is needed regarding—
- project design to limit negative impacts and understand positive benefits to natural communities, particularly species of management concern and suitable habitat;
- cultural resources on the beach, nearshore, and back barrier (including ebb and flood shoals); and
- the impact of dredging and nourishment activities adjacent to GINS.

[6]Section 110 archeological surveys are required by law (16 USC. 470) under the National Historic Preservation Act (NHPA). Relevant here, the National Park Service must inventory lands for historic properties and objects and take steps to manage and protect identified properties and objects. This study also identified Section 106 surveys as an important and somewhat urgent need, but to a lesser extent than the Section 110 archeological surveys. Section 106 of the NHPA requires surveys (terrestrial or maritime) within the area of potential effect (APE) prior to management actions being implemented in consultation with State historic preservation offices. In this study, Section 106 APE archeological surveys are necessary in areas of the dredging, staging, and placement of sediment, as well as for the viewshed.

Participants suggested that a thorough assessment of the broader research community (for example, academics) is needed to expand the awareness and use of existing data, seek collaborative research funding to target the needs identified in this study, and reduce the unnecessary duplication of efforts. Data quality was also discussed; for example, it was recommended that updated inlet management plans are needed based on complete inlet surveys (ebb and flood shoals) for each inlet, with two or more comparable surveys. Additionally, it was suggested that the explicit integration of science and policy through a structured decision-making process—similar to what was accomplished as part of the State of Alabama, U.S. Army Corps of Engineers, and USGS collective project at Dauphin Island (https://cesamusace.maps.arcgis.com/apps/MapSeries/index.html?appid=ea29cd4e1f3b432e8c520df3fb7a9f8b)—is needed to enhance the transparency of stakeholder values and management decisions. Ultimately, this workshop documented the observation that clear recommendations (for example, action versus inaction) are needed.

Summary

A strategic approach to data collection and analysis priorities must be developed to assess and define coastal change at the Gulf Islands National Seashore (GINS) and address the research necessary to measure change and support integrated-resource managers. National Park Service (NPS) and U.S. Geological Survey (USGS) scientists and managers supported this approach by hosting a two-part research-needs assessment workshop with other Federal and State agencies. The focus of the workshop was to identify and prioritize specific research needs that address seafloor change and sediment transport along barrier islands and adjacent inlets. A goal of the workshop was to determine how this research could enhance NPS efforts to effectively balance the conservation of natural resources with cultural and infrastructure management while promoting public access to, and education about, these resources. The workshop sought to identify available scientific data, knowledge gaps, and resources and capabilities that can be brought to bear.

The workshop series was held in two parts. The April workshop with NPS and USGS staff identified and documented research and data needs and priorities related to sediment transport and budgets at GINS. The May workshop convened regional agency and nongovernmental partners to explore regional research and data needs and the priorities of external partners related to the priorities established at the previous workshop. The May workshop included presentations that provided an overview of existing knowledge and research needs and feedback from stakeholders addressing the primary concerns.

The identified research and data needs include (1) the dynamic modeling of nearshore sediment transport and updating the operational sediment budget; (2) updating

seafloor elevation data; (3) integrating sediment management needs with cultural and natural resource management priorities and recreational opportunities; and (4) the modeling of inlet dynamics in response to alteration scenarios and storm impacts. Through an online survey, the workshop participants ranked these needs in terms of importance (most necessary) and urgency (most time-sensitive). The results of this evaluation can inform managers and researchers about issues that are of priority concern. Section 106 surveys were determined to be of the "highest importance and urgency" for the "cultural resources" theme. The participants did not establish a research need for the "natural resource" theme as "most important" but did identify an urgent need to collect information on habitat and habitat use. Developing a sediment transport budget and the predictive modeling of sediment transport were determined to be the "most urgent and important" research activities for the "sediment resource" theme. Updated elevation maps and maps of seafloor morphology (inlets and shoals) were found to be of the "highest importance and urgency" for the "mapping" theme. Finally, effective management plans for sediment dredging and inlet maintenance were high priorities for the "management and policy" theme.

An integrated investigative approach could balance management concerns (in particular, protecting cultural resources and promoting recreational use) with positive benefits for natural communities. This integration could be implemented through an iterative, structured decision-making process. The results suggest that this type of needs-assessment workshop is an effective tool for determining what research capabilities and data exist, identifying and prioritizing research studies, and addressing how these efforts can capitalize on regional partnerships to advance natural and cultural resource conservation and management at National Parks.

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Appendix 1. Workshop Agenda and Initial List of April and May Workshop Research and Data Needs

GULF ISLANDS SEDIMENT BUDGET RESEARCH NEEDS

Via WebEx

Thursday, April 23, 2020 & Friday, April 24, 2020

NOTE: ALL TIMES CENTRAL

PARTICIPANT AGENDA

Leaders and Planning Team: Erin Seekamp (NCSU), Jim Flocks (USGS), Kelly Irick (NPS), Linda York (NPS)
Facilitators: Kelly Samek, Caitlin Young (NOAA) **Notetaker:** Courtney Hotchkiss (NCSU)

Objectives
Managers at Gulf Islands National Seashore need sediment budget information to support the proper placement of dredge material in adjacent littoral zones to protect and preserve the islands' natural processes, and to provide baseline data to discourage the disruption of natural lateral sand transport through the creation or existence of maintained channels or passes through or adjacent to the barrier islands. A workshop in May 2020 with regional partners will inform these needs. In order to prepare for that meeting, participants at this meeting will share knowledge of the following:

- Sediment budget issues and areas of concern at Gulf Islands National Seashore;
- NPS policy and administrative guidance for coastal parks;
- Overview of natural and cultural resource management at Gulf Islands National Seashore;
- Completed studies on geological resources, coastal geomorphology, and hydrodynamic modeling; and
- An overview of the upcoming NPS-USGS project, "Determining Sediment Management Strategies to Most Effectively Protect GUIS Resources."

These presentations and subsequent discussion will inform the creation of a prioritized list of data and research needs for GUIS.

Approach
Virtual meeting that includes substantive presentations and discussion between attendees to determine what information is presently known and additional information is needed. Serves as an informational meeting to inform a larger group workshop a month later. These meetings are not decision-making in nature, but rather are informational for park management.

Thursday, April 23

9:00-9:25	Introductions & Overview Dr. Erin Seekamp & Kelly Samek
9:25-9:40	Context GUIS Superintendent Dan Brown
9:40-9:55	Park Presentation I: Coastal Adaptation Strategies Dr. Rebecca Beavers (NPS)
9:55-10:10	Park Presentation II: Natural Resources Erin Plitsch (NPS)
10:10-10:25	Park Presentation III: Cultural Resources Catherine Everitt (NPS)

Figure 1.1. Images of two-page participant agenda for Gulf Islands Sediment Budget Research Needs workshop, Thursday, April 23 and Friday, April 24, 2020.

10:25-10:30	BREAK
10:30-10:45	Project Presentation I: Mississippi Coastal Improvement Program (MsCIP) Dr. Linda York (NPS)
10:45-11:00	Project Presentation II: Coastal Geomorphology Monitoring Jeff Bracewell (NPS)
11:15-11:25	Project Presentation III: Geologic Resources Inventory Jason Kenworthy (NPS)
11:25-11:40	Project Presentation IV: Hydrodynamic Modeling Dr. Davina Passeri (USGS)
11:40-11:55	Project Presentation V: Sand Transport Management Study Jim Flocks (USGS)
11:55-12:00	Wrap-Up, mid-Workshop Evaluation, and Adjourn

Friday, April 24

9:00-9:20	Welcome Back Kelly Samek and Dr. Caitlin Young
9:20-9:30	Opening Remarks Superintendent Dan Brown
9:30-9:50	Group Discussion Facilitators & Participants
9:50-10:00	BREAK
10:00-10:30	Prioritization Exercise Facilitators & Participants
10:30-10:45	Group Discussion Facilitators & Participants
10:45-10:55	Re-prioritization Facilitators & Participants
10:55-11:00	Wrap-Up and Adjourn

Figure 1.1.—Continued

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GULF ISLANDS SEDIMENT BUDGET RESEARCH NEEDS REGIONAL WORKSHOP

Via WebEx
Wednesday, May 27, 2020 & Thursday, May 28, 2020
NOTE: ALL TIMES CENTRAL

PARTICIPANT AGENDA

Leaders and Planning Team: Erin Seekamp (NCSU), Jim Flocks (USGS), Kelly Irick (NPS), Linda York (NPS)
Facilitators: Kelly Samek, Caitlin Young (NOAA) **Notetaker:** Courtney Hotchkiss (NCSU)

Objectives
Managers at Gulf Islands National Seashore need sediment budget information to support the proper placement of dredge material in adjacent littoral zones to protect and preserve the islands' natural processes, and to provide baseline data to minimize the disruption of natural lateral sand transport through the creation or existence of maintained channels or passes through or adjacent to the barrier islands. This workshop with regional partners will inform these needs. Participants at this meeting will share knowledge of the following:

- Sediment budget issues and areas of concern at Gulf Islands National Seashore, including overview of natural and cultural resource management at Gulf Islands National Seashore;
- Completed DOI studies on geological resources, coastal geomorphology, and hydrodynamic modeling;
- An overview of upcoming NPS-USGS project, "Determining Sediment Management Strategies to Most Effectively Protect GUIS Resources"; and
- Recent and ongoing projects and research adjacent to GUIS involving partners in the region.

These presentations and subsequent discussion will inform the creation of a prioritized list of data and research needs for both GUIS, specifically, and the region, generally.

Approach
Virtual meeting that includes substantive presentations and discussion between attendees to determine what information is presently known and additional information is needed. These meetings are not decision-making in nature, but rather are informational for park management. A series of online elicitations ("Polling Survey") will be delivered via email prior to the workshop and immediately following each day of the workshop, which will be used to structure discussions and identify the most important and urgent priorities.

Wednesday, May 27

10:00-10:20	Introductions & Overview Dr. Erin Seekamp & Kelly Samek
10:20-10:35	Context GUIS Superintendent Dan Brown
10:35-10:50	Presentation I: Geologic Resources Inventory Jason Kenworthy (NPS)
10:50-11:05	Presentation II: Mississippi Coastal Improvements Program (MsCIP) Elizabeth Godsey (USACE)

Figure 1.2. Images of the three-page participant agenda for Gulf Islands Sediment Budget Research Needs workshop, Wednesday, May 27 and Thursday, May 28, 2020.

USGS science for a changing world

NC STATE UNIVERSITY College of Natural Resources

GULF ISLANDS SEDIMENT BUDGET RESEARCH NEEDS REGIONAL WORKSHOP

11:05-11:20	Presentation III: Barrier Island System Management: Objectives-orientated Regional Sediment Management Dr. Soupy Dalyander (Water Institute of the Gulf)
11:20-11:35	Presentation IV: Sand Transport Management Study Jim Flocks (USGS)
11:35-11:50	Project Presentation V: Hydrodynamic Modeling Dr. Davina Passeri (USGS)
11:50-12:00	Check-In Dr. Erin Seekamp
12:00-1:00	LUNCH BREAK
1:00-1:15	Project Presentation VI: Pensacola Pass Inlet Management Plan Tim Day (Escambia County)
1:15-1:30	Project Presentation VII: Appropriate Sediment and Beach Profile for Sea Turtle Nesting Beaches Dr. Robbin Trindell (FWC)
1:30-1:45	Project Presentation VIII: South Atlantic Coastal Study Meredith LaDart (USACE)
1:45-2:00	Project Presentation IX: Council Monitoring and Assessment Program Inventory and Assessments Randy Clark (NOAA)
2:00-2:50	Discussion All
2:50-3:00	Wrap-Up and Adjourn Dr. Erin Seekamp
4:00	Post-workshop Polling Survey (delivered via email; to be completed by midnight Wednesday, May 27th)

Thursday, May 28

10:00-10:15	Welcome Back Kelly Samek
10:15-10:35	Presentation Recap Dr. Caitlin Young
10:35-10:45	Polling Results Overview Dr. Erin Seekamp

Figure 1.2.—Continued

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GULF ISLANDS SEDIMENT BUDGET RESEARCH NEEDS REGIONAL WORKSHOP

10:45-11:45	Geomorphology Results Discussion Dr. Erin Seekamp, Dr. Caitlin Young & Participants
11:45-12:00	Check-In Dr. Erin Seekamp
12:00-1:00	LUNCH BREAK
1:15-1:40	Cultural Resources Results Discussion Dr. Erin Seekamp, Dr. Caitlin Young & Participants
1:40-1:45	Check-In Dr. Erin Seekamp
1:45-2:10	Natural Resources Results Discussion Dr. Erin Seekamp, Dr. Caitlin Young & Participants
2:10-2:15	Check-In Dr. Erin Seekamp
2:15-2:35	Management and Policy Results Discussion Dr. Erin Seekamp, Dr. Caitlin Young & Participants
2:35-2:45	Mapping Results Discussion Dr. Erin Seekamp, Dr. Caitlin Young & Participants
2:45-3:00	Final Discussion, Wrap-Up and Adjourn
4:00	Post-workshop Polling Survey (delivered via email; to be completed by Friday, May 29th at 5:00pm)

Figure 1.2.—Continued

Table 1.1. List of research and data needs identified in the May preworkshop elicitation survey and refined following day one discussions; grouped by theme and subtheme.

[Miss., Mississippi; SAV, submerged aquatic vegetation; GIS, geographic information system; Ala., Alabama]

Subtheme	Sediment budget research and data needs
	Sediment
Location	Identifying locations and types of sediment resources for coastal restoration (offshore, nearshore, upstream).
Temporal	Long-term sediment needs across the region.
Source material	Impact of sediment source and type on natural beach communities and functions, including nesting and foraging habitats (for example, marine turtles, migratory birds, beach mice).
	Suitability of available sediment sources to meet varying project needs (design).
Watershed changes	Linkages in land use, climate, and management in upstream watersheds affecting the location and type of sediment resources.
Transport	Understanding sediment movement within the system and the actions (for example, living shorelines) that can enhance coastal habitat's resilience without moving sediment.
	Update or validate the previous sediment budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport, especially west of Ship Island, Miss.
	Dynamic modeling of natural and managed sediment transport volumes and directions affecting beaches, habitats, and cultural resources for the region.
	Shoreline change: Identify erosional hot spots, areas of natural sediment supply, potential areas of breaching, and short-term erosion rates both on the islands and offshore to inform the development and management of infrastructure along the Florida-Alabama-Mississippi Coast.
	Cultural resources
Archeological inventory	Area of potential effect archeological surveys (terrestrial or maritime) (dredge, staging, placement, viewshed) (Section 106 surveys[1]).
	General archaeological surveys of barrier islands (Section 110 surveys[2]).
Cultural landscapes	An understanding of the cultural landscapes within the area of potential effect (dredge, staging, placement, viewshed).
Fort stewardship	Assess the effects of Fort Massachusetts, Fort Pickens, and Fort McRee stewardship (for example, adaptation strategies that could include the mitigation of coastal erosion and sediment management) on barrier island management.
	Natural resources
Project design impacts	Design to limit negative impacts to natural communities on the beach, in the nearshore, and in the backshore (including ebb and flood shoals).
Project design impacts—negative	Impacts to natural resources, especially how sediment affects seagrass.
Project design impacts—positive	Understanding the positive benefits of restoration nourishment to natural resources (contributions of sand to a sand-starved system).
Inventories and surveys	Sea turtles: Surveying and monitoring to determine how resources like nesting sea turtles can be affected by management of the barrier island system.
	Shorebirds: Surveying and monitoring to identify hotspots for Federally protected migratory shorebird use on barrier islands.
	Seagrass: Updated natural resource survey data (for example, SAV data is from 2012 and, as noted, has likely changed greatly) to assess potential impacts.
	Barrier island habitat mapping and use data (that incorporates elevated dunes), including relation to natural and cultural resources and park assets.

Table 1.1. List of research and data needs identified in the May preworkshop elicitation survey and refined following day one discussions; grouped by theme and subtheme.—Continued

[Miss., Mississippi; SAV, submerged aquatic vegetation; GIS, geographic information system; Ala., Alabama]

Subtheme	Sediment budget research and data needs
	Inlet management
Best practices	Pensacola Pass inlet management plan that defines the beneficial use of sand that shoals in the inlet to alleviate beach erosion along the adjacent shorelines, while minimizing natural resource (meaning listed species) and cultural resource (for example, Fort Pickens) impacts.
Dredging and nourishment	Identify how park areas can be affected by dredging and nourishment activities at adjacent beaches.
Inlet survey	Complete an inlet survey (ebb and flood shoals) for each inlet that has been altered, modified, or improved for navigation, with two or more comparative surveys (updated inlet management plan).
	Management
Capacity	Agency ability to support States and the needs for pass and navigational maintenance.
	Economics of larger projects using sand dredged from offshore borrow areas or dredging the nearshore sand transport system (including inlet bypassing shoals) versus smaller projects using upland sand (including an assessment of incremental beach management).
Comprehensive	Linking sediment management with cultural and natural resource priorities and recreational opportunities.
Decision making	Clear recommendations for decision makers (action versus inaction).
Restoration	Barrier island maintenance.
Planning	Sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on current cost estimates; for example, the cost for monitoring and to ensure that postdredge handling of sediment keeps it in the littoral system).
	Ensuring that the sediment is used efficiently and avoids multi-use conflicts.
Stakeholders	Update regulatory and jurisdictional overlap depictions. Current boundary GIS data are based on Lands Resources Division files from 2007 and do not reflect current shorelines.
	An explicit integration of science and policy to enhance the transparency of stakeholder values and management decisions (for example, “Structured Decision Making” study at Dauphin Island, Ala.).
	Modeling
Elevation data	Elevation data (seafloor, inlet); hydrographic surveys.
Inlet dynamics	Inlet studies with dynamic model inputs.
Nearshore wave	Nearshore wave data.
Sea-level rise and subsidence	Higher resolution models for sea-level rise and subsidence.
Shoals dynamics	Modeling of nearshore morphologic processes.

[1]Surveys done under section 106 of the National Historic Preservation Act (54 USC § 306101) and its implementing regulations (36 CFR Part 800).

[2]Surveys done under Section 110 of the National Historic Preservation Act (16 USC 470).

Table 1.2. Sediment budget research and data needs identified during the April workshop and grouped by theme.

[Fla., Florida; Miss., Mississippi; GINS, Gulf Islands National Seashore; MsCIP, Mississippi Coastal Improvement Project; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description
	Cultural resources (8 respondents)
Adaptation	Identify the benefits, disadvantages, and costs of adaptation.
Arch	Conduct Section 110 archaeological surveys[1]of Santa Rosa Island (Fla.), Perdido Key, Horn Island (Miss.), and Cat Island (Miss.).
CC SLR	Assess potential impacts of climate change, including sea-level rise and storms.
CLI Horn	Depending on management strategies for wilderness islands, complete a cultural landscape inventory for Horn Island, Miss.
CLI PK CI	Complete cultural landscape inventories for Perdido Key and Cat Island, Miss.
Dredge PensPass	Identify the effects Pensacola Pass maintenance dredging and the placement of spoil have on cultural resources.
Forts	Assess the effects of the stewardship of Fort Massachusetts and Fort Pickens on the management of barrier islands, including adaptation strategies that could include sediment management and the mitigation of coastal erosion.
Paleo	Compile a paleontological resources inventory.
	Natural resources (11 respondents)
Benth_Food	Benthic ecology: Identify benthic invertebrate species present at GINS and which of those serve as important food sources for shorebirds and fish. Include intertidal areas.
Benth_Rest	Benthic ecology: How can restoration or other activities affect the benthic ecology and food-webs?
CC_Phen Dist Impacts	Climate change and sea-level rise: Potential effects of climate change and phenology and distribution changes associated with species and species groups (for example. what are the likely distributions and population parameters in 20–50 years considering climate change projections—sea turtles, shorebirds, and others).
Fisheries	Fisheries: Pass and nearshore usage by migratory species of concern (for example, Gulf sturgeon).
HabRestInv	The inventory of other types of habitat restoration projects being considered (not including sediment) that may affect the dynamics of the system.
Mammals	Marine mammals: How can restoration or other activities affect marine mammals?
Seagrass_Survey	Seagrass: Updated natural resources survey data (for example, SAV data are from 2012 and, as noted, have likely changed greatly) to assess potential impacts.
SeaTurtles	Sea turtles: Surveying and monitoring to determine how resources like nesting sea turtles can be affected by management of the barrier island system.
Shorebirds	Shorebirds: Surveying and monitoring to identify hotspots for federally protected migratory shorebird use on barrier islands.
Water_Fresh_MS	Water resources: Freshwater sources on the barrier islands, including freshwater lenses that create freshwater wetlands; for example, West Petit Bois Island offshore of Mississippi.
Water_WQ Navarre	Water resources: Water quality and turbidity studies park-wide, including effects on water quality and salinity if Navarre Pass is reestablished.
	Geomorphology—general (8 respondents)
CC/SLR	Climate change and sea-level rise.
Dredge	Dredging.
Geol Fmwk	Detailed subsurface geologic framework.
Modeling	Modeling.
Reg Sed Budg	Regional sediment budget.
Restor	Restoration.
ShoreChg	Shoreline change.
Surf Sed	Surficial sediment characteristics.

Table 1.2. Sediment budget research and data needs identified during the April workshop and grouped by theme.—Continued

[Fla., Florida; Miss., Mississippi; GINS, Gulf Islands National Seashore; MsCIP, Mississippi Coastal Improvement Project; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description
	Geomorphology—specific (22 respondents)
CC_BenDisCost	Climate change and sea-level rise: The benefits, disadvantages, and costs of adaptation.
CC_Impacts	Climate change and sea-level rise: The potential effects of climate change including sea-level rise and storms.
CC_Vuln Monit	Climate change and sea-level rise: Geomorphic monitoring, particularly to provide and update the exposure component of the Mississippi islands' vulnerability to sea-level rise and storms.
Dredg_Adj	Dredging: How park areas could be affected by dredging and renourishment activities at adjacent beaches.
Dredg_Circul	Dredging: How dredging affects circulation and sediment transport—navigation channel and borrow site activities.
Mod_Navarre	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: Current and predictive sediment transport and shoreline-change models along Santa Rosa Island, Fla., to address the effects of a proposal to cut a channel through the island at the east end of Navarre Beach.
Mod_PensPass	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: the study of sand transport for Pensacola Pass and downdrift of the GINS shoreline.
Mod_PetitBois	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: A study of the evolution of Petit Bois Island, Miss., and modeling sediment placement scenarios that replicate natural processes of sediment movement through Petit Bois Pass.
Mod_Storm	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: An understanding of island elevation and temporal response to storm impacts (for example, dune profile response).
Rest_App Nour	Restoration: Guidance on whether beach nourishment is appropriate in certain park areas and, if so, in which areas.
Rest_Post Assess	Restoration: A postrestoration assessment where restoration (for example, Ship Island, Miss., after MsCIP) and littoral sediment placement (for example, Pensacola Pass dredge material placement on Perdido Key) activities have occurred.
Rest_Sand_Inv	Restoration: Inventory of available sand sources (for example, at or near Perdido Key and Pensacola Pass).
Sed_Dates	Regional sediment budget: Characterize prior placement and removal activities with dates, volumes, locations, and the composition of sediment.
Sed_Nat Chg	Regional sediment budget: Identify potential "natural" changes to the future sediment budget outside of dredging and nourishment activities (for example, Pensacola Pass, Gulfport ship channel).
Sed_Regional	Regional sediment budget: Update and validate the previous budget to determine whether the system, in addition to individual islands, is losing sand and include the confirmation of westward sand transport, especially west of Ship Island, Miss.
Sed_update valid	Regional sediment budget: Updating and validating the previous budget.
Shor_Downdrift	Shoreline change: A better understanding of downdrift erosion extent and timing near inlets and breaches, both natural and artificial.
Shor_Eros Hot Spot	Shoreline change: Identify shoreline erosional hot spots and potential areas of breaching to inform the development and management of infrastructure along the Florida-Alabama-Mississippi coast.
Shor_Hist Cntxt	Shoreline change: Complete the coastal change surfaces to align the current configuration of the islands within the historical context. Much is complete for Mississippi; Florida remains to be done.
Shor_Topobathy	Shoreline change: Consistent temporal and spatial coverage of topobathymetric changes.
Surf_Geo Fram	Detailed geologic framework (subsurface).
Surf_Seafloor	Surficial sediment characteristics, including seafloor texture and composition (see NPS geologic resources inventory in "Inventories 2.0" (DeVivo, 2019) for subaerial [land-based] portion).

Table 1.2. Sediment budget research and data needs identified during the April workshop and grouped by theme.—Continued

[Fla., Florida; Miss., Mississippi; GINS, Gulf Islands National Seashore; MsCIP, Mississippi Coastal Improvement Project; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description
	Mapping (3 respondents)
Habitat	Barrier island habitat mapping and use data, including the relation to natural and cultural resources and park assets.
Reg Jurisd	Update regulatory and jurisdictional overlap depictions. Current GIS data are based on Lands Resources Division files from 2007 and do not reflect current shorelines.
Standards	Develop or adopt standards for updating information for mapping.
	Management and policy (6 respondents)
Cstl Eng Inv	Coastal engineering inventory.
GRI 2.0	NPS geologic resources inventory in "Inventories 2.0" (DeVivo, 2019).
Rest Assess	Restoration assessment.
SDM	Structured decision making and prioritization.
Sed Mgt Plan	Sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs not based only on current cost estimates (for example, cost for monitoring and ensuring that the postdredge handling of sediment keeps it in the littoral system).
Stakeholder	Stakeholder prioritization.

[1]Surveys done under Section 110 of the National Historic Preservation Act (16 USC 470).

Appendix 2. Bibliography of Reports Associated with Research and Data Needs

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Appendix 3. Descriptive Statistics of Research and Data Need Importance and Urgency Ratings

Table 3.1. Descriptive statistics of the importance (necessary) and urgency (time sensitive), measured on scale of 1=not at all to 5=extremely of all research and data needs identified during the April workshop.

[Fla., Florida; GINS, Gulf Islands National Seashore; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	Number	Mean	Standard Deviation	Number
Cultural resources (fig. 1)							
Adaptation	Identify benefits, disadvantages, and costs of adaptation.	3.29	1.047	17	3.24	0.903	17
Arch	Conduct Section 110 archaeological surveys[1] of Santa Rosa Island (Fla.), Perdido Key, Horn Island (Miss.), and Cat Island (Miss.).	4.44	0.727	16	4.13	0.885	16
CC SLR	Assess potential impacts of climate change including sea-level rise and storms.	3.61	1.195	18	3.50	0.924	18
CLI Horn	Depending on management strategies for wilderness islands, complete a cultural landscape inventory for Horn Island, Miss.	3.50	0.966	16	3.25	0.775	16
CLI PK CI	Complete cultural landscape inventories for Perdido Key and Cat Island, Miss.	4.06	0.929	16	3.63	0.806	16
Dredge PensPass	Identify the effects Pensacola Pass maintenance dredging and the placement of spoil have on cultural resources.	4.18	0.809	17	3.76	1.091	17
Forts	Assess the effects of stewardship of Fort Massachusetts and Fort Pickens on the management of barrier islands, including the adaptation strategies that could include mitigation of coastal erosion and sediment management.	3.72	0.669	18	3.61	0.916	18
Paleo	Compile paleontological resources inventory.	2.87	0.990	15	2.67	0.724	15
Natural resources (fig. 3)							
Benth_Food	Benthic ecology: Identify benthic invertebrate species present at GINS and which of those serve as important food sources for shorebirds and fish. This includes intertidal areas.	3.56	0.964	16	3.13	1.025	16
Benth_Rest	Benthic ecology: How can restoration or other activities impact the benthic ecology and food webs?	3.75	1.000	16	3.19	0.834	16

Table 3.1. Descriptive statistics of the importance (necessary) and urgency (time sensitive), measured on scale of 1=not at all to 5=extremely of all research and data needs identified during the April workshop.—Continued

[Fla., Florida; GINS, Gulf Islands National Seashore; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	Number	Mean	Standard Deviation	Number
Natural resources (fig. 3)—Continued							
CC_Phen Dist Impacts	Climate change and sea-level rise: Potential effects of climate change and phenology and distribution changes associated with species and species groups (what are likely distributions and population parameters in 20—50 years considering climate change projections: sea turtles, shorebirds, and so on.	3.44	1.094	16	2.75	1.125	16
Fisheries	Fisheries: Pass and nearshore usage by migratory species of concern (for example, Gulf sturgeon).	3.44	0.892	16	2.88	0.806	16
HabRestInv	Inventory of other types of habitat restoration projects that are being considered (not including sediment) that may affect dynamics of the system.	3.18	1.015	17	2.88	0.993	17
Mammals	Marine mammals: How can restoration or other activities affect marine mammals?	2.88	0.885	16	2.69	0.793	16
SeaTurtles	Sea turtles: Surveying and monitoring to determine how resources like nesting sea turtles can be affected by management of the barrier island system.	4.31	0.873	16	3.88	1.025	16
Seagrass_Survey	Seagrass: Updated natural resources survey data (for example, SAV data are from 2012 and, as noted, may have changed) to assess potential impacts.	4.00	1.033	16	3.63	0.957	16
Shorebirds	Shorebirds: Surveying and monitoring to identify hotspots for federally protected migratory shorebird use on barrier islands.	4.13	0.834	15	3.67	1.113	15
Water_Fresh_MS	Water resources: Freshwater sources on the barrier islands, including freshwater lenses that create freshwater wetlands; for example, West Petit Bois Island, Miss.	3.19	0.911	16	2.69	0.704	16
Water_WQ Navarre	Water resources: Water quality and turbidity studies park wide, including effects on water quality and salinity if Navarre Pass is reestablished.	3.63	0.806	16	3.31	0.704	16

Table 3.1. Descriptive statistics of the importance (necessary) and urgency (time sensitive), measured on scale of 1=not at all to 5=extremely of all research and data needs identified during the April workshop.—Continued

[Fla., Florida; GINS, Gulf Islands National Seashore; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	Number	Mean	Standard Deviation	Number
Geomorphology (general) (fig. 4)							
CC/SLR	Climate change and sea-level rise.	3.68	1.157	19	3.42	1.071	19
Dredge	Dredging.	4.17	0.618	18	4.00	0.840	18
Geol Fmwk	Detailed geologic framework (subsurface).	3.50	0.786	18	3.00	0.970	18
Modeling	Modeling.	4.05	0.911	19	3.89	0.809	19
Reg Sed Budg	Regional sediment budget.	4.47	0.772	19	4.32	0.749	19
Restor	Restoration.	3.84	0.834	19	3.58	0.838	19
ShoreChg	Shoreline change.	3.95	0.911	19	3.74	1.098	19
Surf Sed	Surficial sediment characteristics.	3.61	0.698	18	3.11	0.676	18
Geomorphology (specific) (fig. 5)							
CC_Impacts	Climate change and sea-level rise: Potential impacts of climate change, including sea-level rise and storms.	3.79	1.032	19	3.32	1.003	19
CC_BenDisCost	Climate change and sea-level rise: Benefits, disadvantages, and costs of adaptation.	3.47	1.073	19	3.00	1.202	19
CC_Vuln Monit	Climate change and sea-level rise: Geomorphic monitoring, particularly to provide and update the exposure component of the Mississippi islands' vulnerability to sea-level rise and storms.	3.84	0.898	19	3.53	1.020	19
Dredg_Adj	Dredging: How park areas can be affected by dredging and renourishment activities at adjacent beaches.	4.21	0.787	19	3.89	0.937	19
Dredg_Circul	Dredging: How dredging affects circulation and sediment transport (navigation channel and borrow-site activities).	3.89	0.832	18	3.63	0.955	19
Mod_Navarre	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: Current and predictive sediment transport and shoreline change models along Santa Rosa Island, Fla., to address the effects of a proposal to cut a channel through the island at the east end of Navarre Beach.	4.11	0.809	19	3.89	0.937	19

Table 3.1. Descriptive statistics of the importance (necessary) and urgency (time sensitive), measured on scale of 1=not at all to 5=extremely of all research and data needs identified during the April workshop.—Continued

[Fla., Florida; GINS, Gulf Islands National Seashore; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	Number	Mean	Standard Deviation	Number
	Geomorphology (specific) (fig. 5)—Continued						
Mod_PensPass	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: Study of sand transport for Pensacola Pass and downdrift of the GINS shoreline.	4.37	0.761	19	4.21	0.713	19
Mod_PetitBois	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system: A study of the evolution of Petit Bois Island, Miss., and modeling sediment placement scenarios that replicate natural processes of sediment movement through Petit Bois Pass.	4.06	0.873	18	3.89	0.963	18
Mod_Storm	Modeling—dynamic models that incorporate changes in all habitats along the migrating barrier island system): Understanding of island elevation and temporal response to storm impact (for example, dune profile response).	3.58	1.017	19	3.26	1.147	19
Rest_App Nour	Restoration: Guidance on whether beach nourishment is appropriate in certain park areas and, if so, which areas.	4.00	0.882	19	3.74	1.284	19
Rest_Post Assess	Restoration: Postrestoration assessment where restoration (for example, Ship Island, Miss., post-MsCIP) and littoral sediment placement (for example, Pensacola Pass dredge-material placement on Perdido Key) activities have occurred.	3.89	0.875	19	3.53	0.905	19
Rest_Sand_Inv	Restoration: Inventory of available sand sources (for example, at or near Perdido Key and Pensacola Pass).	3.63	0.597	19	3.32	0.820	19
Sed_Dates	Regional sediment budget: Characterize prior placement and removal activities with dates, volumes, locations, and composition of sediment.	3.79	0.918	19	3.47	0.905	19
Sed_Nat Chg	Regional sediment budget: Identify potential "natural" changes to the future sediment budget outside of dredging and nourishment activities (for example, Pensacola Pass, Gulfport ship channel).	3.95	0.780	19	3.68	0.946	19

Table 3.1. Descriptive statistics of the importance (necessary) and urgency (time sensitive), measured on scale of 1=not at all to 5=extremely of all research and data needs identified during the April workshop.—Continued

[Fla., Florida; GINS, Gulf Islands National Seashore; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	Number	Mean	Standard Deviation	Number
Geomorphology (specific) (fig. 5)—Continued—Continued							
Sed_Regional	Regional sediment budget: Update and validate previous budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport, especially west of Ship Island, Miss.	4.37	0.761	19	4.32	0.820	19
Sed_update valid	Regional sediment budget: Updating (and validating) the previous budget.	4.17	0.857	18	4.17	0.985	18
Shor_Downdrift	Shoreline change: A better understanding of downdrift erosion extent and timing near inlets and breaches, both natural and artificial.	4.05	0.848	19	3.68	0.820	19
Shor_Eros Hot Spot	Shoreline change: Identify erosional hot spots and potential areas of breaching to inform the development and management of infrastructure along the Florida-Alabama-Mississippi coast.	4.05	1.079	19	3.95	0.911	19
Shor_Hist Cntxt	Shoreline change: Complete coastal change surfaces to align current configuration of the islands within the historical context. Much is completed for Mississippi; Florida remains.	3.67	0.767	18	3.28	0.958	18
Shor_Topobathy	Shoreline change: Consistent temporal and spatial coverage of topobathymetric changes.	3.81	0.981	16	3.56	0.892	16
Surf_Geo Fram	Detailed geologic framework (subsurface).	3.61	0.778	18	3.33	0.907	18
Surf_Seafloor	Surficial sediment characteristics, including seafloor texture and composition (See NPS geologic resources inventory in “Inventories 2.0” (DeVivo, 2019) for subaerial [land-based] portion).	3.58	0.838	19	3.00	0.594	18

Table 3.1. Descriptive statistics of the importance (necessary) and urgency (time sensitive), measured on scale of 1=not at all to 5=extremely of all research and data needs identified during the April workshop.—Continued

[Fla., Florida; GINS, Gulf Islands National Seashore; NPS, National Park Service; SAV, submerged aquatic vegetation]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	Number	Mean	Standard Deviation	Number
	Mapping (fig. 6)						
Habitat	Barrier island habitat mapping and use data, including the relation to natural and cultural resources and park assets.	4.63	0.518	8	3.75	1.035	8
Reg Jurisd	Update regulatory, jurisdictional overlap depictions. Current GIS data are based on Lands Resources Division files from 2007 and do not reflect current shorelines.	4.00	0.756	8	3.50	0.756	8
Standards	Develop or adopt standards for updating information for mapping.	3.75	0.707	8	3.00	0.926	8
	Management and policy (fig. 7)						
Cstl Eng Inv	Coastal engineering inventory.	3.68	0.671	19	3.21	0.976	19
GRI 2.0	NPS geologic resources inventory in “Inventories 2.0” (DeVivo, 2019).	3.58	0.769	19	3.37	0.955	19
Rest Assess	Restoration assessment	3.50	0.786	18	3.28	0.575	18
SDM	Structured decision making and prioritization.	4.32	0.671	19	4.05	0.780	19
Sed Mgt Plan	Sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on current cost estimates; for example, cost for monitoring and ensuring that the postdredge handling of sediment keeps it in the littoral system.	4.47	0.841	19	4.21	0.713	19
Stakeholder	Stakeholder prioritization.	3.78	0.808	18	3.61	0.979	18

[1]Surveys done under Section 110 of the National Historic Preservation Act (16 USC 470).

Table 3.2. Descriptive statistics of the importance and urgency of all research and data needs identified during the May workshop.

[Ala., Alabama; APE, area of potential effect; GIS, geographic information systems; Miss., Mississippi; N, number]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	N	Mean	Standard Deviation	N
Cultural resources (fig. 8)							
106 Surveys	Archeology inventory: APE archeological surveys (terrestrial or maritime; including Fort McRee and cultural landscapes) (dredge, staging, placement, viewshed) (Section 106 surveys[1]).	4.07	0.884	15	4.00	1.038	14
110 Surveys	Archeological inventory: General archeological surveys (including Fort McRee and cultural landscape inventories) of barrier islands (Section 110 surveys[2]).	3.87	0.915	15	3.50	0.941	14
Cultural	Cultural Landscapes: An understanding of the cultural landscapes within the APE (dredge, staging, placement, viewshed).	3.47	0.743	15	3.14	1.027	14
Fort Stewardship	Fort Stewardship: Assess the effects of Fort Massachusetts, Fort Pickens, and associated batteries stewardship (for example, adaptation strategies that could include mitigation of coastal erosion and sediment management) on barrier island management.	3.88	0.697	17	3.69	0.873	16
Natural resources (fig. 9)							
Benefits	Project design impacts—positive: Understanding the positive benefits of restoration nourishment to natural communities (species of management concern and suitable habitat) (contributions of sand to a sand-starved system).	4.15	0.587	20	3.68	1.003	19
Design to Avoid Negative Impacts	Project design impacts: Design to limit negative impacts to natural communities (species of management concern and suitable habitat) on the beach, in the nearshore, and in the back barrier (including ebb and flood shoals).	4.25	0.786	20	3.58	0.838	19
Habitat Mapping and Use	Inventories and surveys: Barrier island (beach, nearshore, back barrier) habitat mapping and use data (species of management concern and suitable habitat).	4.24	0.625	21	4.15	0.745	20
Negative Impacts	Project design impacts—negative: Impacts to natural communities (species of management concern and suitable habitat), especially how sediment affects seagrass.	4.10	0.788	20	3.63	0.831	19
Sediment (fig. 10)							
Existing Data	Existing data: Conducting assessments of the broader research community (for example, academics) to expand the awareness and use of existing data (for example, Perdido Key land loss and updates to “1999 Pensacola Pass Inlet management plan” study),	4.15	0.813	20	3.70	1.031	20

Table 3.2. Descriptive statistics of the importance and urgency of all research and data needs identified during the May workshop.—Continued

[Ala., Alabama; APE, area of potential effect; GIS, geographic information systems; Miss., Mississippi; N, number]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	N	Mean	Standard Deviation	N
Sediment (fig. 10)—Continued							
Location	Location: Identifying locations and types of sediment resources for coastal restoration (offshore, nearshore, upstream).	3.86	0.655	21	3.47	0.841	19
Source Availability	Source Material (borrow): Suitability of available sediment sources to meet varying project needs (design).	3.76	0.700	21	3.42	0.838	19
Source Impact	Source Material (borrow): Impact of sediment source and type on natural beach communities and functions, including nesting and foraging habitats (for example, marine turtles, migratory birds, beach mice).	4.05	0.887	20	3.83	0.985	18
Temporal	Temporal: Long-term sediment needs across the region.	4.10	0.553	20	3.58	0.902	19
Trans: Budget	Transport: Update and validate the previous sediment budget to determine whether the system, in addition to individual islands, is losing sand and include confirmation of westward sand transport (especially west of Ship Island, Miss.).	4.35	0.671	20	4.32	0.582	19
Trans: Modeling	Transport: Dynamic modeling of natural and managed sediment transport volumes and directions affecting beaches, habitats, and cultural resources for the region.	4.40	0.681	20	4.21	0.855	19
Trans: Resilience	Transport: Understanding sediment movement within the system and the actions (for example, living shorelines) that can enhance coastal habitat resilience without moving sediment.	4.14	0.793	21	3.89	0.809	19
Trans: Shoreline Change	Transport—shoreline change: Identify erosional hot spots, areas of natural sediment supply, potential areas of breaching, and short-term erosion rates, both on the islands and offshore, to inform the development and management of infrastructure along the Florida-Alabama-Mississippi coast.	4.15	0.671	20	4.00	0.577	19
Watershed	Watershed changes: Linkages in land use, climate, and management in upstream watersheds affecting the location and type of sediment resources.	3.05	0.686	20	2.79	0.631	19

Table 3.2. Descriptive statistics of the importance and urgency of all research and data needs identified during the May workshop.—Continued

[Ala., Alabama; APE, area of potential effect; GIS, geographic information systems; Miss., Mississippi; N, number]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	N	Mean	Standard Deviation	N
Mapping and modeling (fig. 11)							
Elevation Data	Elevation Data: Elevation data (seafloor, inlet, and ebb and flood shoals); hydrographic surveys.	4.40	0.681	20	4.00	0.882	19
Habitat Modeling	Habitat: Modeling habitat hotspots (species of management concern), including the identification of disturbances that may be inhibiting the use of suitable habitat.	4.05	0.740	21	3.84	0.958	19
Inlet Dynamics	Inlet dynamics: Inlet studies with dynamic model inputs.	4.29	0.717	21	4.05	0.705	19
Shoals Dynamics	Shoal dynamics: Modeling of nearshore morphologic processes.	4.15	0.671	20	4.06	0.802	18
SLR and Subsidence	Sea-level rise and subsidence: Higher resolution models for sea-level rise and subsidence.	3.70	0.733	20	3.28	0.752	18
Wave and Currents Data	Nearshore wave and currents data: Nearshore wave and currents data (need for site-specific gages).	4.10	0.718	20	3.83	0.707	18
Water Levels Data	Water-level data: Water-level (and tide-) gage data (gage needed).	4.20	0.834	20	3.89	0.832	18
Management and policy (fig. 12)							
Capacity: Economics	Capacity: Economics of larger projects using sand dredged from offshore borrow areas or dredging the nearshore sand-transport system (including inlet-bypassing shoals) versus smaller projects using upland sand (including the assessment of incremental beach management).	3.33	0.796	21	3.10	0.852	20
Capacity: Support Nav. Maint.	Capacity: Agency abilities to support States and the needs for pass and navigational maintenance.	3.38	1.024	21	3.37	0.955	19
Comp.	Comprehensive: Linking sediment management with cultural and natural resource priorities and recreational opportunities.	4.30	0.733	20	3.79	1.032	19
Decision-Making	Decision making: Clear recommendations for decision makers (action versus inaction)	4.14	0.910	21	3.65	1.089	20
Inlet Mgt: Adj Dredge and Nourish	Inlet management—dredging and nourishment: Identify how park areas can be affected by dredging and nourishment activities at adjacent beaches.	4.19	0.680	21	3.95	0.759	20

Table 3.2. Descriptive statistics of the importance and urgency of all research and data needs identified during the May workshop.—Continued

[Ala., Alabama; APE, area of potential effect; GIS, geographic information systems; Miss., Mississippi; N, number]

Label	Need description	Importance			Urgency		
		Mean	Standard Deviation	N	Mean	Standard Deviation	N
Management and policy (fig. 12)—Continued							
Inlet Mgt: Best Practices	Inlet management—best practices: Pensacola Pass inlet management plan that defines the beneficial use of sand that shoals in the inlet to alleviate beach erosion along the adjacent shorelines, while minimizing natural (listed species) and cultural (for example, Fort Pickens) resource impacts.	4.19	0.928	21	4.00	0.795	20
Inlet Mgt: Inlet Survey	Inlet Management—inlet survey: Complete inlet survey (ebb and flood shoals) for each inlet, with two or more comparative surveys (updated inlet management plan).	4.10	0.700	21	3.90	0.912	20
Restoration Design	Restoration design: Barrier island maintenance and overlying slope and elevation design to mimic natural processes and support suitable habitat.	3.85	0.933	20	3.67	0.767	18
Sed Mgt Plan	Planning—sediment management plan: A long-term plan for ensuring natural sediment transfer and associated costs (not based only on current cost estimates; for example, cost for monitoring and ensuring that the postdredge handling of sediment keeps it in the littoral system).	4.10	0.831	21	3.79	0.787	19
Stakeholders: Jurisdiction	Stakeholders: Update regulatory and jurisdictional overlap depictions. Current GIS data are based on Lands Resources Division files from 2007 and do not reflect current shorelines.	3.65	1.040	20	3.44	0.922	18
Stakeholders: Multi-use	Stakeholders: Ensure that sediment is used wisely and avoid multi-use conflicts.	4.00	0.918	20	3.67	1.138	18
Stakeholders: Science and Policy	Stakeholders: Explicit integration of science and policy to enhance the transparency of stakeholder values and management decisions (for example, "Structured Decision Making" study at Dauphin Island, Ala.).	4.15	0.813	20	3.67	0.840	18

[1]Surveys done under section 106 of the National Historic Preservation Act (54 USC § 306101) and its implementing regulations (36 CFR Part 800).

[2]Surveys done under Section 110 of the National Historic Preservation Act (16 USC 470).

Appendix 4. Open-ended Workshop Evaluation Comments

Table 4.1. List of open-ended comments received following the April Workshop. Comments are numbered solely for ease of reference.

Number	Comment
1	I think the needs poll was great and the output of relative importance and urgency is great too. But I think it could've been significantly more effective if the many of the items were combined and simplified where possible.
2	I understand this virtual workshop was not the planned route of attack when it comes to polling questions and coalescing the responses, but it did work out and provide the desired feedback.
3	Well done.
4	The first poll was very rushed. No time to think about answers or even absorb what the different items were to prioritize. Would have been much more effective in person with stickers so we could have interacted and shared how we were interpreting the statements.
5	The workshop felt rushed. Allowing sufficient time to fully explore each concept and how concepts overlap, and bear on one another would help participants rank needs. There was a lot of overlap in themes. I don't believe anyone should say that turtles are more important than crabs or cannonballs - we each have a perspective about what's an important resource, and a park has a role in protecting each of those resources within the context of its enabling legislation. It seems like baseline inventories for all park resources is necessary for understanding 'what's being managed for' in a sediment budget plan . . . or any other management plan. I wonder if it would be useful to start with the perspective that each topic is important; let's identify gaps in understanding; then order the processes to meet an objective. At times, it felt like the objective was being lost. It might help to stay on track if connections between a topic and the objective were continually being drawn or strengthened.
6	It's always better to be in person, but all things considered this went well. Really glad y'all did a test day before the webinar so we could iron out microphone and video issues.
7	Great adaptation from in-person to virtual meeting
8	The virtual setting worked pretty well considering some participation methods (polling) was still being refined during the workshop. It would have been better to have had more time for discussion of initial poll results but understand that the method for polling and showing results was still being worked out. The next workshop should include more discussion time.
9	Overall, I was very impressed by the online workshop, especially the speed with which the survey results were compiled and displayed for discussion.
10	Great job!
11	Just FYI. I took the poll from the perspective that my assessment should support GINS's (Gulf Islands National Seashore) expressed priority needs: (1) beneficial reuse at Pensacola Pass, (2) opposition to the Navarre pass project, (3) understanding the dynamics of Petit Bois Island to better inform sand placement.
12	Thanks again for the opportunity to participate! I would not have been able to participate in an in-person workshop (no travel funds), so the invite to this remote setting is appreciated.
13	Thank you to the organizers & facilitators.
14	More time to complete the initial survey, or further condense/simplify all the points into less detailed topics when rating. It was hard to differentiate the importance or urgency between similar points in the research fields I am not as familiar with. The final poll was much more concise. Thank you!
15	I thought the workshop was great! The workshop was well organized - great choice of presenters and topics. The presentations very focused and effective. The real-time polls worked out fine. The only suggestion would be to have done the poll on Day 2 and have you send out the plots, then come back on Day 3 to discuss. The time we spent waiting for the data to be plotted was not an issue -- but, seeing the plots for first time and trying to comment on them was challenging -- I needed more time to digest what I was seeing and gather my thoughts.

Table 4.2. List of open-ended comments received following the May Workshop. Comments are numbered solely for ease of reference.

Number	Comment
1	I think the habitat modeling text was going to be rephrased to eliminate "hotspots," so "modeling suitable habitats for species of mgt concern, incl. identification of....." Very productive - especially for a virtual meeting! Nice job of trying to keep folks engaged and informed!
2	I thought the meeting organizers and facilitators did an outstanding job. I am now disappointed that we didn't have the opportunity to network in person, but believe the virtual meeting effectively accomplished its goals. As a follow-up it would be nice to receive an attendee list with everyone's contact information. I think the workshop was conducted in a highly professional manner, which is to the organizers and facilitators credit. They did an excellent job! And the presenters likewise did an outstanding job of presenting their piece of the puzzle.
3	We appreciate being able to participate. I realize BOEM (Bureau of Ocean Energy Management) didn't make comments; Jim Flocks was kind enough to include us and it was a great deal of new information that we hope to collaborate more in the future.
4	The virtual setting, while successful in this case, always feels like it inhibits more discussion. Nothing we can do about it at this time. Great job and successful meeting.
5	Despite some of the technological challenges-the format worked well with the challenges of COVID-19 (Coronovirus Disease 2019). Thank you!
6	I think there was something of a mismatch between the attendees and the objectives. Given that the objective was specifically informing NPS re. dredge placement, it seemed like there should have been a greater diversity of researchers and subject matter experts that could identify a wider suite of available data and models and inform the greatest process understanding gaps to meet park objectives. On the flip side, this set of attendees would have been great to discuss the wider range of management interests in the area.
7	The presentations were good but it felt rushed and there was no opportunity for questions or discussions before jumping into the list of priorities. The list was too long with too many overlapping priorities, making it difficult to really prioritize one over the other. For example, if a dataset is needed to do a model of the system, what is more important, the data or the model? Each person will have a different approach to this so the results will be difficult to interpret.
8	I hate that COVID (Coronovirus Disease) made this a webinar, but y'all did the best job possible under the circumstances.
9	Thanks very much for this workshop! I think it was a valuable use of time and resulted in some great discussion of a very complex issue. There is a lot for the park to think about. I think the virtual setting went as well as could be expected, so the organizers should be pleased with their efforts. An in-person meeting might have generated more discussion, though, it may also have limited participation re: not everyone would have been able to attend. Great job.
10	Great workshop and adjustments to make it virtual. This was extremely helpful and I believe a positive working relationship will come from this moving forward.

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