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Communicating and Understanding Ecosystem Services Assessment With Coastal Stakeholders: Obstacles and Opportunities

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This paper reports on insights and lessons learned from stakeholder engagement, particularly focus groups, conducted during a multi-year, NOAA-sponsored transdisciplinary project. A major project goal was to demonstrate and communicate benefits of natural and nature-based features (NNBFs) (e.g., barrier islands, dunes, and marshes) in the northern Gulf of Mexico region through the lens of economic impacts and ecosystem services. Overall, the findings indicate economic impacts and ecosystem services can be challenging topics to communicate because of complexity in conceptualization and valuation. From our experiences, we recommend using "ecosystem services assessment" (ESA), a more encompassing, accurate, and understandable term to stakeholders. ESA recognizes the integrated human (or built) and natural ecosystem and holistic benefits provided by and to both. The paper concludes with a discussion of future research opportunities for improving ESA-oriented science and outreach.

Keywords: ecosystem services, stakeholder engagement, environmental communication, coupled natural and human system, coastal resilience

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INTRODUCTION

An ecosystem services assessment (ESA) is an effort to describe the intrinsic value of ecosystems via direct and indirect benefits that species and natural systems provide to human society (Yee et al., 2017), including flood protection, fisheries, water filtration, aesthetics, and tourism. An ESA accounts for and measures the value of the benefits that we receive from our natural system. The measurement can be either monetary and/or non-monetary. A traditional cost-benefit analysis would include the benefits estimated from an ESA and then compare those to the cost of undertaking a project, such as the restoration or conservation of wetlands. ESAs integrate bio-geo-physical and social-behavioral-economic data that can produce actionable information to improve decision making. This could be especially helpful to communities confronted by coastal hazards (e.g., nuisance flooding, hurricane storm surge), now and under relative sea level rise, and are facing the difficult choice of implementing hard infrastructure (e.g., sea walls) or building with nature. Both the process of developing ESAs and acting on their findings requires community

negotiation and balancing needs of multiple stakeholders (Hauck et al., 2013). Thus, facilitating effective discussions about ESA data with a range of audiences is crucial for coastal resilience, but can be complex and challenging due to lack of consistent terminology and differing conceptions of what ecosystem services or economic impacts involve (Thompson et al., 2016). Researchers need a better understanding of how different stakeholders conceptualize, consider, and talk about ecosystem services and economic impacts to tailor model development and research products to their needs.

For example, the northern Gulf of Mexico coastal land-margin (**Figure 1**) faces a complex array of socioeconomic challenges such as vulnerable industry, low per capita income, and low level of educational attainment (Centers for Disease Control, 2020; Semega et al., 2020). These socioeconomic issues are exacerbated by present and future bio-geo-physical challenges to critical local industries such as fishing, shrimping, and oystering, which are especially important in rural and low-income areas (Chen, 2017). In particular, rising sea levels will have significant impacts on coastal habitats that are critical for coastal protection and provision of services (Passeri et al., 2015; Sweet et al., 2017; Fleming et al., 2018).

This paper addresses that need by reporting on insights and lessons learned from stakeholder engagement during a multi-year, NOAA-sponsored transdisciplinary project involving Natural and Nature-based Features (NNBFs). A major project goal was to learn how to best demonstrate and communicate benefits of NNBFs (e.g., barrier islands, dunes, and marshes) through the lens of economic impacts and ecosystem services in the northern Gulf of Mexico region (**Figure 1**). This was accomplished by: (1) estimating changes in traditional economic metrics such as impacts to housing and critical facilities from nuisance flooding and hurricane storm surges under present and future conditions (i.e., sea level rise), (2) demonstrating further direct benefits (i.e., beyond flood reduction) from incorporation of NNBFs, and (3) illustrating the enhanced value of ecosystem services resulting directly and indirectly from NNBFs.

To succeed in this endeavor, the project team needed to better understand the perspectives, experiences, and concerns of regional and local stakeholders regarding ESAs. We gathered this information through various stakeholder engagement mechanisms (i.e., workshops, presentations, facilitated discussions, data exploration activities, focus groups, webinars with interactive polling, and evaluation surveys). The present paper reports primarily on the focus groups, but also incorporates connections to the other engagement techniques, reflections from our project experiences and team communication, and links to relevant literature. To conclude, we highlight major findings, discuss implications and lessons learned, and offer practical guidance and future research recommendations.

We begin by defining key terms and concepts forming the basis of an ESA, including economic impact analysis, ecosystem services, and ecosystem services valuation. In general, economic impact analysis (EIA) analyzes effects that an exogenous or differential event will have on the economy through direct and indirect impacts (Pleeter, 1980). For our work, we use EIA to demonstrate bio-geo-physical changes to natural environments that have an effect on traditional socio-economic metrics (e.g., jobs, incomes) and built systems (Hagen et al., 2017). This application of EIA is to understand, for example, the number of people affected, value of buildings and contents lost, and amount of infrastructure exposed and/or damaged during storm surge under current and future sea levels.

Ecosystem services valuation (ESV) entails identifying and measuring primarily non-traditional benefits humans receive from the natural environment, which can be expressed in monetary and non-monetary terms. Ecosystem services are benefits received from the natural environment that impact

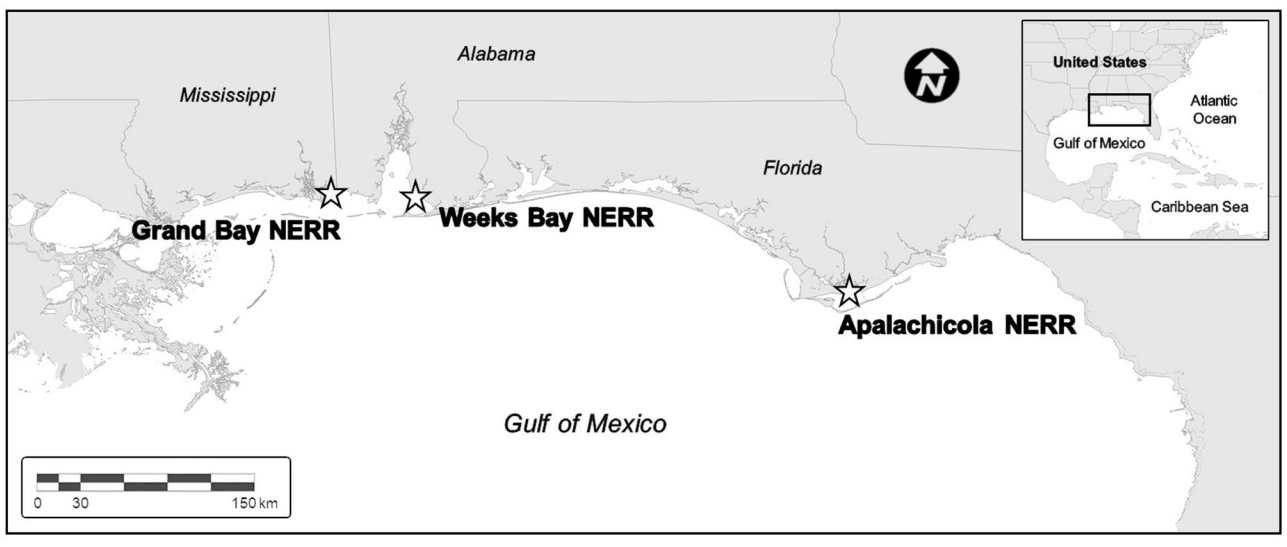

FIGURE 1 | Locations of the Grand Bay, Weeks Bay, and Apalachicola National Estuarine Research Reserves (NERRs) where focus groups were conducted. The overall study spanned the entire coastal land-margin region of the northern Gulf of Mexico, including Mississippi, Alabama, and Florida.

human well-being, including security (personal safety, resource access), material (livelihoods, food, shelter), health (strength, feeling well, clean air), social relations (cohesion, mutual respect), and freedom of choice and action (opportunity to achieve what an individual values doing and being) (Bekessy et al., 2018). Some examples are storm protection, water supply, commerce, food, raw materials, ornamental resources, recreation, science and education, and spiritual and historic connections (Daily, 1997; Millenium Ecosystem Assessment, 2005; Yoskowitz and Russell, 2015).

Including both ESV and EIA to support ESA creates a fuller picture of ecosystem services in a system and can improve decision making (Yoskowitz et al., 2010; Hauck et al., 2013). For example, an oyster reef offers some quantifiable ecosystem services including commercial and recreational fishing, other types of recreation, storm surge protection, and water quality. Other ecosystem services (e.g., aesthetics, spiritual and historic connections) are hard to value monetarily (Bekessy et al., 2018), making them more difficult to quantify but no less valuable. If developed in a transparent and participatory way, ESA has potential to create a shared baseline for decision making among competing interest groups (Granek et al., 2010), though it cannot be the only factor for decision making about complex issues (Bekessy et al., 2018).

In support of the aforementioned transparent and participatory development of ESA, there is a need for further improvement on conceptualizing and communicating this process to better inform decision making. Previous research on ecosystem services communication with stakeholders points to the importance of considering the specific ecosystem context, competing interests and management alternatives, and diversity of stakeholders and their frames of reference and values (Asah et al., 2014; Koschke et al., 2014; Bekessy et al., 2018). Moreover, the types of ecosystem services data needed by stakeholders are context-specific and depend on their intended use of the data in various situations. Thus, research suggests avoiding generalizations about how ecosystem services should be represented in communication (Koschke et al., 2014), and instead emphasizes participatory, deliberative approaches for framing ecosystem services-related functions and terminology to meet the needs of multiple stakeholders (Clark et al., 2000; Raymond et al., 2013). Prior studies have not traditionally focused on communicating economic benefits of NNBFs with mitigation of storm surge or nuisance flooding under SLR or enhanced NNBFs (e.g., Sutton-Grier et al., 2015; Gray et al., 2017).

For the northern Gulf of Mexico, present and future (for the year 2100) flooding scenarios have been produced (Bilskie et al., 2016a,b; Bilskie et al., 2019) and were employed as critical inputs for an EIA to frame conversations with stakeholders. The major focus group research questions explored stakeholders' understandings of EIA, experiences with EIA, and perceptions of the benefits and drawbacks for using EIA data for NNBF-related decision-making. The present study focuses on use of these economic impacts and ecosystem services in an under-studied communication context while adding to the literature on tailoring ecosystem services-related communication to the needs of stakeholders via a participatory research approach resulting in transdisciplinary outcomes.

METHODS

Focus group interviewing is a social science technique for gathering participant perspectives and comments that can strengthen scientist-stakeholder communication, build trust, and improve decision making and usability of scientific research and products (Lemos et al., 2012; Addison et al., 2013). The focus group process fosters interaction and allows participants to respond in their own words, which can minimize researcher biases and enable emergence of unplanned insights (Eisenhauer and Nicholson, 2005; Newig et al., 2008). Though the focus group method may seem straightforward, careful preparation and implementation are crucial for success (Krueger and Casey, 2000; Stewart and Shamdasani, 2015; Lune and Berg, 2017).

We conducted four total focus groups of between nine and twelve participants each during the project's annual workshops in 2018 and 2019 at National Estuarine Research Reserve facilities in Grand Bay, Mississippi and Weeks Bay, Alabama. The workshops' purpose was to reiterate the project's goals, provide updates on the research, and collect further stakeholder input on the project process and products. The workshops were presented by the team of natural and social scientists and engineers and directed to a volunteer regional project advisory board as well as to local stakeholders in each of the coastal communities. Both the regional advisory board and local community stakeholders were comprised of natural resource professionals (e.g., natural resource managers, community planners, extension specialists) who all participated in this project voluntarily. The advisory board was involved throughout the project from the start, whereas local stakeholder participation varied by geographic venue. The workshop attendees were recruited through professional contacts and networks.

The structure of the workshops remained generally the same and consisted of several presentations on the scientific research and modeling, including ESA considerations; various stakeholder engagement activities (e.g., data exploration worksheets and participatory mapping using an online interface, facilitated discussions, focus groups, evaluation surveys). The ESA presentations included an overview of the concepts and methods, examples, purposes in the project, and demonstration of data applications. There was a question-and-answer session after each presentation.

During each workshop, two purposive sample subsets of attendees convened in separate rooms to participate in concurrent focus groups. One group consisted of advisory board regional stakeholders and one group consisted of local stakeholders. Implementation was the same for all focus groups. Each year, a team social scientist with qualitative research expertise moderated the advisory board stakeholder group and a team science communication expert who had focus group training and experience moderated the local community group.

The focus groups started with an introduction, explanation of objectives, and instructions. The moderator then asked open-ended questions stemming from a flexible interview guide. All participants were engaged while the moderator listened attentively, maintained non-judgmental positive rapport, and asked probing questions when necessary for clarification or elaboration. The groups were audio-recorded with permission; lasted about an hour each; and had a research assistant who took notes.

The interview guide was constructed by the project team and pretested. Many questions remained consistent each year (knowledge, experience, beliefs, and information needs regarding nuisance flooding and mitigation options, including NNBFs). However, there was some variation in questions about ESA. These questions addressed participants' knowledge about ESA; prior experiences using ESA methods and data; perceived benefits and drawbacks of ESA data for NNBF decision making; plans to use ESA data; and recommendations for ESA data outputs, applications, and communication. The 2018 interview guide asked distinct questions about EIA and ESV. However, in response to a team debriefing indicating lack of time for substantial focus group discussion of both EIA and ESV and some stakeholder confusion between the two concepts based on other engagement activities, we only included questions about EIA in 2019.

All focus group audio-recordings were transcribed in entirety by the moderators and double-checked for accuracy. The data set consisted of 106 total pages of typed transcripts. Data analysis involved an interpretive approach which included listening to the audio-recordings and reading all transcripts and notes closely; coding the text (sentences, phrases) manually in a word-processing program based on interpreted relevance of the data and developing categories; and making comparisons within and between the coded data to identify subcategories, relationships, and themes (Miles et al., 2014; Lune and Berg, 2017).

RESULTS

The study findings were grouped into three themes: (1) stakeholders' knowledge about and experiences using ESA, (2) stakeholders' perceived challenges with ESA, and (3) stakeholders' expectations and perceived opportunities for ESA. Overall, stakeholder participants were aware of ESA concepts but had limited experience using ESA methods or data; articulated various challenges with conceptualizing, calculating, or communicating it; and perceived opportunities for implementing ESA in the future. Below, we present these findings, along with supportive illustrative participant quotations.

Stakeholders' Knowledge About and Experiences Using ESA

The focus group participants were generally familiar with ESA, some due to their attendance at the project's workshops and webinars, which included presentations with overviews and demonstrations of these methods. Participants believed both the economic and ecosystem services dimensions of ESA have potential for providing important and useful quantitative data for NNBF communication (e.g., *"if we have some better understanding of the value and the benefits maybe that would encourage people to protect it more"*) and decision making (e.g., *"In our local environment, the economy is directly related to the natural resources so if we're not understanding and protecting our natural resources then our economy is going to tank,"* and *"the most important thing is, you've got to quantify if you're going to justify spending federal money, state money, local money"*).

Stakeholder participants' experiences using ESA methods and data varied, but overall were relatively limited (e.g., *"I only have what I get when I come to these trainings so I try to focus as much as I can on the economic… it's not part of my daily project management-type stuff."*) Most of their descriptions were brief, such as, *"we'll use it in project proposals… to show what benefits you're getting out of the results,"* or *"We share those numbers with Congress, so they continue to fund us."*

Acquiring and working with ESA data was also apparently somewhat of a struggle. For example, participants claimed, "*We've tried to do rank assessments for our properties… visitor use… because a lot of our areas are remote.*," and *"We've been trying to look at some economic impacts related to some stream restoration work we've been doing… but it's been kind of a struggle to put that into an easily digestible number or value."* Other participants expressed interest in generating ESA data if they had a better understanding of the process, e.g., *"We haven't gotten to the point of being able to assign a dollar value to it, but I think that ultimately, that would be helpful in communication."*

Stakeholders' Perceived Challenges With ESA

The focus groups identified and discussed various challenges with incorporating ESA in their activities, especially for community resiliency. These challenges can be divided into three broad interrelated categories: (1) conceptualization-related challenges, (2) calculation-related challenges, and (3) communication-related challenges. **Tables 1–4** provide participant quotations supporting the three categories of challenges, and we elaborate on each below, along with subcategories and interrelationships that emerged from analysis.

Conceptualization-Related Challenges

Participants did not seem entirely clear or confident in knowledge about ESA concepts (**Table 1**). For example, economic impacts were defined with brief phrases. Less common were more nuanced understandings of ESA capturing the decision-support capacity of this technique, including how it relates to sea level rise and the project.

Calculation-Related Challenges

The stakeholder participants also had uncertainty and skepticism about ESA methodological procedures. They found ESA calculations to be puzzling (e.g., *"I don't really know… how to quantify it,"* *"it can get complicated,"* and "*we've always understood the value to a certain extent, but not the complete value*") and it seemed this was a common perception or experience in their professional arenas. The major questions and concerns

TABLE 1 | Example quotations for conceptualization-related challenges for incorporating ESA into their work.

Specific component of challenge	Representative quotations
Defining economic impacts	"It means dollars." "What's the benefit of our investment?" "What's the impact of a project you propose? Is this good for the economy or bad for the economy…if you put a marsh out there?" "What is the cost vs. what is the benefits that it will bring?" "All that stuff we just talked about quantified and put in a tidy paper so people will look at it."
Defining ecosystem services	"[It] sounds like you're talking about the cost analysis to me…It's hard to define." "It seems like it's a big, catch-all term." "What kind of dollar value you can put on ecosystem services, I guess." "Trying to put a number on ecotourism, and recreational fishing, and this and that on these habitats."

TABLE 2 | Example quotations for challenges related to quantifying intangible ecosystem services using ESA.

Specific component of challenge	Representative quotations
Quantifying intangible ecosystem services	"…Ecosystem service valuation could be…less obtainable information from the community… What intrinsic value they get out of that natural area. How it adds to their quality of life…things you can't put a dollar value on…people may…go to the shoreline to see the sunset and how do you put a value on that? But it's definitely of value and a service that it provides. I'm all for getting to those dollar values- how a marsh can clean up as compared to a waste treatment plant. But there are other values…that I think that term means as well." "We just tend to fall back on the traditional ways of quantifying damages or what we've prevented from being damaged: the structures – commercial, residential, industrial. Those things that are very easy to say they've been inundated, therefore, they're damaged. I think the part where it's challenging…is quantifying these ecosystem benefits…How do you put a dollar figure on productivity increase? There's ways to do it but that's even more of a fuzzy science." "Ecosystem service valuation is based on assumptions…there's always faulty assumptions." "We're having to rely on modeling to kind of figure out what those benefits will be and what the savings may be over time, but time will really tell…We have to wait for an event to happen." "I'm always concerned that it will be undervalued...not giving enough value to certain components of the natural system…who's to say, "This piece of shoreline is worth ten million dollars to this community." Then somebody can come along and say, "Okay, here's eleven million dollars, and I'll put a condo there."" "The cynical side of me says fuzzy math when I hear it…I realize there's more of a science to it…In practical application, I have issues…So out there is a marsh. It probably doesn't provide the same function across each acre. I would imagine most evaluations of that services would plot the single value for that scale for that value across that landscape…if anybody sees that number, they assume that's a real number without any range." "I've always been kind of philosophically opposed to assigning very specific dollar values to those ecosystem services from the standpoint of you're putting a line in the sand that it's worth this to us. We don't fully understand the biological or physical characteristics of these systems. What are we missing out on? What value?"

centered on how to quantify intrinsic ecosystem services and how to include NNBFs in ESA calculations. Regarding quantifying intangible ecosystem services, participants were concerned about an inability to put a value on quality of life or aesthetic considerations like, *"go[ing] to the shoreline to see the sunset."* Another participant felt that while intangible ecosystem services could potentially add to traditional methods of loss calculation, it amounted to *"fuzzy science"* (see **Tables 2**, **3** for full quotes).

Stakeholders had general expectations about ecosystem services that seemed connected to their overall concerns about ecological modeling, such as models not being exact or definitive or not completely accepting modeling results until validated by real-world experience. They also perceived lack of accuracy in measuring intangible ecosystem services to be troubling and problematic. One concern was that placing a monetary value on a location would encourage developers to pay a slightly higher rate to purchase and develop the land. Other concerns related to uncertainties in valuing ecosystems that are not completely understood.

Regarding incorporating NNBFs in ESA calculations, there were some perceptions that NNBFs can compound the methodological complexity. For example, one perception was it is easier to calculate direct benefits of traditional engineered structures like a seawall than indirect benefits of establishing an oyster reef. Further, participants thought there were several situational factors that should be considered in computer modeling when including NNBFs in ESA. These factors, which encompass ecological and social characteristics, include: (1) appropriate scale of analysis pertaining to size of NNBF (e.g., acres vs. linear feet), (2) type and location of infrastructure or habitat the NNBF is expected to protect (e.g., human-built infrastructure vs. natural habitat), and (3) growth rate and future community development patterns.

In addition to uncertainty and skepticism about underlying ESA methodological procedures, there was also concern among participants that the measures would not be accepted as valid by the broader community and thus a potential obstacle for NNBF-related initiatives. This concern connects the calculation-related challenges with communication-related challenges category discussed below.

TABLE 3 | Example quotations for challenges related to including NNBFs in ESA calculations.

Specific component of challenge	Representative quotations
How to include NNBFs in ESA calculations	"The thing I think is difficult with ecosystem services is…you can talk about how much does an oyster bag cost…but…let's say you put in a living shoreline…when you can say, "If I implement this green infrastructure improvement relative to, say, a formal engineered improvement, then…I can mitigate some water quality"…but that's not immediately quantifiable." "The scale that you're measuring the value. So it is an acre or is it a linear footage of shoreline? …what is variability in that?" "What you're protecting. Are you putting something to protect some type of critical infrastructure, or are you putting something to protect some sort of natural habitat…how that factors into how you evaluate the economics of it is important." "Especially with infrastructure…with sea level rise…all the coastal roads that are going to have to be elevated, if not moved…We're talking a lot of expense." "Future land use, land cover changes…how development may or may not occur in an area…the cost of the vulnerabilities associated with that."

TABLE 4 | Example quotations for communication-related challenges for incorporating ESA into their work.

Specific component of challenge	Representative quotations
Communicating complexity and uncertainty	"Trying to explain to people…all of the cost-benefit." "...It's not like economics, like you can say we're saving one dollar for every one dollar we're investing…It's kind of hard for the public to wrap their mind around, like, "We're creating X number of habitat units." What does that mean?" "…You've just got to be careful in how you present that information." "How…confident are you with how much uncertainty is associated with those projections that you're going to dish out to the public? Telling that message is a little bit abstract…modeling uncertainty, and confidence levels, and statistical analyses to Joe Blow public. Finding a way to creatively do that in a simplistic manner that people can understand…telling that story is one that we haven't figured out how to do effectively yet."
Connecting to diverse audience values	"Understanding what's important to the people who live here and what's important to me or you may not be what's important to the rest of the constituency." "Unfortunately, our decision makers, they're not listening to ecological economic benefits. They're listening to how many people are moving to my community."
Creating compelling narratives	"I think one of the challenges is tying together the economics, the engineering, and the social side. To weave a story that shows the whole picture." "…What you have to convey now if you're going to try to argue persuasively is the emotional side of an issue...visuals, and telling these stories…and trying to find the right trigger point to get changes made."

Communication-Related Challenges

The focus group participants thought confusion about ESA conceptualizations and calculations could be problematic for stakeholder and public communication, acceptance, and support of coastal projects, including those involving NNBFs (**Table 4**). For example, communicating about ESA to the public was perceived as more difficult to explain than traditional cost-benefit analysis, which was regarded as challenging in itself. Further, explaining assumptions and uncertainties in projects' mathematical models to decision makers and other community members was viewed crucial for transparency, but not an easy task. Participants believed these communication difficulties could be addressed in part by understanding and connecting to local audience values, though there were also concerns that ongoing population growth was resulting in an influx of new residents with different cultural values. Many new residents move to the coast from inland with a romanticized vision that does not appreciate the nuances of what comprises the natural wonder. One technique participants described for connecting with diverse audiences was using emotional messages and storytelling to develop effective and persuasive communication.

Stakeholders' Expectations and Perceived Opportunities for ESA

Despite the challenges, most stakeholder participants expected they would be using ESA methods and data in their various professional roles in the future, such as in helping in project selection, determining where to build, and establishing new regulations. For instance, *"we might…use it as leverage for new regulations politically and stuff because…if you can show the politicians or whoever's in charge that you're helping the economy then that gets their attention…"*

The focus groups appreciated the ESA data being incorporated into the project's research and computer modeling, as well as being involved in sharing input and feedback on the process and scientific products. They thought the resulting tools would provide accessible and useful guidance for decision making. They also perceived opportunities for multiple types of applications across various coastal contexts and scales. For example, participants stated, *"if a site selector or a developer is looking at your area, this tool might help them make…better decisions for their business and your community"* and *"from a park service perspective…the sea level predictions, I think, will let us*

target areas that we can continue to open to the public vs. areas that might become natural wilderness."

DISCUSSION

Overall, the findings further document that economic impacts and ecosystem services can be challenging to communicate to coastal stakeholders because of the complexity of conceptualization and valuation. Though there were several economic impacts and ecosystem services informational presentations during workshops and webinars and related team and stakeholder discussions, activities, and interactions, there seemed to be a disconnect between the economic data and its relevance to NNBFs, especially when considering benefits NNBFs provide through ecosystem services.

Regarding conceptualization-related challenges, there was lack of clarity about differences between types of information provided by EIA vs. ESV and when and how to use those outputs. Stakeholder participants seemed to generalize these two data types into a single, broad "economic data" category, while they do have two distinct and mutually-supportive meanings. There was also some confusion about distinguishing EIA data from the other modeling and decision support tools being produced and refined in this project. While ESV is a flexible concept, similar concerns about both the definition and application of ESV have been observed in other research (e.g., Bull et al., 2016).

Regarding calculation-related challenges, participants were initially hesitant about ESA methods and outputs. Perhaps this reaction reflected their being somewhat overwhelmed by these new concepts, definitions, and gaps in understanding of economic and ecosystem processes. However, the participants were more comfortable with ESA after the workshops and webinars. This finding stems from workshop evaluation survey responses to questions about these concepts and focus group data indicating participants were able to discuss the topics more readily and provide more substantive descriptive examples at later points in the project.

Regarding communication-related challenges, it is well-acknowledged that non-practitioners typically have an automatic mental connection of ESA with money, which is not always the case. This strong perceptual association is known to persist despite explanations by experts that ESV does not necessarily have to be measured in monetary terms, as there are many other potential valuations. Similarly, EIA can include certain factors other than simply dollar value dimensions of impact (e.g., it can be indirect in the form of numbers of people displaced by a flooding event). Various scholars and practitioners have advocated for considering economic impacts and ecosystem services more holistically. For example, Bekessy et al. (2018) caution against uncritical use of ecosystem services to frame communication about conservation issues, in part because the contrast between the economic message and individual emotional connection to nature may be perceived as contradictory. A holistic approach to ESA could complement situated approaches to environmental communication that recognize the key role of place attachment for coastal communities (Jarreau et al., 2017).

To address these issues, our project team realized it was beneficial to adopt a broader conceptualization of economic impacts and ecosystem services, which had communication implications. Thus, we recommend, and have used throughout this paper, the term "ecosystem services assessment" (ESA) to recognize the integrated human (or built) and natural ecosystem and the holistic benefits provided by and to both. We believe that a simplifying change in terminology to ESA for reflecting the overall concepts of economic impacts and ecosystem services is more encompassing, accurate, and understandable by stakeholders. ESA is developed as a mutual vocabulary that takes an explicitly deliberative approach among researchers and stakeholders, as suggested by Raymond et al. (2013) and Moon et al. (2020).

Another important point is that ESA challenges emerged in this project not only in interactions with stakeholders but also internally within the team. For example, one conceptualization-related hurdle the team encountered was distinguishing economic impacts from ecosystem services impacts of flooding. In addition, team members struggled with the same challenge noted with stakeholders in thinking economic impacts were dollar values only. Another and more communication-related obstacle, involved inconsistent use of terminology (e.g., "economic impact assessment" vs. "economic impact analysis" and "ecosystem services valuation" vs. "ecosystem services evaluation") during various project activities. This obstacle may not be surprising, as just the term "ecosystem services" itself has a history of being troublesome and plagued with an array of definitions, interpretations, and applications (Munns et al., 2015). The terminology has also had trouble bridging the research to operations divide (Beaumont et al., 2017). However, "ecosystem services" does consider the benefits that humans receive from a well-functioning natural system and by accounting for those benefits encourages protection and enhancement of the natural environment (Daily, 1997). Thus, we advise that those involved in future related transdisciplinary research are careful and consistent in terminology and language across all project activities and throughout the project duration.

There are a number of future research opportunities for improving ESA-oriented science and outreach. In particular, more studies are needed to provide empirically-grounded guidance on best practices for developing useful ESA data and outputs in diverse contexts with engaged stakeholders. Studies specifically examining effectiveness of different ways of communicating ESA results with various stakeholder groups to benefit the complex integrated natural and human system are also crucial. Further investigations using qualitative social science methods are especially encouraged. We believe our study's findings and lessons learned have implications that can be useful for planning such efforts (e.g., careful attention to wording concepts in interview guides, allocating time for moderator debriefing). Importantly, researchers must have a legitimate willingness to adapt their ESA calculation and communication methods to meet the needs of non-academic stakeholders, as articulated through mutual conversation.

In sum, the obstacles encountered within the project team and while engaging with stakeholders regarding economic impacts and ecosystem services related to NNBFs resulted in recognizing the utility of ESA terminology. The interdisciplinary team solidified their understandings and applications of the concepts and methods and the stakeholder participants became more comfortable discussing ESA topics and better able to provide more substantive input and descriptive examples. We believe this success was due to a combination of factors including experienced project management; team commitment, reflection, openness, and flexibility; strong relationships with project partners and stakeholders; two-way communication; and mutual respect. Project commitment stemmed from recognition by all involved of the importance of ESA for building coastal resiliency and the need to better understand and incorporate the information into planning for present conditions and future changes from interrelated natural and anthropogenic influences.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

All study procedures involving human participants were reviewed and approved by the first author's Institutional Review Board. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DD planned and led the research design and performed data collection, analysis, and writing of the manuscript in close collaboration with SS. SH conceived and supervised the overall project, provided important intellectual content, and assisted with data analysis, manuscript preparation, and editing. DY helped with data analysis and provided ESA-related content and editing. RC oversaw broader stakeholder engagement and participant recruitment and editing. All authors contributed to the article and approved the submitted version.

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