United States Department of the Interior

U.S. GEOLOGICAL SURVEY

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Margo Schulze-Haugen
Director, National Centers for Coastal Ocean Science
National Oceanic and Atmospheric Administration
1305 East West Highway
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Dear Margo-

Please find below a brief summary of our review of NCCOS' Coastal Change Program, and the individual panelist reports. We all express our thanks for the opportunity to participate in this review, and look forward to continued high-impact contributions from this program. Please let me know if you have any questions.

Sincerely,

Neil Ganju
Research Oceanographer
U.S. Geological Survey

GENERAL SUMMARY OF PANEL REVIEWS AND RECURRING THEMES

Presentation format

- A more detailed presentation of spending across all portfolios would be helpful, including examples from individual projects, both internal and external. Attempting to represent facilities and overhead costs (based on a percentage of overall labor) would also be useful
- Closed sessions with other federal partners, stakeholders, and externally funded scientists would enable panelists to solicit frank responses regarding program strengths and potential areas for improvement

Internal social science portfolio

- There was a broad consensus among panelists that the focus on vulnerability assessments, while valuable to some stakeholders, could 1) transition to more innovative research, 2) partner with other disciplines within NCCOS, and 3) integrate better with the other portfolios

Internal resilience portfolio

- The high-quality, local research on beneficial sediment re-use, living shorelines, and nature-based solutions would be higher impact if, in the future with increased funding, projects can be spatially expanded and results can be shared more broadly across the field of practice
- Communicating the possibilities and limitations of nature-based solutions will be an important role for the internal science and communications team, as increased restoration funding will be directed to numerous projects nationally

External resilience portfolio

- The quality and performance of the ESLR program was noted by all panelists, however all panelists recognized a tendency for "stove-piping" of certain scientific approaches that is not intentional, but perhaps a result of narrowly focused funding calls. Broadening the pool of grantees and supporting projects with a more exploratory nature might benefit the scientific community more widely

Partnerships

- With an influx of coastal resilience funding, there may be opportunities to build partnerships with other federal agencies with a focus on wetlands and coasts

Capacity building

- The service delivery/communications team (currently one full time employee) plays a vital and valuable role in the overall mission, and expanding that team to develop more public-facing resources will benefit the program and the wider community
- The program would benefit from a dedicated position that integrates internal and external projects, where possible, to transfer knowledge and increase the value of the products to stakeholders

INDIVIDUAL PANEL MEMBER REVIEW #1

Quality

Findings

From reviewing the materials, presentations, and feedback from partners, it is clear that NCCOS products are of high scientific quality and value. Partners speak highly of NCCOS's work and its value to their organizations. For example, the representative from the US Army Corps of Engineers (USACE) spoke highly of NCCOS contributions to the International Guidelines on Natural and Nature-Based Features and of the value of having NCCOS as a partner on their Engineering with Nature initiative.

NCCOS products are delivered in a manner that maximizes their utility (understandable, accessible). The California resilient roads story map is a good example.

Recommendations

Recommend NCCOS produce additional products, similar to the California resilient roads story map, that make NCCOS science accessible to broader audiences.

Recommend NCCOS work with NOAA Office for Coastal Management (OCM) to further leverage the Digital Coast platform to share findings from NCCOS projects and to showcase local work that has national applicability.

Relevance

Findings

NCCOS products are well aligned with NOAA and NCCOS mandates and priorities. The new NCCOS Strategic Plan seems to set a good process for focusing resources on priority areas.

NCCOS products are used to inform decision-making. For instance, NCCOS developed habitat maps to guide coral restoration efforts after Hurricanes Irma and Maria. As another example, the town of Oxford, MD used the vulnerability assessment developed by the NCCOS social science team to apply for grant funding. As a third example, NCCOS analysis and field data collection at USACE Engineering with Nature sites informed USACE thin layer permitting requirements.

On the question of research areas that should or should not be pursued based on relevance to societal needs and NOAA priorities, please see recommendations below.

Recommendations

Recommend social science unit shift focus away from vulnerability assessments. Vulnerability assessments are a firmly established practice at this point and not innovative research. A number of tools have already been developed to guide communities in conducting vulnerability assessments. Examples include the Steps to Resilience in NOAA's US Climate Resilience Toolkit and the Climate Mapping for Resilience and Adaptation (CMRA) tool, which was developed to help communities conduct a quick assessment to see where they should focus climate adaptation efforts when applying for federal funding under the Infrastructure Investment and Jobs Act (IIJA).

Recommend that the social science unit instead focus on analyzing actions to reduce vulnerabilities. Climate adaptation actions often involve trade-offs regarding who is protected and require balancing differing values and perspectives of groups within communities. Social scientists are well positioned to

tackle these difficult issues, working closely with engineers and physical scientists who can answer questions such as probabilities of flooding and structural damage.

Recommend social science unit better integrate with the other disciplines within NCCOS internal research so as to add strong social science component to interdisciplinary projects with ecologists, engineers, modelers, etc.

Recommend that NCCOS internal and external science focus on providing research to state and local governments that gives them the information they need to wisely spend the current influx of federal funding for climate change adaptation, including funds from IIJA and the Inflation Reduction Act (IRA). The NCCOS Effects of Sea Level Rise (ESLR) program collaboration with FEMA's Building Resilience Infrastructure and Communities (BRIC) program and NOAA's National Coastal Resilience Fund (NCRF) are good examples. Additional efforts from both NCCOS internal and external science programs could positively influence the effectiveness of many billions of dollars of investment in coastal resilience. One major opportunity is for NCCOS to provide analysis to transportation agencies that they need for developing projects to improve transportation resilience to climate change impacts using the funding provided by the PROTECT program. This new US Department of Transportation (DOT) program provides $7.3 billion in formula funding and $1.4 billion in discretionary funding over five years for improving the resilience of highways, ports, transit, and rail to climate change impacts. Nature-based solutions are eligible. There are opportunities for NCCOS to partner and provide analysis of feasibility of nature-based solutions to simultaneously protect roadways and restore ecological functions. NCCOS is well situated given the ability to build off the existing ESLR work with US DOT and the Climate Smart Transportation partnership.

Performance

Findings

Given the descriptions of the projects, the NCCOS Coastal Change program appears to be operating effectively and efficiently within a modest budget of in FY21, $4 million for external research and under $1.5 million for internal research.[1]

The coastal change portfolio is a small portion of the total NCCOS budget, which is approximately $70 million per year currently. NCCOS indicated that while interest in the coastal change portfolio is growing, it is difficult to expand the program substantially given congressional mandates to spend 60 percent of funding on harmful algal blooms. The FY 23 Senate Mark encourages work on resilience, however.

NCCOS has cultivated relationships with partners to increase the impact of NCCOS work. Partnerships include those with state level Sea Grant programs, US Army Corps of Engineers, the Environmental Protection Agency (EPA), NOAA Office for Coastal Management (OCM), and National Estuarine Research Reserves (NERRs). ELSR's partnership with US Department of Transportation is yielding high quality research with interdisciplinary teams and joint funding and management of projects. The projects are using coupled models to analyze coastal hazards, damage to roadways and opportunities for nature-based solutions to reduce impacts.

[1] External research funding is from Figure 2 of Briefing Book and includes all expenses related to the external research project (salaries of scientists, supplies, field research, contracts, facilities, overhead). Internal research funding is from Figure 3 of Briefing Book and includes salaries of scientists, supplies, field research, and contracts but not facilities and overhead.

NCCOS provided a list of milestones per year which was helpful in indicating program accomplishments. NCCOS did not provide performance measures to reviewers, making it difficult to fully gauge program effectiveness. NCCOS did provide data that they worked on 52 coastal change projects during the review period and produced 118 publications.

Recommendations

Recommend NCCOS either establish performance metrics for the Coastal Change Program or show how the Coastal Change Program is contributing to existing NCCOS performance metrics.

It would be helpful for both review purposes and management purposes to have a sense of total spending on the different portfolios. Defining internal science funding as only contracts, supplies, and field research, without including the largest investments (salaries of scientists, laboratory facilities, overhead) skews perceptions of what is actually being spent. While it is true it is difficult to allocate facilities and overhead spending by portfolio, it could be done by allocating percentages based on percent labor for each of the portfolios.

For efficiency purposes, recommend social science unit not focus on surveys since it is cumbersome to get OMB approval under Paperwork Reduction Act. Instead, recommend NCCOS rely on partners, such as associations, to conduct surveys.

NCCOS did not receive significant funding under IIJA. IRA spend plans are still being developed and it is not known how much funding NCCOS may receive. If NCCOS does receive additional funding, even if it is not part of annual appropriations, recommend increasing hiring in order to bring on additional expertise and staffing needed to fulfill coastal change portfolio goals. NCCOS may wish to consider approaches used by other federal agencies, such as USDOT, which has increased hiring even without a guarantee that funding will continue. Even if funding increases are not permanent, agencies can still hire while funding is available, knowing that over the next few years some staff will retire and others will move on. This facilitates work on priority areas and helps in succession planning. A downside to term employment is that it is harder to recruit talent. NCCOS staff mentioned that they do not have internal scientists with expertise on beaches and dunes. Recommend hiring staff with expertise in beaches and dunes, given their importance to coastal change.

Recommend changes to the ESLR program to allow explicit eligibility for state and local decisionmakers to receive project funding that would enable them to be a more integral part of the project team and to participate more extensively in projects. For instance, ability of state DOT staff to charge their time to Federal Highway Administration (FHWA) resilience pilot projects was cited as very helpful for more in-depth participation.

Review Process Recommendations

I very much appreciated the well-organized review that provided a great deal of interesting and helpful information. I enjoyed learning more about NCCOS. Participating in the review sparked ideas for future collaboration between my organization and NCCOS.

Recommend reviewing the recently updated NOAA Office of Oceanic and Atmospheric Research (OAR) Evaluation Guide for processes or techniques that could be useful to NCCOS reviews. For example, OAR asks stakeholders to fill out questionnaires providing perspectives on strengths and weakness of the lab or program. The questionnaires are shared with the reviewers but not with lab/program staff to allow for candor. Reviewers than have closed sessions with stakeholders to ask follow-up questions and dig

deeper. The NCCOS partner sessions did not offer opportunities for in-depth engagement between the reviewers and stakeholders or much opportunity for discussion of areas for improvement.

Recommend including explicit reference to diversity, workforce, and management under the performance criterion, as that criterion is focused on program execution, and these are important aspects of program execution.

It would be helpful to hear from ELSR Management Transition Advisory Group (MTAG) members about the value of the projects in addition to hearing from the ESLR Principal Investigators.

INDIVIDUAL PANEL MEMBER REVIEW #2

Introduction

I would first like to thank NCCOS leadership for giving me the opportunity to serve on this panel. The dedication of the entire team was evident and demonstrated the high standards of federal science agencies. I benefitted greatly from participating in the panel and learned a great deal about how successful partnerships are created and maintained between federal agencies, stakeholders, and communities.

For reference, my background is in estuarine science, with a focus on observational, remote sensing, and numerical methods for understanding geomorphic evolution, ecosystem function, and water quality. I am very familiar with the approaches and state-of-the science with regards to the internal resilience and external competitive grant programs, perhaps slightly less so with regards to the internal social science portfolio.

I have divided the review by those three portfolios, with a brief overview of my general impressions, then specific comments regarding the quality, relevance, and performance of the projects. Lastly I suggest some areas for improvement aimed to maximize the impact of the science. It is also important to note that the new strategic plan for better integration between the portfolios likely addresses most of the comments aimed at optimizing approaches.

Internal resilience portfolio

Overview

The internal resilience portfolio largely consists of interdisciplinary studies of coral reefs, salt marshes, coastal resilience, and high-quality communication tools. The team that presented the material did an excellent job providing high-level background as well as detailed descriptions of specific studies. I felt the overall delivery of this portfolio was spot-on.

Quality

The overall quality of the entire internal resilience portfolio is evident from the number of peer-reviewed articles, technical memorandums, and visualization/outreach materials delivered to partners and stakeholders. These notes are intended to encourage continued work along these lines and suggest changes that will improve the quality incrementally.

The internal resilience work on coral reef resilience and restoration is of exceedingly high quality. The combination of on-the-ground reef assessments, partnerships with modeling groups, and valuation of ecosystem services represents a robust approach that provides an excellent framework for coastal resilience work more broadly. Despite the relative recency of some of this work, the quality is high likely because of the broad partnerships made with other federal agencies, academic groups, and NGOs. The participation in the Coral Reef Consortium and Mission:IR ensures that the work is not being performed in an echo chamber (see related comments later) and leverages the best work being performed globally. The visualization tools used to guide recovery and restoration are similarly of high quality.

The internal resilience work on salt marshes is also of high quality given the state of marsh restoration science, but perhaps suffers from limited spatial scope and partnerships. This is partly due to actual

staffing limitations and feasibility of larger scale studies in collaboration with the multitude of groups performing such work. The impact of such limitations is that larger scale decisions, such as guidance documents for shoreline stabilization and sediment re-use, are based on limited field studies instead of broader findings from larger collaborative groups. There are some effective partnership strategies being deployed in the corals work that could be duplicated with salt marsh resilience, thereby increasing the quality of the work.

Relevance

The relevance of the entire internal resilience portfolio has never been higher. The increasing threats in the coastal zone coupled with increased investments in coastal resilience make this work of prime importance. Specifically, the post-hurricane work on coral reef recovery and restoration optimization were striking examples of connecting intensive basic science with practical application. On the marsh landscape, the future investments of agencies such as USACE in sediment re-use must be guided by quality science, and the past and ongoing efforts in marsh restoration are widely needed. There is a huge gap between planning, implementation, and monitoring in this space and NOAA can play a central role with the right investments in people and partnerships.

Performance

In general, performance of projects completed in a 5 year window is difficult to assess immediately thereafter. There are a few tangible examples however, including the rapid assessment of coral damage post-Hurricane Irma and the translation of complex model outputs for application in restoration and implementation of nature-based solutions.

Recommendations

The coral reef work seems to have the strongest connections with other agencies, the salt marsh work could use a similar model. For example, the Interagency Coastal Wetland Work Group appears to have some NOAA representation but largely misses the mark with regards to restoration approaches and foundational science. The internal resilience team could make a large contribution to this group and encourage collaboration across regions and practitioners. I also encourage the team to explore opportunities to properly communicate the role of NBS in coastal resilience with a focus on practicality and expectations, i.e. a living shoreline will not protect an area from SLR. There is a substantial amount of general misunderstanding on what NBS can and can't do, and this team could encourage some realism in the general community of practice. Lastly, I also encourage some caution in promoting strategies that are not rigorously evaluated over large spatial scales. For example, extrapolating small-scale studies of living shorelines or sediment placement across entire regions should be performed with extreme caution if broader studies are not considered as well.

Internal social science portfolio

Overview

The internal social science portfolio consists of projects aimed at vulnerability assessment in coastal communities, with regards to climate change. I had a difficult time assessing this portfolio during the review given the format of the presentations. The presented material was essentially a broad, scripted overview, while the partner discussions did not yield much additional information. A combination of high-level content with a few specific demonstrations of methods and approaches would have given me a quicker feel for the nature of the work.

Quality

This part of the portfolio is not engaged in data creation, therefore the inherent quality must arise from the combination of data layers and associated analytical methods (e.g. principal component analysis etc). From a scientific perspective, the combination of data layers into a vulnerability assessment, while useful for under-supported coastal areas, does not represent a significant scientific contribution to the general field of social science applications in coastal zone management (if it does, that was not made clear in the review).

Relevance

The relevance of this program is inherently tied to the selection and implementation of projects. However, the mechanisms by which projects are selected appeared clear at some points, but vague at others. For example, it was suggested that projects are typically undertaken in areas with a town planner, but insufficient resources to gather data layers. However it wasn't clear if there was some established set of criteria or a rubric to guide selection. Partners reported that initiation of projects arose from being approached by project scientists. While that is certainly an effective method of project initiation, it does not appear to be a robust method for guiding federal investments in social science for coastal vulnerability.

Performance

From strictly a deliverables perspective, the performance of the selected projects was satisfactory, as evidenced by delivery of technical memorandums and in some cases peer-reviewed articles. Ultimately the performance should be assessed more holistically by evaluating whether assessments were integrated into actual policy at the planning level. This is difficult to assess generally, and the broad recommendation of standardizing the tracking of such integration across NOAA is relevant here.

Recommendations

Scientifically, I am not qualified to assess the approaches of the team and whether the quality is up to the state-of-the-science regarding social science and vulnerability assessments. My most useful recommendation would be to better integrate the social science team with the internal resilience team (e.g. aligning restoration projects with local stakeholder planning and vulnerability assessments) and with the stakeholder engagement portions of the ESLR projects. It appears that these groups are operating in isolation but would benefit from some formalized collaboration either geographically or methodologically.

External Competitive Research portfolio (ESLR)

Overview

I have served on multiple ELSR panels over the years, and therefore I am most qualified to comment on this portfolio. I appreciate the focused efforts of the program managers to ensure the quality, relevance, and performance of the funded projects over many cycles. There has clearly been a strong effort to balance scientific rigor with applicability and relevance to stakeholders, which is a great model for other

federal agencies aiming to support internal science that responds to practical needs. The presentation of this portfolio would have benefitted from some details on how projects were selected, with perhaps specific examples of successful and unsuccessful Letters of Intent and proposals, and examples of projects with clear returns vs. those with perhaps less clear returns. This would be valuable information because the ESLR approach is distinct from the approach of NSF, for example. NSF basically funds a broad array of projects, which may or may not hit a variety of targets. ELSR is funding a specific array of projects with a relatively narrow set of targets (i.e. relevance to stakeholders more so than advancing basic process understanding). Now that the program is slightly more mature, it could perhaps broaden the set of targets somewhat. I have recommendations along these lines below.

Quality

The overall quality and relevance of the projects funded through the ESLR program is exceptional. Several of the projects delivered both fundamental and applied results of broad impact to stakeholders and the wider scientific community. I do need to highlight some threats to the quality in order to provide some useful guidance for the future. Mainly, I would caution against the stovepiping of science funded by ESLR (especially in the realm of marsh modeling). There were many allusions to the "novel" science being performed within some ESLR projects, however I would argue that many of those novel approaches are being conducted in somewhat of an echo chamber. Specifically, the coupling of coastal models is being explored across many groups, e.g. recent NSF workshops looking to advance the field of coupled biophysical modeling. Those efforts are largely separate from ESLR funded projects, and I would argue that the some of the ESLR funded modeling efforts would benefit from integrating more recent approaches. I provide some specifics in the recommendation section below.

Relevance

The breadth of the portfolio, especially the recent addition of transportation resilience, is excellent and relevant to present-day and future coastal challenges. I am very impressed with the focus on co-production and involvement of the program manager in ensuring relevance. Echoing some of the thoughts above and below however, it may be time to broaden the relevance to not just stakeholders, but also the wider scientific community, but selecting some basic foundational research projects that may not yield immediate stakeholder benefit but guide future efforts.

Performance

As noted throughout, tracking performance is difficult. From a scientific product perspective, ESLR projects are very productive in terms of peer-reviewed journal articles, but again I would caution again using this as a stand-alone metric. The impact on the broader scientific field is equally important, and there is some variability in how impactful ESLR projects are, depending on the field.

Recommendations

I am using this recommendation section to sketch out some specific and broad concerns about the projects funded by ESLR. Again, please note that the overall portfolio of projects and deliverables is impressive by any standard, but I aim to make some constructive points to improve the program even further.

Whether intentional or not, there are some philosophical disconnects between the approaches used by grantees (even the same grantee in different years). The most glaring examples are 1) the application of models that are not adequately assessed in the literature, and 2) the disparate consideration of geomorphic

principles (e.g. sediment transport) between projects. For example, in a set of projects from a single research group, over three ESLR calls, the models used neglected geomorphic change for modeling future storm surge, then modeled sediment transport when considering barrier island dynamics, then again ignored sediment transport when modeling marsh change. Conversely, another set of projects deployed a model that coupled sediment transport with dune vegetation, on the open coast, thereby accounting for bio-geomorphic processes in a way not considered by the marsh models.

This internal inconsistency is problematic for a number of reasons: it ignores basic processes that must be considered given that these models are being implemented not for basic process research, but for applied coastal management. In my opinion the bar for model robustness should be higher if results are potentially used for management. If strictly being used to explore physical processes or model physics, then the bar would actually be lower. This falls into the type of modeling supported by NSF or similar basic research RFPs. It seems counter-intuitive, but in reality the more applied the model, the more robust the model formulation and assessment should be. However in practice, the opposite seems to be the norm. Secondly, it gives the appearance that these models are being developed in isolation from other work in the larger community that provides important insight into geomorphic evolution, though the work is not focused on applications in coastal management.
Given the focus on stakeholder co-development and applications, the ELSR portfolio might benefit from broadening approaches (especially with respect to modeling) and fund research that aims to translate simpler models/metrics (e.g. from the coastal geomorphic modeling community) into applied use. Functionally this is a perfect role for both NOAA external and internal coastal science: making high-quality, basic process models and concepts transferable to coastal management. While the ESLR program is doing this quite well, broadening the portfolio might increase the overall impact without creating unnecessary risk.

INDIVIDUAL PANEL MEMBER REVIEW #3

Introduction

This document summarizes my findings as a panel member for NOAA's National Center for Coastal Ocean Science's Coastal Change Program review. Hereon in, I abbreviate the Coastal Change Research Program to "Program". The perspective I share are those of a "boundary spanning" professional who works in the space between science/data/information and on-the-ground coastal managers. I also come from two decades of working as a direct NOAA partner through the National Estuarine Research Reserve System. I enjoyed bringing my knowledge and skills to bear through my comments and recommendations. Thank you for the opportunity to serve in this role.

Review Criteria

Quality

The Program's internal fundamental research to understand ecosystems functions has resulted in science research publications, grey literature, and useful data tools. Specific projects that stood out were: (1) the living shoreline and wave energy shoreline siting tool, co-developed with The Nature Conservancy and North Carolina Permitters and, (2) the U.S.S North Carolina naval tidal data visualization. Additionally, the Program's work to inform the streamlining of state and federal policy language, for the purpose of living shoreline permitting, also speaks to the quality of the Program's work.

In the coral reef/coastal protection portfolio, the work to develop the Coastal Visualization too, the Marine Protected Area's Coral Resilience Siting tool, and the "Mission Iconic Reef" concept demonstrate the high quality work of the Program.

<u>Reviewers Recommendations:</u>

External funding

Although the external funding program has an impressive list of outcomes and outputs, it does not have grand diversity in the individuals it funds. This was acknowledged by the Program during the review, with the staff noting a need to improve ways new Principal Investigators can compete successfully in the proposal process. Suggestions regarding addressing these educational needs for reaching new perspective externally funded science teams are addressed elsewhere in the document. Additionally, it will be important to clearly explain how the opportunities for the Ecological Effects of Sea Level Rise technical assistance and FEMA BRIC technical assistance are the same, different, and/or complementary to the existing external funding programs. It was unclear to me in the review.

Ensure Social Science Team Defines Their Value-add in the Role of Vulnerability Assessments

The Social Science Team shared valuable, user-driven vulnerability assessment projects, co-produced with local communities. While there is tremendous value-added by having social scientist lead this type of work, vulnerability assessments are also done by many consultants. By defining the social science's added value, beyond the typical vulnerability assessment process, their work on vulnerability assessment can set them apart from other service providers and consultants.

Inform Others About Your Success and What You Have Learned

The Program presented many successes and transferable project outcomes, outputs, and lessons. Sharing this stellar work not only benefits the Program, but it helps other agencies, organizations, and programs

learn from the accomplished efforts. Transferability is an indicator of relevance and success. Suggestions regarding amplification of NCCOS' successful efforts include:

- *Partnering with NOAA's Digital Coast* – The Digital Coast platform and the Digital Coast Partnership are great avenues for elevating the knowledge regarding your work. Renewing discussions with the Digital Coast team with the aim of highlighting data sets, developed tools and approaches, and your experience with applied science use could be beneficial to the Program, the Digital Coast, and your collective audiences.
- *Develop a NOAA Service Delivery Framework Case Study* – In the past year NOAA has embraced a Service Delivery framework model. Several of the projects and products shared by the Program could provide illustrative examples of the service delivery framework in action. A conversation with NOAA's Service Delivery Team could result in gained understanding and spotlights of user informed Program products.
- *Webinars* – In this new digital age, the use of webinars to share project outcomes, lessons learned, and successes should be considered. A webinar series highlighting the work in the external and internal Program portfolios would not only educate others about what the Program is doing but could also educate new partners and potential new Principal Investigators (PI's) on the type of use inspired research undertaken and the methods employed. A similar model was hosted by NOAA's Office for Coastal Management in a webinar series highlighting NOAA-funded Regional Coastal Resilience projects.
- *Training the Next Generation of Scientists* – The Program mentioned a need to educate prospective PI's who are not currently applying comparatively for the external awards. This lack of diversity in cooperative applications has led to multiple PI's multiple cycles of continuous funding, and other proposals not being competitive. One way to address this gap is to start training graduate students and fellows in the practice of user-inspired research. While creating a new NOAA fellowship program may not be the right solution, partnering with other NOAA programs already engaging graduate fellows could be a good partnership strategy, implemented through existing professional development avenues. This includes reaching fellows in programs such as the Knauss Program, the Digital Coast Fellowship, the Coastal Management Fellowship and the NERRS Margaret A Davidson Fellowship.
- *Evaluation of Long-term Funded Projects* – While the review team heard many examples of anecdotal Program success, there was an expressed interest to evaluate the impact of the Program more purposefully, especially through long-term funded projects. The NERRS Science Collaborative External Funding program is currently also starting this same conversation, looking to better quantify the "ripple effect" of collaborative science projects funded through their program. There could synergies and efficiencies in discussing the shared desire to better evaluate the impacts of this funding. In additional to exploring a partnership with the NERRS Science Collaborative, the Program could prioritize an impacts assessment of their projects, potentially tapping into some of the internal discretionary funding available to the Program annually.

Relevance

The presented research priorities of the Program - Marine and Spatial Planning, Stressor Impacts/Mitigation, Coastal Change and Social Science - are all very highly relevant topics that lend themselves to applied science and products. The value and relevance of the leveraged partnerships are clearly demonstrated in both the internal and external science portfolios. A focus on nature based solutions, addressing questions of Why? Where?, and How? makes the outputs of this work relevant and actionable.

Examples of directly applied useful Program data and products include science input into various US Army Corps of Engineers Districts and State Natural Resources Departments. The externally funded Effects of Sea Level Rise (ESLR) projects presented by project teams spoke to the important connections between research questions and a desire to make the information useful to stakeholders. This success was cited as a role of the novel, interdisciplinary teams and the Management and Transition Advisory Groups, a required stakeholder element of all externally funded projects. As presented by one of the ESLR partners, the model of project implementation where - stakeholders provide input to shape the research, then the science teams run "models" which lead to the creation of data outputs, and then project teams have facilitated discussions about the data outputs with stakeholders to identify the data to management disconnects,
and ultimately result in the refinement of data delivery products to meet the needs of the end users - is a framework that could be represented on the ESLR website for other interested project teams to learn from.

Reviewers Recommendations:

Seek Deeper Partnerships within NOAA

As a fellow NOAA National Ocean Sciences program, NCCOS can draw from the other resources within NOAA to discover deeper collaborations for enhanced collective impact. Some specific programs within NOAA that NCCOS can seek more purposeful partnerships with include:

- *NOAA's Office for Coastal Management* - There were many examples of great Program relationships and projects with OCM's NERRS program. Continuing to find opportunities for work at NERRS sites makes sense for the benefit of both programs. Additionally, OCM's Reserves and Coastal Management Programs will be receiving restoration capacity-building funds and will have the opportunity to compete for additional restoration project funding. The experiences and knowledge these programs will have in coastal restoration, paired with the Program's knowledge from internal and external projects could be very powerful.
- *The NERRS Science Collaborative* – The NERRS Science Collaborative is another NOAA external applied science research program that focuses on funding user-defined projects. During the Program's review, a need was voiced for quantifying the impact of sustained investment in these research areas. The NERRS Science Collaborative is currently working to understand a similar question – what are the impacts and "ripple effects" of our funded projects? Reaching out to the NERRS Science Collaborative to share thinking and maybe come tother on program impact evaluation approaches would be very beneficial and timely. Additionally, the NERRS Science Collaborative has developed a training for graduate students on Collaborative Science approaches. They also have developed a Guide to Collaborative Science which could be a very valuable resource for potential NCCOS Principal Investigators. Finally, through the NEERS Science Collaborative a Resilience Metrics Toolkit was developed. This resource could address the need for more information about resilience metrics which was brought up by the Social Science Team. Learning more about these educational resources could be useful to the Program as they seek to expand the pool of potential successful applications to their external science Program.
- *Marine Fisheries* – The Program, and its projects, could benefit from more engagement with NOAA's National Marine Fisheries Service (NMS). Often nature-based project, in the permitting phase, are met with challenges from the NMS who have a regulatory responsibility to protect marine fish habitat. Restoration projects can challenge this mission if they seek to convert open water to marsh habitat. Coming to a common understating of these tradeoffs and seeking

opportunities for collective fishes and salt marsh habitat gains could benefit the entire nature-based solutions community.

Performance
Over the period of performance reviewed, 52 projects were completed, and 118 publications were produced. As presented to the Review Panel, increased funding for the external science program and the FY'23 Senate mark with funding noted for specific NCCOS program are strong indicators of success across all three review criteria – quality, relevance, and performance. Along with the increased funding, the growth in the number of externally funded projects overtime, is an additional indicator of program performance.

Reviewers Recommendations:
What is the program's vision for growth?
The recent and rapid growth of the Coastal Change Program was noted several times by the program staff. Growth in the program budget is a great indicator of the success and value of the program. Having a vision for the program would help ensure that growth is directed in strategic areas and works towards achieving programmatic goals. Taking time to vision a full "build-out" of the program would be valuable to the program, and others who may be looking to help you grow, by knowing where you would like to head and what needs to be done to achieve that vision.
Another noted challenge to think about within this vision is the recent issues with staff retention. Staff departures were noted several times. Understanding the levers for those decisions and how to reduce them in the future would be an important part of the overall programmatic growth and visioning process.

Building Capacity within the Program
Lack of staff capacity was a common theme. If the Program is in a funding position to add capacity, staff and/or contractor support in the following areas would help further the Program's impact:

- *Service Delivery* – There was clear success in the projects that involved service delivery. This function was touted as having great value, but only one staff member focused on the role. As this has been an area of growing success, and as NOAA embraces a new Service Delivery framework, the program could position itself as a leader in the service delivery space.
- *Integration Function* – As the Program looks to operationalize a more integrated "across teams" approach, creating a position focused on integration across the internal and external projects would help see connections that bridge focus areas and catalyze new team opportunities and shared outcomes.
- *Communications* – A position focused on internal (to NOAA), and external (beyond NOAA) communications could help spread the reach of success of the Program and transfer useful approaches and science. These communications could focus on topic areas, project successes, lessons learned, partner networking, and project outcomes and outputs. This is a model that is utilized by NOAA's Office for Coastal Management, wherein they have a communications team focused on promoting the work of the office, as well as externally funded project successes. They also help edit and polish documents, presentations, etc., freeing up project leads to focus more on the "content" and less on the "presentation". This could work to create efficiencies in team workloads as well.
- *Additional NCCOS "Hub" Locations* – The current NCCOS Hubs are achieving very successful outcomes but appear to be at capacity with their local workloads and partnership opportunities. The geographies that benefit from the current NCCOS Hubs are very fortunate for this local focus and the provided resources. As part of the "vision" for the build out of the Program, the addition

of more Hubs would allow for more success stories from an even larger geographically diverse set of locally dedicated NCCOS resources.

Program Partnerships

The Program partnerships appear very strong and seem to be at the heart of Program success. Partners for both internal and external projects displayed very close relationships with their program liaisons, even commenting on the value they found in the "high touch" nature of the program management as compared to other external funding programs. The partners the review team interacted with genuinely felt the partnership was mutually beneficial and helped meet locally relevant science and management needs.

- *New Partnerships to Explore* – The Environmental Protection Agency's (EPA) ongoing coastal wetlands work lends itself to a new federal partnership opportunity. Much like the Program's goal of understanding the science and bringing that to bear on local management needs, the EPA's coastal wetlands work seeks to understand the impact of climate change on the nation's coastal wetland habitats. Exploring the work at the EPA could result in a mutually beneficial partnership built on a common purpose.
- *Seek Strategic Partnerships with the Influx of Coastal Restoration Funding* - The nation's coastal wetlands have become a focus in the funding resources valuable through a variety of grant programs. These funds include monies under the Bipartisan Infrastructure Act, the Inflation Reduction Act, the National Fish and Wildlife Foundation's Coastal Resilience fund, and their America the Beautiful funding. Tracking the projects, partners, and target restoration goals of the projects funded under these programs, could lead to new and potentially unique partnerships for the Program, not to mention lessons learned and new ideas for future science-informed coastal management. Additionally, through Bipartisan Infrastructure Funding designated for NOAA's OCM, all National Estuarine Research Reserves and Coastal Management Program are set to receive non-competitive capacity building and competitive project funding over the next 5-years. The Program could build on its existing relationship with these "on the ground" programs, seeking ways to learn from this focused work and use it to catalyze additional work through the Program.

The Program's New Strategic Plan/Process

The Program outlined several new programmatic strategies. Some thoughts regarding these new projects and proposed approaches:

- An exciting, proposed project, with deep and highly relevant value, is the proposed census of federally funded nature-based solution projects. It will be great (nationally, regionally, and locally) to have a database of these types of projects.
- As the Program seeks to integrate across program areas, it is important to keep in mind that not everything needs to be integrated all the time. An intentional look at what projects would benefit from (and which project won't benefit from integration) would save project teams from unnecessary frustration.
- Relative to integrated projects, identifying an "early win" integrated project that draws from the internal science team's most relevant experience, could demonstrate the benefits of an integrated approach while keeping teams within content focal areas where they feel most familiar.
- During the review we heard numerous success stories involving specific individual staff and their partnerships. These "human" assets have been key to program success. As the new strategic approach is implemented, investing in specific programmatic areas, while honoring the current assets the Program has in their staff and existing relationships, will result in extended programmatic success, beyond the life of individual staff and partnerships.

- Finally, as the Program strives for an "holistic coastal planning" approach in FY'22 – '26, not only does this recognize a need for thinking about all parts of the coast as integrated, but it leans on the Program to think of their individual teams as part of an integrated unit. This is opposed to current "feel" of the program whereas the separate parts of the Program operate relatively independently.

INDIVIDUAL PANEL MEMBER REVIEW #4

Quality

Question 1: *How would you characterize the scientific quality of the findings and products generated by the Coastal Change Program?*

Response: The scientific quality of the findings and products generated by the Coastal Change Program is very high. The internal scientific staff are highly qualified as evidenced by their bios, and routinely publish results of studies in the peer-reviewed literature and present findings at scientific conferences, providing the opportunity for additional review and learning. A number of the publications authored by staff include expert academic coauthors, and some of the publications are published in journals with impact factors greater than four.

The Effects of Sea Level Rise Program (ESLR) has an impressively long list of peer-reviewed publications developed from funded projects. This demonstrates the robust and cutting edge science that is being produced from this program, that is also developed to be actionable. This provides leading, high quality science in a framework that informs management decisions.

Question 2: *Describe the value of the research provided to the scientific community, including resource managers, by the Coastal Change Program, and how can the Program enhance this value further?*

Response: The NOAA Coastal Change Program effectively integrates management needs and stakeholder engagement to produce relevant and actionable science and tools. By producing and facilitating decision-relevant science, the Coastal Change Program provides ecosystem and community resilience solutions that reduce uncertainties in management decisions. Finding solutions that are sustainable in the face of coastal change are critical to effective management and continued environmental and economic productivity of coastal regions.

One of the focus areas of the internal social science team has been on vulnerability assessments, which provided products that informed adaptation planning in communities such as Los Angeles CA and Oxford MD. Building a proposed framework for vulnerability assessment that includes multiple disciplines and data (such as biophysical) would be valuable, but would require significant resources to acquire the input of experts in various natural processes areas. It would be beneficial to produce indicators that are broader scale to provide a product that is more transferable to other regions. It is unclear that this is possible since the work of vulnerability assessments being very place based. The bridge from vulnerability assessment to implementation by decision makers is an area where a boundary organization may be helpful, and thought might be given if the Coastal Change program could effectively play this role.

The ESLR external competitive research program has been a leader in developing the vision and mechanisms to foster decision relevant science. The program pioneered incorporating managers and end users to produce highly relevant science that is used in management decisions. Initially, the program incorporated conversations with managers, followed by formal inclusion in project via Management Technical Advisory Groups. Successfully incorporating scientific findings into management decisions remains a challenge. Some of the project teams very successfully incorporated managers into the project, although there is some variability across projects. Therefore, as the program progresses, it would be helpful to review and learn from the teams what worked well and areas of improvement through a lessons learned exercise. Lessons learned can be applied to modifications or guidance in future funding calls, and as a resource for project teams. Next steps to further bridge the scientific knowledge-management action

gap should also be evaluated. For example, explicitly incorporating resource management throughout the research project process, in order to progress to production runs for planned restoration and protection projects using the models and tools developed, could further advance actionable science. There will be considerations to this approach, including the need for program staff to foster relationships between researchers and decision makers, and a potential reduction in the overall number of research proposals due to an uncommon project team structure. In future review meetings, it would be helpful to also receive input/presentations by coastal managers involved with projects. The ESLR Program staff also facilitate networking for researchers across projects, which raises awareness of research activities and limits duplication. The Program also trains an interdisciplinary workforce; outcomes would be further enhanced by fostering diverse project teams.

Increased integration across the internal and external research programs would help reduce silos and move forward more programmatically toward program goals.

Question 3: *Are scientific products delivered to the community in a manner that maximizes their utility (e.g.- timely, understandable, sufficiently detailed, and readily accessible format) and what actions would enhance their delivery?*

Response: Numerous peer-reviewed publications have been produced summarizing project results. Also, additional products such as a podcast, infographic, story map and handbook have been produced to communicate project results in additional ways to various stakeholders. A data mapping tool was also developed for SET measurements in North Carolina. The development of the Coral Restoration Monitoring Guide provides easily accessible scientific guidance to managers for coral reef restoration. A living shorelines siting tool allows evaluation of wave energy in North Carolina, which facilitated a streamlined permit approach for residential living shoreline applicants.

The development through the ESLR program of process-based models for coastal dynamics has been a timely development to improve the accuracy of project and future conditions, especially in the Gulf of Mexico region where many restoration planning decisions are being made. The program has projects that span coastal regions nationally, covers a wide range of relevant topics, and funds interdisciplinary teams which provide novel tools that consider multiple drivers for management.

The Complementary Products and Service Delivery is a very successful model to increase relevance and use of scientific products by decision makers. The review panel benefited firsthand from the work of this team, with a web application that was very informative. Increasing accessibility and relevance of projects requires a special skillset that the Coastal Change program staff bring to the table. Additional communications of the uncertainties of model outputs would also be beneficial. For decision makers, there is value in doing side-by-side comparisons of models, to have a better understanding of the roles of each of the models as tools in the toolbox. Also better understanding the differences in the models, what models to use for what purposes, and uncertainties. The Complementary Products and Service Delivery team has successfully contributed to and facilitated these types of discussions based on results from ESLR projects, and increased efforts in this area would increase the use of project outputs, and improve management. The Complementary Products and Service Delivery team seems a very valuable area for increased staffing and expansion.

Relevance

Question 4: *How and to what extent are products aligned with NOAA, NCCOS legislative mandates and priorities, and what actions would improve this alignment?*

Response: With a focus in 2017-2021 on Vulnerability and Risk Assessment, Natural and Nature-Based Features (NNBF), Climate Impacts on Ecosystems, and Restoration, the Coastal Change Program addressed some key uncertainties in how to best implement NNBF, methods to assess changes in coastal ecosystems, guidelines for ecosystem restoration, and assessment of ecosystem and community resilience.

The 2022-2026 NCCOS Strategic Plan positions the Coastal Change Program for increased leadership by building on past results with an update to the priorities to reflect a more integrated and holistic approach that targets scientific questions to facilitate resilience and adaptation. This is in alignment with NOAA and NCCOS priorities, and important with funding streams becoming available for the implementation of infrastructure and restoration projects impacting coastal systems.

Question 5: *To what extent do those beyond the scientific community, including resource managers, use findings and products generated by Coastal Change Program projects to inform decision-making, improve preparedness, management and/or response to events and issues handled by other Federal, local, state, tribal, and regional governments?*

Response, Internal Science: Fundamental research being undertaken by the internal science team on the response of wetlands to environmental conditions and stressors is critical to the management need of accurately predicting wetland building potential for coastal planning.

Quantifying the variation in carbon burial rates is important to developing accurate predictions of sequestration potential and comprehensive ecosystem benefits in regional, state, and national coastal protection and resilience planning efforts.

Developing methods to effectively use Unmanned Aircraft System imagery supports a growing management need to fill data gaps, improve data quality, reduce assessment and monitoring costs, understand system function, and provide new or improved techniques for assessing restoration projects.

Living shorelines work includes design and siting, monitoring for assessment of project success, policy development, and outreach. A long-term monitoring record (since 2003) allowed assessment of paired natural and sill-based living shorelines.

Work assessing the fine-scale hydrodynamics of reefs, and alterations from restoration efforts is valuable for quantifying restoration benefits.

The evaluation of nature-based solutions in partnership with USACE provide guidance for application of thin layer beneficial use.

Response, External Science:

Question 6: *Are there research gaps that should/should not be pursued and if so, why?*

Many coastal changes occur due to event-based drivers. Therefore, it is a significant achievement that the ESLR program has developed a way to get event-based funding incorporated into the program. Consideration should be given to broadly communicating event-based funding to ensure transparency.

Numerous research gaps existing in both the restoration and NNBF priorities for the Coastal Change Program. The Beneficial Use efforts have provided valuable results and tools, but due to limitations in funding and staff, results are on a regional scale. To scale up this work, a metric could be developed to prioritize Beneficial Use efforts on a national scale, by evaluating how much dredging happens in a state or region, how much of that sediment is being beneficially used, and the trajectory of sediment being used

beneficially. This would enable targeting specific areas to build capacity, and align the work more closely with the USACE goal of 70% of beneficial use of dredged sediments by 2030.

The 2022-2026 NCCOS Strategic Plan integrates Beneficial Use into nature based solutions (NBS). The focus on assessment and forecasting how NBS will meet goals is a critical area, as multiple projects are being implemented on the landscape in coastal states. Implementation of policies around NBS is also an important area to address. Assessment and forecasting of these project types is being grappled with in some coastal states, and the work of the Coastal Change Program on regional and national-scale assessment and forecasting would benefit the evaluation and adaptive management of these innovative projects. Communication around this topic is also important, and developing materials to facilitate communication and the uncertainties for the assessment and prediction of these restoration projects is critical. Overlain on natural coastal changes processes, anthropogenic infrastructure, processes, and projects now dominate coastal areas in most places. Characterizing and communicating the effects of NBS on coastal processes and evolution is also a gap relevant to decision making.

The evaluation and restoration design of coral reefs seems to be a niche area that is a good fit for NOAA, and the Coastal Change Program is a recognized leader. Assessment of reefs status would be important to any future Natural Resources Damage Assessments as well as evaluating restoration performance.

The ESLR program has been very effective in filling process-based predictive capabilities, and improving understanding of sea level rise effects on coastal systems. With sea level rise predicted to radically change coastal areas in the 21st century, continued research and synthesis in this area is relevant to management decisions. Understanding coupled natural and human systems, and developing modeling capabilities is still a developing area, that might be a good fit for future research.

Question 7: *How effectively does the Coastal Change Program utilize funded collaboration and external partnerships to achieve desired program outcomes, increase overall return on investment, and strengthen the impact of our science?*

Response: With stellar staff, extensive partnerships, and highly productive multidisciplinary external research projects, the program performance is very high.

This relatively small internal team of seven staff undertake a wide variety of projects to increase understanding of wetland and coral reef dynamics, and address implementation of NNBF, and restoration. The team is adept at leveraging partnerships demonstrated by multi-department and organizational teams. A number of the projects and partnerships appear to be place-based around NOAA offices, such as in North Carolina. This is understandable due to the limited staff and budget, however going forward expanding some of the program areas such as beneficial use programmatically, and better communication of how regional work informs management decisions on a national scale would be helpful.

A wide array of partners includes Federal, state, private industry, and academic for projects along the east coast. The partnership with USACE appears to be particularly effective at leveraging funding opportunities in this arena and scaling up beneficial use and NNBF.

The role ESLR program staff play as a boundary organization for linking science to management and stakeholders appears to be particularly effective in increasing the relevance and use of the research by decision makers. With researchers and academics often having limited time, dedicated program staff to ensure integration and transfer of tools and technology is very effective.

Question 8: *How well does the Coastal Change Program execute its research and related studies in an efficient and effective manner given appropriated resources?*

The Coastal Change Program has been very efficient and effective and producing high quality products. However, it is limited by both funding and staffing when considering the large-scale national needs of coastal ecosystems and communities. The leadership positions for NCCOS (Director and Deputy Director) are filled with activing staff (the Director since 2018), and it would beneficial to the program to have a near-term plan for permanently filling these positions, and staffing succession planning for positions key to achieving goals of the 2022-2026 strategy. I find it compelling that the Coastal Change Program is female led, showing a commitment to setting an example for promotion of diversity, equity, and inclusion.

The targeted call for research proposals employed by ESLR communicates specificity in research needs that is relevant to decision makers, increases efficiency of the grant application process for researchers by clearly developing priorities, and increases the relevancy of the research funded for decision making. The ESLR program has a robust and transparent request for proposals and review process, that includes reviews by experts and a panel evaluation approach. Finding ways to encourage a diverse pool of applicants, and examining evaluation criteria and metrics would help evaluate the equability of the grant program, and enhance diversity, equity and inclusion.

As the program moves into implementing the new strategic plan, it seems that there will be more opportunities for staff in the biophysical and social science divisions to work together, which will provide more integrated products.

Question 9: *How effective are the strategies that the Coastal Change Program has for identifying, establishing & maintaining relationships with stakeholders, the non-scientific community and what steps would expand and strengthen relationships and ensure they are effectively leveraged?*

Response: With a focus on partnerships, the internal Coastal Change Program team undertakes interdisciplinary research on coral reefs and coastal wetlands to provide information to models and tools used by coastal communities and decision makers.

Emphasis is correctly placed on working directly with state and federal resource managers, although with a limited budget and geographical considerations, much of the state-level work centers around where the NCOOS offices are located. Many of the very effective partnerships seems to have been developed based on personal relationships.

The partnership with the US Army Corps of Engineers (USACE) on NNBE demonstrates the value and high regard of the Coastal Resilience team in the restoration realm.

The ESLR program, with its emphasis on co-production, got regional decision makers on board through its projects, and provides output with management utility. Managing the funded projects as cooperative agreements is a great benefit to the performance of the program by developing and maintaining relationships with the researchers and managers, and keeping abreast of scientific advances. The ESLR program may also consider formalizing a process to convene researchers and managers from funded projects beyond the timeline of the project to better assess the use of science and tools developed by decision makers.

INDIVIDUAL PANEL MEMBER REVIEW #5

The NCCOS Coastal Change Program is an impressive program with many strong accomplishments and contributions over the last five years. The program has highlighted the importance of the coproduction of science, as well as the necessity of interdisciplinary teams – issues that clearly are essential to address current coastal management issues.

I enjoyed the chance to participate in the review, as I learned a lot about the Program, NCCOS, and NOAA. I also want to highlight that the NCCOS staff made it very easy to review the program; the presentations, briefing book, and web page were all informative and extremely well organized. The discussion throughout the three days of meeting was very open and provided valuable insights into the Coastal Change Program.

Overall, the Coastal Change Program is very successful, and my comments below are intended as suggestions for further improving a very strong program.

Quality

1. How would you characterize the scientific quality of the findings and products generated by the Coastal Change Program?

2. Describe the value of the research provided to the scientific community, including resource managers, by the Coastal Change Program, and how can the Program enhance this value further?

3. Are scientific products delivered to the community in a manner that maximizes their utility (e.g.- timely, understandable, sufficiently detailed, and readily accessible format) and what actions would enhance their delivery?

The Coastal Change Program has made valuable contributions over the last five years, with a mix of projects across important areas of research and management needs, as well products geared for different audiences. The output of individual projects has been somewhat mixed in terms of quantity and quality (as measured by peer-reviewed publications) – with a small number of projects producing a very large number of publications and others producing just 1 or 2. This variability is somewhat to be expected, and overall most of the projects have produced both academic publications and valuable management products. It is valuable to continue to push projects to provide mixed output, as outreach to both other researchers and to the management community is needed.

The research provided by the Coastal Change Program is clearly valued. The evidence from the Partner Conversations from all three components of the program (ESLR, Coastal Resilience, and Social Science Teams) showed very strong and enthusiastic support for the Program, from state and federal agency staff, and other researchers and stakeholders. It is somewhat difficult to evaluate the context of this support since understandably everyone who presented as part of the Partner Conversations had strong connections to the program, but the enthusiasm for the program was very strong.

The Program has been very mindful of value the co-production of science and of interdisciplinary teams, as well as the importance of integration across different types of models. These are highlighted as areas of achievement for the ESLR Program. These approaches are valuable and appear to be working very well; they should be continued, including the early formation and incorporation of advisory teams to guide research projects. Interdisciplinary teams appear to be more effective for the outside funded work than for some of the internal research within the Coastal Change Program. Similar approaches and emphases on interdisciplinarity should be incorporated into the internal efforts of the Program.

It was acknowledged that development of strong interdisciplinary teams, including connection with advisory teams takes substantial upfront effort and that only a small subset of proposals that are received excel in these areas. Given the importance of these components to successful projects, it may be useful to consider how to provide guidance and cultivate these approaches in order to expand the breadth of successful future proposals. This would expand the horizon of future efforts and also send a clear message to future proposal writers regarding the importance of co-production, as well as integrated, multi-disciplinary projects.

The internal research efforts of the Program are highly valued where they have been undertaken, but national awareness and impact of the internal efforts could be strengthened. I was very impressed with what has been accomplished by the limited staff on corals, tidal marshes, and other efforts by the internal science and resiliency staff; however, these are limited geographically. While I realize that complete coverage across the country is not possible with the limited staff that is available, I would recommend that you more clearly identify broader benefits of the regional work that is done by making it relevant and available more broadly (including raising awareness of the internal work that is being done). In addition, with future funding and positions, it will be important to identify how you can strategically build on the existing successes to reach a broader national audience with the internal program. One example of the unequal geographic footprint of the internal program was that all of the panel members of the Coastal Resilience Partner Conversation came from the southeast rather than with a more national perspective. Similarly, the development of strong state partnerships is an outstanding way to leverage the work of the Coastal Change Program (both the internal and external components), but it seems like this has been limited geographically. Consideration of how to promote state partnerships more broadly could substantially expand the impact of the Program's work. In addition, the physical footprint of the Program's facilities and labs are limited geographically. Of course, this is the most challenging to expand spatially, but overall consideration of the geographic impact of the Program's internal efforts across the country would improve the effectiveness of the Program.

The internal social science work is also effective where it has been completed, but this seems even more localized than the work of the internal coastal resiliency team. I very much appreciate the focus of staff on helping local communities, but this seems narrowly focused for a federal agency. It would be useful to evaluate how to get more national effectiveness out of the limited staff. The prioritization that was laid out for how projects are being chosen was informative, and indicates that the team is moving in a good direction in weighing where to focus future efforts. I encourage the team to consider national impact of their work to ensure that the team has maximal effect that is relevant to a broad national audience. I initially thought that the development of tools or evaluation of approaches would be more useful to a broad audience of communities across the country; however, staff indicated that national tools are not what communities are asking for. This is not at all my area of expertise, but it seems like some additional consideration of priorities is needed for this group to maximize relevance and benefits on a national scale. If working with individual communities is what is determined to be of highest value, then some follow-up work to ensure that other communities are aware of lessons from these case studies would be useful to ensure that there are wide-reaching, national benefits.

As above, the work that is being done by the Coastal Change Program appears to be very well connected to end users. The use of advisory groups and the engagement of stakeholders early and often are both very valuable to ensure that findings are delivered in a meaningful way. In addition, we learned of the specific efforts within the Program to improve communication and outreach of individual projects. From what I have seen of projects, both outside the review as well as in the briefing book and web page, these communication efforts are very much on target. As was discussed at the meeting, staff capacity to do

further outreach and communication efforts is definitely limited. Given the importance of communication to make multiple audiences aware of the projects that the Program is working on and funding, it would seem that this is a high priority area to build additional capacity. The Program should consider future hires specifically in the area of scientific communication (with an emphasis on multiple audiences for applied work and management relevant communication). In addition the Program should provide support and incentives to improve communication work of the externally funded efforts (similar to the existing efforts to promote engagement with end users/stakeholders), so that project staff build their own communication skills and capacities. This could include Program supported trainings for PIs and other project staff on scientific communication.

Relevance

1. How and to what extent are products aligned with NOAA and NCCOS legislative mandates and priorities, and what actions would improve this alignment?

2. To what extent do those beyond the scientific community, including resource managers, use findings and products generated by Coastal Change Program projects to inform decision-making, improve preparedness, management and/or response to events and issues handled by other Federal, local, state, tribal, and regional governments?

3. Are there research gaps that should/should not be pursued and if so, why?

It appeared that there is a mix of mandates related to coastal change issues within NOAA and NCCOS, with a focus on resiliency. The four subpriorities for the Coastal Change Program (Vulnerability and Risk Assessment, Natural and Nature-based Features, Climate Impacts on Ecosystems, Restoration) seem very well connected to broader NOAA mandates. In addition, throughout the review meeting, the use of the NCCOS strategic documents from 2017-2021 and the new plan from 2022-2026 as guides for the Coastal Change Program was highlighted. This is very useful in ensuring a strategic approach to program development and alignment with broader goals.

As above, partners clearly value the work that has been done, and the Program is very aware of the need to connect with decision makers and other stakeholders. There could be stronger integration of social science and natural science projects; as well as integration of internal and external projects. It appeared that there is more integration of social science and natural science components on the external projects. Stronger integration of the social and natural science efforts within the internal projects would strengthen both components of the Coastal Change Program, and provide a more cohesive overall Program. One way to make initial steps towards improved integration would be to pick a small number of existing projects that allow staff expertise to collaborate and work together internally. And probably even more importantly, it would be very valuable to identify how you can strategically bring in new hires that will help to bridge programs and increase overall program cohesiveness.

Similarly, it would be valuable to identify how to improve connections between the internal and external efforts of the Coastal Change Program. At present, they appear to be separate efforts, despite the fact that they are both working on the same general issues. At a minimum better integration in the messaging of these two components would present a more cohesive picture of the Program's overall work, something that likely will be useful in growing support and funding for the Coastal Change Program going forward.

Finally, it may be useful to have some specific focus on synthesis efforts to identify the current state of coastal change science and management, identify priorities, etc. As specific subtopics with the Program's purview become "ripe" for synthesis, this could be an effective way to maximize integration, both across

disciplines, as well as across science and management, as it requires a mix of scientists and managers to work together to integrate past achievements and identify upcoming challenges. Within the Sacramento-San Joaquin Delta, the Delta Science Program has put a specific focus on synthesis work, with some strong benefits: https://deltacouncil.ca.gov/delta-science-program/science-synthesis.

I don't have any strong recommendations on research gaps in terms of topics. It was pointed out that dunes and beaches have not been a priority, especially for internal projects, primarily because of staff limitations – I am not advocating for address these particular systems, but if they are a Program priority, hopefully staff capacity won't constrain their prioritization. As indicated elsewhere, it also would be useful to consider geographic spread for internal projects. Other panel members recommended a move away from vulnerability analyses for the internal social science research, and this seems on target.

Performance

1. How effectively does the Coastal Change Program utilize funded collaboration and external partnerships to achieve desired program outcomes, increase overall return on investment, and strengthen the impact of our science?

2. How well does the Coastal Change Program execute its research and related studies in an efficient and effective manner given appropriated resources?

3. How effective are the strategies that the Coastal Change Program has for identifying, establishing and maintaining relationships with stakeholders and the non-scientific community, and what steps would expand and strengthen relationships and ensure they are effectively leveraged?

The Program appears to be very effective in achieving high level impact of science; as noted above, capacity issues have constrained some components of the program in the past, and it appears that the Program has the potential for some growth in support with the increasing emphasis on climate change issues and resiliency. Using the strategic plan to guide development will be valuable.

From the recent number of submitted letters of interest and proposals, there clearly is wide interest in the Program's funding support. I encourage you to continue to evaluate how best to cultivate proposals beyond the groups you've been able to fund with so far. There is definite value in narrowly focused FFO's, and this approach is likely to bring in much more effective proposals when there is a clear priority for upcoming research. But, you may want to consider mixing this up occasionally with some broader FFO's, so that you bring in a wider range of projects and PIs over time – or explore other approaches to ensure broad participation and success. Also consider offering webinars/workshops to provide guidance to new proposers on how they can develop successful proposals. It may take time to cultivate projects from outside groups, but it is critical to reach out to non-typical universities and researchers. In addition, consider how proposals are evaluated, and how to incentivize diversity and inclusion in proposal development and evaluation.

Separately, I also encourage you and other NOAA Programs to make equity issues a more explicit component of future program reviews, including review questions/topics specifically focusing on equity and diversity issues as a part of the review guidance. This would highlight the commitment to equity and inclusion, and reinforce the importance of addressing these issues.

As above, the program appears to be effective and efficient. Given the diverse range of impacts (from ecosystems to communities and more) of the Program's work, it is difficult to quantify effectiveness and return on investment, as we discussed at the meeting. One non-quantitative approach that could be valuable in highlighting the effectiveness of the Program's work is to accumulate clear and concise

summaries/stories of impact from past projects. Narratives of success can be very impactful, but this requires checking in with projects years after they are completed, as the real impact of projects may take time to develop. Some follow-up work to catalog and effectively summarize successes of past projects would be a worthwhile use of staff time, as it provides concrete examples that are valuable in highlighting effectiveness and return on investment of large-scale, complex undertakings like the Program's work.

Additional Comments

In summary, the Coastal Change Program has been very effective and has outstanding opportunities going forward to increase impact and awareness of the Program's efforts. Given the critical nature of resilience going forward, the Program can best take advantage of future opportunities by growing on its past success, and continuing to collaborate and grow the coastal change community. It will be important to continue to raise awareness of the Coastal Change Program going forward, with clear messaging regarding the past successes and current focus of the Program. Coordinating and integrating the various components of the program will help to strengthen this message. The programmatic focus of the NCCOS 2022-2026 strategic plan is a strong step in this direction.

There are many inherent constraints for the Program, but as much as possible, I encourage you to be strategic in filling future hires and designing FFO's in order maximize the following: integrating social and natural sciences, integrating internal and external work, improving equity and diversity internally and externally, addressing regional coverage, and improving communication and messaging. This will ensure that the Program is seen as an integrated, open, and national program that continues to lead on coastal change efforts.

INDIVIDUAL PANEL MEMBER REVIEW #6

Summary

I appreciated the opportunity to learn about the work NCCOS is doing to address its 2017-2021 Strategic Science Priority related to "Coastal Change: Vulnerability, Mitigation, and Restoration." The review panel was well run – from the detailed materials provided before the group convened to the thoughtful and engaging presentations delivered during our meeting. A highlight was hearing directly from and talking with the NCCOS staff, scientists, and partners. They are a smart and energetic group who clearly care about and enjoy the work they do.

Coastal change, vulnerability, and resilience priorities are advanced by largely applied science that rests on foundational research, both led by a small team of NCCOS scientists, as well as NCCOS-funded external partners. The current internal research portfolio is focused on nature-based solutions for addressing coastal hazards and building resiliency, specifically related to wetlands (Jenny Davis) and coral reefs (Shay Veihman). The work is supported by a nascent effort focused on Complementary Products and Service Delivery (Christine Buckel). A Competitive Research Program entitled Effects of Sea Level Rise (ESLR; Trevor Meckley) funds external, multi-disciplinary teams to co-develop scientific research and applied products that will help users address coastal hazards and vulnerability. Finally, the portfolio is rounded out by a developing capability in social science (Theresa Goedeke), which is not part of the review but rather was presented to provide information on current directions.

The internal and external science programs value and focus on meaningful stakeholder engagement, as well as building multi-disciplinary teams, to ensure that scientific products are relevant, useful, and accessible. The importance of these relationships was evident from both the scientists and partners and are key to the success of the program. The combination of strong scientists, thoughtful leadership, and involved partners has resulted in high quality work that is used and appreciated by local decision-makers.

Summary statements on challenges and opportunities

- Encourage leadership to think and act even more strategically on coastal change, vulnerability, and resilience. Leadership stated that they are moving towards a more programmatic approach that better defines their unique role in a massive and consequential topic. (They noted that the 2022-2026 Strategic Plan includes some of this.)
- Opportunities exist for connecting to other parts of NOAA working on similar topics.
- Explore purposeful and meaningful connections between the three topics – corals, wetlands, and social science
- Build capacity on science teams and on product delivery. This could be via connection to other parts of NOAA or potentially advocating for funding shifts to the Coastal Chang Program.
- Consider expanding focus to include other environments such as beach and dunes. This is a potential area for developing new partnership.
- NCCOS has an opportunity to help local governments and communities connect with and wisely use federal funding for building coastal resilience that will be available through BIL and IRA.

A detailed review follows. It is structured around the three review criteria – quality, relevance, and performance. Within each section I address the program components mentioned above and provide some overarching comments. I close with some suggestions for the review process as well as some notes on the developing social science portfolio.

Quality

1. **How would you characterize the scientific quality of the findings and products generated by the Coastal Change Program?**
2. **Describe the value of the research provided to the scientific community, including resource managers, by the Coastal Change Program, and how can the Program enhance this value further?**
3. **Are scientific products delivered to the community in a manner that maximizes their utility (e.g.- timely, understandable, sufficiently detailed, and readily accessible format) and what actions would enhance their delivery?**

Internal

I do not feel prepared to judge the quality of the scientific findings as I am not an expert in topics presented nor did we receive information that would help us evaluate that. However, the research teams are producing peer-reviewed scientific articles and are thus being rigorously evaluated for quality and accuracy. I encourage NCCOS to continue to support peer-review of scientific findings before the results are used in applications. We did hear examples of how the corals work is being used to inform research in other federal agencies (for example, Viehman's work with USGS). A literature review and analysis of cited references can be used to provide a more thorough and quantitative assessment of whether the research is being used and expanded up by other researchers in order to grow the fundamental understanding of the systems.

The applied products derived from internal research (coral reefs and marshes for coastal resilience) do appear to be delivered in a manner that is timely, understandable, and accessible. NCCOS understand the importance of this and is working to grow in this area. The creation of the Complementary Products and Service Delivery area of focus has allowed NCCOS to repurpose their data (from both internal and external research programs) to help communities address coastal hazards. The products are co-created with users in order to provide tools that are accessible, relevant, and understandable. The NCCOS science teams raved about the public data products created; however, one person on staff is working on this critical aspect of science delivery. Recommendation: As part of strategic planning, determine whether this capability is a priority and the level of staffing needed to implement it fully.

ESLR

The scientific quality of the work supported by the ESLR program was noted in the scientist presentation via their publication record. And those published results were then built upon by other research teams investigating similar topics. Again, continuing to support the peer-review process and publication of all results is essential for maintaining high quality research that advances both the basic science foundation as well as applications.

The products appear to be delivered in a manner that is appropriate for the users. The research teams work with the stakeholders from the start of the project, co-developing products that are needed to address the coastal questions they are facing. The MTAG (advisory group) helps ensure that the products are of the quality that is needed by users (as well as ensuring relevance and performance). Given the importance of this group in connecting science to products and the value to the research teams, NCCOS may want to consider compensating them for their time.

The ESLR program tends to fund the same project teams repeatedly. While the value of sustained funding is understood (providing time to deeply explore topics and build off previous work), there is also value in

looking beyond the usually funded group - those who are now well-versed in transdisciplinary teamwork - and bringing in other perspectives and new ways of thinking. This has the potential to increase the quality (and relevance) of the work.

Other

The panel asked several questions about the Coastal Change Program's efforts to ensure diversity, equity, inclusion, and accessibility in both the workplace and related to the scientific products delivered. NCCOS leadership is currently focused on efforts initiated and led by NOAA, such as improvements to hiring, more intentional recruitment, and improving the workplace atmosphere. They admit that they have challenges and are still learning. The ESLR program stated that it has not been focused on this topic. There is an opportunity for ESLR, with its unique ability to provide sustained support to students, to expand the group of people who are funded and help develop the next generation of scientists that is more inclusive. This could be included as a part of the ESLR review criteria.

Relevance

1. **How and to what extent are products aligned with NOAA and NCCOS legislative mandates and priorities, and what actions would improve this alignment?**
2. **To what extent do those beyond the scientific community, including resource managers, use findings and products generated by Coastal Change Program projects to inform decision-making, improve preparedness, management and/or response to events and issues handled by other Federal, local, state, tribal, and regional governments?**
3. **Are there research gaps that should/should not be pursued and if so, why?**

Alignment with NOAA Priorities and User Needs

The priorities outlined in the 'Coastal Change: Vulnerability, Mitigation, and Restoration' component of NCCOS Strategic Science Priorities for 2017-2021 are Vulnerability and Risk Assessment, Nature and Nature-based Features, Climate Impacts on Ecosystems, and Restoration, which are well aligned with broader NOAA and administration priorities. The internal coastal change research portfolio is focused on understanding the vulnerability and value of two ecosystems - coral reefs and wetlands - under a changing climate, while much of the research funded through the external program (ESLR) addresses these sub-priorities on open coast and urban environments.

The work on wetlands and coral reef environments includes fundamental research, applied research (informing policy and permitting), and outreach/communication. Fundamental research is aimed at understanding ecosystem function, response to stressors, such as storms and sea level rise, as well as developing new methods for observation, and monitoring. The applied research centers on developing products and tools to inform decision-making, improve preparedness, and guide hazard preparedness and/or response, providing critical information to other Federal, local, state, tribal, and regional governments. Examples of the use of the research include supporting litigation related to ecosystem restoration; development of guides to restoration planning, permitting and evaluation; visualization tools that inform policy and support outreach. The strongest examples were presented by two partner scientists within NOAA who work on coral reef policy and restoration. They pointed to value of specific and consistent methodologies for reef monitoring (National Coral Reef Monitoring Program) and disaster response planning (Mission Iconic Reef). The partners on the wetlands work also shared success stories where NCCOS research was used to inform state resilience plans, support USACE Engineering with Nature projects, and extrapolate beneficial use of sediment placement.

Products informed by Relationships with Stakeholders

The coastal change science teams assure relevance of products by working closely with stakeholders from early project development. Often, there are working from existing relationships which allows NCCOS scientists to shape research directions by the needs of their partners. The value in this is obvious – the results are immediately useable. However, there is also a risk that program directions are not being steered by a larger strategic plan but more organically by 'opportunities.' As a federal organization responsible for delivering information to the Nation, the program would benefit from a more coordinated approach to assessing user needs, perhaps learning from other parts of NOAA that are focused on building those relationships. This would allow research teams to go into geographically focused projects that have the potential to be scaled up or transferred to other locations.

On the internal research side, we heard about 'legacy' projects or work being undertaken because it aligned with current staff expertise who may have been hired when the project was focused on other priorities. Now is the opportunity to be more strategic about that. What have you learned from these ventures into geospatial and social science about how to better connect users to NCCOS coastal change portfolio?

The external research program also benefits greatly from an intentional focus on transdisciplinary team science that includes not just a variety of scientific disciplines but also coastal managers, engineers, city planners, policy analysts. The team is developed at the start of the project and helps ensure that the work is designed to provide scientific information decision makers needs. We learned that in project planning they think about the long-term needs and actions, or "planning beyond the life of the project." I had not heard of that philosophy before but could see it playing out in many of the projects we were introduced to. With more programmatic and strategic connections to other parts of NOAA that are working on coastal issues, there is an opportunity to share these insights more broadly with your agency.

Informing Community BIL/IRA Investments

Several scientists and partners mentioned the disconnect between federal and local organizations with respect to funding that will be made available to communities via the Bilateral Infrastructure Law (BIL) and the Inflation Reduction Act (IRA). Communities will be overwhelmed with possibility of funding for coastal resilience projects, and many will need help knowing what their options are with nature-based solutions. An opportunity exists for the NCCOS coastal change program to provide guidance based on what has been learned in the both the internal and external science projects.

Research Topics

A few research gaps were exposed. One of the more obvious was the absence of beaches and dunes from research on coastal resilience and nature-based solutions. Leadership stated that it was a 'purposeful omission' based on scale and available expertise, as they align work with expertise of current staff. However, there are opportunities to expand, potentially integrating coastal ecosystems, by partnering with other groups inside and outside of NOAA who are focused on this subject. It is recommended that NCCOS think about beaches and dunes in the development of implementation plans for 2022-2026 priorities related to coastal change.

Additional suggestions include adding geomorphology to marsh models and studies, expanding the coral work to Pacific environments, and connecting wetlands work to open coast living shorelines (a need expressed by the scientist from the NOAA restoration center who works on habitat conservation and restoration).

There may also be opportunities to strengthen research programs and applications by occasionally coordinating topically between internal projects and ESLR funded work. The multidisciplinary teams ESLR requires could address science questions within the coral or wetlands groups, helping to connect them to new groups of stakeholders and providing expertise to accelerate advances in scientific discovery.

Performance

1. **How effectively does the Coastal Change Program utilize funded collaboration and external partnerships to achieve desired program outcomes, increase overall return on investment, and strengthen the impact of our science?**
2. **How well does the Coastal Change Program execute its research and related studies in an efficient and effective manner given appropriated resources?**
3. **How effective are the strategies that the Coastal Change Program has for identifying, establishing, and maintaining relationships with stakeholders and the non-scientific community, and what steps would expand and strengthen relationships and ensure they are effectively leveraged?**

Programmatic Approach to Science Planning and Execution

Throughout the review – in the presentations and the briefing book – we saw examples of how NCCOS coastal change program was providing fundamental and applied science to address user's questions related to coastal resilience. Many of the projects were developed in collaboration with partners, aligning with the expertise and research directions of existing staff. This has result in success in delivering relevant products to user. Stories from partners revealed that much of that success is credited to the NOAA staff they are working with. For example, we heard one partner state that they were part of the 'Shay [Viehman] fan club' and another pointed to Jenny Davis and her relationship-building skills as 'the' reason for their successful partnership.

We also heard a partner mention that some of the project work is 'reactive' rather than 'proactive, programmatic or strategic.' There were several stories of partnerships developing 'organically' because of pre-existing relationship (such as a former post-doc who moved to a new agency and then maintained connections to NCCOS) or project selection based on geographic ease of access. While there is great value in those deep and steady relationships, it also reveals an opportunity for growth for the Coastal Change Program. With a more programmatic approach, NCCOS can be very intentional about building the workforce, collaborations, and partnerships that advance will its priorities for addressing coastal vulnerability and resilience nationally.

With respect to scientific leadership, the program depends on a few staff with expertise in current science priorities to lead all research projects for a particular topic, leaning on contractors to fill support roles. While this does allow for flexibility in the workforce and allow the organization to be responsive to funding shifts, it can also present a threat if priorities change or key scientific staff leave. For example, does the program have a plan for what would become of the coral studies Shay Viehman leads if she were to leave? Would the position be refilled or would NCCOS shift focus to give more support to wetlands and social science? Is there a plan to build a team of federal employees to work with Viehman, developing the next generation of leaders and allowing NCCOS to think about succession planning?

Additionally, as the program grows, there will be more ways to connect with other parts of NOAA to for two-way knowledge transfer and capabilities sharing. The program briefing book mentions that the 'NCCOS coastal change portfolio complements NOS capabilities and maintains partnerships within

NOAA,' leveraging products from CO-OPS and other NOAA groups; however, examples of the linkages were not obvious in the presentations from internal or external groups. Opportunities exist for NCCOS internal and external projects to connect to other parts of NOAA on specific topics for cost sharing and for better advancing shared priorities.

Summary suggestions for programmatic approach (many of which we learned are currently being implemented for the 2022-2026 Strategic Plan)

- Define big, programmatic directions and identify projects that advance those objectives, rather than relying on existing relationships or staffing. (Examples include considering expanding to ecosystems other than corals and wetlands and identify project location based on science goals rather than proximity.)
- To serve a more national audience, consider transferability/scalability of approaches, science, methods from local to broader application.
- To improve capacity and add value to existing work, consider developing more intentional connections to other parts of NOAA doing similar work.
- Similarly, explore possible connections between 3 elements presented. A staff hire in the Complementary Products and Data Services group could oversee the advancement of this topic.
- Explore possibility of shifting funding to NCCOS coastal change program from other NOAA line offices by demonstrating the need for and value of applied research and well as the current limitation in capacity.

Additional notes specific to ESLR

ELSR was praised by funded researchers for providing sustained support for topics of societal relevance and for allowing them to build upon previous work. However, a concern is that the ESLR program often fund the same science teams. There is value in providing the opportunity to others, particularly for this unique program that is focused on addressing coastal change challenges with interdisciplinary teams. There is an opportunity for NCCOS to build on that success and train more multi-disciplinary teams. It was stated that the same teams are often funded because "they have skills in building and working on multi-disciplinary teams." Perhaps the program could provide training or guidance on building those teams, thereby transferring the knowledge – the business of integrated science - from the previous projects to more people. Setting aside funds for supporting new teams would help develop the interdisciplinary skill set in more researchers, thereby increasing the value of the program.

The ELSR program is commended for its consistent support of students. With four-year timelines, students have the time to dig deep on a topic, build relationships, and become experts. The program is helping to develop the next generation of scientists who will think about their research from the perspective of societal needs and who will understand the value of integrated and multi-disciplinary science. We heard that the program has 'launched careers.' One research remarked, 'I carried the transdisciplinary approach with me to [my new job].'

Return-on-Investment

One final note on performance… To measure return-on-investment, NCCOS could build their own methodology to track this based on what is important to them and the information that would best tell the story of the value of the products. For example, partners are sharing your work and others are asking for it. Can you devise a system to regularly document and measure this? From what we saw, the need for the work is outpacing the current capacity. Perhaps being able to clearly demonstrate the need for the work (accompanied by a strategy to execute), funding could be redirected to the support the growth of the

Coastal Change Program. Additionally, NCCOS could learn from other parts of NOAA who are also asking this same question. A panel member pointed to the NERR science collaborative, which is also looking for a metric to track their return on investment. Details are likely in that panelist's individual assessment.

Other Comments

Suggestions for review process

The meeting organizers planned an effective meeting and created a comfortable and welcoming environment. Program information was conveyed in several different ways - the briefing book, the pre-meeting, the online resources, the presentations from the scientists, the feedback from the partners, the conversations with leadership – giving the panel many ways to assess quality, relevance, and performance.

There were times when it felt like we were just getting into the details, and sometimes with possible questions or concerns emerging, but there was little time to explore. The suggestions might help to provide that time.

- Present budget information earlier in the review session; include summary (or bulk) statistics for science budgets for internal and external that include federal salaries
- Reduce the length of presentations and provide more time for discussion and conversation, particularly with the partner groups
- Allow review panel to talk to groups – management, scientists, partners – separately, allowing them more freedom to speak
- Consider requesting consistent information from the scientist presentations. The internal presentations were most useful in gathering information for the evaluation.

Notes on Social Science area of focus [under development and thus outside the scope of the review]

The social science team works with communities to improve their adaptive capacity and develop vulnerability assessments and to improve their adaptive capacity. The products – often a layered, mid-scale geospatial analysis – are designed to help people make decisions. The value to the partners/stakeholders could not be determined at this time as this area of focus is just developing; however, it's clear that there is demand for this work.

NCCOS is encouraged to think programmatically as they grow this area of focus. A focus on bigger goals and what is needed nationally from a federally funded agency will avoid the appearance of consulting for a single town. Local projects can be selected to help advance the larger goals, with time spent at the end of a project on knowledge transfer and broader applicability. Framing the work in a larger strategy and being more intentional in project selection would give the work done more impact and increase the value. Suggestions as you move forward include:

- Consider shifting away from performing vulnerability assessment and towards assessment of action resulting from the vulnerability assessment (the 'what do we do next?')
- Develop a process or cycle for how to align the scientific research with user needs and timetables.
- Build direct connection between social science group and the natural science teams, exploring the vulnerability of the environment (marshes, coral reefs) connected to vulnerability of people.
- Explore partnerships with other social science teams in NOAA to share knowledge and add value.

The team lead requested from the panel: (1) feedback on how to connect products to local adaptation planning activities and track local outcomes; (2) references to tech guidance on how to best choose which hazards or climate models best suit context; and (3) guidance on how to better explain models and analysis to partners and stakeholders, including limitations and uncertainty. These are questions that the social science group could focus on answering. Answers would be information that can be applied nationally, helping all communities, rather than the single communities where projects are currently focused.