

Coastal Community Resilience:
An Evaluation of Resilience as a Potential Performance
Measure of the Coastal Zone Management Act

Final Report of the CSO Coastal Resilience Steering Committee
July 2008



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Performance Measure of the Coastal Zone Management Act

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EXECUTIVE SUMMARY

The Coastal States Organization (CSO) has partnered with the National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center (CSC) to engage state coastal management programs and other relevant partners on issues related to coastal resilience. This white paper was developed in collaboration with the CSO Coastal Resilience Steering Committee, which is composed of representatives from NOAA and the states and staffed by CSO.

The concept of "coastal resilience" is a new way of thinking about how to better protect coastal communities from a range of natural hazards. Resilience incorporates elements of coastal management, emergency response, and community development. Many communities across the country have already begun to implement programs to enhance resilience, and these communities can serve as examples of how to effectively incorporate resilience principles into coastal management. Resilient communities understand the hazards they face, take specific and coordinated actions to reduce their vulnerability, and develop response and recovery plans to facilitate a quick response and effective long-term recovery should a disaster occur.

Resilience has been proposed by some in the coastal management field as a way to measure state progress on the objectives of the Coastal Zone Management Act (CZMA) because it incorporates a broad range of elements – land use planning, hazards mitigation, resource protection, community cohesiveness, cultural preservation, etc. – that contribute to overall coastal community health. If resilience could be pared down to one or several simple "scores" from an aggregate of indicators, then it could be a useful tool for tracking progress in the states and a straightforward way to convey the effectiveness of coastal management programs to Congress and the public.

There are several impediments, however, to modifying the existing CZMA Performance Measurement System to include resilience. After evaluation, the CSO Coastal Resilience Steering Committee does not recommend the use of resilience as a CZMA performance measure at this time because:

1. There is currently no widely accepted mechanism for measuring resilience.
2. Resilience indicators or measures are often site-specific and not necessarily useful for measuring progress or conditions on a statewide or national scale.
3. It is impossible to accurately evaluate and compare the effectiveness of the existing CZMA Performance Measurement System before the phased implementation is complete and analyses are conducted on the results.
4. States have invested significant resources to implement the existing CZMA Performance Measurement System. It is unlikely that the use of resilience measures would ease data collection for the states and it may even make data collection more difficult. States would most likely require significant resources to modify the system.

The Steering Committee nonetheless recognizes the value of resilience to coastal management and concludes this paper with some concrete recommendations for advancing the concept of resilience in coastal states and communities.

Introduction

Coastal communities in the United States and around the world are increasingly vulnerable to natural hazards that have the potential to threaten life and cause widespread damage to homes, businesses, and infrastructure. Episodic events such as hurricanes, tsunamis, flooding, and severe storms cause human loss and suffering; damage property and natural resources; displace residents; and disrupt daily life. Chronic disturbances like sea level rise, fluctuating lake levels, and climate change may prove to be even more damaging to coastal communities over the long-term.

Vulnerability in the coastal zone is increasing as more people move to the coast and natural buffers such as wetlands and dunes are lost to development and erosion. Coastal counties make up only 17% of the land area of the U.S., but account for approximately 53% percent of the population (NOAA 2004). By the year 2025, nearly 75% of Americans are expected to live in coastal counties. High coastal population density coupled with projected increases in storm frequency and severity may exacerbate the impacts of coastal disasters and slow subsequent recovery and community rebuilding efforts. Recent events such as the 2008 cyclone and 2004 tsunami in Southeast Asia and Hurricane Katrina along the Gulf Coast have illustrated how significant the social and economic costs can be when a major natural disturbance occurs in a developed coastal area.

In the wake of such events, private citizens and public officials are questioning how coastal communities can better prepare for potential hazards. While most hazards are outside of a community's control, proactive measures may be taken to reduce vulnerability and increase a community's capacity to absorb and bounce back from disturbance. The concept of "coastal resilience" is a new way of thinking about how to better protect coastal communities. Resilient communities understand the hazards they face, take specific and coordinated actions to reduce their vulnerability, and develop response and recovery plans to facilitate a quick response and effective long-term recovery should a disaster occur.

While resilience has been used for years to describe ecological systems, it is a relatively new way of thinking about how to comprehensively manage coastal areas to reduce vulnerability. Resilience is now being actively promoted as a management strategy by organizations and agencies such as the National Oceanic and Atmospheric Administration (NOAA), Resilience Alliance, United Nations International Strategy for Disaster Reduction, and World Wildlife Fund, among others. Proponents of the concept suggest that planning for resilience can proactively reduce vulnerability by recognizing and accounting for the complex ecological, social, engineering, and economic links that exist in communities.

In the U.S., coastal managers are already involved in many activities that promote resilience, such as hazard mitigation, shoreline management, and land use planning. Since resilience is becoming an accepted management strategy for reducing vulnerability in coastal communities, the important role played by state and territorial coastal programs must be recognized and enhanced. To date, states have implemented coastal resilience principles to varying degrees. It has become apparent that some coastal states are embracing the concept, while others are wary of its utility or unsure how to move resilience from an academic concept to on-the-ground action.

It is in this context that the Coastal States Organization (CSO) has partnered with the NOAA Coastal Services Center (CSC) to engage state coastal management programs and other relevant partners on issues related to coastal resilience. In 2007, CSC provided CSO with grant funding to:

1. Enhance states' understanding of coastal resilience.
2. Explore whether coastal resilience could be used as a tool for measuring the effectiveness of the Coastal Zone Management Act (CZMA).
3. Increase states' knowledge on the opportunities to incorporate coastal resilience into state and federal legislation.
4. Serve as a liaison between CSO, coastal states, and CSC on activities related to coastal resilience.

The purpose of this white paper is thus to provide an overview of coastal resilience and, more specifically, evaluate whether coastal resilience would be a valuable performance measure of the CZMA. Development of this white paper has been guided by the CSO Coastal Resilience Steering Committee, which is composed of representatives from NOAA and several state coastal management programs (Appendix A).

The white paper will first provide an overview of the CZMA and the existing CZMA Performance Measurement System. It will then provide an overview of resilience as it relates to coastal management, including information on the history of resilience in academic literature, a definition of coastal resilience, characteristics of resilient coastal communities, and methodologies for assessing and measuring resilience. The paper will then review some of the benefits and impediments to using resilience as a performance measure, and will conclude with a discussion and recommendations for moving forward with resilience in the coastal management context.

Background on the Coastal Zone Management Act

In 1972, Congress passed the Coastal Zone Management Act (CZMA) to “preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation’s coastal zone for this and future generations.” The CZMA established a federal-state partnership to manage the coasts in a manner that balances resource protection with economic development. Currently, 34 out of 35 eligible coastal and Great Lakes states and territories have established coastal management programs under the CZMA. States are given significant flexibility to tailor state programs to their unique issues and resources, and NOAA administers the CZMA on behalf of the federal government. The CZMA also established the National Estuarine Research Reserve System (NERRS), which currently has 27 reserves located in 22 coastal states/territories. The reserves represent different biogeographic regions of the U.S. as reference sites for research, monitoring, and education.

Because each state coastal management program and reserve is unique in its structure and function, it has been historically difficult to quantify the effectiveness of the CZMA. Triennial state and reserve program evaluations and independent assessments have generally indicated

that NOAA and the states were successful at meeting the goals and objectives of the CZMA; however, more quantifiable performance measures are necessary to effectively track progress and have also been requested by Congress and the Office of Management and Budget (OMB).

Coastal Management Performance Measurement System

In 2001, NOAA contracted with the H. John Heinz III Center for Science, Economics and Environment to develop a framework for a National Coastal Management Performance Measurement System (Heinz Center 2003). The Heinz Center identified the following six focus areas that capture CZMA objectives and contain elements that could be quantitatively measured:

1. Coastal habitats
2. Coastal hazards
3. Coastal water quality
4. Coastal dependent uses
5. Public access
6. Coastal community development

The Heinz Center further developed dimensions or sub-themes for each of the six focus areas. The final report recommended the development of indicators based on those dimensions.

NOAA then began a collaborative process with state coastal management programs and the reserves to develop a performance measurement system that would provide adequate information to objectively assess state program and reserve effectiveness, and also provide the flexibility to accommodate varying management structures and state priorities. The resulting CZMA Performance Measurement System measures on-the-ground results of the state-federal CZMA partnership through the collection of performance measures and contextual indicators.

Performance measures, adapted from the focus areas and sub-themes identified in the Heinz report, assess how well programs are achieving the objectives of the CZMA. Contextual indicators, on the other hand, provide a picture of environmental and socioeconomic conditions, such as population and development trends, that influence the state coastal management programs. State programs generally have little influence over these parameters, but they are important to track because they influence coastal resources and program performance. In 2005, NOAA and the state coastal management programs began phased implementation of the CZMA Performance Measurement System, and the measures have been refined as necessary through the process. The current list of performance measures is included as Appendix B. To date, states have provided data on measures for coastal habitats, coastal water quality, public access, and government coordination and decision-making. The last phase of implementation began in 2008 with the collection of performance measures related to coastal hazards and community development.

It is difficult to assess the effectiveness of the CZMA Performance Measurement System at this time because phased implementation is still in progress. Only four of the six categories of

performance measures have been collected, and NOAA has not yet publicly reported that data. Contextual indicator data, summarized either regionally or nationally, are available on the NOAA Office of Ocean and Coastal Resource Management (OCRM) website. As previously mentioned, however, the contextual data do not directly measure state program performance at meeting CZMA objectives, but simply provide a picture of environmental and socioeconomic conditions in the coastal zone. Throughout the phased implementation process, NOAA and the states have worked together to streamline and improve the performance measurement system. In 2007, the number of performance measures was significantly reduced to focus on performance measures that best demonstrate progress towards meeting the goals of the CZMA. OCRM has expressed a willingness to work with the states to further refine the system after the phased implementation period is complete and results are assessed.

Anecdotal evidence suggests that data collection has been a challenge for many states. Coastal management programs devoted significant resources to develop data collection and reporting systems for the phased implementation. Many state programs already faced resource limitations (both funding and staff), making the identification and collection of performance measurement data particularly difficult. To fully implement the performance measurement system in the long term, NOAA and the states will need to invest additional resources for staff, training, equipment, and data management.

It has been proposed by some in the coastal management field that resilience be used as a performance measure of the CZMA. Because coastal resilience is so cross-cutting – it incorporates elements of land use planning, hazards mitigation, resource protection, community cohesiveness, cultural preservation, etc. – proponents argue that it could provide an overall picture of coastal community health and effectively capture progress towards meeting the varied goals and objectives of the CZMA. Furthermore, since resilience is assessed in a site-specific manner, it may accommodate the different structures and needs of the different coastal states. If resilience could be pared down to one or several simple “scores” from an aggregate of indicators, then it would be a useful tool for tracking progress in the states and a straightforward way to convey the effectiveness of coastal management programs to Congress, OMB, and the public.

In order to evaluate whether resilience should be considered as a performance measure for the CZMA, we first need to know: 1) how does resilience relate to coastal management and to the objectives of the CZMA?; 2) how is resilience assessed or measured?; 3) would resilience be more effective than existing performance measures?; and 4) what are the costs of modifying the current system?

Resilience and Coastal Management

Resilience - the ability of a system to adapt to and recover from disturbance.

The foundation for the term “resilience,” as it is used in the context of coastal management, comes from the field of ecology. Resilience was first defined as an ecological concept by C.S. Holling in his influential paper, “Resilience and stability of ecological systems” (Holling 1973). According to Holling’s original definition, resilience determines the persistence of relationships

within a system and is a measure of the ability of these systems to absorb changes and still persist.

The concept of ecological resilience has since expanded and been applied in a larger context as the critical links between social and natural systems have become better understood. It is widely accepted that effective natural resource management requires an understanding of both the social and ecological properties of a system. The roots and development of the social-ecological resilience perspective are well documented in the academic literature, and many organizations and agencies have adopted definitions of resilience using that work as a foundation.

The CSO Coastal Resilience Steering Committee reviewed and evaluated many of the existing definitions of resilience (Appendix C) and adapted a definition that fits the goals and objectives of CSO's constituents:

Coastal community resilience refers to the ability of linked social, ecological, and economic systems within the coastal zone to adapt to and recover from disturbances such as hurricanes, tsunamis, floods, sea level rise, Great Lake level fluctuation, and harmful algal blooms. A resilient coastal community can absorb shocks while maintaining function. When change does occur, resilience promotes renewal and reorganization.

Coastal community resilience can be strengthened by decreasing the probability that a hazardous event will become a disaster, avoiding or mitigating the potential effects of a disturbance, and/or facilitating recovery after a disturbance has occurred (McCarthy et al. 2001). Common characteristics of resilient systems include redundancy, diversity, efficiency, autonomy, strength, interdependence, adaptability, and collaboration (Godschalk 2003). In a resilient system, disturbances have the potential to create new opportunities and promote innovation. It is important to note, however, that resilience is not always desirable. Some system characteristics that decrease social welfare or diminish ecological functioning may also be highly resistant to change, such as the "resilience" of many invasive species in non-native habitats.

An important point regarding resilience is that it must be evaluated within an appropriate site-specific context. For any particular coastal community we must consider resilience **of** what and **to** what. For example, communities may consider the resilience **of** the built environment **to** hurricane winds or the resilience **of** the commercial fishing industry **to** coastal habitat degradation. Each coastal community must comprehensively consider ecological, social, and economic vulnerabilities in light of potential threats in order to understand its overall resilience.

Coastal community resilience incorporates elements of coastal management, emergency response, and community development. As such, resilience does include many of the objectives of the CZMA and many of the activities conducted by state coastal programs, but it is also much broader. Using a resilience approach to reduce vulnerability of coastal systems will require a cooperative effort from entities and professionals unaccustomed to working together, including emergency managers, hazard mitigation planners, coastal managers, land use planners, engineers, floodplain managers, and representatives from the insurance, development, and real

estate industries. It will also require support and participation from local decision-makers, nongovernmental organizations, faith-based organizations, and coastal residents.

Many coastal communities that have begun to promote resilience are finding that tools and services developed for other disciplines (e.g., hazard mitigation, sustainable development), such as the Association of State Floodplain Managers' Coastal No Adverse Impact guidance, the National Flood Insurance Program's Community Rating System, storm surge and other visualization and hazards models, and GIS-based vulnerability assessments, can be used to strengthen community resilience. Some examples of existing and emerging tools that can be used to promote coastal community resilience are provided in Appendix D.

Measuring Coastal Resilience

At this time, there is no widely accepted method for measuring coastal resilience, although several organizations have developed guidance for completing community resilience assessments. The U.S. Indian Ocean Tsunami Warning System (U.S. IOTWS) Program, which is a partnership of U.S. and Southeast Asian agencies and organizations formed in response to the 2004 tsunami, recently released, "How Resilient Is Your Coastal Community: A Guide for Evaluating Coastal Community Resilience to Tsunamis and Other Hazards" (2007). The IOTWS guidance was developed to address coastal hazards and reduce risk to vulnerable communities in the Indian Ocean region. It is intended for use by a broad cross section of government agencies and nongovernmental institutions involved in planning, community development, coastal management, and disaster relief. The guidance provides a rapid assessment framework that is intended to be a collaborative and participatory effort to highlight strengths and identify weaknesses and gaps in community resilience. It was written to complement existing planning tools and approaches, and to serve as a first step in defining actions to reduce risk, accelerate recovery, and adapt to change. Although it was written for use in Southeast Asia, the guidance is highly adaptable and may be applied to any coastal region.

The Resilience Alliance is a multi-disciplinary research organization comprised of scientists and researchers interested in understanding and promoting concepts related to the dynamics of social-ecological systems, including resilience. In 2007, the Alliance published a workbook that outlines a framework for assessing the resilience of natural resource systems and for considering sustainable management options (The Resilience Alliance 2007). The workbook was developed for practitioners, managers, and stakeholders engaged in strategic planning and management of natural resources. Through a series of targeted discussions and questions, the workbook prompts managers to define the properties and scale of social, ecological, and economic systems within their community; identify the links and feedback loops among systems; evaluate the adaptability of systems; and plan appropriate interventions to enhance resilience.

The Centre for Community Enterprise has also developed a model that can be used by communities to assess resilience and to set priorities for strengthening resilience (Centre for Community Enterprise 2000). The manual was designed to help rural communities strengthen their ability to respond to and influence the course of social and economic change. Although

the guidance was written with this particular constituency in mind, many of the principles it describes are applicable to a range of communities and could be adapted as necessary.

A number of other efforts are also underway to develop resilience indicators. An indicator is a measured or observed parameter that describes a subject such as an ecosystem or one of its critical components. Indicators communicate information about the status of a system and can be used to record changes over time. Indicators are often used to characterize systems and trends and develop possible interventions (National Research Council 2000).

Resilience of coastal communities is inherently complex. Coastal communities consist of numerous linked ecological, social, engineered, and economic systems occurring at various temporal and spatial scales, which are vulnerable to a range of natural and man-made disturbances. Resilience is affected by all of these linkages, but obviously not everything can be measured. Critical parameters that can provide information on overall system functioning, or the “big picture,” must be identified. The development of an indicator system appears to be an appropriate mechanism for evaluating coastal resilience and comparing resilience across communities. Table 1 summarizes ongoing efforts to develop resilience indicators.

Evaluation of Resilience as a CZMA Performance Measure

As discussed above, resilience has been proposed as a measure of the CZMA because it incorporates a broad range of elements – land use planning, hazards mitigation, resource protection, community cohesiveness, cultural preservation, etc. – that contribute to overall coastal community health. If resilience could be pared down to one or several simple “scores” from an aggregate of indicators, then it could be a useful tool for tracking progress towards meeting the goals of the CZMA in the states and a straightforward way to convey the effectiveness of coastal management programs to Congress, OMB, and the public.

One of the primary difficulties with using resilience as a performance measure of the CZMA is that there is currently no accepted mechanism for measuring resilience. Several efforts to develop indicators are in progress, but none are developed enough to evaluate their utility to the CZMA Performance Measurement System. One potential concern is that, when complete, these indicator systems could be too geographically- or hazard-specific to be of use as a national performance measure. Another concern is that an accurate measure of resilience will necessarily include elements that go beyond the scope of most state coastal programs and it may be difficult to modify the indicators to the needs of coastal managers and the CZMA Performance Measurement System while preserving the integrity of the methodology. Furthermore, it is questionable if resilience could be used to assess performance on a statewide or national scale, as would be necessary. Resilience is often site-specific, so that increasing resilience in one part of a state coastal zone does not mean other locations also become more resilient. As noted earlier, we must consider resilience *of* what and *to* what and this is not always conducive to a broad index or performance measure.

Additionally, it is difficult to assess whether resilience would benefit the CZMA Performance Measurement System by providing a more effective evaluation of coastal management or easing data collection for the states as compared to the existing system. The phased

TABLE 1. Resilience Indicator Projects

Organization	Location	Description	Status
NOAA Coastal Services Center (CSC)	Gulf Coast	CSC has cooperative agreements with The University of New Orleans, Texas A&M University, and State University of New York to develop resilience indicators and a community self-assessment framework for pilot communities in coastal Texas and Louisiana. The goal of the cooperative effort is to integrate spatial and non-spatial data to identify scientifically defensible indicators (ecological, economic, socio-cultural, and physical) for community resilience. The project will also recommend potential options for integrating resilience indicators into locally relevant decision support tools.	CSC is working with the three universities and pilot communities on data collection and model development. The project is in its first of two years of funding.
Sea Grant	Gulf Coast	Louisiana Sea Grant and the Mississippi-Alabama Sea Grant Consortium are collaborating on a coastal resiliency index. The index is intended to be a simple and inexpensive method for communities to predict if they would be able to reach and maintain an acceptable level of functioning and structure after a disaster. Although it is being developed in the Gulf Coast region, it is applicable to coastal communities across the U.S. The assessment takes into account the location of infrastructure and facilities, transportation, community plans and agreements, mitigation measures, business plans, and social systems. The results translate into a score of LOW, MEDIUM, or HIGH resilience and can be used to help identify problems or needs within the community.	The draft index has been released and is under review. The index will be field tested in coastal communities along the Gulf Coast.
Urban Coast Institute	New Jersey	UCI contracted with the Hazards and Vulnerability Research Institute at the University of South Carolina to develop a framework to measure coastal hazard resilience in New Jersey communities. The assessment framework includes indicators that measure social vulnerability, the built environment and infrastructure, natural systems and exposure, and hazards mitigation and planning.	The conceptual framework is complete, but requires testing and refinement at the local level.
Community and Regional Resilience Initiative (CARRI)	Gulfport, Mississippi; Charleston, South Carolina; & Memphis, Tennessee	CARRI is working in three pilot communities to understand and measure community resilience and ultimately develop a program that would accredit or certify communities as “resilient.” The project methodology combines academic research with community case studies. The development of indicators or a measurement framework is one goal of the project.	CARRI has established working teams for each community. The development of indicators is a long-term goal. Research is in progress, but it is unclear when CARRI’s resilience measurement framework will be complete.

implementation of the current system is still in progress, so NOAA has not been able to fully assess the effectiveness of the system. In order to evaluate whether resilience would improve the existing system, we need to know how effective the current performance measures are at assessing progress toward CZMA objectives.

Data collection has been challenging for the states and that is unlikely to change if the system were modified to include resilience. Many of the current performance measures are related to resilience; however, since community resilience encompasses many activities that go beyond the scope of most state coastal management programs, it is likely that there would be additional data requirements for a resilience measure. States would most likely require significant resources to modify the existing system and collect additional data.

Therefore, the CSO Coastal Resilience Steering Committee does not recommend the use of resilience as a performance measure of the CZMA at this time because:

1. There is currently no widely accepted mechanism for measuring resilience.
2. Resilience indicators or measures are often site-specific and not necessarily useful for measuring progress or conditions on a statewide or national scale.
3. It is impossible to accurately evaluate and compare the effectiveness of the existing CZMA Performance Measurement System before the phased implementation is complete and analyses are conducted on the results.
4. States have invested significant resources to implement the existing CZMA Performance Measurement System. It is unlikely that the use of resilience measures would ease data collection for the states and it may even make data collection more difficult. States would most likely require significant resources to modify the system.

In making this recommendation, the Steering Committee does not dismiss the value of resilience to coastal management. Resilience encourages communities to consider the critical links between natural and social systems; involve all sectors of the community in planning efforts; and take proactive measures to reduce their vulnerability to a range of hazards. As interest in the concept grows, new tools and guidance will be developed to help communities and coastal managers implement resilience at the local level. Over time, it may also become more evident how resilience relates to the CZMA and if it is a useful proxy for assessing the effectiveness of state coastal management programs. The Steering Committee recommends re-evaluating the potential for resilience to be used as a performance measure of the CZMA after current or new efforts to define resilience indicators are complete.

Conclusions and Next Steps

The CSO Coastal Resilience Steering Committee does not recommend altering the existing CZMA Performance Measurement System to include resilience, but does recommend that resilience be enhanced at the state and community level. Since resilience is still an emerging concept and has not been broadly applied in coastal management, states and communities need concrete guidance on how to promote resilience in the coastal zone. As discussed, numerous efforts are underway to help define and measure community resilience and

numerous tools have been adapted from other disciplines. In addition, nationally available datasets related to resilience are becoming more available and can provide state and local managers with important information about resilience. These resources are a good starting point for communities that want to learn more about enhancing resilience. The Steering Committee has also outlined the following set of actions and recommendations that will help advance coastal community resilience:

States and Localities

1. Leverage the economics of disasters. Framing coastal management as part of disaster resilience may be a way to gain resources and support from those that would not traditionally support environmental programs.
2. Utilize existing federal programs, such as the FEMA Hazard Mitigation and Pre-Disaster Mitigation Grant Programs, to implement projects that will increase coastal resilience.
3. Learn from and incorporate principles of smart growth and low impact development.
4. Look for ways to involve the private sector in pre- and post-disaster recovery and redevelopment planning. In addition, work with non-traditional groups such as local Chambers of Commerce, nonprofit organizations, and faith-based institutions to promote more resilient communities.
5. Learn from the numerous resilience efforts already underway, such as the NOAA-led Risk-Wise partnership and the Gulf of Mexico Alliance's Coastal Resilience Working Group. Develop mechanisms for sharing information and lessons learned among the various groups.
6. Develop ways to measure resilience without reducing the dynamic and organic aspects of resilience.
7. Recognize the importance of a multi-disciplinary, collaborative approach.
8. Take advantage of the national attention on climate change, which should result in opportunities and available resources for states to move forward with adaptation planning, sea level rise modeling, etc.

NOAA

9. Provide education and outreach to states and localities about available tools and resilience concepts.
10. Identify and collect appropriate national datasets that can provide status and trend data related to resilience in coastal communities and be incorporated as contextual indicators for the CZMA Performance Measurement System.

Administration

11. Recommend changes in the National Flood Insurance Program (NFIP) to reduce incentives for development in high-hazard areas.
12. Provide funding to states and localities to conduct adaptation planning and to otherwise prepare for the potential consequences of climate change.

Coastal States Organization

13. Identify appropriate partners to evaluate if and how the NFIP contributes to community resilience.

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APPENDIX A: CSO Coastal Resilience Steering Committee Membership

Phillip Hinesley (Chair), Alabama Department of Conservation and Natural Resources

Tina Shumate (Co-chair), Mississippi Department of Marine Resources

Kimberly Collini (Staff), Coastal States Organization

Kelly Brinkman, Alabama Department of Conservation and Natural Resources

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Josh Lott, NOAA Office of Ocean and Coastal Resource Management

Ann Ogata-Deal, Hawaii Coastal Zone Management Program

Barry Pendergrass, New York Department of State

Wesley Shaw, Massachusetts Office of Coastal Zone Management

APPENDIX B: CZMA Performance Measurement System

Government Coordination & Decision Making (reported annually)

1. Percent of federal consistency projects submitted where the project was modified due to consultation with the applicant to meet State CZM policies
2. Number of a) educational activities offered by the CZM program and b) the number of participants by category ¹
3. Number of a) training opportunities offered by the CZM program and b) the number of participants, by category ¹

Public Access ² (reported annually)

4. Number of new public access sites added through acquisition or easement using CZM funds
5. Number of existing public access sites that have been enhanced using CZM funds
6. Number of sites where public access sites are a) created, b) protected, or c) enhanced through CZM regulatory activities

Coastal Habitat ³ (reported annually)

7. Number of acres of key coastal habitats a) created or b) restored using CZM funds
8. Number of acres of key coastal habitats protected by acquisition or easement using CZM funds
9. Number of acres of key coastal habitats lost or gained due to activities subject to core CZM regulatory (including mitigation) programs [to be phased in by all programs for reporting by FY2010]

Coastal Water Quality (reported annually)

10. Percent of marinas in the coastal zone participating in a Clean Marina designation program
11. Number of volunteer monitoring program activities in coastal watersheds conducted with CZM funds
12. Number of miles or number of sites monitored by volunteer programs
13. Number of coastal communities supported by CZM funds in developing or implementing ordinances, policies, or plans to control or prevent polluted runoff to coastal waters

Coastal Hazards (reported annually)

14. Number of communities in the coastal zone that have a) undertaken activities to reduce future damage from hazards and b) implemented educational programs or campaigns to raise public awareness of coastal hazards using CZM funds

Coastal Dependent Uses & Community Development (reported annually)

- 15. Number of coastal communities supported by CZM funds in a) developing and implementing local plans that incorporate growth management principles and b) port or waterfront redevelopment projects

Financial Measures (reported semi-annually)

- 16. CZM dollars a) spent and b) leveraged project dollars by CZM funds by category⁴
- 17. CZM dollars used to support local governments through a) technical and b) financial assistance

State-reported Contextual Measures (reported every 5 years):

Public Access

- 18. Percent of public that feels they have adequate access to the coast for recreation purposes
- 19. Number of acres in coastal zone open for public access
- 20. Miles of shoreline open for public access

Coastal Habitat

- 21. Number of CZM programs that have habitat restoration plans for key coastal habitats, by category³
- 22. Number of CZM programs that have mapped inventories of key coastal habitat, by category³
- 23. Number of acres of key coastal habitat a) created and restored and b) protected through acquisition or easement using State, non-CZM funds, by category³

Coastal Hazards

- 24. Number of communities in the coastal zone that use setbacks, buffers, or public ownership to direct development away from areas vulnerable to coastal hazards
- 25. Number of communities in the coastal zone that have a mapped inventory of areas affected by natural coastal hazards by category⁴

¹ Reporting categories for education and training events and number of participants: a) Public Access; b) Coastal Habitat; c) Coastal Water Quality; d) Coastal Hazards; and e) Coastal Dependent Uses and Community Development

² Reporting categories for public access: a) recreational boating access and b) all other public access in the coastal zone.

³ Reporting categories for key coastal habitats: a) tidal wetlands (Great Lakes wetlands); b) beach and dune; c) nearshore (intertidal, sub-tidal, submerged) habitat; and d) Other

⁴ Reporting categories for financial reporting in performance reports: a) Public Access; b) Coastal Habitat; c) Coastal Water Quality; d) Coastal Hazards; and e) Coastal Dependent Uses and Community Development

CONTEXTUAL INDICATORS

The NOAA Office of Ocean and Coastal Resource Management (OCRM) tracks contextual indicators to support performance measurement information. Below is the current list of contextual indicators that are tracked by OCRM using reliable national data sets:

- Percent change in population of coastal counties
- Current estimated population in coastal counties
- Proportion of national population in coastal counties
- Population density in coastal counties
- Percent change in value of coastal tourism and recreation
- Percent of national employment attributable to coastal counties
- Percent of employment within coastal counties dependent on coastal and ocean resources
- Number of businesses in coastal counties dependent on coastal and ocean resources
- Percent of national economy attributable to coastal counties
- Number of invasive species identified in coastal watersheds
- Coastal habitat index
- Water use in coastal counties and states
- Water quality index
- Sediment quality index
- Benthic index
- Proportion of Federal Disaster Declarations occurring in coastal areas
- Proportion of coastal Federal Disaster Declarations that are directly related to coastal hazards
- Total estimated cost of all billion-dollar weather disasters related to coastal hazards
- Percent land cover change in coastal areas

APPENDIX C: Resilience Definitions

- Resilience is the capacity of human and natural/physical systems to adapt to and recover from change. (*Gulf of Mexico Alliance Resilience Working Group*)
- The ability of a system to absorb shocks, to avoid crossing a threshold into an alternate and possibly irreversible new state, and to regenerate after a disturbance. (*Resilience Alliance*)
- A resilient community is one that takes intentional action to enhance the personal and collective capacity of its citizens and institutions to respond to, and influence the course of social and economic change. (*Centre for Community Enterprise*)
- The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures. (*United Nations International Strategy for Disaster Risk Reduction*)
- The capacity of a community to adapt to and influence the course of environmental, social, and economic change. (*U.S. Indian Ocean Tsunami Warning System Program*)
- The capacity of a system to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, identity, and feedback. (Walker et al. 2004)

APPENDIX D: Overview of Existing and Emerging Tools to Promote Resilience

Coastal No Adverse Impact

Developed by the Association of State Floodplain Managers (ASFPM), the “No Adverse Impact” (NAI) approach to floodplain management is essentially a “do-no harm” policy based on the understanding that everyone benefits when individual community or property owner actions do not adversely affect others. NAI development anticipates the potential negative effects of actions on other people, their property, and on the coastal environment itself. Most importantly, NAI helps states and coastal communities achieve disaster resilience: that is, a coastal environment that can withstand disturbance and readily recover from it. Such resilience contributes to the long-term sustainability of the coastal zone. NAI also creates a strong legal foundation that reduces community vulnerability to “takings” and negligence claims.

See ASFPM’s Coastal No Adverse Impact Handbook for more information:
http://www.floods.org/CNAI/CNAI_Handbook.asp

Community Rating System

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that encourages communities to implement floodplain management activities that go beyond minimum NFIP requirements. For participating communities, flood insurance premium rates are adjusted to reflect the reduced flood risk.

Additional information, including a list of eligible activities, can be found at:
<http://training.fema.gov/EMIWeb/CRS/m1s1main.htm>

HAZUS

HAZUS-MH is a risk assessment software program used to analyze potential losses from floods, hurricane winds, and earthquakes. The program uses current scientific and engineering knowledge coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before or after a disaster occurs. Federal, state, and local government agencies and the private sector can order HAZUS-MH free-of-charge from the FEMA Publication Warehouse.

For more information or to order HAZUS-MH, visit:
http://www.fema.gov/plan/prevent/hazus/hz_orderform.shtm

Community Vulnerability Assessment Tool (CVAT)

The Community Vulnerability Assessment Tool (CVAT) was designed by the NOAA Coastal Services Center to assist communities in identifying their hazard risks and assessing their vulnerability to the potential impacts of those hazards. The methodology, which is available on CD-ROM, assesses physical, social, economic, and environmental vulnerability at the community level.

For more information or to order the CD-ROM, visit:

<http://www.csc.noaa.gov/products/nchaz/startup.htm>

Habitat Priority Planner

The Habitat Priority Planner is a spatial decision support tool designed by CSC to assist users in prioritizing important areas in the landscape or seascape for conservation or restoration. The tool allows the user to develop alternate scenarios and generate pertinent reports, maps, and data tables.

Download the Habitat Priority Planner from:

<http://www.csc.noaa.gov/hpp/>

SLOSH Model (Sea, Lake, and Overland Surges from Hurricanes)

SLOSH is a computerized model run by the National Hurricane Center to estimate storm surge heights and winds resulting from historical, hypothetical, or predicted hurricanes. The calculations are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads and other physical features. The SLOSH model is generally accurate within plus or minus 20 percent. It is most useful for defining the potential maximum surge for a location.

For more information visit:

<http://www.nhc.noaa.gov/HAW2/english/surge/slosh.shtml>

Social Vulnerability Index

The Social Vulnerability Index uses a common set of indicators to explore differences in social vulnerability among places (counties, census tracts, or census block groups). Social vulnerability influences both the ability of individuals and communities to prepare for, respond to, and recover from disasters. The index graphically illustrates the uneven capacity for preparedness and response and can be used to help communities allocate resources to compensate for different levels of vulnerability prior to a disaster.

For more information visit:

<http://www.cas.sc.edu/geog/hrl/sovi.html>