NERRS Science Collaborative Projects:
An Assessment of Characteristics, Grantee Reflections & Lessons Learned from the 2010-2014 Grant Cycle

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Table of Contents

List of Figures

List of Boxes

List of Diagrams

I. INTRODUCTION

NOAA's National Estuarine Research Reserve System's (NERRS) Science Collaborative is a competitive research grant program. It funds applied science research conducted in partnership with the reserves and other local and regional agencies and organizations involved in coastal management and decision-making. Between 2010 and 2014, the program was administered by the University of New Hampshire (UNH); since 2015, it has been administered by the Water Center at the University of Michigan (U-M).

This working paper summarizes the notable characteristics, grantee reflections and lessons learned in the 31 Science Collaborative projects funded between 2010 and 2014. In particular, it identifies key attributes of the science produced by these projects and the nature of end user engagement and influence in the research process. It also describes the challenges encountered by Science Collaborative grantees and their observations about the factors that enabled their progress.

The Science Collaborative program compels a specific type of research question, one that is applied and management-relevant. It also compels a specific type of research process, one that is collaborative and engages end-users in order to encourage the production of science that is both usable and used. The projects funded during the 2010-2014 period represented the "best and the brightest" of the proposals submitted for consideration. That is, they were judged to be on a topic that was deemed important to management of estuarine ecosystems of concern to individual reserves and NERRS and conducted in a manner that effectively involved end users. Given these explicit parameters, what are the notable attributes of the Science Collaborative research projects that met this high bar? How were end users engaged in the research and, moreover, with what effect? What proved particularly challenging about this important yet novel approach to advancing consequential applied research? What were the notable observations about collaborative science offered by the 2010-2014 grantees in this program that might be of value to future grantees?

<u>Assessment Purpose</u>

This assessment was undertaken with the simple intent to help advance understanding and expectations of the U-M team as it administers the next phase of the Science Collaborative. In concert, it provides an opportunity to distill major insights and lessons of value for future grantees under the Science Collaborative; inform the focus and structure of the U-M team's research on co-production of science and how it might be tracked and measured in this NOAA program; and identify useful data requirements for progress and final reports of UM-administered Science Collaborative projects, thereby guiding U-M's program administration and research moving forward.

We wanted to gain greater insight into the specific characteristics of Science Collaborative projects as evidenced by those conducted during the 2010-2014 grant cycle. We sought to identify their notable similarities and differences, hoping that this understanding would enable us to more effectively guide and support future projects. By distilling these core characteristics and variations we were also interested in learning about the dimensions of Science Collaborative projects that might mirror those of other applied research that we have conducted and/or supported and for which the goal of usable science is the same.

Initially, our intent in undertaking this assessment was to conduct a quick and simple synthesis purely for internal U-M Science Collaborative team use and drawing solely from the summary project reports that were available at the time. What we began learning, however, proved both interesting and of potential value beyond our internal use and reference. Hence, we expanded the scope of the assessment when final project reports became available in order to complete a more thorough review that would effectively capture the full experience of completed Science Collaborative projects. Notably, the final project reports contained several sections that were not available in the earlier progress reports. These sections conveyed researcher reflections on the unique challenges, benefits and lessons learned in conducting science in a collaborative manner. The availability of grantee responses to six open-ended questions in the final reports warranted analysis. Section IV of this paper discusses those findings.

<u>Assessment Process</u>

This working paper represents an assessment drawn from the written progress reports, project summaries, and final reports compiled and submitted by the 31 individual Science Collaborative project research teams during the 2010-2014 funding period. With the assistance of a graduate student research assistant supported by the U-M School of Natural Resources & Environment, each set of reports was carefully reviewed to probe the following topics and questions:

- Characteristics of the Research Projects:
  - What ***focal issues*** are addressed by Science Collaborative projects?
  - What is the ***system*** of interest to the research?
  - What is the ***scale*** of interest and influence for the research?
  - What is the ***nature of the science*** produced?
- Characteristics of the Collaborative Process:
  - Who serves in the ***collaborative lead*** role?
  - Who are the ***intended end users*** of Science Collaborative research?
  - What is the ***level of end user engagement*** in projects?
  - How are ***research results and products disseminated to end users***?
- Grantee Reflections:
  - How did involvement of ***intended users impact*** the project?
  - What was ***most challenging or unexpected*** about the project?
  - Was the ***team skill set and project budget*** sufficient?
  - What do the grantees ***know now that they wish they had known*** at the outset?
  - What were the ***lessons learned*** by the grantees?

Each topic and sub-question of interest is discussed below, with figures illustrating the frequency and distribution of characteristics across all 31 projects. The assessment concludes with a summary of key observations about the nature of collaborative science conducted within the reserve system as evidenced in these 31 projects.

Limitations

This paper represents only the first step in beginning to understand the characteristics and accomplishments of Science Collaborative projects. No interviews or site visits were conducted for this assessment. Inevitably, some progress and final reports were more comprehensive and detailed than others, potentially causing some attributes to be undercounted or misinterpreted. Furthermore, we were only able to draw from the self-reporting of researchers; we were not able to specifically probe the actual presence or absence of different factors. While some final reports included perspectives of other team members, most contained only the principal investigator's descriptions. Regardless of these limitations, we are confident that the most notable project characteristics, experiences, and grantee insights have been captured in this assessment.

II. CHARACTERISTICS OF THE RESEARCH PROJECTS

The following section describes the main attributes of the research conducted within the 31 projects. Our objective was to discern the core characteristics of the research. The specific assessment questions addressed in this section are:

1. What **FOCAL ISSUES** are addressed by Science Collaborative projects? Is there breadth to the focus of the funded research?
2. What is the **SYSTEM FOCUS** of the research? Are all of the projects focused solely on natural ecological systems of concern to the reserves, or are broader socio-ecological systems also in the mix?
3. What is the **SCALE of INTEREST and INFLUENCE** in the projects? Are the projects narrowly focused on individual reserves or do they encompass other scales?
4. What is the **NATURE of the SCIENCE** produced? To what extent is basic data that is the norm of traditional scientific research being produced in contrast to more applied, end-user-informed science as intended by the Science Collaborative?

RESEARCH QUESTION #1:
What FOCAL ISSUES are addressed by Science Collaborative projects?

Science Collaborative research projects differ in numerous ways. The first question of interest to us was "what specific issues are the central focus of the research?" To answer this question, progress and final report descriptions of (1) stated and implied research question(s); (2) stated project objective(s); and (3) outlined project goal(s) were reviewed. Four broad categories of focal issues were revealed from this overview:

1. Stormwater and Water Quality;
2. Climate Change, Adaptation Planning, and Land Use Change;
3. Estuarine Ecosystem Dynamics and Habitat Restoration; and
4. Ecosystem Services, Valuation, and Economic Incentives.

These focal issue categories closely align with the five priority research areas of the 2006-2011 NERRS Research and Monitoring Plan (i.e. habitat and ecosystem coastal processes, anthropogenic influences on estuaries, habitat conservation and restoration, species management, and social science and economics). All four focal issues are interrelated. Hence, we categorize projects by their "primary" and "secondary" focal issues (see Figure 1).

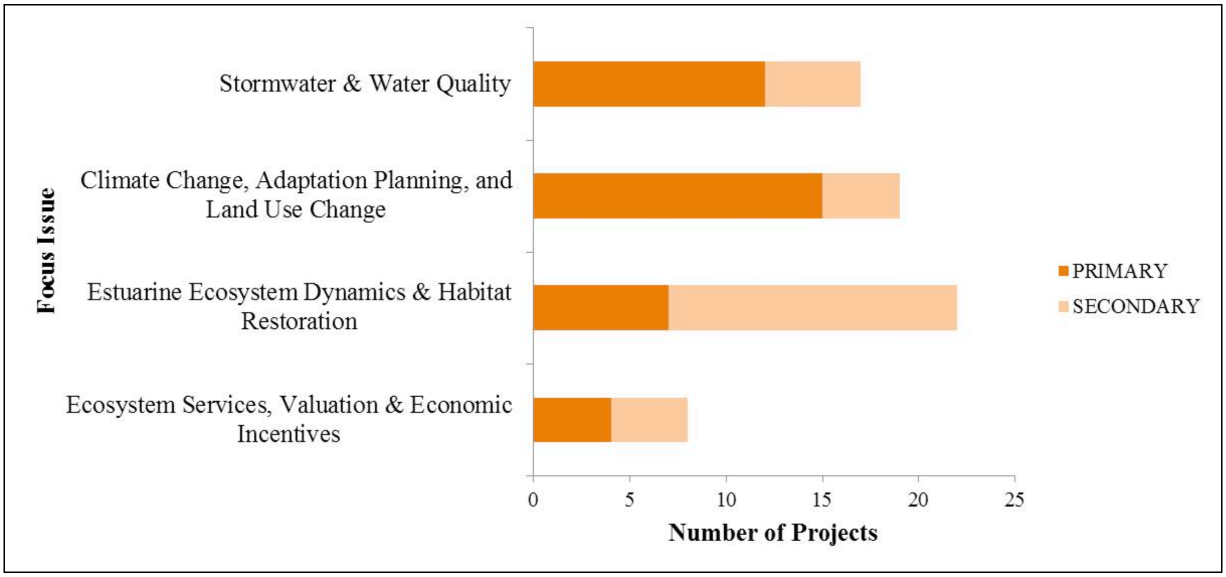
<u>Description of Each Focal Issue</u>

1. **Projects relating to stormwater and water quality:** *Twelve* projects had *Stormwater and Water Quality* as a primary focal issue. These projects seek to address water quality degradation from point and nonpoint source pollution, with a particular focus on:

    a. Understanding hydrologic and hydraulic flows;
    b. Patterns of nutrient loading; and
    c. Testing and/or installing new methodologies for stormwater management.

    The Great Bay reserve's "Managing Nonpoint Nitrogen Pollution" is one example of this type of project. The main goal of this project was to "map nitrogen 'hot spots'" and "understand their sources" in order to target water quality management efforts for the mitigation of hypoxic events. More practice-oriented projects like those conducted by the North Carolina reserve are also included in this category. The primary objective for their project, "Removing Coastal Stormwater Pollution," was to "reduce the amount (volume) of polluted stormwater runoff" by identifying sites for stormwater management retrofits and implementing installation efforts at those sites. Some education and advocacy-oriented projects also fit within this category. For example, "Advancing Low Impact Development in Coastal South Carolina," a joint project conducted by the ACE Basin and North Inlet-Winyah Bay reserves, is focused on bringing stormwater practitioners together to "develop a Low Impact Development (LID) Manual to provide local decision makers with the knowledge and resources to help them implement LID practices."

Figure 1. Distribution of Project Focal Issues



2. **Projects relating to climate change, adaptation planning, and land use change:** *Fifteen* projects had *Climate Change, Adaptation Planning, and Land Use Change* as a primary focal issue. There are a number of Science Collaborative projects that specifically address land use, planning, and conservation in the face of climate change in order to inform management initiatives. To do so, projects that fall within this category perform research that both further understanding of dominant environmental shifts that will occur with climate change and the best ways to plan for or address these shifts. Many of these projects also include an assessment of community understanding and acceptance of climate change. Projects within this category primarily focus on:

    a. Creation of climate adaptation plans;
    b. Refinement of climate vulnerability assessment techniques; and/or
    c. Assessment of likely climate change impacts on ecosystem dynamics.

    Projects with this focal issue typically include climate change or planning language in the project title and objectives, for example: "Collaborative Planning for Climate Change Adaptation," "Managing for Resilience in the Face of Climate Change," and "Planning for Sea Level Rise." The Hudson River reserve projects – "Assessing Resilient Shoreline Treatments" and "Promoting Sustainable Shorelines" – are examples of research within this issue category. These two projects evaluate and install the most effective shoreline stabilization management techniques for "preserving important natural functions…especially as sea level rise accelerates and storms increase in intensity" for "communities as they plan for climate adaptation" and for "managing shoreline erosion and change." Another example is the New

England Climate Adaptation Project (NECAP), a joint effort of the Waquoit Bay, Narragansett Bay, Wells, and Great Bay NERRs. This project focuses on building the capacity of coastal towns to "manage climate change risks" and "support coastal adaptation efforts." The NECAP project also tested simulation exercises as a tool for "educating and engaging the public in climate change adaptation."

3. **Projects relating to estuarine ecosystem dynamics and habitat restoration:** *Seven* projects had *Estuarine Ecosystem Dynamics and Habitat Restoration* as a primary focal issue. These projects investigate environmental, ecological, biological, chemical, and/or physical dynamics within estuarine ecosystems. Their objectives are to provide insights about natural dynamics to help improve management, restoration, and stewardship of ecosystems of interest to the reserves. Common research questions for projects with this focal issue are:

    a. What are baseline environmental conditions?
    b. What are the nutrient/environmental flows within the system?
    c. How has a particular aspect of the ecosystem changed over time?

    For example, the San Francisco Bay reserve's "Mud on the Move" project aims to "improve understanding of sediment dynamics" so that coastal wetland and marsh managers can model sediment movement to better target conservation and restoration efforts in these ecosystems. The "Bringing the Oly Oyster Back to Oregon's Coos Bay" project provides another example. This South Slough reserve project seeks to understand the "oyster's reproductive biology and early life history" to help identify priority areas for oyster restoration projects within the estuary.

4. **Projects relating to ecosystem services, valuation, and economic incentives:** *Four* projects had *Ecosystem Services, Valuation, and Economic Incentives* as their primary focal issue. These projects focus on market-based incentives for estuarine management, protection, and restoration. This focal issue is the least common among Science Collaborative projects. These projects typically seek to:

    a. Identify ecosystem services prioritized by communities;
    b. Quantify priority ecosystem services; and/or
    c. Investigate economic-based incentives and cost-effectiveness for particular estuarine management and restoration decisions.

    These projects usually make specific reference to "cost-effectiveness" and/or "ecosystem services" in their project objectives and goals. For example, the Waquoit Bay reserve's "Bringing Wetlands to Market" project investigated the "potential to bring coastal wetlands into international carbon markets and incentivize investment in tidal wetland restoration and preservation." Another example is the Tijuana reserve's "Healthy Wetlands, Healthy Communities" project, which had a specific research component focused on "identifying ecosystem services provided by wetlands."

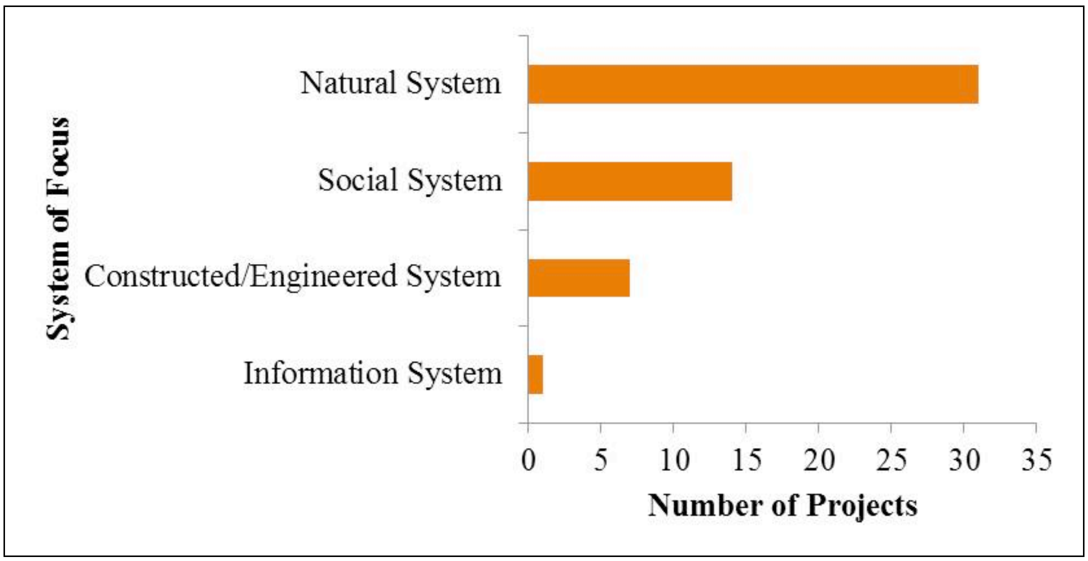
RESEARCH QUESTION #2:
What is the SYSTEM of interest to the research?

Each Science Collaborative project contributes to a body of knowledge about one or more systems of relevance to NERRS:

1. Natural System
2. Social System
3. Constructed/Engineered System
4. Information System

The *System Focus* of a Science Collaborative project was determined by assessing the (1) project research objectives and goals, (2) project research methods, and (3) types of data collected. Most projects have more than one system focus since the projects often investigate interactions and interdependencies between systems.

Figure 2. Distribution of Projects by System Focus



Natural System: All *thirty-one* projects have a *Natural System* focus to at least some degree. The projects have ecological, biological, hydrological, biogeochemical, and/or physical research topics as part of the research. For example, the Grand Bay reserve's "Planning for the Future with an Eye to the Past" project investigated "land-use related nitrogen sources and pathogen changes" using sediment coring, oyster sampling, and water sampling techniques. Some projects within this category are not as centrally focused on the natural sciences, but still provide insight to the natural system. Specifically, the NECAP project was primarily social science research but nonetheless performed climate change risk assessments and collected data on climate change forecasts as part of their research process.

Social System: *Fourteen* projects were focused on the *Social System*. These projects investigated social, behavioral, institutional, and/or regulatory questions of relevance to coastal management decision-making. This research typically attempts to (1) further understanding of the attitudes, values, and beliefs people hold about coastal ecosystems and/or (2) increase understanding or improve coastal management regulation and planning. The progress and final reports for every project in this category contain language that refers to (1) behavioral research (i.e. assessment of "knowledge," "attitudes," "values," and/or "beliefs"), (2) testing a "decision-making support tool," (3) reviewing a "decision-making process," and/or (4) trying to influence or inform policy or permitting processes. For example, the NECAP project very clearly states that its research is to test role-play simulations as a mechanism for engaging the public in climate change conversations and planning processes. This project also collected data on "public attitudes." The Chesapeake Bay, Maryland reserve's "Increasing Resilience to Sea Level Rise" project had as its primary research objective to "understand the provision of socio-ecological services by marsh systems and decision-making processes." This project includes an "anthropological applied science" component and an investigation of how individuals form "values for ecosystem services and what language works to best communicate those values" as well as "conceptualizations of resilience and vulnerability." Another example is Old Woman Creek reserve's "Stormwater Solutions in Ohio" project which included a large component related to understanding and influencing local stormwater regulations. To this end, the project team collected data on the zoning codes, permitting processes, and local and state water quality and quantity requirements as a part of their overall research.

Constructed/Engineered System: *Seven* projects had a *Constructed/Engineered System* focus. Constructed, or engineered, system projects (1) test, (2) install, and/or (3) promote understanding and use of manmade solutions to negative environmental impacts or estuarine management challenges (i.e. low impact development or green infrastructure). Projects in this category also fall almost entirely under the Stormwater and Water Quality Focal Issue category. Summaries and progress reports for projects within this category typically include language referring to "demonstration sites," "stormwater retrofits," "low impact development," "green infrastructure," and/or "shoreline stabilization." Additionally, all projects within this category include "installation" and "construction" of one or more stormwater or water quality management methods.

Information System: *One* project had a focus on an *Information System* that would improve coastal management decision-making by (1) enabling access to current data, (2) promoting data sharing, and (3) creating a mechanism for collaboration, communication, and partnership building. The only project in this category was the Jacques Cousteau reserve's "Facilitating Access to Long-Term Data" project that created an "online database" for information sharing among fisheries managers in the Mid-Atlantic. This category does not refer to projects that create project websites as one of several strategies for disseminating project information and findings.

RESEARCH QUESTION #3:
What is the SCALE of interest and influence for the research?

A broad spectrum of *Scales of Interest and Influence* is apparent across the full suite of 31 Science Collaborative projects. Some projects were focused at a smaller reserve scale while others aspired to eventually influence activity at the International level (see Diagram 1). It is notable that the scale of an individual reserve was rarely the primary focus. Most of the Science Collaborative projects aspired to influence knowledge and management activity at the broader Watershed and Regional scales.

Diagram 1: Spectrum of Scales of Interest to Science Collaborative Projects

Reserve
↓
Watershed
↓
Regional
↓
NERRS
↓
National
↓
International

Each project's scale of primary and secondary interest and influence was determined by review of several factors identified within the project's progress and final reports:

1. Report statements regarding realized, intended, or desired project scale.
2. Location(s) where the research occurred.
3. Geographic area represented by intended user groups.
4. Whether the project involved a single or multiple Reserves.

Some progress and final reports mention that the project reached a broader audience or aspired to achieve influence beyond that which was initially or primarily targeted; these are categorized as "secondary" scales in Figure 3.

Reserve Scale: All Science Collaborative projects ultimately affect individual Reserves because all seek to improve local estuarine health, function, and management of the system within which the Reserve resides. While *three projects* were *primarily* focused on the Reserve scale, *fifteen* projects have the Reserve Scale as a *secondary scale* of interest. These fifteen projects explicitly identify a specific Reserve as an "intended user" of the project results in either the project summary or progress or final reports. For example, the Wells reserve's "Balancing Land Use Decisions" project was intended to "provide information on ecosystem tradeoffs and values in a concrete, useful format, available for use by Wells reserve in coordination with the Wells reserve stakeholder network to promote sustainable management of riparian land use and habitat."

Watershed Scale: *Eleven* projects have the Watershed Scale as their *primary scale* of interest. These projects specifically state that their research and end user engagement is occurring beyond a single reserve. These projects tend to address factors and activities that influence inputs to the reserve's estuarine ecosystem. Some explicitly state that research is occurring within the "watershed." For example, the "Managing Nonpoint Nitrogen Pollution" Great Bay reserve project explains that the project assesses "sources and transport in Great Bay tributaries." Similarly, Rookery Bay reserve's "Planning for the Future of Freshwater in Southwest Florida" project investigated water use and flows to "adaptively manage freshwater in the Henderson Creek watershed."

Figure 3. Distribution of Projects by Project Scale

Regional Scale: *Twenty-two* projects have a broader Regional Scale as their *primary scale* of interest. These projects are focused on an area slightly greater than the watershed, engaging users and performing research across the greater biogeographic region. These projects include those that have received a joint Reserve Science Collaborative grant or discuss project operations at a scale greater than the watershed. For example, project reports for the Wells reserve's "Balancing Land Use Decisions in Southern Maine" project note that this research also applies to New Hampshire where strong research and management connections exist. Many projects primarily focused at the Regional Scale have the Watershed Scale as a secondary focus.

NERRS System Scale: *Four* projects had the reserve System as a whole as their *primary scale* of intended interest and influence. These projects specifically focus on producing science that is transferable to other NERRS Reserves. For example, the "Refining the NERRS Climate Change Vulnerability Assessment Tool" project – a joint project at the North-Inlet Winyah-Bay and Chesapeake Bay, Virginia NERRs –

was a pilot program to produce a "tool that can be used by all the NERRS sites." Both the NECAP project and the Waquoit Bay "Bringing Wetlands to Market" project identify the reserve System as one of the primary intended users of their research.

National Scale: *One* project had the National Scale as its *primary scale* of interest: the Waquoit Bay "Bringing Wetlands to Market" project specifically targets intended users in coastal areas across the country. The six projects that have the national scale as a secondary interest typically create a tool or a plan that can be generalized to fit other coastal environments or communities.

International Scale: *Two* projects had the International Scale as a *secondary scale* of interest, making it the least common of the project scale categories. Projects having this scale as a secondary interest either note that the project team aspires to have relevance at the international scale, or they unintentionally achieve recognition at the international scale. In the case of the NECAP project, for example, international audiences reached out to the project team to express interest in the project. The Waquoit Bay NERRs "Bringing Wetlands to Market" project reports note that the research team would like to engage with international carbon markets.

RESEARCH QUESTION #4:
What is the NATURE of the SCIENCE Produced?

Each Science Collaborative project produces "science" in a form that occurs along a spectrum of increasing management applicability (see Diagram 2). At the most basic level, the science produced is in the form of basic data. While all projects produce data, some take the next step and analyze the data acquired through their research in order to provide insights or increase knowledge regarding the research topic or related management. Most Science Collaborative projects, however, convert the new knowledge or insights into directly applicable capacities and/or skills. Capacities and/or skills are transferable tools, plans, or processes as well as enabling structures or partnerships. Projects are categorized by where they fall along this spectrum as determined by their intended and realized deliverables described in the project progress and final reports. The distribution of projects by the nature of the science they produced is shown in Figure 4.

Diagram 2. Spectrum of "Nature of Science" Produced

Data

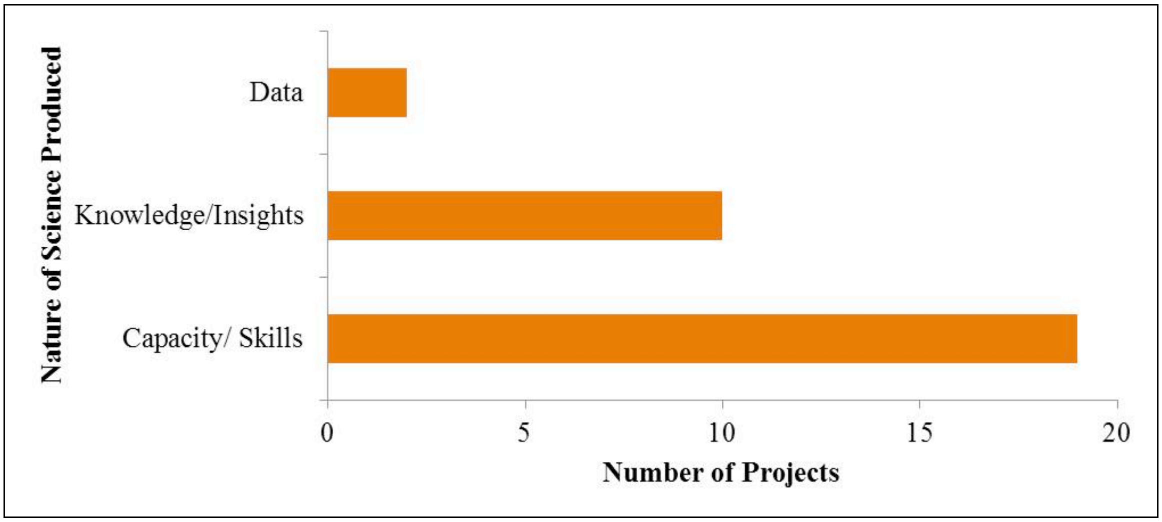
↓

Knowledge/Insights

↓

Capacity/Skills

Figure 4. Distribution of the Nature of Science Produced



<u>Data:</u> All projects collect or compile data as part of their overall research process but *two* projects produced *Data* as their final research product. The data categorization refers to raw data that is created (i.e. newly collected data) or compiled (i.e. existing data that is gathered and organized) throughout the research process. Products include data from: (1) field sampling and long-term monitoring; (2) historic records; (3) case studies and literature reviews; (4) interviews and surveys; (5) laboratory work; and, (6) GIS and maps. For example, the Jacques Cousteau reserve's "Facilitating Access to Long-Term Data" project consolidated fisheries data from sources across the eastern seaboard to better enable improved fisheries management decision-making in the face of climate change.

↓

Knowledge/Insights: The synthesis of *Knowledge and Insights* represents the next step along the nature of science spectrum. In these projects, data is analyzed and interpreted to provide broader conclusions meant to inform specific management and decision-making purposes. *Ten* projects have *Knowledge/Insights* as the final science product of the project. For example, the Kachemak Bay reserve's "Planning for a Changing Landscape" project performed a study on the relative rates of sea level rise and coastal uplift occurring in the Bay. This project collected a significant amount of raw data which was then analyzed to determine that while the rate of coastal uplift outpaced the rate of sea level rise across the entire Bay, the rate of sea level rise was much higher in one of the most developed areas of the Bay. In so doing, the project used data to provide an important insight for management. The project's findings were made available to managers to assist in their planning and management decision-making.

↓

Capacity/Skills: *Nineteen* projects have *Capacity & Skills* as the final form of Science produced. *Capacity & Skills* are produced through the transformation of research *Data* and *Knowledge & Insights* into a readily usable product. Projects that fall within this category typically contain a description of the final capacity or skill in the project progress and final reports. For example, the Guana Tolomato Matanzas reserve's "Planning for Sea Level Rise on the Florida Coast" project developed an "integrated sea level rise adaptation planning process." Similarly, the Wells reserve's "Balancing Land Use Decisions in Southern Maine" project created a "decision support tool;" and, the San Francisco Bay and Elkhorn Slough NERRs' "Oyster Restoration in the Face of Climate Change" project noted that the project would increase the resilience of oyster restoration projects by "developing restoration planning tools that characterize and prioritize sites and source material for restoration projects."

III. CHARACTERISTICS OF THE COLLABORATIVE PROCESS

The following section describes the main attributes of the collaborative processes that were evidenced across the 31 projects. Our objective was to discern the core characteristics of the research interface with intended end users. The specific assessment questions addressed in this section are:

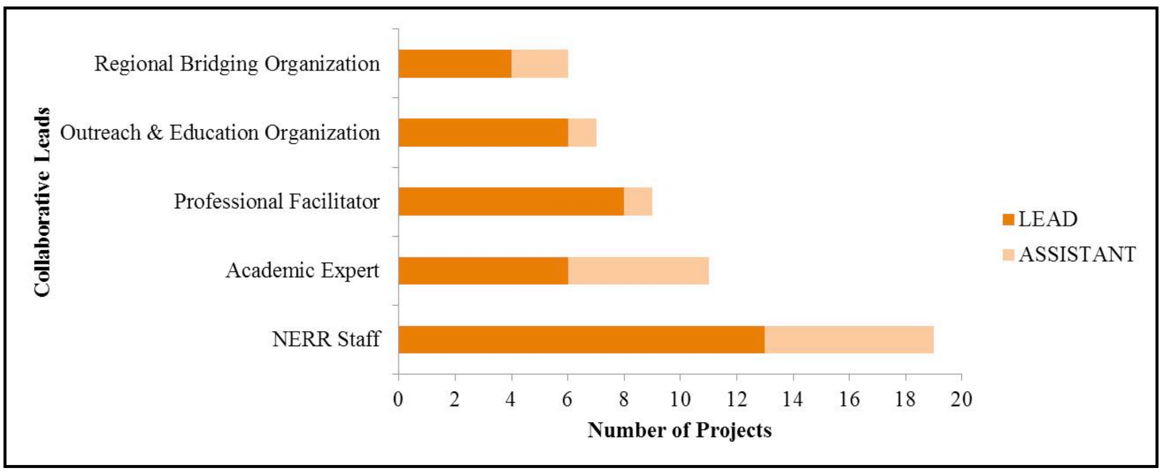
1. Who serves in the **COLLABORATIVE LEAD** role? This role is particularly unique and critically important to the success of Science Collaborative projects. Who is at the helm of the process, ensuring that it proceeds in a collaborative manner between the researchers and end users?
2. Who are the **INTENDED END USERS** of Science Collaborative research? Are the projects largely targeting the same types of end users?
3. What is the **LEVEL of END USER ENGAGEMENT** on projects? Are these projects truly collaborative in the sense that end users have a meaningful role with potential to influence the project?
4. How are **RESEARCH FINDINGS and PRODUCTS DISSEMINATED** in order to convey project results to end users? How readily accessible is the science that is produced?

PROCESS QUESTION #1:
Who Serves in the COLLABORATIVE LEAD Role?

Each Science Collaborative project has a team member who is explicitly responsible for ensuring that collaboration and integration occur during the research process. This Collaboration or Integration Lead (Lead) is sometimes assisted by one or more additional team members. The Collaboration Lead role is filled by individuals from different domains (see Figure 8).

By far the most common Leads (thirteen of the 31 projects) are in-house reserve staff, predominately Coastal Training Program Coordinators (CTPCs), although a Stewardship Coordinator was the Lead in one project and a Reserve Manager served as a co-Lead in another. Academics with expertise and skills in communication and collaboration were enlisted to serve as Lead in six projects. Professional facilitators, including several from the Consensus Building Institute, also served as Leads for eight projects. In six cases, individuals from Outreach and Extension organizations, such as Sea Grant or the NOAA Coastal Services Center, served as Leads. In four cases, the Collaborative Leads were respected and knowledgeable individuals from regional "bridging" organizations (governmental and non-governmental) that have a convening or partnership-building mission, such as the California Coastal Conservancy or Coos Watershed Association.

Figure 5. Distribution of Collaborative Leads



These five Collaborative Lead categories were determined through review of: (1) listed project team roles and titles found in project progress and final reports; (2) collaboration contact person noted in the project summary; and, (3) home organization of the designated Collaborative Lead(s) and Assistants.

PROCESS QUESTION #2:
Who are the INTENDED END USERS of Science Collaborative Research?

Each Science Collaborative project is required to identify intended end users of the project's eventual research findings and products. Grantees often used the terms "end users" and "stakeholders" interchangeably in their reports. While specific target audiences are outlined when the project is initiated, the array of end users inevitably changes and often expands as the research process progresses. Intended users are closely tied to project scale: the broader the scale of the project, the broader the range of intended and potential user groups. Several projects explicitly separate their intended users into multiple groupings (i.e. core or primary intended users vs. secondary intended users) in order to better target collaborative and outreach efforts.

Seven categories of intended users were identified through review of project reports:

1. Public Sector
2. Business/Professional Sector
3. Environmental/Conservation NGO Sector
4. Reserve System
5. Academic Researchers
6. Community Members
7. Reserve Manager and staff

These categories were determined based on progress and final report statements about: (1) intended user groups; (2) organization affiliation of project team user representatives; (3) organization affiliation of project Advisory Committee/Board members; and, (4) project meeting and event attendees. *Primary Intended Users* (see Figure 6) are those who were (1) clearly stated to be the target audience; (2) represented as an intended user on the project team; and/or, (3) served on a project Advisory Board. *Secondary Intended Users* are those who were regularly involved in the project but were not specifically targeted by the project team as their core intended audience.

1. **Public Sector:** *All thirty-one* projects have public/governmental entities as a *primary* intended user group. This Public Sector grouping includes local, county, and state agencies and/or organizations. These intended users include representatives of local government, typically planners, town council members, elected officials and/or public utility employees. It also includes tribal and state agency representatives (i.e. Dept. of Natural Resources, Dept. of Fish and Game, Division of Marine Resources).

2. **Environmental/Conservation NGO Sector:** *Sixteen* projects had the Environmental/Conservation NGO Sector as a *primary* intended user group. This user group consists of local organizations such as land trusts, scientific research non-profits, and watershed associations as well as national organizations like The Nature Conservancy.

Figure 6: Distribution of Project Intended End Users

3. **Business/Professional Sector:** *Twelve* projects had the Business/Professional Sector as a *primary* intended user group. This group represents a wide array of local and regional professionals, including engineering firms, environmental consultants, fishermen, oyster farmers, landscapers, and ecotourism businesses among others.

4. **Reserve System:** *Five* projects had the reserve System as a *primary* intended user group. These include joint Science Collaborative projects involving two or more Reserves. Several projects identify more than one Reserve or the reserve System in general as an intended user group. These projects typically apply for Science Collaborative transfer grants to share findings with other reserves.

5. **Community Members:** *Three* projects had Community Members as a *primary* intended user group; and *fourteen* as *secondary* end users. This grouping broadly refers to the general public and local landowners. For example, one of the main project goals of the ACE Basin reserve "Restoring Natural Barriers" project was to "increase public commitment to stewardship." To this end, the project team actively engaged community members as well as schools in volunteer restoration days, workshops and trainings. In the Kachemak Bay reserve's "Planning for a Changing Landscape," the research team produced educational "Discover Labs" for the general public to learn about the changing landscape around Kachemak Bay.

6. **Academic Researchers:** *Two* projects listed Academic Researchers as a *primary* intended user group. These projects specifically engage academic researchers to share information and resources. Engaging academic researchers also appears to enable long-term partnerships that support continuing research.

7. **Reserve Manager and Staff:** *Two* projects had the reserve manager and other reserve staff as a *primary* intended user group, while *eleven* projects identified these as a *secondary* intended user of the research findings and products.

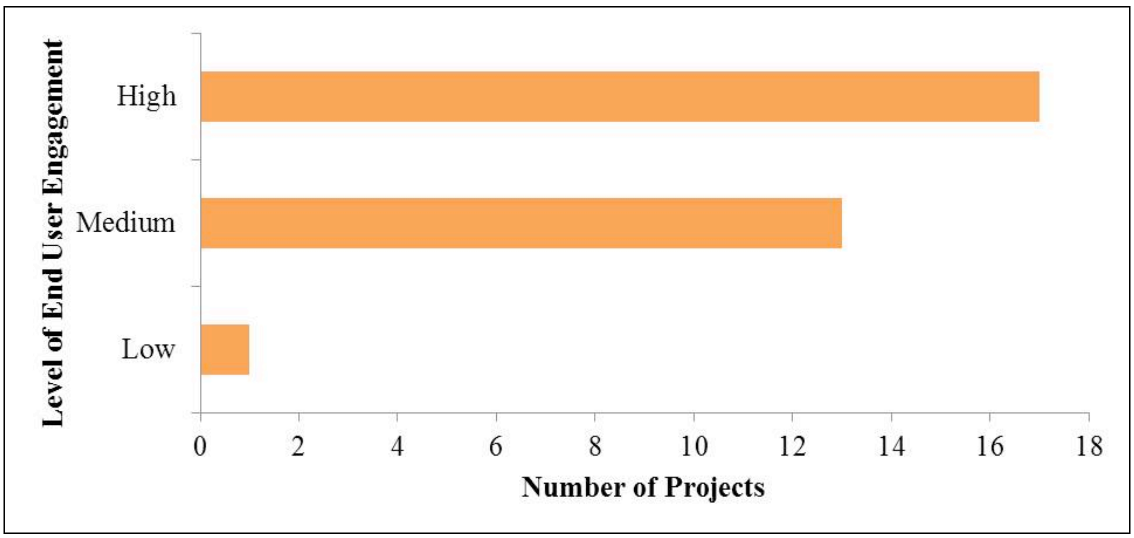
PROCESS QUESTION #3:
What is the LEVEL OF END USER ENGAGEMENT in Projects?

All Science Collaborative projects are required to engage end users in the research process in some manner. How each project did so varied, as did the level of engagement and influence of end users with the research. To assess the level, not just the existence, of end user engagement, we reviewed all progress and final reports to determine:

1. Frequency of end user feedback on the project.
2. Methods used to obtain end user feedback.
3. Aspects of the project that appear to have been changed due to end user feedback.
4. Evidence of end user influence changing a project that was offered anecdotally in progress and final reports.

Projects were rated as having *low*, *moderate* or *high* levels of end user engagement (see Figure 7) based on the factors described below.

Figure 7: Distribution of Projects by Level of End User Engagement



<u>*High Level of End User Engagement*</u>

Seventeen projects exhibited a high level of end user engagement. End users in these projects had frequent opportunity to provide input to the project. In addition, the method used to solicit end user feedback for high engagement projects appeared to promote meaningful two-way interaction and dialogue between the project team and end users. These methods included: (1) standing advisory committees; (2) interviews; (3) workshops, trainings, or focus group meetings; (4) site visits or tours; and, (5) small group presentations. In several instances, progress and final reports for high engagement projects indicate that end user feedback resulted in significant substantive changes to the research process. For example, in the Kachemak Bay reserve's "Planning for a Changing Landscape" project, intended users were engaged in every stage of the research process and, according to progress and final reports, helped develop the project proposal, influenced the project scope and process, and defined preferred project deliverables. Projects with a high level of end user engagement are better positioned to potentially achieve co-produced science.

Moderate Level of End User Engagement

Thirteen projects appeared to have a more moderate level of end user engagement. For these projects, end user feedback was solicited but less frequently and, generally, in less direct and/or actively interactive ways. For example, communication usually occurred via: (1) email or written surveys; (2) keypad polling; (3) written comments; and/or (4) large group presentations. The progress and final reports indicate that fewer notable refinements resulted from end user input for moderate engagement projects.

Low Level of End User Engagement

Only *one* project was judged from the project reports to have a low level of direct engagement of end users. In this project, aside from slight changes to sampling methodologies, the progress and final reports showed little indication of end user involvement or feedback changing any aspect of the project. The project research, scope, process, and products appeared to remain the same as originally intended.

PROCESS QUESTION #4:
How are RESEARCH RESULTS AND PRODUCTS DISSEMINATED to End Users?

Every Science Collaborative project has either explicit or inferred methods for disseminating project findings and products to intended end users. This section describes the mechanisms by which research findings and products are made accessible to intended end users. Each project's progress and final reports and other documents were examined to assess the method by which the science generated by a Science Collaborative project was to be transferred to intended users. Projects were categorized based on project descriptions of (1) how intended users were engaged; (2) project products and deliverables; and, (3) the listed project activities and accomplishments described in the progress and final reports. According to the language used to describe the deliverables, project categorizations were given primary or secondary status.

We found that results were disseminated through four major pathways (see Figure 8):

1. **Implementable Products (Plans, Guidelines, Recommendations, and/or Tools)** are often produced by Science Collaborative projects and can be applied by intended/end users as needed. These products include:

    a. Plans
    b. Best management practice manuals/guidelines
    c. Assessment tools
    d. Decision-support tools
    e. Policy Recommendations

2. **Co-Produced Science** occurs when the intended users learn by being involved throughout the Science Collaborative project. Co-production is evidenced by:

    a. Intended/end user representatives on the project team
    b. User-driven research objectives and goals
    c. Users involved in decision-making about the project
    d. Citizen science component
    e. Standing Advisory Board or Committee

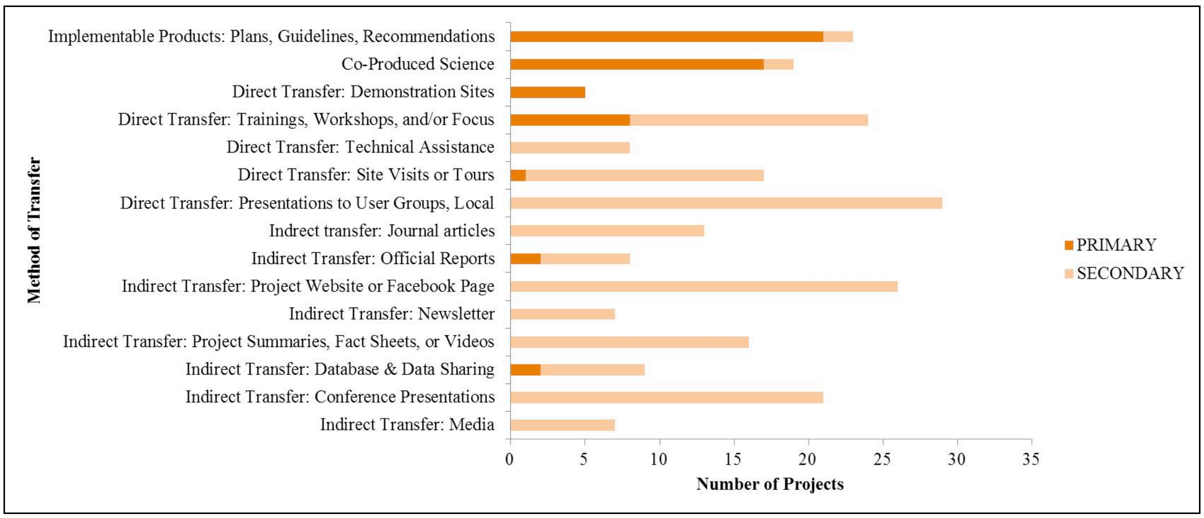
3. **Direct (Active) Transfer** occurs when intended end users receive project updates and findings through interaction with the project team via:

    a. Demonstration sites
    b. Training, workshop, and/or focus group meetings
    c. Technical Assistance
    d. Site visits
    e. Presentations to user groups, local government, and/or the community

4. **Indirect (Passive) Transfer** occurs when intended/end users are able to access or receive project updates and findings, through methods that do not involve direct interaction with the project team. These methods include:

    a. Journal articles
    b. Official reports
    c. Project websites and/or Facebook pages
    d. Project newsletters
    e. Project summaries and/or fact sheets
    f. Databases and Data-sharing
    g. Conference presentations
    h. Media

Figure 8. Distribution of Science Dissemination Categories



<u>Description of Individual Dissemination Methods</u>

1. **<u>Implementable Products (Plans, Guidelines, Recommendations, and/or Tools):</u>** *Twenty-one* Science Collaborative projects provide a specific product that intended users can independently apply in coastal management and decision-making processes as a primary product of the research. These products are in the form of:

    a. Adaptation, management, and/or monitoring plans;
    b. BMP manuals/guidelines;
    c. Assessment tools;
    d. Decision-making support tools; and
    e. Policy recommendations.

    Intended user groups reacted to these products in contrasting ways. For example, the South Slough reserve's "Planning for Change" project focused on updating the estuary's management plan, a major need that had been identified by the local government and community. In contrast, intended users of the Elkhorn Slough and

San Francisco Bay NERRs' oyster restoration project expressed a "general lack of enthusiasm for formal decision-support tools," and sought other products instead.

2. **<u>Co-produced Science:</u>** Intended users are directly engaged in the research of many Science Collaborative projects and hence are more likely to have immediate ownership and possession of its results. Co-production of science is the goal of NOAA's Science Collaborative and a large number of the projects achieve co-production to varying degrees. The *seventeen* projects categorized as evidencing co-production had:

    a. User representation on the project team;
    b. User-driven research objectives and goals;
    c. User involvement in decision-making about the project;
    d. A component of citizen science; and/or
    e. End user membership on a project Advisory Board or Committee.

    Projects that exhibited more than one of these characteristics appeared to achieve a higher degree of co-production. For example, the Kachemak Bay reserve's "Planning for a Changing Landscape" project trained and engaged community members in long-term monitoring activities. This project was also user-driven. As one project report stated, "In 2009, the mayor of Homer, Alaska, and other local community leaders had approached the Kachemak Bay Reserve. The request was motivated by a series of newspaper articles about coastal uplift and personal observations of change in coastal terrain." Co-production is seldom the only method by which project results are disseminated. Projects categorized here under "co-produced science" also employed other dissemination strategies.

3. **<u>Direct (Active) Transfer:</u>** Some Science Collaborative projects employ direct dissemination methods that actively engage users in opportunities to learn about project activities and results. Direct transfer occurs through:

    a. <u>*Demonstration Sites:*</u> *Five* projects employed demonstration sites as a primary dissemination method. This method is typically a component of stormwater and water quality management projects. Demonstration sites are locations where the project team installed a Low Impact Development (LID) or green infrastructure measure as part of the project. These sites function as a way to (1) help a community solve or mitigate an ongoing problem; (2) engage the local community in LID or green infrastructure construction/installation; and/or, (3) accommodate ongoing, site-specific means of public education and outreach.
    b. <u>*Trainings, Workshops, and/or Focus Group Meetings:*</u> *Eight* projects employed trainings, workshops, and/or focus group meetings as a primary method for disseminating their project findings and products. Many projects utilized ongoing trainings and workshops as a method of transfer and a small number of projects specifically focus on creating and providing these opportunities in both the short- and long-terms. Trainings and workshops took

the form of (1) traditional CTP trainings, (2) "focus group" meetings, and/or, (3) "roundtable" sessions. These formats were highly variable and would adapt to the situation and intended user group. From the project reports, the most successful formats appeared to be the smaller focus groups and roundtable sessions, which allowed for more two-way dialogue. In addition, it seemed to be particularly helpful when the intended users were not only able to be involved in discussing the project, but were also able to present to the group about their own work and how it related to the project.

c. _Technical Assistance:_ *No* projects employed technical assistance as a primary dissemination method, but *eight* projects used technical assistance as a secondary method of transfer Some projects provide technical support as a way to overcome barriers associated with capacity and understanding in implementation of project-related coastal management decisions and techniques. For example, the Great Bay reserve's "Water Integration Planning" project team specifically created a "Circuit Rider" role to provide "technical assistance to each of the three communities."

d. _Site Visits:_ *One* projects used site visits as a primary method for transferring project results, but *sixteen* projects employed site visits as a secondary method. Several projects hosted site visits or tours with intended user groups. Site visits, according to project reports, were an effective method, enabling users to understand the physical context of the research. For example, the North Inlet-Winyah Bay reserve hosted interpretive tours in which they discussed the project and its findings, as a part of their "Assessing the Impacts of Stormwater Swashes on Coastal Water Quality" project. Participants indicated that they were "very pleased by the program and that it was very informative."

e. _Presentations to User Groups, Local Government, and/or Community:_ Though never a primary method of transfer, ***twenty-nine*** projects gave presentations to user groups, local government, and/or the community. The project reports often note that the project team made various presentations. These presentations were categorized as direct dissemination when they were given to either the intended user groups, the local government, and/or to the community in a manner that provided for interactive discussion.

4. **_Indirect (Passive) Transfer:_** Most projects included a component of indirect education and/or outreach. In some cases, these dissemination methods were targeted to specific intended user groups and sometimes they were targeted to the general public. While direct methods of transfer actively engage end-users, indirect methods simply make the project information and findings available to anyone, including end user groups. Unlike direct transfer, indirect transfer does not involve interaction between the project team and the users; engagement is almost entirely unidirectional. In a few projects, indirect methods represented the primary method of dissemination. In most projects, these methods were secondary. Indirect transfer methods include:

   a. _Journal Articles:_ While *no* projects produced academic journal publications as a *primary* method of transfer, *thirteen* projected produced journal articles as a *secondary* transfer method. Often, there were journal publications when graduate students were involved in a project.

b. *Official Reports:* *Two* projects created official reports or manuscripts as a *primary* method, and *six* projects used this as a *secondary* method to share findings. One example is the Guana Tolomato Matanzas reserve's "Planning for Sea Level Rise" project that completed a synthesis report: "Planning for Sea Level Rise in the Matanzas Basin: Opportunities for Adaptation."

c. *Project Website or Facebook Page:* *Twenty-six* projects created a project (1) website; (2) Facebook page; and/or, (3) portal on the reserve's website or Facebook page as a *secondary* method of disseminating results. These were used to provide regular updates on the project and to alert interested individuals to upcoming project related events.

d. *Project Newsletter:* *Seven* projects used print or e-newsletters as a more formal *secondary* method of transfer. Similar to the project website or Facebook page, a newsletter would give an overview of the project status, findings, and events. In some instances, newsletters were more frequent and specific to the project, but in most cases the project team had a single article in a Reserve or estuarine science newsletter.

e. *Project Summaries or Fact Sheets:* *Sixteen* projects created short project summaries and fact sheets. These documents could be accessed by, or distributed to, end users. They usually provided a quick overview of the project or a particular aspect of the project as supplementary information.

f. *Database and Data-sharing:* *Two* projects had the creation of a database for, or data sharing with, project end users as their *primary* method of science transfer. For example, the Jacques Costeau reserve "Facilitating Access to Long-Term Data" project produced a database that provided an online location for user groups to store and share fisheries data. While the intent of this database was to increase collaboration through the sharing of information, it is considered indirect transfer since users do not necessarily need to interact with one another or with the project team to use this resource. *Seven* other projects used databases or data-sharing as a *secondary* method of transfer. For example, the Lake Superior reserve "Restoring and Preserving Wetlands Functions" project transferred digital map books containing the data layers for land cover and surface water detention for use by county and township partners.

g. *Conference Presentation:* In addition to direct dissemination presentations, *twenty-one* project teams also gave formal presentations at scientific conferences as a *secondary* method of transfer. These presentations are considered indirect transfer because they do not narrowly target the projects' intended user groups nor typically produce two-way comprehensive discussion.

h. *Media:* *Seven* projects disseminated project results and outputs through formal media outlets as a *secondary* method of transfer. In all cases, the teams targeted a general public audience. They communicated through radio interviews, television spots with local news outlets, and newspaper articles.

IV. GRANTEE REFLECTIONS ON THEIR EXPERIENCE CONDUCTING COLLABORATIVE SCIENCE

This section of the working paper compiles and discusses the reflections of grantees on their experiences conducting collaborative science. In their final reporting requirements, each grantee was asked to answer a series of open-ended questions that probed their perspectives on intended user impact, challenges, sufficiency of skill sets and budget, lessons learned and, basically, anything else they would like to share about their experiences with their Science Collaborative-funded research projects. The specific open-ended questions were:

1. How did collaboration with intended users impact the applied science components of the project?
2. What did you find most challenging or unexpected about the project?
3. Did you have all of the skill sets on the team that you needed?
4. Did your budget include sufficient resources to execute the project?
5. What do you know now that you wish you had known when you started?
6. Please describe any lessons learned, obstacles, accomplishments or anything else you'd like us to know about your experience on this project.

Before presenting the grantees' responses to these questions, it is important to first clarify the limitations inherent in our analysis. The open-ended questions posed in the final reporting requirements are illuminating but also limited. Not all grantees responded to all questions. The responses varied both in content and depth, most likely reflecting what was most salient to the individual(s) writing the final report and/or most important within the context of their particular project. The topics raised in the grantee responses are both self-reported and not offered in response to targeted questions explicitly designed to gauge the prevalence and relative importance of pre-determined factors. Future research by the U-M team will use the insights gleaned from these grantee reflections to more systematically and comprehensively assess the role of factors, such as those identified here, in advancing the usability of science. Future research will also examine these factors from the perspectives of grantees as well as the perspectives of the broader set of project team members and end users.

GRANTEE REFLECTIONS #1:
"How did Involvement of Intended Users Impact the Applied Science Components of the Project?"

Grantees were asked how the involvement of intended users changed the applied science components of their projects. Thirty of the thirty-one final project reports included a response to this question. The comments were both varied and detailed. The responses encompassed four distinct categories of impacts and what enabled those impacts: impacts on the research process; impacts on the final products; impacts on researcher understanding and motivation; and, factors enabling end user impacts. Notably, over one-third of the descriptions of intended user impact employed language suggesting that the impacts were substantial. For example, representative comments included: "led to a fundamentally different and significantly more beneficial result;" "influenced every applied science aspect;" "major impact on all aspects." One grantee commented: "There is no question that the meaningful collaboration achieved with intended users was a key factor in contributing to the quality of the applied science achieved as well as to its broad dissemination."

Box 1
Impact of Intended Users on Applied Science Components of Process
(Responses = 30)

Changes in Research Focus and Process (n=16, 53%)
Objectives, methods and priorities (n=11)
Contributed local knowledge, historical and new data (n=6)
Assisted with the research (n=6)

Effect on Researcher Motivation and Understanding (n=13, 43%)

Changes in Form and Content of Final Product (n=9, 30%)

<u>Changes in Research Focus and Process</u>

In responding to the question about intended user impact, over half of the grantees highlighted impacts on the research focus and process. Specifically, eleven grantees described how the objectives, approach and/or priorities of the research project had been influenced by end user engagement. Six grantees noted the important local knowledge contributed by end users, in particular site information, new data, historical data and relevant local information. Six grantees also commented on the ways in which intended users were hands-on, actively assisting with the research. Representative responses are provided below.

Impact on Research Objectives, Methods and Priorities

- "While there were clear and predetermined research objectives, our collaborative interactions helped to place emphasis on particular outcomes, shape ongoing and future research objectives, and inform the structure and format of outreach to our stakeholder network and the larger community."

- "Intended users helped select locations where current meters should be placed; helped define the parameters of the modeling scenarios; selected species of interest for additional research."

- "Major impact on all aspects, from goals, to experimental design, to objectives of the data analysis, and to context of presented results."

- "Working with intended users changed how the engineering applied scientists collected and presented data."

Contributed Local Knowledge and Data

- "Their first-hand knowledge of the issues important to their communities and of the potential project sites in need of attention to address erosion was invaluable. The area of concern for this project was quite large, and the local knowledge of the stakeholders who live, work, and play on the waterways was key to determining priority locations to address."

- "Throughout the project, the intended users provided invaluable data, local knowledge, and logistical support. They contributed valuable interpretation of the results based on their in-depth local knowledge at the completion of data collection."

Assisted with the Research

- "Guided the design, construction and monitoring of this project."

- "Helped to define and implement the communication strategy."

- "The team conducted additional, related analyses for topics of interest."

<u>Effect on Researcher Understanding and Motivation</u>

While intended user influence on the research process and products was to be expected, one surprising impact was on the understanding and motivation of the researchers themselves. Thirteen (43%) of the grantees responding to this question offered comments about how the involvement of intended users advanced their own understanding of the issues and changed their own perspectives and enthusiasm about the research in a positive way. The intended user enthusiasm proved contagious for a number of them. For example:

- "Face-to-face meetings with stakeholders and visits to the study area motivated the research team to put forth their best work."

- "Having a process and framework for stakeholder engagement throughout this project allowed coastal zone managers to learn, state their needs, offer input, and discuss with peers and scientists how this short project could best benefit their needs in this regard, while also learning, recognizing and accepting the inherent limitations of the project. In turn, the project team learned the prominent needs of the community of stakeholders and were able to test and/or apply suggestions early on, hopefully making the resulting protocol and report more robust."

- "We learned about the use of our information and their challenges, needs, and concerns. This knowledge has shaped our work."

- "We discovered that water resources decision-making was largely made on a one-to-one, informal basis with little formal stakeholder or partner input."

- "By creating an open dialogue and joint review of technical information, researchers were able to gain a better understanding of how intended users integrate information and what the barriers might be to incorporating new information into decision-making processes."

<u>Changes in Form and Content of Final Products</u>

One-third of the grantees responding to the question about intended user impact noted that intended users had influenced the content and form of the research products. Some researchers expressed surprise at end user preferences for the final products; others felt that they learned things that they did not already know about end user needs and constraints in acting on the research. For example:

- "The users were specific on the need for raw data, downloadable, creating the ability for them to be able to run their own calculations. The user feedback from the beta testing very much shaped the scope and the direction in the way the metadata manual was presented."

- "Through collaborative dialogue, we were able to discuss and refine what other information needs were required by intended users to integrate data from this study into regulatory and permitting processes."

- "The [Technical Advisory Panel] TAP suggested that the final products include short, site-specific case studies that would be useful for engineers, site owners, and regulators. The final format of the forensic analysis reports is a direct reflection of this guidance."

- “One minor surprise was that end-users did not favor formal decision-support tools, the sort where you input some information and then get answers out at the end. Rather, they preferred very transparent summary tables for site evaluations, where all calculations are accessible and can be understood and adjusted by the end-user.”

- “The top product desired was a traditional written guide to be used as a reference. This was somewhat surprising.”

- “The input received from intended users will allow us to ensure the information is translated and conveyed such that it can be used by decision-makers and elected officials.”

Summary

What emerges from these comments about intended user impact is a picture of a highly interactive process in which end users had a meaningful and consequential role and impact on the research. They were not just a target audience to be contacted when the project was complete. For the most part, the collaboration was real and the learning occurred in both directions. Motivated intended users brought enthusiasm to the projects that proved contagious and energizing for the researchers. Their input ensured that local knowledge and expertise was incorporated and, in some instances, they directly participated in helping to conduct the research. Intended user feedback and involvement ensured that the form and content of final products met their applied management needs.

Grantees were not explicitly asked the question “what factors enabled intended users to have impact?” Nonetheless, it was possible to glean some insight to potential answers to this question from report discussions of the ways in which intended users were involved. One third of the responding grantees described the central role played by their advisory groups in facilitating research and end user communication. They offered comments such as:

- “As a result of the participation and input of the Advisory Board, it became evident that there was a need for change in the approach the project team used in addressing issues, and a more focused approach to implementation efforts.”

- “Collaboration with a subset of the intended users MAT [Management Advisory Team] heavily impacted the applied science components of the project. The MAT was integral in writing the proposal and setting up the project. Additionally, the MAT steered the direction of the experimental design adaptively throughout the project. The heavy involvement of the MAT ensured the applied science portion of the project directly addressed research needs of end-users.”

In addition to the contributions of formal advisory groups, grantees also described the frequent opportunities that had been provided for interaction between researchers and intended users that clearly fostered continuing dialogue and influence. Regularly scheduled meetings provided these opportunities, as did periodic workshops and field trips to research or demonstration sites. For example:

- "Quarterly meetings provided opportunity for joint review of the data and information gathered, and created participatory dialogue which facilitated a shared understanding of the technical information and decision-maker needs."

- "The series of workshops and one-on-one discussions with the intended users provided significant input to the overall project. Each workshop was designed to garner input and provide opportunities to realign the project."

The examples conveyed in answers to this final report question about intended user influence provide some evidence of the unique nature of the process of collaborative science. Additionally, the examples provide insight to the types of process structures (i.e. advisory groups, workshops, regularly scheduled meetings, field trips) that can enhance the effectiveness of end user engagement and the likelihood that the project will produce the applied, usable science that is its objective.

GRANTEE REFLECTIONS #2:
"What did you find most CHALLENGING or UNEXPECTED about the project?"

Grantees were asked to offer their perspectives on what they found most challenging or unexpected about their collaborative science projects. Responses to this question highlighted both procedural and research-related challenges. Each is discussed below. Six of the thirty-one grantees did not respond to this question; one grantee expressed the comment: "Overall, this project proceeded largely as originally envisioned with no major surprises."

Box 2
What was most Challenging or Unexpected?
(Responses = 25)

Collaborative Process Challenges (n=19, 75%)
- *Integration of Collaboration and Applied Science (n=11)*
- *Personnel Changes & Relationship Impacts (n=8)*
- *Time involved (n=8)*
- *Unfamiliarity with new process (n=5)*
- *Translation (n=4)*

Research Process Challenges (n=14, 56%)

Unexpected/Surprising (n=7, 28%)
- *Enthusiasm of End Users (n=3)*
- *Beneficial Ripple Effects (n=3)*
- *Other (n=3)*

Collaborative Process-related Challenges

Seventy-five percent of those grantees responding to this open-ended question in their final reports offered comments focused on the collaborative dimension of their research project. In particular, they found it challenging at times to integrate the collaborative and applied science components of the project; found that personnel changes were particularly challenging given the central role of strong relationships in supporting collaborative interactions; were surprised and challenged by the amount of time invested in effective collaboration; and, finally, some noted that the process was new and unfamiliar and hence particularly challenging to navigate. A few also noted challenges associated with translating the science so it could be understood by end users.

Integrating the Collaborative and Applied Science Processes

Almost half of those responding to this question commented about the challenges inherent in trying to integrate collaboration with end users and other stakeholders with the applied science research process. In addition to the logistical challenges, some grantees found that some end users were more interested in just learning the results, not being involved in the research. Others found working with end users challenging because their interests and needs were not monolithic. Two also noted the inherent tension between the need to be flexible and adaptive in order to realize the benefits of a collaborative approach in the face of very real time and budget constraints associated with the research grants.

For example:

- "Integration of the collaboration and applied science was difficult due to the fact that effort required to integrate and synthesize was high yet it typically fell on one or two team members to accomplish it."

- "The stakeholders were generally more interested in the specific outcomes from the new research rather than in the learning process to arrive at the outcomes."

- "More budget resources were needed to support overall project coordination as we ended up needing more calls and meetings and participating in more workshops than originally anticipated."

- "Project administration and management challenges we encountered included keeping our entire team in the loop on all aspects of the project, particularly when progress at different sites was proceeding at different speeds."

- "We had varying levels of buy-in, support and enthusiasm about the project from our various partners….we had to learn early on how much time and energy they were willing and able to give to the project."

- "The biggest challenge to completing this project was the goal to include stakeholder and other researchers' input in the project as we went along, discovering great ideas for refinement, and then not having the resources readily available to implement changes."

Personnel Changes & Relationship Impacts

A number of grantees commented that managing personnel changes in the project team proved particularly challenging. While personnel transitions inevitably pose challenges in any research project, because of the associated loss of skills, expertise, and data familiarity, these grantee comments noted the particular challenges of personnel transitions to the relationships necessary for successful collaboration. Grantees noted the importance of sustained relationships to effective collaboration and the need to carefully manage transitions, which proved to be a time-consuming process. For example, one commented: "These personnel changes required a substantial amount of administrative work to re-establish and re-envision relationships." Another grantee cautioned about the potential shift in priorities that can accompany personnel changes: "Changes in management at the reserves that may occur after a project has begun should be closely scrutinized to make sure that a shift in priorities does not impact the success of the project."

Time Involved

One-third of those offering a response to this question commented on the time commitment associated with conducting applied research in a collaborative manner. For example:

- "This required significantly more time than we anticipated."

- "We underestimated the amount of time we would need to allocate to stakeholder integration. We soon recognized that collaborative science slows the research process."

- "Scheduling and time commitments of intended users was another challenge during the project. The intended users are a diverse and busy group. Finding a common meeting time for each pilot study was difficult."

Unfamiliarity with Collaborative Processes

Five (20%) of those commenting on challenges associated with their research project noted that "Collaborative Science" was new and unfamiliar to them and they found it more challenging as a result. They made comments such as:

- "We faced challenging management issues because the project differed from past projects; everyone was simultaneously adapting their standard habits to fit the project."

- "The demands of rigorous disciplinary research were embedded within a paradigm shifting framework of interdisciplinarity and stakeholder engagement."

- "This project was a learning experience that challenged the Project Team members to reach beyond their areas of expertise and learn new skills."

- "The collaborative research model was a new concept for most team members."

- "It was challenging for the members of the project team to develop proficiency in working together."

Science Translation and Communication

A few grantees commented on the challenge associated with the reality that end users and stakeholders come to the research project with varying levels of knowledge and expertise about the science and research process. This familiarity gap needed to be bridged and that proved time-consuming.

- "We also experienced the challenges of adapting technical findings for general audiences."

- "It was often challenging to get stakeholders to understand how seemingly different components worked together in the short amount of time available for meetings."

- "Because of the relative newness of blue carbon, we had to do a lot of one-on-one outreach initially with stakeholders at the state and local levels to explain the potential."

<u>Research-related Challenges</u>

Of those grantees providing a response to the question of challenges, 14 (56%) highlighted research-related challenges that are common to any research project, and not unique to *collaborative* research involving end users. The comments noted challenges associated with modeling, monitoring, field sampling, data analysis, weather delays, limited field seasons and various technical issues. Representative responses included:

- "We underestimated the time, resources, and coordination required to design even simple demonstration sites."

- "Unexpected difficulty in obtaining reliable tidal velocity measurements."

- "Unavoidably dry weather."

- "Hurricane Isaac."

- "The highly heterogeneous urban areas, water bodies nearby, and the barren land on wetland areas were difficult to model due to their complexity when doing land-use modeling."

<u>Most Unexpected and Surprising</u>

While most grantee comments were focused on challenges associated with the collaborative and/or research processes, a few also noted some aspects of their projects that they found particularly surprising and unexpected. In particular, three noted the enthusiasm of their end users; for example, "We were honored and rewarded to hear many members effusively praise the project and its outcomes." Three others commented on ancillary benefits of the collaborative process; for example, “That broadened collaboration is ongoing and we are excited about the synergy of our efforts.” Others were surprised at their team’s resilience in the face of myriad challenges and the degree to which effective facilitation enabled the success of their project.

Summary

For the most part, responses to the question about challenges that were encountered highlight the reality that collaborative science is a different mode of research, one that stands apart from that which traditionally-trained scientists are most accustomed. While most grantees offered comments suggesting that the experience was personally and professionally rewarding, it nonetheless was quite challenging due to its unfamiliarity. Many found it challenging at times to integrate the collaborative and applied science components of the project; found that personnel changes were particularly challenging given the central role of strong relationships in supporting collaborative interactions; were surprised and challenged by the amount of time required for effective collaboration; and, commented that the process was new and unfamiliar and hence particularly challenging to navigate. At the same time, grantees noted several unanticipated outcomes that will likely benefit future research and other interactions involving the project team. In many ways, the NERRS Science Collaborative can be viewed as an experiment-in-place with applied research. The challenges encountered by grantees, and the ways in which they navigated those challenges, provide tremendous insight for others, including future Science Collaborative grantees as well as researchers in other contexts that would similarly benefit from applied, management-relevant science.

GRANTEE REFLECTIONS #3 and #4:
"Did you have all the SKILLS SETS on the team that you needed?"
"Did your BUDGET include sufficient resources to execute the project?"

Grantees were asked two related questions about the sufficiency of the human and financial resources available for their projects. Discussion of responses to these two questions is combined here. Twenty-four grantees answered one or both of these questions; seven provided no response to either question. Only seven grantees indicated they had all needed skills sets; and, only three grantees indicated that their budgets were sufficient (see Box 3 and Box 4). The majority of the grantee responses (87% for the budget question; 70% for the skills question) focused on the ways in which they leveraged additional people and funds to complete their projects or simply made do with less. As is often the case with research, and particularly true with collaborative applied science research involving end users, these processes took longer than anticipated, and project management proved more important than expected.

Box 3
Sufficient Skill Sets on the Team?
(Responses = 23)

Yes (n=7)
Leveraged Additional Skills & Expertise (n=12)
Did Without (n=4)

Box 4
Sufficient Budget Resources to Execute Project?
(Responses = 23)

Yes (n=3)
Leveraged Additional Resources (n=9)
Made do with Less (n=11)

Several commonly employed strategies for addressing skill or budget gaps were apparent in the grantee responses. They reached out to community members and others in the project network; capitalized on the skills and expertise of their project advisory groups; sought funds from other sources; partnered with university researchers who could leverage other funding resources; engaged student researchers; partnered with research institutes that had facilities and equipment; asked for no cost extensions; and, sometimes, simply did less by cutting corners where it would not diminish the integrity of the core research. Many noted that their projects would have been enhanced if they had been better able to add complementary expertise. Specifically mentioned were engineers, statisticians, economists; social scientists; ecologists; chemists; soil scientist; and anthropologists. Some project team members invested more of their own time than they had planned.

Nine grantees responding to the “skills” question explicitly mentioned ways in which they leveraged additional skills and expertise by tapping into their broader project team network, advisory group, agencies, universities and research institutes. Similarly, seven grantees responding to the “sufficient budget” question mentioned leveraging additional funding through complementary partnerships with other researchers and supplemental grants. As one commented, “we had to leverage a lot of resources from elsewhere…to make the work possible.” They reached very deep into their networks, as this comment illustrates:

- “The Project Team members relied on the expertise of members of the Manual Advisory Committee, Technical Advisors, and additional professionals along the coast to help fill in the gaps. Examples include knowledge of local and state stormwater regulations; skills related to the InDesign publishing software; and understanding of climate change implications for the coastal region of South Carolina.”

The need for enhanced project management capacity was also noted by a number of grantees, for example:

- “We could have used a dedicated project manager. The project budget approached $1 million over five years, and we managed a significant number of sub-projects and teams. It was difficult to keep track of the various tasks underway and the overall timelines and identify cross-learning needs; we would have benefited from some additional project management skill sets.”

Summary

Most research endeavors confront budget and capacity constraints; it is usually the case that more could be accomplished with an expanded set of available resources and expertise. What is most revealing about the grantee responses to these two questions about budget and skill sets is the glimpse they provide into the tremendous adaptability and leveraging that occurs within the Science Collaborative program and the NERRS more generally. Rather than saying *“We don’t have the resources so we can’t do it;”* these project teams appear to have a very different perspective. They are more apt to say, *“We don’t have the resources so where are we going to get them?”* by seeking new partnerships, tapping existing networks, and uncovering new funding sources. The NERRS community is embedded in a network that enables leveraging of resources and these Science Collaborative project teams clearly capitalized upon that fact. Collaborative research might inherently enable leveraging. By agreeing to collaborate, participants are more likely to be committed to the success of the process and more creative about finding ways to ensure that it results in research products of value to them.

GRANTEE REFLECTIONS #5:
“What do you know now that you wish you had known when you started?”

Grantees were asked two questions that prompted them to reflect on lessons they have learned from their experience conducting collaborative science. The first question, “what do you know now that you wish you had known when you started?” elicited 18 responses. [The second question is discussed in the next section, *Grantee Reflections #6*.]

Two grantees commented that they had nothing more to add to their report: “*This was an outstanding experience overall. I do not think there was anything major that I would have needed to know for a positive outcome of this collaboration.*” In contrast, sixteen grantees offered reflective observations about what was unanticipated (see Box 5). Most grantees focused their comments on specific observations about the collaborative dimension of the research process, offering observations about unanticipated benefits and/or challenges of the process. Some translated their observations about their experiences into advice for others. Five grantees noted various challenges encountered with their research methods and data analysis that they wish they had better anticipated. These challenges were not

Box 5
What do you know now that you wish you had known when started?
(Responses = 18)

Nothing (n=2)
Collaborative Process Observations (n=14)
Challenges
Benefits
Advice
Research Process Observations (n=5)

specific to the collaborative dimension of the research but are frequently encountered in any research enterprise.

Collaborative Process Observations

Fourteen grantees offered observations about the benefits and challenges associated with collaborative applied research, and provided advice for those considering a collaborative science project.

Challenges associated with the collaborative process

Several grantees commented on unanticipated challenges associated with the process, many noting that it consumed considerably more time and effort than they had planned for:

- "Conducting this type of collaborative research was much more time intensive than the project team had initially estimated – meetings occurred more frequently and required a great deal of time to plan and prepare."

- "Project management was challenging due to the large project scope and long timeframe, and the university setting where researchers, staff, and students having multiple demands, high turnover, and limited administrative support. Integration of the collaboration and applied science was difficult due to the fact that effort required to integrate and synthesize was high yet it typically fell on one or two team members."

Benefits associated with the collaborative process

Two grantees mentioned benefits of the collaborative science process that they wished, in hindsight, they had anticipated and planned for:

- "We did not appreciate at the beginning of the project that this network would present us with a new set of research questions…and serve as a platform for intervention activities."

- "An additional lesson learned was that some of the strongest collaborative learning occurred during the planning and writing of funding proposals, even though we hadn't planned on this as a key project activity. In the future, we may include proposal writing as a core collaborative learning method."

Advice for others undertaking collaborative science

Finally, several offered specific observations containing advice for others considering a collaborative science project:

- "I would be up front with collaborators from outside institutions about the time required to participate on conference calls, on-site meetings, and meetings with stakeholders. Our team gave considerable time to this interaction."

- "Discuss and clarify the following very early in the process: expectations of all partners … responsibilities of all involved… and a clear communication structure."

- “Divide the project to include two field seasons. The ability to field check technical products and spend collaborative time outdoors would help build understanding and consensus.”

- “Some of the things we now know that we wish we had known when we started include: The importance of getting the entire team together in person during the first month of the project. There may have been some benefit to a ‘pre-project program’ that could have been entirely dedicated to the critical phase of capacity-building with intended users.”

- “Either collect less data or budget more time.”

- “We learned that we have to plan multiple ways (besides reviewing models) to engage stakeholders during the initial phase of the project since modeling delays can cause stakeholder engagement efforts to lose momentum.”

- “Since you can’t engage everyone, and people are SO busy, leaders in town staff and elected positions are KEY to keeping the project results and outcomes in the forefront.”

GRANTEE REFLECTIONS #6:
"Please describe any lessons learned, obstacles, accomplishments or anything else you would like us to know about your experience on this project."

The final question posed of grantees for their final project reports was an open-ended "kitchen sink" question. That is, it asked grantees if there was "anything else" they would like to share about their project experience. Twenty grantees offered an array of concluding comments that were easily captured in 3 broad categories: the ancillary benefits associated with a project conducted with end users; observations about research conducted in a collaborative manner; and, lessons learned from the experience (Box 6).

Box 6

Anything else you would like to share about your experience?

(Responses = 20)

Ancillary Benefits Realized (n=10; 50%)

New relationships and partnerships
Subsequent research influenced
Stronger stakeholder and researcher connections with Reserve
New networking opportunities
Graduate students exposed to different research paradigm
Became better professionals

Observations about Collaborative Science (n=7; 35%)

Collaborative science is different and takes getting used to (n=5)
Sometimes end users need to be educated about project relevance (n=3)
Enables Reserves to demonstrate responsiveness (n=1)

Varied Lessons Learned (n=4; 20%)

Ancillary Benefits of Collaborative Science involving End Users

Ten grantees (50% of those responding to this open-ended question) described the ripple effects they have experienced because of collaboration with end users in their research. They commented about the ***new relationships and partnerships*** that were established by the collaboration that have, in turn, expanded the scope and reach of the project and leveraged future work:

- "We have been pleased by various corollaries (and leveraged funding) that were, and continue to be, derived from this project."

- "This project has leveraged many other projects and people outside the nucleus project team."

- "The project team was able to leverage several partnerships in order to expand the scope and range of several project objectives."

- "It has also helped galvanize the creation of a state agency community of practice that is now informing the development of state policy, regulatory guidance, and funding guidance."

They noted that ***subsequent research has been substantively influenced*** by their Science Collaborative grant, in particular because it identified new applied questions, new approaches, and new opportunities to undertake research. Some perceived that the collaborative interaction has ***established stronger connections with the Reserve by stakeholders and researchers*** and introduced ***new networking opportunities***:

- "We developed trusting relationships between scientists and community partners, and created a group of stakeholders that are planning to continue the project in the future with our support."

- "The networking opportunities provided by the collaborative nature of this project were very valuable in helping the Reserve build new and stronger connections to local researchers and stakeholders. The benefit of this collaborative effort … will go far beyond the successes seen in the workshops and in the management of freshwater inflows, but will allow us to continue working on important management issues from the numerous relationships developed with stakeholders throughout this process."

A few appreciated the added value associated with ***introducing graduate students in a fundamentally different approach to research***, one that they hope these students emulate in their careers:

- "Participation in the project allowed these students to gain valuable on-the-ground research experience, while also enhancing their outreach, communications, and public engagement skills."

Finally, two grantees offered comments suggesting that the opportunity to participate in a collaborative approach to research has ***changed them professionally***:

- "Many people who were involved in this project have candidly stated that it made them better professionals – better engineers, better regulators, better scientists, better facilitators, and better project managers."

Observations about "Collaborative Science"

Seven grantees (35% of those responding) offered insights about the unique, often challenging, attributes of science conducted collaboratively with end users. In particular, five noted that ***collaborative science is new and different and takes getting used to,*** but can also be quite energizing:

- "This was a unique project for most of the project team members and stakeholders in that we hadn't been involved in a project that brought together such a diverse group of scientists, community members, government officials, and others within a sustained collaboration long enough such that the collaboration became organized enough to function as a network."

- "This project helped evolve a different way of doing business in a highly collaborative mode with a neutral facilitator, and this approach is now being widely employed in other projects."

- "We made difficult decisions in the process, grappled with an ever-evolving state of knowledge and thinking, maintained flexibility despite varying timelines, deliverables and products in-hand, and engaged intended users…we made mistakes, and learned new information."

- "People were genuinely excited to be contributing to meaningful work, and to be working across a variety of disciplines and perspectives."

- "We were surprised and pleased by the enthusiasm for the tool."

Three grantees highlighted the reality that ***sometimes end users need to be educated about a project's relevance*** to their needs. This chicken-egg conundrum poses a challenge for a collaborative science program in which projects are judged at the outset by the level of demonstrated end user engagement and support. One suggested that collaborative science ***enables Reserves to demonstrate responsiveness*** to the complementary needs of its partners and host agencies.

Lessons Learned

Finally, four grantees (20%) provided a grab-bag of lessons learned: face-to-face interaction is more productive than virtual; it pays to be proactive in outreach to end users; progress reports that force reflection are helpful; effective facilitation is imperative.

- "Personal, face-to-face collaboration vs. depending on electronic communication is key. We conducted several collaborative team meetings and are convinced that these meetings with collaborators and intended users were key to the success of this project. Personal interaction, whether it is working through designs in a meeting or walking a site as a group to better understand the complexities of a project, was an effective investment of time and expertise."

V. SUMMARY OBSERVATIONS ABOUT THE NATURE OF COLLABORATIVE SCIENCE IN THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

The NERRS Science Collaborative is a unique program designed to advance management-relevant science through a collaborative process that engages end users with researchers. There are few other research funding programs that mirror its intent and approach. Consequently, there is value in assessing the research projects undertaken and the researchers' experiences to date in order to better inform our understanding of what appears to enable consequential management-relevant science. That was our objective in undertaking this preliminary assessment of the characteristics, grantee perspectives and lessons learned from the 2010-2014 Science Collaborative grants.

What we learned about these collaborative science projects through analysis of the 31 final project reports was informative and sometimes unexpected. It is clear that the research differs in some fundamental ways from more traditional basic research that lacks the explicit connection to management needs and manager engagement. While most grantees offered comments suggesting that the experience was rewarding for them, it nonetheless proved quite challenging because of its unfamiliarity. It was new terrain for both the researchers and end users to navigate. The challenges encountered by grantees, and the ways in which they navigated those challenges, provide tremendous insight for others, including future Science Collaborative grantees as well as researchers and managers in other contexts that similarly aspire to advance applied, management-relevant science.

As noted earlier, there are several limitations to this assessment. No interviews or site visits were conducted for this assessment. This paper represents only the first step in beginning to understand the characteristics and accomplishments of this set of Science Collaborative projects. Inevitably, some progress and final reports were more comprehensive and detailed than others. Not all grantees responded to all questions and their responses varied both in content and depth. Additionally, the topics raised in grantee responses are both self-reported and not offered in response to targeted questions that had been explicitly designed to gauge the prevalence and relative importance of pre-determined factors. Hence, our summary observations noted below are preliminary in nature. The actual usability and use of the science produced through Science Collaborative projects is being assessed through more systematic research that is currently underway by U-M researchers.

Summary of Notable Characteristics of NERRS Science Collaborative Projects

The first two sections of this report examined the core attributes of Science Collaborative projects, in particular: focal issues, system and scale of interest, nature of the science produced, collaborative lead, intended end users and their level of engagement, and how research findings and products are disseminated. In a nutshell, we found that:

- The projects were focused on issues that cut across all of the NERRS 2006-2011 priority areas; no single issue-type predominated.

- While all of the research projects were interested in natural system issues, some nonetheless also focused on social and/or constructed/engineered systems.

- Most projects were focused on the Watershed or broader Regional Scale; *few were solely reserve-focused*.

- Most projects were applied in nature, producing science that intentionally built capacities and skills for management action. None were more traditional basic data-centered science.

- Reserve staff played a predominant role in leading or assisting with the collaborative process, as did skilled professional facilitators from both the public and private sectors.

- All projects included a primary Intended End User from the Public Sector (state and federal resource agency managers; local and regional managers, officials and planners); but public, private and non-profit sectors were well-represented as project end users.

- From the project reports, it appears that end users were engaged in significant ways in the majority of the projects.

- A very broad spectrum of methods was and continues to be used to convey the science produced to intended end users. Most methods are direct, meaning that they involve users in an interactive exchange and employ hands-on tools, plans, and guidance.

<u>A Systems, not Reserve, Orientation</u>

One striking observation from this preliminary assessment is the decidedly systems-focus of most Science Collaborative projects. These projects reveal a deliberate NERRS emphasis on informing and influencing decisions made by a broad array of individuals and organizations whose activities affect the larger estuarine ecosystem of concern to Reserves. Far from the image of a reserve-level manager and researcher working together on a narrow site-specific research question, instead we found a complex and varied set of relationships between researchers, reserve staff and potential end users. The *estuarine ecosystem*, often including its social elements, is the central focus and concern of most projects, *not the individual reserve*.

Two-way Learning

Another notable observation from our review of the full set of 31 project reports is that it is quite apparent that substantial two-way learning is occurring in the majority of these projects. Some might assume that collaborative research simply means that the researchers reach out to end users at the beginning of a project to learn what is needed, and then return to their research with those needs in mind. In fact, most of these projects were truly collaborative in nature, with sustained interaction between researchers and end users that enabled shared learning to occur. Knowledge and expertise were shared in both directions, and the project focus and products were adapted accordingly. The projects evidence a highly interactive process in which end users had a meaningful and consequential role and impact on the research. They were not just a target audience to be contacted when the project was complete.

Synergies and Ripple Effects

The collaborative nature of these research projects not only fostered two-way learning, it also created synergies that similarly advanced the immediate research. End user energy and enthusiasm about the projects proved motivating for the researchers. Local knowledge and networks brought new ideas and opportunities into the process. We were struck by the numerous comments made by grantees about the ancillary benefits of their Collaborative Science projects. These projects are clearly not insulated activities, with a narrow set of influences. Instead, the fundamentally different collaborative approach to this research not only created new science and research products but it also engaged and transformed a network of people who continue to interact within new initiatives. The projects had synergistic effects on future research, individual professional practice, ecosystem understanding and community relationships that will likely endure once the research projects are concluded. Graduate student researchers who were involved in the projects gained skills and insights into how to conduct collaborative science.

Collaborative Science is Unfamiliar and Requires More Time and Skill Sets

Science conducted in a collaborative manner involving end users is not easy. It is quite apparent from the experiences of the 2010-2014 Science Collaborative projects that collaborative science, conducted in a manner that truly capitalizes on the full intent and opportunity inherent in researcher and end user interaction, requires additional time and skills sets than traditional basic research. It is a different research process that is unfamiliar and challenging to those grounded in more traditional research paradigms. Grantees quickly confronted that reality and had to adapt accordingly. All involved – researchers, end users, and collaborative leads – invested considerably more time than anticipated in interacting and adapting to new ideas and directions. Those responsible for project management encountered logistical challenges that were sometimes daunting and quite unique to the collaborative nature of the endeavor.

Intentional Processes that Ensured Intended User Engagement & Influence

Grantees were not explicitly asked a question for their final project reports about what factors had fostered the meaningful intended user influence that they had observed on the applied science component of the research. However, their descriptions nonetheless conveyed a picture of sustained involvement of intended users throughout all stages of the projects. These interactions between researchers and end users do not magically happen; they need an opportunity within which to take place, and a process facilitated in a manner that capitalizes on those opportunities. Advisory groups, workshops, regularly scheduled meetings, field trips and the like, provided those important opportunities in which interaction, learning and project adaptation occurred.

Leveraging Strategies

It is invariably true with almost any research that budget constraints will exist and more could be accomplished with an expanded set of available expertise. Grantee reflections provide a glimpse of the tremendous adaptability and leveraging that occurs within the NERRS Science Collaborative community in navigating these constraints. Project teams have been able to leverage additional resources and expertise by seeking new partnerships, tapping existing networks, and uncovering new funding sources. The NERRS community is embedded in a network that they clearly capitalized upon in conducting these Science Collaborative research projects.

Science Diffusion within an Extended Network

The story that quickly emerges from grantee descriptions of the myriad ways in which they disseminate the results of their research is that the NERRS community resides within an extensive and dynamic network. Applied research implies application and most Collaborative Science researchers appear quite committed to conveying what they have learned to those who can potentially use it, both within the NERRS community and beyond. While some project findings are disseminated through traditional academic conferences and publications, most are transferred through more interactive, often hands-on, opportunities involving professional associations, community groups, agency workshops, demonstration projects, and products that can be easily distributed to those who are interested.