Mission-Aransas National Estuarine Research Reserve (NERR) Needs Assessment

Kelly Dunning, July 2019

Introduction: Coastal Stressors Facing Mission-Aransas NERR

Populations are growing along American coasts, especially along the Gulf of Mexico. In the United States, 29% of the population live within coastal counties, counties that are also some of the country's largest concentrations of population and economic activity (Cohen 2018, National Climate Assessment 2014). Coastal counties along the Gulf of Mexico ("the Gulf") in particular have increased by 24.5% between 2000 and 2016, meaning regional growth there is fastest compared to other U.S. coastal regions (Cohen 2018). Nearly 14 million total residents call the Gulf home, a region with twice the rate of population growth compared to the American population overall (U.S. Census Bureau 2015).

More people means that ecosystems are dramatically altered by human stresses, with climate change resulting in continuing loss of ecosystem services that benefit human well-being (National Climate Assessment 2014). For example, development leads to the loss of coastal habitat such as wetlands. This is accompanied by a loss in buffering and coastal protection services that keep communities safe from storms, erosion, and flooding (Costanza et al. 2008). With more people in coastal zones, managers and decision-makers will need to be prepared for hazards facing coupled human-natural systems such as flooding, droughts, sea level rise, erosion, ecosystem degradation, and reduction of ecosystem services (Huntjens et al. 2011).

Gulf ecosystems, including those of the Mission-Aransas NERR, face stressors for a range of human activities including the expansion of oil and gas industry, recreation and tourism, infrastructure, and housing construction. The Gulf has the highest levels of workforce employed in construction and natural resource extraction (10.8%) in the U.S. (Cohen 2018). Following the 2015 lifting of the federal exporting ban on crude oil, a surge of oil and gas development, infrastructure, and jobs is making its way to the Texas Gulf Coast. Multiple pipelines are under construction to bring oil from the West Texas Permian Basin to the coast, and with these pipelines over 2000 jobs are expected in the City of Corpus Christi, a major crude exporting hub, and one of the municipal areas covered in this study (Hopkins 2018). Approximately two-thirds of imported oil enters through Gulf of Mexico ports as well, areas at risk to storm-related flooding, erosion, and permanent inundation from sea level rise (National Climate Assessment 2014). With new coastal jobs come demand for housing and raw materials, with the Gulf seeing 4.5 million new housing units between 1960 and 2008 (U.S. Census Bureau 2015).

In addition to the extractive industries, unique ecosystems and wildlife make tourism the backbone of many coastal communities in the Gulf of Mexico, with tourism responsible of 8% of regional employment in coastal South Texas ("the Coastal Bend"), and over a billion dollars in economic activity annually in the city of Corpus Christi along (Lee 2014). Balancing the regional economic importance of the resource extraction industry with the tourism industry is a major challenge for key stakeholders that include planners; local, state, and federal government officials; resource managers; and community groups.

Growth along the Gulf makes hurricane readiness and recovery a fact of life. Property damage incurred over the past four decades of hurricane seasons has increased exponentially (Cutter and Emrich

2005). There is evidence that hurricanes, due to an increase in sea surface temperatures over the Gulf of Mexico, are increasing in intensity in the region, meaning these trends may continue (Karnauskas et al. 2013).

Analyzing coastal governance, and how institutions respond to coastal hazards is more important as these hazards become exaggerated by climate change. Coastal hazards predicted to worsen with current climate change projections include increased vulnerability of "coastal lifelines" such as water supply, energy infrastructure, and evacuation routes; disruptions to economic activity in tourism assets such as fishing sites and ports; limitations caused by socio-economic disparities that may prevent some communities from absorbing the impacts of hazards; and further ecosystem degradation (National Climate Assessment 2014).

Therefore, the major stressors that the Mission-Aransas NERR Coastal Training Program must address are population growth, habitat loss, balancing economic growth in oil and gas with nature-based tourism, and the threat of climate change impacts.

Research Methods

This Needs Assessment consisted of two components: one-on-one interviews, and an in-person survey. The interviews were conducted first, upon completion of the literature review above, and those responses were used to help create the survey. Overall, 30 key informant interviews were completed and 84 surveys were analyzed. Target respondents are identified in the table below:

Respondent Category	Number Surveyed
Resource manager (such as Nueces County Coastal Parks, Aransas National Wildlife Refuge)	36
City/local government (such as Port Aransas, Aransas County, and Corpus Christi officials)	23
Scientists and academics	15
Community groups, NGOs	10

In accordance with UT Austin Institutional Review Board (IRB) protocols, all respondent identities and affiliations are private and confidential, which is standard for studies involving human subjects. Respondents may be identified with a broad affiliation. Surveys asked respondents a range of questions asking yes or no answers or utilized a likert scale ranking system. The survey was structured with a list of training topics updated from the existing interview guide. Surveys were entered into Excel, and analyzed using basic descriptive statistics. Interviews were coded using thematic coding, where broad themes were identified for individual respondents, and then cross-compared between respondents. Themes were sorted by major and minor themes, and are reviewed in the following sections.

Results

For the survey, respondents were asked to review a list of training subjects and rank them on a scale of 1 (minimal interest) to 5 (strong interest) in receiving the training. The ten most popular topics identified by survey respondents were marine debris, climate change, water quality and industrial pollution, coastal and shoreline planning, science communication, ecosystem-based management, desalination, ecosystem services, endangered species, and coastal resilience. Topic scores are listed in

the table 2 below. These ten topics became the source of an interview manual, eliciting more specific sub-topics of training needs for respondents. These sub-topics and specific training needs are described and expanded upon in the following sections.

Topic	Score
Marine Debris	4.9
Climate Change	4.9
Water Quality and Industrial Pollution	4.9
Coastal and Shoreline Planning	4.8
Science Communication	4.8
Ecosystem-based Management	4.7
Desalination	4.5
Ecosystem Services	4.5
Endangered Species Management	4.0
Coastal Resilience	4.0

Table 2. Ten most popular training topics and their scores.

Marine Debris

Of all topics mentioned by respondents, marine debris was of the highest priority. Respondents repeatedly mentioned concerns are plastic pollution, microplastics in the gut contents of fish, plastics found in the x-rays of turtles and birds, and the low tide prevalence of plastics on Texas beaches as being major concerns. Respondents asked for training on institutions tasked with marine debris and plastics removal from Texas beaches, citizen-science opportunities for tracking and measuring plastics, and explanations on why Texas beaches seem to be covered in plastic pollution compared to other Gulf beaches in states like Florida. The desired formats of marine debris trainings include symposia on the latest research and trainings on citizen-science opportunities.

Climate Change

Climate change was also one of the top three desired training topics among respondents. Resource managers worry that habitat loss and human infrastructure for tourism (such as boat ramps and piers) will be more vulnerable to increased storm damage and sea level rise (SLR). Local government officials were interested in planning strategies for impacts of climate change and resources on where the impacts (current and future) of climate change can be researched. The fact that many predictions for climate change impacts tend to be regional vs. local, and that there is a great deal of uncertainty over specific municipal or county level impacts, is frustrating to officials looking to be prepared, but facing uncertainty.

Subtopics of interest relating to climage change include: communicating risk, sources on future impacts, how to communicate insurance to the public, nuisance flooding, and how hurricanes will change through time. Communicating risk was the most commonly identified need for training among community members fresh after Hurricane Harvey. Respondents repeatedly cited the poor communication from officials to citizenry that followed Harvey on topics such as when people may return after a storm, or what types of insurance coastal property owners should have. Improvements to risk communication was universally identified across respondents as being challenging and an area

where they can build capacity. Respondents requested trainings on where they can find resources on impacts including future projections for sea level rise, flooding increases, and habitat loss such as coastal squeeze. Coastal squeeze will occur when sea level rise floods coastal wetlands habitat, leaving fewer wetlands and more urbanized settlement. Examples of such resources include the National Climate Assessments, NOAA's C-CAP Atlas, and others.

Local decision-makers asked for training on how to communicate insurance to citizens of the Coastal Bend. Many cited the pervasive lack of insurance, or "under-insurance" leading to catastrophic financial damages to Coastal Bend families across socio-economic strata. Many residents failed to properly insure their homes, whether they owned or rented, and were confused about where to apply for payouts after the storm. Many renters did not know that if the owners were not insured, that their repairs could take months or years. Trainings on the basics of communicating housing risk to the public were requested from every respondent working in the planning sector. Navigating the claims process after was also a major request as, even two years later, residents are continuing to navigate this complex and challenging process.

Two topics of high importance relating to climate impacts that people deal with today include how day-to-day nuisance flooding from regular storms will change through time, and how hurricane strength and frequency will change through time. Communicating these impacts to the public, as well as how they can mitigate impacts (insurance) will be key to the next few years of the Coastal Training Program.

Water Quality and Industrial Pollution

Respondents requested training on local data/indicators on water quality. There is a prevalent feeling among decision-maker stakeholders that water quality, which so much oil, gas, and petrochemical infrastructure in the area, is lower than it should be. That said, many respondents are unsure how this is measured, who measures it, and what triggers an institutional response when toxins are found in the water. Even the common types of toxins that may be in the water in an area with high levels of petrochemical infrastructure were a significant source of uncertainty, and a topic requested regularly for training. Key actors (possible sources of pollution, monitoring bodies) and key data sources were topics over which respondents desire additional training. Stakeholders from fishing community groups especially are concerned with fish populations and the long-term effects of water quality as it relates to fishing livelihoods.

Another concern identified by respondents regarding water quality is the important Texas subject of freshwater inflows. Respondents requested training in the relevant stakeholder groups of freshwater inflows, and how inflows are monitored and proper levels enforced. Given the involvement of several NERR staff on freshwater inflow stakeholder groups, a workshop can easily be planned and implemented at a regular interval discussing this topic and the governance of freshwater inflows in the Coastal Bend.

Coastal and Shoreline Planning

Urban planners make up a significant target audience for the Mission-Aransas NERR. There is significant regional interest in the National Flood Insurance Program, the Community Rating System (CRS), and related concepts. The Federal Emergency Management Agency (FEMA) create base flood

elevation (BFE) maps at regular intervals, and many stakeholders expressed interest in technical support in navigating these concepts. Aransas County and the City of Rockport is currently working on certifying themselves in CRS, with the assistance of Texas Sea Grant, based on the work of a previous CTP coordinator on coastal floodplain management. These topics are of high interest to community members because they spell real financial incentives (savings on flood insurance premiums) for the public. Floodplain management, Fortified Building Standards, Hurricane Safe Building Codes, and communicating the benefits of these concepts were the key demands listed by stakeholders in this topic. There is also a need to provide technical assistance to county governance on planning for resilience through the implementation of living shorelines and green infrastructure. The Aransas County Long-Term Recovery Team and their Resilience Working Group are key stakeholders focused on these subjects. The major need is how decision-makers can follow developing rules (Texas General Land Office has authority over both green infrastructure and living shorelines) and avoid red tape in implementing these projects in their jurisdiction. Having the GLO give a training on this subject for city and county officials was a desired training concept among respondents.

Respondents expressed an interest in receiving technical training relating to urban planning in Google Earth, ArcGIS, and statistical software for policy analysis.

Science Communication

A recurring them that transcends individual topics for training was the ability to communicate complex science to the public. Whether it is officials being able to communicate the importance of enrolling the municipality in the CRS, or why people need to have both flood and wind insurance in coastal zones, communication was of major importance to respondents from all stakeholder groups. Communication skills respondents specifically asked to be trained in included facilitation and mediation, science-based communication, and visualizing risk. Respondents also mentioned the need for training on politically sensitive topics (man-made climate change) that many not appeal to their constituents, but may be a day-to-day reality with SLR and increased nuisance flooding. Workshops aimed at different stakeholder groups (decision-makers, planners, academics) on how to do scientific or technical communication to their core audiences may be a critical topic for training in coming years.

Ecosystem-based Management

Ecosystem-based management (EBM) is a complex topic that goes by many names. The National Academy of Science, Engineering, and Medicine (NASEM) Gulf Research Program refers to this as managing coupled human-natural systems. This concept is receiving a lot of funding and decision-makers attention as its importance becomes increasingly clear. Examples of EBM relevant to the Mission-Aransas NERR context include 1) how increases to the petrochemical industry can have impacts to coastal wetlands and fisheries, and how these impacts can be balanced with economic growth; 2) how oil spills may impact eco-tourism, beach recreation, and coastal wetlands; 3) how industrial development in the Port of Corpus Christi may impact commercial and recreational fisheries, and how can mitigation measures be put in place; and 4) how does land-use/land-cover change associated with high levels of population growth impact coastal tidal bays and inlets. All of these questions are complicated and require a range of disciplinary backgrounds and expertise to answer, but all were of great interest to respondents, and may constitute interesting, well-attended training events with opportunities for University of Texas Marine Science Institute faculty to present ongoing research.

Desalination

As of 2019, desalination is of major interest to decision-makers and community groups. There are several proposed environmental permits in process for the Port of Corpus Christi to lease Harbor Island to a desalination plant, and to dredge its shipping channel to accommodate very large crude carriers (VLCCs). Many respondents are concerned with the potential ecological stressors that may results from desalination. These may be potential training topics, and they include: how brine discharge may impact larval fish (and commercial and recreational fisheries), how entrainment of larval fish from the intake valves may impact populations, how deeper channels may impact velocity of water and coastal erosion of habitat, how all impacts may combine to change the character of tourism-based Port Aransas. This issue is politically sensitive but very popular among respondents.

Ecosystem Services

Ecosystem services are defined as the benefits that people derive from ecosystem functions. Respondents were primarily interested in how decision-makers can better incorporate ecosystem services into decisions. For example, if deeper shipping channels that accommodate VLCCs bring the city of Corpus Christi more income from shipping and petrochemical industry, how can those gains be measured against the potential loss of wetlands? Wetlands provide benefits that are hard to quantify, such as coastal protection of property and flood control. Pete Wiley is currently working on developing training materials for the NERRs on the subject of ecosystem services. The Mission-Aransas NERR can benefit from delivering these trainings as they develop.

Ecosystem services that respondents were most interested in receiving training on include coastal protection services (erosion protection) of wetlands and dunes of coastal property; flood control services of coastal wetlands; storm surge protection of coastal wetlands; the recreational services of bird populations such as whooping cranes, which bring in significant amounts of ecotourism income; the carbon sequestration (regulating services) of coastal wetlands; habitat services whereby coastal wetlands provide nursery space for commercially important species of fish and crabs; and recreational services that commercial and recreational fisheries provide.

Endangered Species Management

The Coastal Bend is home to two iconic endangered species, the Kemp's Ridley turtle and the whooping crane. Stakeholders expressed an interest in regular meetings for stakeholders where the latest research can be shared. For example, the noted the Hurricane Harvey Research Symposium of 2018, where Harvey's impacts ot the Aransas National Wildlife Refuge and whooping crane populations were shared by scientists and experts working on those subjects. Other topics of interest to resource managers include how to communicate stewardship behavior to the public, such as keeping airboats at a particular distance from cranes.

Coastal Resilience

Coastal resilience is another concept getting a lot of funding and policy attention in recent years. It is defined as the ability of a system (human or natural) to absorb changes created by a stressor and retain essential processes. For example, a resilient wetland when facing an oil spill will not lose all of its saltgrass and marine organisms, and will retain its ability to hold flood water and attenuate waves and erosion. A resilient socio-economic system (such as a city), when hit with a stressor (such as a

hurricane), will recover in a way where it will not lose its residents and essential services in such a way where it would be unrecognizable. Specific concepts respondents are interested in receiving training on include measuring socio-ecological resilience, scenario planning and interventions for resilience, how green infrastructure can enhance resilience, and how policies (such as building codes) can lead to community resilience.

Market Analysis

The primary recipients of Mission-Aransas NERR Coastal Training Program offerings are local and state decision-makers; local, state, and federal resource managers; non-profits; and scientists/academics. These stakeholders are listed in Table 3 below.

Stakeholder Category	Main Examples
Local and state decision-makers	• Aransas County Government • Corpus Christi Government • Port Aransas government • Rockport government • Aransas Pass government • Texas Water Development Board • Texas Division of Emergency Management
Local, state, and federal resource managers	• Nueces County Coastal Parks • Texas General Land Office • Texas Parks and Wildlife • Port Aransas Parks & Recreation Dept. • Aransas National Wildlife Refuge • U.S. Fish and Wildlife
Non-profits	• Coastal Bend Bays & Estuaries Program • Keep Port Aransas Beautiful • Keep Aransas County Beautiful • Coastal Conservation Association • FlatsWorthy • Surfrider
Scientists/Academics	• Texas Sea Grant • Harte Research Institute for Gulf of Mexico Studies • Coastal Studies Center at Texas A&M Corpus Christi • University of Texas Marine Science Institute

Table 3. Examples of stakeholders in the Coastal Bend that participate in Mission-Aransas NERR CTP events

Other local stakeholders offering similar training to the Coastal Training Program include Texas Sea Grant and the Harte Research Institute for Gulf of Mexico Studies. These programs at times have shown potential for duplication of effort, which has been deal with through partnerships and collaboration where appropriate. It may be necessary for the Coastal Training Program to adopt weekly

or monthly calls with its counterpart at these institutions to assure that resources are not leading to duplication of effort. Stakeholders who attend training from these three entities have voiced frustration over not understanding who does what, and how there can at times be duplication of effort.

Organizations that the Coastal Training Program should build stronger links to include the Texas Water Development Board, the Texas Division of Emergency Management, the section of the General Land Office responsible for administering the post-Harvey housing recovery mission, and the Aransas Pass government. All other organizations and agencies listed have some collaborative project that the Coastal Training Program has been involved with within the past five years.

Developing a competitive edge for offering training programs should capitalize on assets already help by the Mission-Aransas NERR, such as our outstanding and newly renovated facilities and our access to world class researchers. The Coastal Training Program could aim to transfer the research of 1-2 UTMSI faculty members per year, as a way of better leveraging the connection to UTMSI and better connecting the university to the NERR. It can also apply for funding to add to its facilities a computer training room for GIS and analytics trainings.

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