Bridging the Divide Between Science and Planning:

Lessons From Ecosystem-Based Management Approaches to Local and Regional Planning in the United States

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Table of Contents

Executive Summary

Over the past several decades, the persistent degradation of coastal-marine systems catalyzed the development of an ecosystem-based approach – known as ecosystem-based management (EBM) – to managing human activities. While still rooted in coastal-marine management, EBM has since grown to address a much wider range of complex ecosystem management issues. EBM approaches typically rely on the use of one or more models of the relevant ecosystem processes, they typically incorporate a comparison of projected outcomes across a range of potential management scenarios, and they typically involve a significant degree of stakeholder participation in the decision process.

Through our analysis of six EBM case studies, we aim to ferret out useful information about the conditions under which communities are able to adopt scientifically complex and politically durable community plans. We draw six key lessons from our analysis:

1. Engage the stakeholders and other key individuals early.
2. Earn credibility for the scientific and/or technical tools.
3. Find a good balance between the precision of the tools and their accessibility and utility.
4. Maintain feedback loops throughout the process.
5. Watch out for exogenous factors that can dramatically impact the planning process.
6. Plan on the process requiring more time than you expect it should.

Throughout all of the case studies and lessons, one underlying theme becomes apparent: although good data, robust models, and a logical decision process all matter, the politics matter even more. How effectively a community planning process unfolds is determined in large part by who participates, how they participate, and what power they each wield. How effectively such a planning process incorporates good scientific information depends on how much credibility the experts and their tools have in the process. In other words, community planning efforts are not exercises in abstracted rationality, but rather they are fundamentally political processes involving multiple parties with divergent interests. All community planning processes and decisions, not to mention subsequent implementation, are subject to the politics of their communities, and any approach to EBM that fails to recognize this is much less likely to produce effective implementation of a scientifically appropriate plan.

Introduction

Over the past several decades, the persistent degradation of coastal-marine systems catalyzed the development of an ecosystem-based approach – known as ecosystem-based management (EBM) – to managing human activities. While still rooted in coastal-marine management, EBM has since grown to address a much wider range of complex ecosystem management issues. EBM is predicated on the view that community or regional planning should consider the entire ecosystem rather than attempting to isolate individual ecological issues or elements. EBM approaches typically rely on the use of one or more models of the relevant ecosystem processes, they typically incorporate a comparison of projected outcomes across a range of potential management scenarios, and they typically involve a significant degree of stakeholder participation in the decision process.

Why is an EBM approach useful? For one thing, ecosystem processes are complex and interrelated; management approaches that isolate individual ecosystem elements or functions are less likely to generate desired outcomes when they are aimed at complex ecosystem dynamics. For instance, an effort to reduce sediment load in a community's waterways (as in our Pelekane Bay case study) may be more successful if it considers upstream land uses and road building practices rather than focusing narrowly on water intake filtration systems. Similarly, an initiative aimed at reducing the impacts of storm surges (as in our Long Island example) may be more successful if it considers the complex ways in which healthy coastal wetlands can temper the impacts of storm surges versus a narrow engineering-based focus on riprap or seawalls.

For another thing, community planning efforts that effectively engage stakeholders are more likely to secure broader political support and are more likely to produce, consequently, more durable implementation. For example, community wildfire plans are unlikely to be implemented effectively regardless of the resources expended or the technical utility of the methods unless individual landowners – those actually responsible for implementing site-specific practices – are themselves supportive of the plan. An EBM approach can thus offer some powerful advantages, but the use of EBM without political buy-in may not produce a strong plan or effective implementation.[1]

Our goal with this study is to better understand the factors that result in successful EBM efforts. Through our analysis of six EBM case studies spanning a range of scales, issues, and geographies, we aim to ferret out useful information about the conditions under which communities are able to adopt scientifically complex and politically durable community plans.

We draw six key lessons from our analysis. We outline these in the next chapter, and in the subsequent chapters we discuss each of the case studies in some detail. Throughout all of the case studies and lessons, however, one fundamental theme becomes apparent: although good data, robust models, and a logical decision process all matter, the politics matter even more. How effectively a community planning process unfolds is determined in large part by who participates, how they participate, and what power they each wield. How effectively such a planning process incorporates good scientific information depends on how much credibility the experts and their tools have in the process. In fact, although we don't tackle this issue in our report, it is apparent that the planning

processes themselves are inherently and fundamentally political: what questions are being asked, who is doing the asking, and what community goals have been established are all products of relationship and power dynamics between parties with varied interests.

The take-home lesson for EBM practitioners is quite simple in concept if difficult in practice: understand that community planning processes are not exercises in abstracted rationality, but rather they are fundamentally political processes involving multiple parties with divergent interests. While it is important to find or develop strong data sources, to integrate effective ecosystem models, and to compare potential management scenarios, none of this matters much if the politics themselves aren't aligned to adopt these scientifically based conclusions. In fact, at times it can be important to sacrifice some scientific precision and technical complexity in order to secure the political buy-in required to actually implement a community plan. By understanding this basic dimension of community planning, EBM proponents and practitioners will be better able to design processes that are more attentive to underlying political dynamics, that are more likely to secure political buy-in from relevant constituencies, and that are more likely to be effectively implemented.

Lessons Learned

Each of the case studies evaluated in this report offers important lessons for incorporating complicated scientific information in community decision-making. However, six lessons stand out as the most important:

1. Engage the stakeholders and other key individuals early.
2. Earn credibility for the scientific and/or technical tools.
3. Find a good balance between the precision of the tools and their accessibility and utility.
4. Maintain feedback loops throughout the process.
5. Watch out for exogenous factors that can dramatically impact the planning process.
6. Plan on the process requiring more time than you expect it should.

1. Engage the Stakeholders and Other Key Individuals Early

Effectively engaging all of the key people early in the process consistently materializes as a key determinant of success in the planning processes we evaluated. This includes stakeholders, experts, people representing interests that might have the ability and motivation to obstruct a planning process, and people whose support will be critical for successful implementation of the adopted plan.

This engagement doesn't need to include every individual with an interest, but ensuring that all of those interests are represented seems to make a substantial difference, and including an adequate range of expertise seems to improve credibility and outcomes. The specific character of the engagement for each of these individuals can vary from full participation from the very beginning of the process, to sporadic and informal engagement, to everything in between. Finally, preexisting relationships between those driving the planning process and the key individuals and constituencies is generally helpful, although it may not be essential.

Doing this seems to matter for several reasons: securing buy-in from individuals whose support will be needed to adopt and implement a plan, giving the plan the political and community credibility it will need for successful implementation, and because participation across constituencies can improve the strength and effectiveness of the plan. In short, effective early engagement seems to improve the process, the outcome, and the durability of the implementation.

2. Earn Credibility for the Tools

Community planning processes that incorporate complex scientific information virtually always rely on models and other tools to help assess current conditions and the range of possible outcomes under different management scenarios. The credibility of these tools seems to matter a great deal to the credibility and effectiveness of the resulting community plan. In fact, even where the models simply verify what everyone already knew – as the sedimentation model did in the Pelekane Bay case

study – they can have an important influence on the willingness of key partners to participate and follow through.

Several factors appear relevant to establishing tool credibility. Political support for the models and other tools out of the gate makes a substantial difference. Involving the experts early and fully seems to make a difference; they can buttress credibility by explaining how the model works and explaining the model results. Community members seem more deferential to experts when the models and the ecosystem processes being modeling are complex. Models and tools that rely on data sources and other models that already have credibility, such as the "Beginning with Habitat" program in the Sanford, Maine case study, have a head start in earning community credibility. If the model results seem intuitive and reasonable, their credibility is enhanced. Credibility appears to improve if the stakeholders are well educated on the relevant issues.

Although it doesn't appear that tool credibility requires every one of these factors to be present, they all seem to help. For instance, most are present in the Colorado Wildfire Protection Plan case study: the successful plans involved the fire behavior and wildfire fuels experts early, the residents involved in the planning processes are generally educated about wildfire and fuels, and the conclusions (primarily involving the removal of vegetation within a "defensible space" around structures) seem reasonable and intuitive.

3. Find a Good Balance Between Precision and Accessibility

Many of the tools available to communities to support decision-making processes are complex and powerful. They can offer enormous predictive power, rich comparisons of different management scenarios, and other detailed information. But in many of the case studies reviewed in this report, we found that the tools had such steep learning curves that their actual utility in planning processes was limited, and while tools with different functions and purposes are often interoperable this added yet another layer of complexity.

In the Sanford, Maine case study, for example, the community wasn't able to use some of the most powerful and useful CommunityViz functionalities. Where communities have been able to employ these tools more fully, they had to rely on outside experts or on a single person in the community to develop the necessary skills, the result of which was a lack of capacity in the community to continue using these tools after that particular planning process was completed.

In other words, powerful tools can bring to bear considerable analytic and visualization capabilities on community planning challenges, but they can also present real barriers, and the communities that use such tools often are unable to continue doing so afterward. The more powerful tools also tend to rely on larger and more complex datasets, imposing a substantial additional resource burden on the communities. Other factors can further amplify data requirements, such as cross-jurisdictional planning processes, planning processes that consider multiple types of data, and the need to digitize data.

The key lesson seems to be to be cautious and strategic in the selection of tools and in the adoption of a strategy for acquiring all of the necessary data. A related lesson is that there are often good workarounds to what may seem initially to be a substantial data requirement. For example, when conventional data acquisition on biodiversity values in the South Carolina case study proved too difficult, the project team found another way to secure the same data: pull all the experts together to collectively answer the remaining data questions.

4. Maintain Feedback Loops

In many of the case studies, it was apparent that feedback loops played an important role in ensuring that the tools functioned as intended. Feedback mechanisms allow project teams to make critical adjustments as the process unfolds. For instance, the "model-adjustment" step in the Mission-Aransas case study played a vital role in allowing the working group to fine-tune the model and, more importantly, to narrow their focus to a more manageable scope. The use of usability testing in the Long Island case study helped ensure that the tool was, in fact, usable by the audiences it was designed for.

5. Watch out for Exogenous Factors

Exogenous factors can play a substantial role in community planning processes and in the implementation of community plans. For example, the broader political landscape in Texas, where counties are working to establish greater land use control, helped bring and keep the counties to the table in the Mission-Aransas case study. In contrast, the lack of legal incentives for the U.S. Forest Service to participate in community-based fuels reduction projects appeared to be a serious obstacle to successful implementation of the community fuels plans in the Colorado Community Wildfire Protection case study.

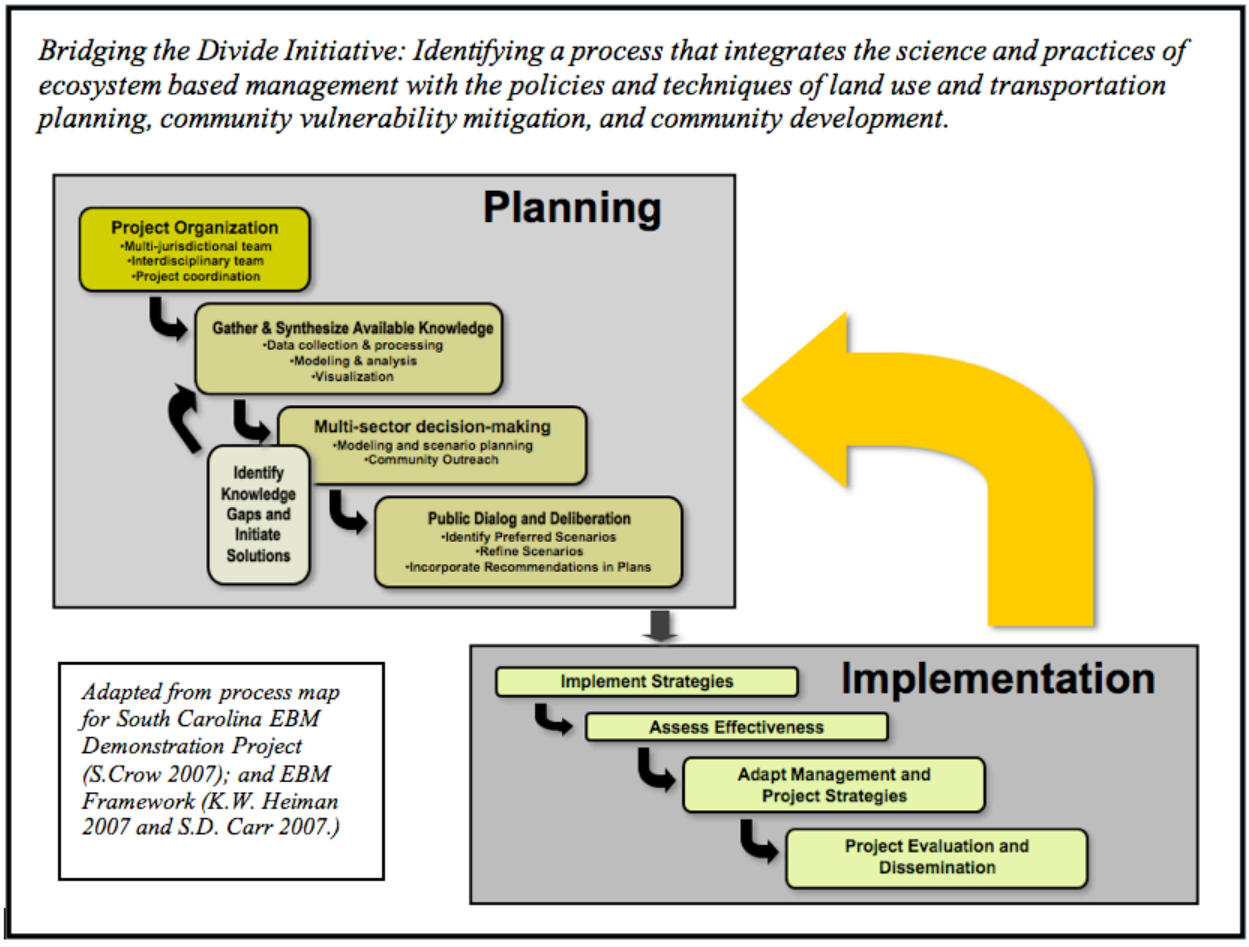
6. Plan on More Time Than You Think

Community planning processes incorporating complicated scientific information frequently took much longer to execute than anticipated. Effectively engaging the full range of key individuals is very time-consuming, and attempts to shortcut this often result in sizable delays as the planning team has to backtrack in order to bring those constituencies on board. Learning the tools and acquiring the necessary data often requires substantially more time than planning teams expect, as occurred in both the Long Island and the South Carolina case studies.

The Intersection of Science, Policy, and Politics

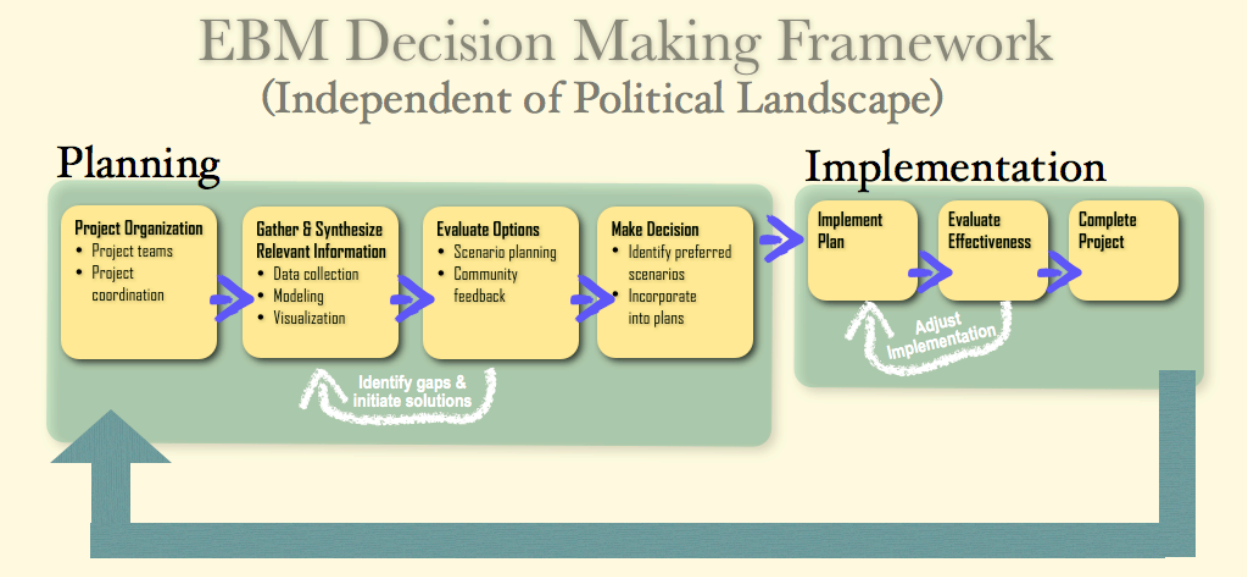
A conventional decision-process model assumes a generally rational, linear progression of steps. Planning precedes implementation, and involves a sensible sequence that begins with organizing the project and is followed by gathering information, assessing options, and making a decision. Implementation follows, beginning with executing the adopted decision, then assessing the effectiveness of those strategies, making adjustments, and eventually completing the project.

An early "Bridging the Divide" Initiative decision model shows precisely this sequence, with an extra feedback loop between assessing options and gathering information, allowing for additional data acquisition if the assessment turns up key knowledge gaps.

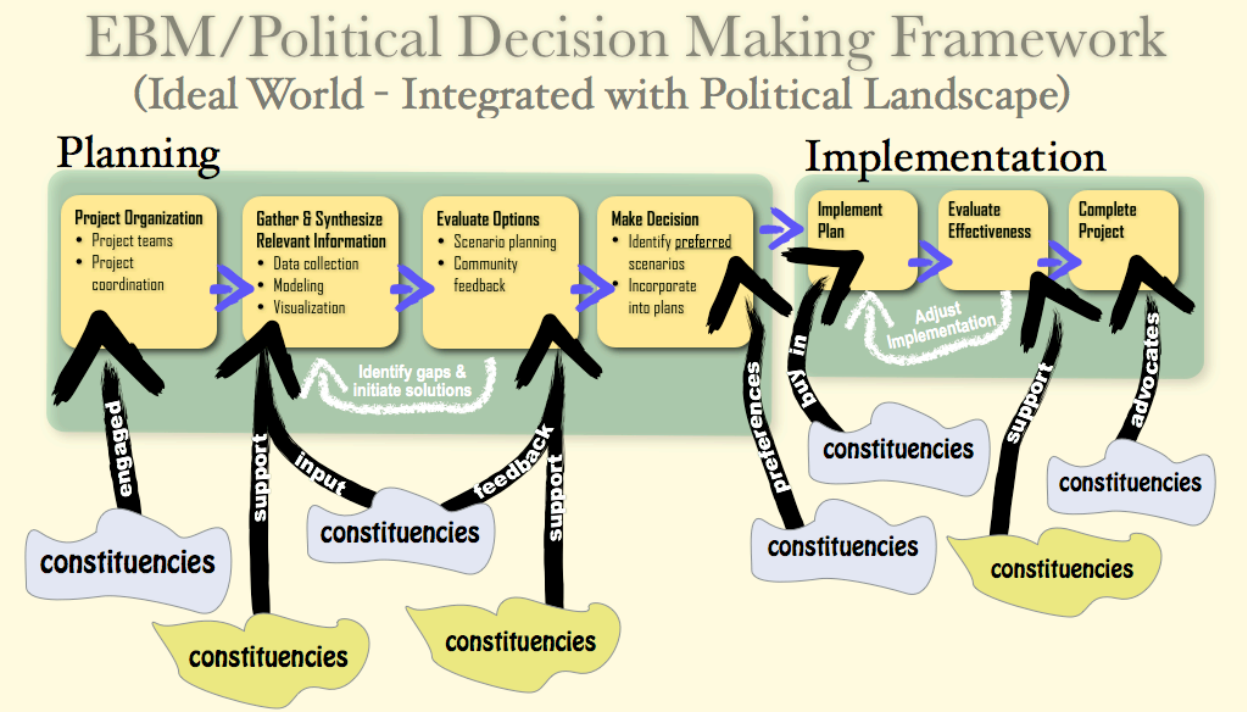


The original "Bridging the Divide" decision process model.

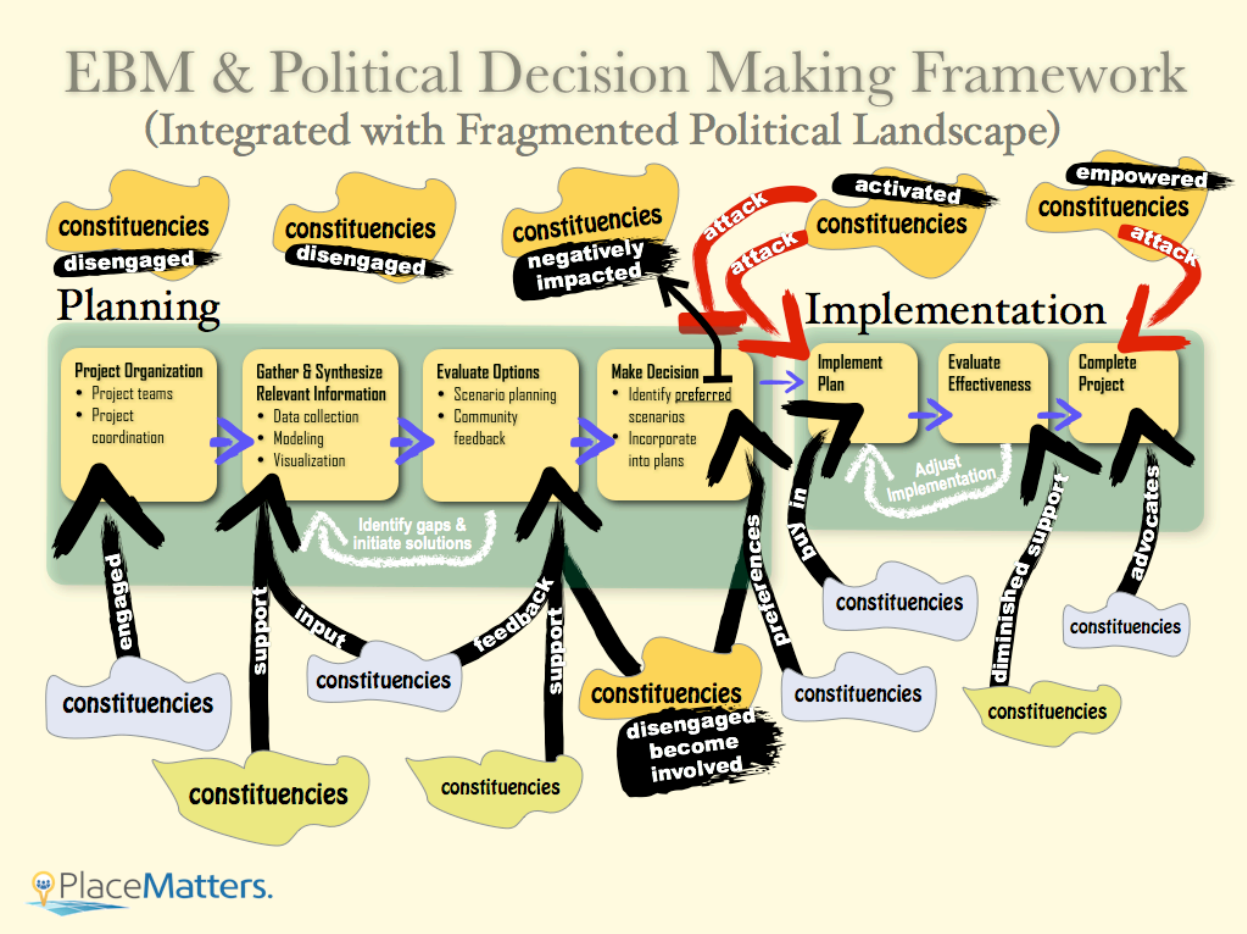
A simplified version of this model highlights its linearity:



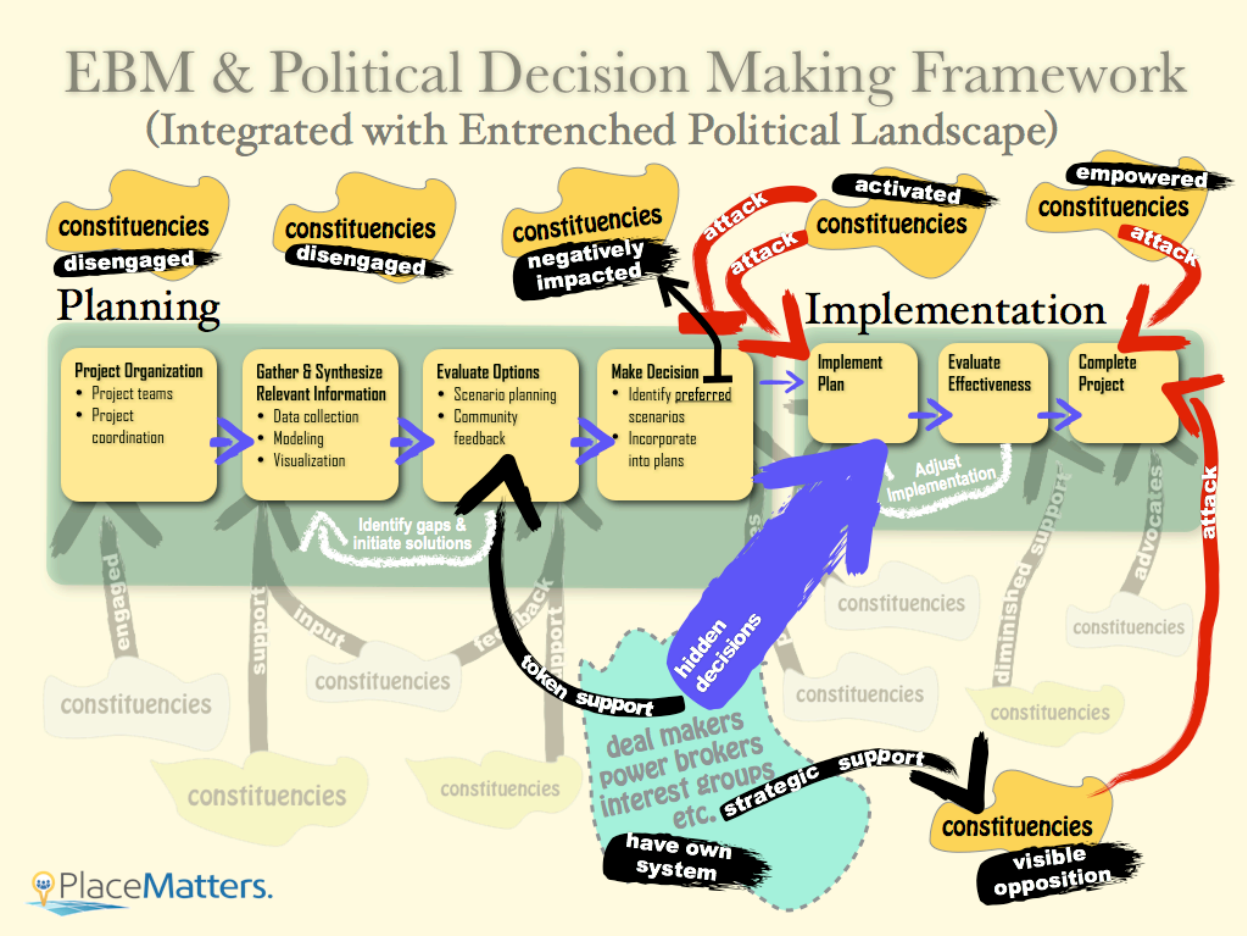
However, what becomes apparent in our case studies is the extent to which political considerations shape community decision processes. One or more constituencies drive the process, initiating it and establishing its questions and goals.



Other constituencies stand outside of the process initially but can either be folded in to the process as engaged participants or they can attack the process if they feel their interests are better represented by hijacking or killing it.



In some situations the political, ethnic, and/or financial power structures are so entrenched and divisive they can undermine the EBM process entirely.



The most basic implication is that choreographers of EBM processes can benefit by mapping and understanding all of the relevant constituencies and then developing strategies to either engage them, keep them uninterested (e.g., because they conclude that the process isn't relevant enough to their interests), expose power structures that are disregarding the public process, or defend the process against attacks.

Our case studies highlight some predictable conclusions about effective EBM processes; the conclusions we found most interesting have to do with this political dimension. Community decisions making is an inherently political process, and while thoughtful, rational analysis can play a role it may not happen on its own. The take-home message for proponents of EBM is clear: we benefit if we understand that politics does matter, and community plans are likely to be stronger if we develop EBM strategies that are mindful of the politics lying underneath every community decision process we are involved in.

Case Study #1:
Mission Aransas Ecosystem Management Plan (Texas)

Basic Information

- *Project Name:* Mission Aransas Ecosystem Management Plan
- *Project Location:* Mission-Aransas National Estuarine Research Reserve and Aransas County, on the Gulf Coast of Texas near Corpus Christi
- *Project and Community Description:* The project involved collaboration between state and federal agencies, several non-profit organizations, and the local communities (including local governments) to develop land use and other policies based on an understanding of the linkages between land use effects on specific coastal-marine ecosystems. One key goal was to link three independent software tools into an interoperable system of planning tools.
- *Start Date:* The project initiation workshop was conducted in December 2007.
- *Status/End Date:* The bulk of the project is completed but the final report hasn't yet been published.

Tools

- *Tool(s) Used:* The project relied on three key tools, CommunityViz (Placeways), Vista (NatureServe), and N-SPECT (NOAA Coastal Services Center)
- *How the Tool(s) Were Used:* The tools were used to "(1) evaluate the current condition of the ecosystem and socio-economic indicators, (2) evaluate future trends based on current policies and economic forces, and (3) develop alternative land use strategies that meet objectives for ecological and socio-economic indicators."[2] CommunityViz was used for analyzing land use scenarios and socioeconomic indicators, Vista was used to evaluate ecological impacts from various land use scenarios, and N-SPECT was used to predict sediment and pollution impacts from each of those land use scenarios.

Stakeholder Engagement

- *Stakeholders:* The mayors of Rockport and Fulton, the Aransas County Judge (the at-large chair of the County Commissioners Court), and representatives of the Mission-Aransas National Estuarine Research Reserve, NatureServe, NOAA Coastal Services Center, Placeways, Texas Coastal Watershed Program, city councilors, other county commissioners, additional academics from the University of Texas and Texas A&M (Corpus Christi).
- *Stakeholder Engagement Methods:* Stakeholder meetings and formal workshops were used to define project goals, coordinate data gathering, present and discuss scenario evaluations and policy options, model-adjustment, hands-on training with the tools, and present study results.

Outcomes

1) Stronger relationships between stakeholders and a stronger understanding of linkages between land use and water quality, ecological, and socio-economic impacts.
2) Aransas County is now preparing a countywide stormwater management plan that could be informed by the Mission-Aransas project. In addition, the final report, once published, will

help demonstrate the need for increased planning authority for Aransas County.

Key Observations and Lessons Learned

1) The team did a good job of engaging key individuals early and throughout the project, which itself then improved the credibility of the process.
2) It might have been better to focus tools training on specific individuals with appropriate skills (e.g., teaching the planners how to use CommunityViz, teaching the engineers how to use N-SPECT, teaching the ecologists how to use Vista).
3) The tools provided powerful analytic capabilities and were useful in the analysis and comparison steps of the planning process. However, they had steep learning curves, which proved to be a barrier for most participants. Many of the participants indicated that more training would have been required in order for them to successfully learn the toolkit. As a result of these barriers, the project did not produce a cadre of experienced tool users that would be able to conduct ongoing analyses after the project was complete or that could compare and evaluate scenarios on other projects and proposals as they had hoped to do.
4) The tools were generally interoperable but the steep learning curve limited the number of people and project partners that were able to actually use the tools effectively, and only one (the project coordinator) learned to interoperate the three software packages.
5) The model-adjustment step was very valuable, allowing fine-tuning based on new data and feedback from the working group. This also helped the group decide to narrow their focus to a more manageable scope.

Project Details

- *Project Website(s):* http://www.utmsi.utexas.edu/about-the-institute/mission-aransas-nerr/stewardship/ecosystem-based-management-tools-project.html
- *Project Partners:* Mission-Aransas National Estuarine Research Reserve, NatureServe, NOAA Coastal Services Center, Placeways, Texas Coastal Watershed Program.
- *Contact:* Kiersten Madden (Mission-Aransas National Estuarine Research Reserve) was a project lead and is a good contact.
- *Contact Email:* kiersten.madden@mail.utexas.edu
- *Contact Phone:* 361-749-6779

Narrative

The Mission-Aransas National Estuarine Research Reserve (NERR) is one of a network of 27 such reserves that represent partnerships between the National Oceanic and Atmospheric Administration and state agencies, in this case the University of Texas at Austin. The reserve network is primarily focused on long-term monitoring and research, but in some cases the Reserves work with the land managers (e.g., state wildlife agencies, the U.S. Fish and Wildlife Services, non-profit partners) to ensure protection of these areas.

The Mission-Aransas NERR lies within relatively undisturbed watersheds and is home to a healthy estuary with high levels of ecological functioning and biological diversity. The bulk of the Reserve also sits within Aransas County on the Gulf Coast of Texas. The Reserve and Aransas County are

part of the Greater Corpus Christi Metropolitan area, an area that is experiencing a high rate of population growth and habitat conversion: the population of Aransas County (which contains the bulk of the Mission-Aransas NERR) has increased by nearly 26% from 1990 to 2000.[3] Recreation, tourism, and estuarine-dependent commercial and recreational fisheries play a key role in the region's economy and are important contributors to the high quality of life in the region. The tool providers themselves had initiated the project, approaching the Mission-Aransas NERR with a request to serve as a pilot study location. They were subsequently able to secure foundation funding for the project because of its coastal location and the opportunity to interoperate the multiple tools.

The project began in December 2007 with an initial "site initiation workshop." The initial participants included the mayors of Rockport and Fulton, the Aransas County Judge (the at-large chair of the County Commissioners Court), and representatives of the Mission-Aransas NERR, NatureServe, NOAA Coastal Services Center, Placeways, and the Texas Coastal Watershed Program. The workshop included a demonstration of the three decision support tools (CommunityViz, Vista, N-SPECT), reaching agreement on the decision-making process, identifying major project milestones, and determining working group membership and roles.

The NERR staff had already worked closely with Aransas County, local conservation groups, and some of the larger municipalities. They had conducted several smart growth workshops, engaged in a great deal of outreach and education about the NERR, and had worked closely with local governments on collaborative projects. These preexisting relationships played a significant role in the ability of the NERR staff to convene the working group and undertake the process.

One of the working group's key early steps was to define the project goals and confirm that existing tools would meet the needs of the project. The identification of two areas of commonality – a shared interest in seagrass conservation (partly because of its commercial value) and some specific areas of interest within the watershed – was one important outcome. NERR staff and other working group members started gathering data and populating the database while simultaneously learning the tools and how to interoperate them. Although Aransas County and City of Rockport were not formal partners in the project, both had representatives at every workshop and were very involved throughout the entire process.

Subsequently, during the winter and spring of 2008 the working group developed and evaluated various land use scenarios. In December 2008 they conducted a second formal workshop to present the initial results and policy options to the partners. The working group also added additional individuals to the mix, including city councilors, other county commissioners, additional academics from the University of Texas and Texas A&M (Corpus Christi), and other stakeholder groups. The work became more refined and detailed as well. Important steps included clarifying some of the conservation goals (e.g., identifying more precisely the values and desired outcomes, determining how much to conserve), identifying potential new developments and likely densities, and an explicit model-adjustment step. This fine-tuning step allowed for refinements based on new data and on feedback from the working group, including the realization that they needed substantially more data. As a result, they decided to narrow their focus to an area – within a single county – for which they had high quality data.

In April 2008, NERR hosted a hands-on pilot training event, including representatives from each of the tool providers, a couple people from state agencies, the Aransas county engineer, some university people, and a few others. The training covered each tool individually and then focused on interoperability among them.

In June 2008, the NERR hosted a meeting to present the results of the study. The approximately 30 participants included many local political officials (both city and county), state agency staff, and representatives of the various stakeholder groups. The essence of the presentation was a number of maps illustrating, in a non-technical manner, the various scenarios that they considered and their evaluation of each.

Aransas County is now developing a countywide stormwater management plan, with some land use planning elements, informed by the outcomes of the NERR process, potentially including best management practices and habitat/ecology elements. The consultant on the project, Naismith Engineering, defined "priority" watersheds for the county and is now working to identify conservation and restoration projects within those watersheds. It is unclear the extent to which the NERR process will be incorporated into the stormwater management plan. In addition, this project seems to be playing a role in other development projects. For example, because of the relationships and research that went into the Mission-Aransas project, county and local officials were able to successfully resist an effort by a developer to build a project with a wastewater plant that would have inappropriately dumped effluent into a low circulation portion of Port Bay.

Key Observations and Lessons Learned:

- Local governments in this part of Texas already have some degree of commitment to conservation practices, so the challenges of engaging them in the process were less substantial than they might be elsewhere. Partly as a result, the NERR didn't encounter much resistance to the process or goals, although the degree of durable commitment to the outcomes is not yet clear.

- Active participation by the county was in part facilitated by the county's ongoing effort to secure more planning authority than it presently has under Texas law. Successful participation in a complex planning project like this one would help bolster the case that the county (and counties more generally) have the capacity to absorb some planning authority. While this particular exogenous political factor might be unique to Texas, it highlights the relevance of these types of factors in other planning processes: participants must have sufficient motivation – defensive or aspirational – to commit resources to a project.

- The credibility of the process was aided by county commissioner involvement and buy-in. They are politically influential, many are very large landowners, and some have been working to change perspectives on land use.

- The NERR's initial intent included training the working group and associated staff to use all the tools so that they could compare scenarios and evaluate impacts on their own after the project was completed. They did not achieve this goal. The individual tools were too complex, and the interoperability between the tools presented an additional obstacle of such a magnitude that only one person (an NERR staff person) had the time to learn how to interoperate all three of them. It might have been possible, one interviewee noted, to focus tools training in a more strategic manner (i.e., engage the city and county planners in learning CommunityViz, engage the engineers in learning N-SPECT, and engage the natural resource staff in learning Vista). Securing this level of commitment by participants would have been difficult, however, and that would still leave the interoperability skills untouched.

- The earlier working group efforts might have been improved with the use of keypad polling tools to help in prioritizing issues and priorities.

- There was very little resistance to the deployment of these three tools and to the reliance on the model outputs. One reason might have been that the politics generally favor some degree of conservation-oriented management. Another might have been the influential role of the county in this process and their perspective that this process may help them advance both their immediate resource conservation goals as well as their broader political goal of securing more land use authority. Finally, the tools are quite complex, which might have further impeded the inclination and ability to push back against the process.

- A final debriefing process with the working group would have been valuable.

Case Study #2:
Community Wildfire Protection Plans (Colorado)

Basic Information

- *Project Name:* Colorado Community Wildfire Protection Plans
- *Project Location:* Various communities across the Front Range and western Colorado.
- *Project and Community Description:* The Healthy Forest Restoration Act calls for the development of Community Wildfire Protection Plans (CWPPs) in communities with wildland-urban interface. More than 80 of these plans have been completed in Colorado and are now being implemented, and dozens more are in progress.
- *Start Date:* The development of CWPPs began after the Healthy Forest Restoration Act was adopted in 2003.
- *Status/End Date:* The development, adoption, and implementation of these plans are ongoing.

Tools

- *Tool(s) Used:* The tools vary by plan, but typically they rely on models of fire behavior that account for topography, crown fire potential, flame length, rate of spread, variable weather conditions, and other factors.
- *How the Tool(s) Were Used:* The tools are used to predict fire behavior in specific locations based on factors like type and amount of fuel, topography, and weather conditions. Based on predicted fire behavior, the tools are also used to assess fire risk across parts of each community.

Stakeholder Engagement

- *Stakeholders:* Stakeholders typically included one or several local leaders.
- *Stakeholder Engagement Methods:* Public meetings advertised through postings on web sites and newspapers, fliers, and direct contact with homeowners' associations.

Outcomes

1) Adoption of Community Wildfire Protection Plans in numerous Colorado communities.
2) Implementation, to varying degrees, of these plans, resulting in reduced risk of property loss and loss of life to forest fires.

Key Observations and Lessons Learned

1) Community members and other stakeholders were willing to trust the fire and fuels experts and the model outcomes, especially if the experts were engaged early in the process and provided thorough explanations for their recommendations.
2) Effective plan implementation seems to require that the stakeholders have a hand in crafting the actual plan, that adjacent land management agencies be involved, that the experts be involved early, and that the plans include specific recommendations and priorities for fuel reduction activities. Word-of-mouth communication among private landowners and communication/outreach efforts by the Community Wildfire Protection Plan team also

appear to be significant factors.

3) Federal agencies with land use control over adjacent properties may not implement their portions of community plans without being sufficiently incentivized or required to do so.
4) The models used in these planning efforts appear to be adequate to the task. We do not know if these tools typically interoperate with other tools, but because they are very specific to determining wildfire risk and predicting wildfire behavior they don't have many applications in other EBM contexts.

Project Details

- *Project Website(s):* http://www.csfs.colostate.edu/pages/community-wf-protection-planning.html
- *Project Partners:* Colorado State Forest Service, U.S. Forest Service, local fire authorities, local governments, community members
- *Project Leader:* N/A
- *Project Leader Contact Email:* N/A
- *Project Leader Contact Phone:* N/A

Narrative

A century of fire suppression on Colorado's Front Range has left many communities vulnerable to wildfire. A recent Headwaters Economics study reported that 95,000 homes across 420 square miles on the Front Range are vulnerable to wildfire.[4] As fire experts, land managers, politicians, and those communities began to appreciate the magnitude of the challenges, they increasingly looked for more sophisticated ways to reduce risk to human lives and homes and better approaches for allocating scarce resources to these efforts. The passage of the Healthy Forest Restoration Act (HFRA) in 2003 established a framework for the creation and adoption of Community Wildfire Protection Plans (CWPPs), and these plans have become a central wildfire protection planning tool across the state.

The CWPP model relies on individual rural and exurban communities – any community facing a significant wildfire risk – to take a leadership role in the creation of a fuels and fire protection plan for their own community. As envisioned by Congress, stakeholder groups representing key constituencies in a community would collaborate with adjacent land management agencies and with fuels and wildfire experts to craft a plan directly addressing all of that community's wildfire protection needs.

The science underlying risk determinations for the ignition risk of individual structures is fairly straightforward, depending largely on a building's exterior materials and design and the amount and type of vegetation within a very short distance (generally 100'-200') of the structure.[5] Prescriptions for individual homes and other structures are thus generally quite simple: remove or alter vegetation within a very short distance of the structure, and construct buildings in particular ways and with particular materials (and where possible renovate existing buildings in these ways). Prioritizing neighborhoods and areas for attention is more complex, relying on more complicated models of fire behavior that account for topography, crown fire potential, flame length, rate of spread, variable weather conditions, and other factors.

The CWPP processes, through the use of the stakeholder group mechanism, are generally community driven. The scale and breadth of stakeholder involvement has varied a great deal, however. The local government(s), the local fire authority, the Colorado State Forest Service, impacted federal land management agencies, and other key stakeholders must all be at least nominally involved. Of these, state forestry staff, county fire professionals, local fire authorities, and local governments were consistently engaged. Involvement by U.S. Forest Service staff was less common, and the extent and diversity of local community involvement varied considerably. The planning process includes the identification of values at risk (typically driven by community members) and a technical analysis of how fuel conditions and anticipated fire behavior impact those values.

The scientific conclusions and recommendations produced by the fire professionals were generally accepted as valid by the CWPPs. While the degree to which adopted plans conformed to the expert recommendations varied, and the degree to which the plans are ultimately implemented varies as well, the credibility of the scientific process was rarely questioned despite the scientific analysis functioning largely as a "black box" to the non-experts. This may have resulted from the fact that the model results seemed reasonable and the stakeholders are generally well educated already about fire and fire behavior. The general credibility of fire fighters (which possibly carries over to fire behavior professionals) may also be a factor. In any case, there has been little need to deliberately build credibility among participants through collaborative model building or other means.

One recent study conducted by the Rocky Mountain Research Station of the U.S. Forest Service and the University of Colorado found that "there is a fairly sophisticated understanding of fire, fire behavior, and fire risk" among homeowners in several Front Range wildland urban interface counties.[6] In addition, homeowners tended to trust information they received from people they recognized as wildland fire experts (e.g., county wildfire specialists). These two factors might further enhance the credibility of the modeling and expert assessments.

The stakeholders were more likely to implement recommendations on their own property and support implementation of the community recommendations if the fire professionals and other folks related to the scientific models were involved early in process (compared to the consultants who participated only at the point that the model runs were required). Younger residents seemed more enthusiastic about implementing the professional recommendations about "home ignition zones" and other recommendations related to changes on individual properties than did older residents. The study noted above also found that non-institutional factors (e.g., informal communication and education through social networks, homeowner perceptions of the physical characteristics of their land, homeowner perceptions of mitigation options) were more important than institutional factors (e.g., formal programs, homeowner insurance incentives and disincentives) in shaping both the understanding of the risks and implementation of the plan. Information tailored to a specific property was more impactful than general information about fire risk and mitigation measures.

Key Observations and Lessons Learned:

- Through a combination of well-educated stakeholders, scientific conclusions that seem intuitively accurate, and possibly other factors, the expert recommendations based on various model runs and other analyses seemed to have a high degree of credibility with stakeholders even when those stakeholders aren't involved in the technical analysis. The stakeholders do generally need to have a hand in crafting the actual plan, however.

- The wildfire tools are very specialized and aren't applicable in other EBM contexts, but they appeared to be appropriate to the task in this particular context.

- The expert recommendations had increased credibility, and plans were more likely to be implemented, when the experts were engaged early in and throughout the community planning process and when they provided thorough explanations and rationales for their recommendations to stakeholders. This includes the fire behavior experts, the fire departments themselves, and the land management agencies.

- The degree of involvement by adjacent land management agencies varied. With increasing involvement, the plans seemed to be stronger and plan implementation efforts seemed to be more effective.

- Implementation of individual homeowner recommendations seems to be influenced by the word-of-mouth communication (e.g., are their neighbors implementing recommendations?), a variable that is itself impacted by factors like the number of people involved in the stakeholder process and their credibility in the community. Other important variables seem to be the extent and effectiveness of communication/outreach efforts by the CWPP teams, the likelihood that individual homeowners receive recommendations specific to their property (versus generalized recommendations), and perceptions of government by affected landowners (i.e., residents in some areas are suspicious of government in general and of their county government in particular). One key element seems to be the extent to which landowners understand that creating a defensible space doesn't require clear-cutting their property and that the wildfire agencies are unlikely to be able to save homes that haven't been protected through defensible space efforts prior to a fire.

- Implementation of the community-wide plan elements was often hampered by the lack of specific recommendations and priorities for fuels reduction activities and, even where the plans identify specific action items, the lack of mechanisms to ensure implementation. The lack of specific recommendations and priorities also seems to make it more likely that the Forest Service will undertake fuels mitigation activities that are inconsistent with community priorities identified in the CWPP. Conversely, specific, localized mitigation recommendations developed collaboratively by the local community and the agencies seem to improve the likelihood of effective implementation. Specific, localized steps focused on landowner education, especially focused on defensible spaces, also seem to improve the likelihood of success.

- The relationships established during the CWPP process between federal land managers, state agency staff, local community officials, and local residents seem to improve the durability and the implementation of the plans. The earlier these relationships begin the better. One frequent limitation of the plans developed by outside contractors is the lack of these sorts of sustained, ongoing relationships.

- Supportive and respectful follow up communication from agencies and other local governments to encourage and offer support for (but not insist on) implementation seem to contribute to a higher likelihood of effective implementation.

- External mechanisms (either incentives or requirements) may be required in order to ensure that non-community entities (e.g., the U.S. Forest Service) make decisions that are consistent with the CWPPs. Even with federal statutory language encouraging the Forest Service to consult with local governments over projects in the wildland-urban interface on projects amounting to 50% of the available fuels mitigation funding, those projects are consistent with CWPP priorities in well under 50% of the projects.

Case Study #3:
Creating Resilient Communities Project (South Carolina)

Basic Information

- *Project Name:* Creating Resilient Communities Project
- *Project Location:* Berkeley, Charleston, and Dorchester Counties, South Carolina
- *Project and Community Description:* The tri-county region within the Berkeley-Charleston-Dorchester Council of Governments includes the urbanized core of the Cities of Charleston and North Charleston as well as extensive rural areas and rapidly growing suburban areas. Population was estimated in 2000 at about 550,000 and is growing at a rate of 8.4% annually. The marine and coastal ecosystems of the region are facing significant environmental pressures tied to growth and land development, pollution caused by land and water use practices, and resource extraction. The region also faces significant and growing threats tied to climate change, including hurricanes, storm surges and flooding, and rising sea levels. Regional governance is fractured across the counties, cities and towns, and Council of Governments, further complicating regional hazard mitigation and long-term planning efforts.
- *Start Date:* August 2007.
- *Status/End Date:* Ongoing.

Tools

- *Tool(s) Used:* NatureServe Vista, NOAA's Community Resilience and Vulnerability Assessment Tool (CRVAT), and Placeways' CommunityViz.
- *How the Tool(s) Were Used:* NatureServe Vista was used to evaluate alternatives and model potential outcomes related to natural hazards, community vulnerability, sea level rise, potential hazards mitigation, and biodiversity. Vista was used with CRVAT to create and conduct vulnerability analyses on two scenarios, a current conditions scenario and a "business-as-usual" scenario. CommunityViz is used for visualizing and comparing land use alternatives. All three tools were then used to evaluate a "mitigation" scenario that was designed to meet conservation and hazard mitigation goals.

Stakeholder Engagement

- *Stakeholders:* Berkeley, Charleston, and Dorchester Counties, Berkeley-Charleston-Dorchester Council of Governments (BCDCOG), community members within those jurisdictions.
- *Stakeholder Engagement Methods:* A text messaging campaign was conducted to get input on community concerns about the future. A "Tools Expo" was held to introduce participants to a variety of decision support tools available for their use. Additional stakeholder engagement will occur primarily through the Our Region, Our Plan process, lead by BCDCOG and their consultants. The results of the Future Use and Mitigation Scenario analyses, in addition to the "Citizen Scenario" created by stakeholders during the October 2010 meetings, will be used to inform the alternative scenarios presented to the public in early 2011.

Outcomes

1) The BCD COG and its consultants are using the analysis results and some of the datasets

available to assist in the creation of four scenarios for public review.

2) The two scenarios that demonstrate the impacts of planning in an integrated way (the Future Use and Mitigation Scenarios) will continue to be available for educational purposes and to guide the BCDCOG in its plan development process.

Key Observations and Lessons Learned

1) The project team might have been better off using fewer tools with less intensive data requirements. While this would have reduced the precision of the analysis and model results, they would have been more accessible and the process would have been less resource intensive.

2) Having a core group of conservation specialists gather to provide data for the Vista analysis proved to be an extremely effective strategy for developing consolidated biodiversity data.

Project Details

- *Project Website(s):* http://resilient-communities.org/ and http://www.bcdcog.com/LRP.htm
- *Project Partners:* Berkeley, Charleston, and Dorchester Counties, Berkeley-Charleston-Dorchester Council of Governments.
- *Project Contact:* Jocelyn Hittle, PlaceMatters
- *Project Contact Email:* Jocelyn@placematters.org
- *Project Contact Phone:* (303) 506-0841

Narrative

The Bridging the Divide project, launched by PlaceMatters and the Packard Foundation in 2006, is designed to improve the use of scientific tools in community decision-making, and to help those communities better understand and protect the natural, cultural and economic resources vital to their long-term vitality. The project was originally academic and research-oriented in nature, with a second "pilot" phase applying the research lessons in the context of a specific planning process.

The Creating Resilient Communities Project is that pilot project, looking at the use of complex scientific tools in sensitive coastal areas in South Carolina facing high growth rates and at high risk from rising sea levels, storm surges, and other natural hazards. The project provided PlaceMatters and Packard a good venue for testing the theories behind the Bridging the Divide project: the project had a strong local champion (Noisette Foundation) with strong local connections and relevant experience, the major cities had comprehensive plans in motion, and there was a regional land use and transportation plan starting up. In addition, PlaceMatters' primary subcontractor was a local organization (Michaux Conservancy) closely linked to the Noisette Foundation. Their point person was extremely effective, efficient, and professional, further improving the likelihood of success.

The Berkeley-Charleston-Dorchester Council of Governments and PlaceMatters launched the project in August 2007. The project initially incorporated a range of specific plans and planning efforts, including a Comprehensive Plan update in North Charleston and a BCDCOG regional transportation plan. The initial project steering committee was fairly narrow in scope, with the intent to grow the committee to include representation from a broad range of constituencies as they ramp up the public participation process. Two key teams have led the project through its first two

and a half years: a Project Implementation Team and Technical Implementation Team. These two teams have worked alongside two groups created by the BCDCOG for the purpose of writing their new Long Term Transportation Plan: a Regional Land Use Plan Steering Committee and a Technical Support Committee.

One key step in the process to date involved creating a regional database for modeling natural hazards, community vulnerability, sea level rise, potential hazards mitigation, biodiversity, and alternative scenarios assessment. This step is complete. Another key step currently underway: creating and analyzing a "current conditions" map and two alternative future scenarios using CommunityViz, Vista, and NOAA's Community Resilience and Vulnerability Assessment Tool, a GIS-based tool that enables community vulnerability assessments. The two future scenarios are a "business-as-usual" buildout scenario and a scenario that attempts to achieve conservation goals while mitigating hazard exposure.

Public outreach to date has included the "Creating Resilient Communities" web site, a brochure, the Tools Expo (noted below), email newsletters, and a series of public meetings late in 2009. The initial design of CRC included a stakeholder engagement process. However, it became clear that a better approach was to integrate the results of the scenario development into the stakeholder engagement process developed as part of the "Our Region, Our Plan" process.

The project team is relying on three primary tools: NatureServe Vista (conservation planning), NOAA's Community Resilience and Vulnerability Assessment Toolkit (CRVAT, hazard assessment and planning), and Placeways' CommunityViz (visualizing and analyzing future land use scenarios). Vista and CommunityViz are already set up to interoperate, but the team will need to integrate the CRVAT tool into CommunityViz.

One challenge was raising awareness among participants about these tools and how they would work, and to that end the project team organized an early "Tools Expo" event in April 2008. Although participation in the Expo was lower than anticipated, the event worked really well, resulting in improved awareness of the tools and enhanced energy and creativity about the overall process.

The degree of participation varied across jurisdictions. Because the North Charleston Comprehensive Plan update had already been completed in July 2008, that jurisdiction wasn't interested in revisiting decisions in the plan, although they frequently participated in the Creating Resilient Communities project meetings. The City of Charleston only occasionally participated. Charleston County was consistently involved but very reluctant to share their data. The County already has a mitigation plan, and they may have been concerned that the project team would ultimately suggest changes to that plan. The BDCCOG, on the other hand, was very enthusiastic about being part of the project, in the context of their new regional land use and transportation plans. For BDCCOG, the project provided an opportunity to secure some helpful high-level regional modeling.

One particular challenge was the Current Conditions Scenario. Acquiring the data proved to be challenging in large part because of Charleston County's trepidation about sharing data but also because of inconsistencies across data sources and types that made aggregation and analysis difficult. These data challenges set the project back by many months. Ultimately, the County agreed to share the data. HNTB, one of the "Our Region, Our Plan" consultants, did some normalization of current land use data, and the current conditions scenario was created.

Consequently, the project team completed the current conditions scenario as well as a 2040 future use scenario. NatureServe is presently analyzing the scenarios for biodiversity impacts to build on preliminary analyses of species populations that might be vulnerable to sea level rise. The project team will subsequently develop a mitigation scenario – considering both community impacts and biodiversity impacts – based on all of these analyses. HNTB and the BCDCOG will then consider and incorporate the scenario planning and analysis in their stakeholder engagement process and possibly as they develop alternatives and make recommendations.

The tools earned the support of the jurisdictions, especially BCDCOG, early in the process, which was a pivotal preliminary step. The key factors seem to include that the tools are used widely and that there are numerous case studies supporting use of these tools. In particular, since BCDCOG has CommunityViz capacity and experience, they were comfortable with using CommunityViz as a key tool. Having NOAA's support was probably significant as well because of its credibility as a federal scientific agency and its local presence (the NOAA Coastal Services Center is in Charleston). The fact that the project has financial support from a major national philanthropic foundation and that the data all came from local sources might be contributing factors as well.

However, the analysis and modeling process adopted by the team and the subsequent selection of tools resulted in substantial data needs, and acquiring these data was challenging and resource intensive. One specific challenge was the lack of necessary metadata and context for some datasets, severely limiting their utility. For example, while the project team secured high quality earthquake data, they lacked adequate information about how to appropriately use these data. In many cases, the data are not especially compatible because they are from multiple jurisdictions, have multiple resolutions, and are coded using different and incompatible categories. One jurisdiction was very apprehensive about sharing data, creating yet more challenges. Another problem was simply the processing power required to analyze high intensity data across a three-county region.

In some cases, the team developed effective workarounds to data challenges. For example, acquiring biodiversity data through individual contact with key sources was very inefficient. The team developed a much more effective alternative strategy, convening the experts and having them hash out their collective knowledge. The value-add for these researchers was access, at the end of the process, to all of the accumulated and vetted data. The result was a very complete dataset about biodiversity values and vulnerabilities. This biodiversity expert group was also used to track down missing and necessary supplemental data.

The entire process has been stalled since early 2009 as a result of the state delaying funding and then altering the programs through which funding for regional land use planning is available. The state and BCDCOG renegotiated their contract, and work on the process began again in October of 2010 with a round of public meetings. These meetings resulted in a conceptual "Citizen Scenario" and that scenario, along with the CRC scenarios will shape the development of alternative scenarios in early 2011.

Key Observations and Lessons Learned:

- Because of the data-intensive nature of the tools selected and the ambitious analysis goals of the project team, the project required substantial data acquisition. Collecting it required an enormous amount of effort. In addition, some of the data lacked adequate metadata and context and in many cases data sets weren't compatible with one another. It would have been helpful, early in the process, to assess and adopt a strategy around data needs, data availability, metadata availability, and data formats.

- Acquiring biodiversity data through individual contact with key sources was inefficient. The alternative strategy of convening of experts was much more effective.

- As the number of tools, the breadth of the data needs, and the intensity of the analysis increase, there is a trade-off between the accuracy and precision of the data and models and the resources required to generate those results. This effort may have been overly ambitious in terms of its use of tools, data, and analysis, producing more thorough and detailed outputs but at a substantial resource cost. In addition, the number and complexity of the tools has hindered the extent to which the local governments invest in and feel ownership over the tools, presumably reducing the potential for long-term post-project capacity building.

- Some of the early stakeholder engagement efforts worked well. Ensuring that everyone on the team, including the remote members, had face-to-face relationships was valuable. The fact that the Council of Governments was actively engaged and supportive made a significant difference. They are the primary project partner and have significant influence in the plan adoption and implementation processes. Having a local champion (the Michaux Conservancy) on the ground and engaged made a huge difference because of their contacts and local knowledge. However, not all of the key players were fully persuaded of the value of the project to their own work, which limited their involvement and investment in the project and made the project more challenging as a result. Proponents need to be strategic and energetic in securing buy-in from the key players.

- It is important to build out project teams with adequate technical expertise. The project may have benefited from Placeways running all analyses, for instance, because of the complexity of the tools and especially the complexity of interoperating these tools. The budget did not ultimately provide for this (Placeways did some of the CommunityViz work, NatureServe did the Vista analysis, and PlaceMatters did the rest of the modeling work).

- It is important to incorporate into project teams and into the project plan the ability to cover for expertise gaps and process challenges. In one instance, a subcontractor simply vanished, requiring the project team to find an alternate mechanism to complete that work. Another example: as a result of the delays caused by state funding problems, community members lost interest. In this case, the project team might have worked with the local governments to create a mechanism for sustaining that involvement even in the face of delays (with additional funding). While it would not be possible to anticipate and plan for every contingency, ensuring some degree of resilience within the team and the project plan can minimize disruptions of this sort.

- The project team substantially underestimated the amount of work required to complete the project, in particular when decoupled from the Bridging the Divide work.

Case Study #4:
Pelekane Bay Watershed Restoration Project (Hawaii)

Basic Information

- *Project Name:* Pelekane Bay Watershed Restoration Project
- *Project Location:* South Kohala, on the northwest coast of Hawai'i Island. Pelekane Bay includes Kawaihae Harbor, constructed in 1955.
- *Project and Community Description:* The Mauna Kea Soil and Water Conservation District completed a Pelekane Bay Watershed Management Plan in 2005 covering 60,000 acres of the watershed. Key issues identified in the plan included upland management (e.g., grazing without appropriate mitigation resulting in excessive erosion) and impacts associated with the construction of the harbor, primarily tied to water circulation. The National Oceanic and Atmospheric Administration provided $2.69 million in stimulus funding to the Kohala Watershed Partnership in June 2009 for Pelekane Bay watershed restoration plan, based on the management plan, focusing on reducing land-based sediment inputs into the bay. Some of the key elements of the plan include erosion control, planting native vegetation, and fencing to exclude feral goats from the project area.
- *Start Date:* The management plan process was initiated in 1992.
- *Status/End Date:* The Mauna Key Soil and Water Conservation District began receiving grant funding from the State Department of Health in 1994 and in the ensuring years adopted a Pelekane Bay Coordinated Resource Management Plan, a fire management plan, a native species revegetation plan, and a sediment management plan. In 2005, the Conservation District adopted the Pelekane Bay Watershed Management Plan, which compiles and incorporates management direction. Some implementation activities have been ongoing, but implementation is expected to accelerate significantly in the wake of a $2.69 million restoration grant awarded in 2009.

Tools

- *Tool(s) Used:* N-SPECT
- *How the Tool(s) Were Used:* N-SPECT was used to assess the cause and magnitude of erosion problems and the dynamics of sediment loading in the harbor. The N-SPECT analysis was also used as the basis for the management plan designed to reduce erosion, sedimentation, and other ecosystem health problems in Pelekane Bay.

Stakeholder Engagement

- *Stakeholders:* The Mauna Kea Soil and Water Conservation District, Queen Emma Land Company (landowner), Parker Ranch (lessee), National Resource Conservation Service, University of Hawaii Extension Service, University of Hawaii at Hilo, County of Hawai'i Department of Water Supply, County of Hawai'i Fire Department, Puukohola National Historic Park, Hawaii Preparatory Academy.
- *Stakeholder Engagement Methods:* Stakeholder meetings.

Outcomes

1) A management/restoration plan for the area.
2) Substantial federal watershed restoration funding based on the plan.
3) Some implementation of elements of that plan.

Key Observations and Lessons Learned

1) Scientific models like N-SPECT can have considerable value even if the study conclusions are consistent with everyone's expectations, giving stakeholders confidence in those conclusions and providing external credibility as well.
2) N-SPECT didn't model terrain and hydrology in Hawai'i as effectively as they had hoped, so use of the model required significant adaptations.
3) There is potential value in designing planning processes so that the key stakeholders are engaged, so that they all feel respected and their contributions valued, and so that they provide a good foundation for collaboration in implementing the plan.
4) A solid plan originating from a planning process, particularly if developed in a manner that gives it political and scientific credibility, can be of significant value in subsequent efforts to fund plan implementation.

Project Details

- *Project Website(s):* http://www.maunakeaswcd.org/projWPELE.html
- *Project Partners:* Mauna Key Soil and Water Conservation District, Army Corps of Engineers
- *Project Leader:* N/A
- *Project Leader Contact Email:* N/A
- *Project Leader Contact Phone:* N/A

Narrative

Pelekane Bay is located in South Kohala on the northwest coast of Hawai'i Island. The bay includes Kawaihae Harbor, which was constructed by the Army Corps of Engineers in 1955 as a proof of concept project, relying on a very large quantity of conventional explosives to establish that nuclear explosives could be used for civic projects.

The watershed and the harbor both suffer from significant environmental degradation related to the construction of the harbor (resulting in substantial water circulation problems) and upland land use (primarily related to grazing management and exotic species).

The Mauna Key Soil and Water Conservation District began receiving grant funding from the State Department of Health in 1994 and in the ensuring years adopted a Pelekane Bay Coordinated Resource Management Plan, a fire management plan, a native species revegetation plan, and a sediment management plan.

Through a process also involving the Army Corps of Engineers and other partners, the Conservation District in 2005 adopted a more comprehensive Pelekane Bay Watershed Management Plan covering 60,000 acres of the watershed as a road map for future management and for restoration

efforts. This plan formed the basis of an effort to secure federal stimulus dollars in support of watershed recovery efforts. While some implementation activities have been ongoing, the award of $2.69 million in restoration funding in 2009 is expected to significantly accelerate those activities.

The Nonpoint-Source Pollution and Erosion Comparison Tool (N-SPECT) was used to assess the cause and magnitude of erosion problems and the dynamics of sediment loading in the harbor. The N-SPECT analysis was also used as the basis for the management plan designed to reduce erosion, sedimentation, and other ecosystem health problems in Pelekane Bay.

The National Oceanic and Atmospheric Administration developed the N-SPECT model to assess potential water quality impacts from various land uses and changing climatic conditions. Although it is a highly regarded model, it turned out not to model terrain and hydrology in Hawai'i as effectively as they needed, so use of the model in this planning process required significant adaptations.

The model's conclusions were consistent with the expectations of Conservation Board, however. The N-SPECT study found that land use issues and exotic species issues are resulting in significant erosion and sediment loading in the bay, and the bay is further impaired as a result of harbor construction. On the one hand, because the model results tracked to the Conservation District's local knowledge, they didn't need a sophisticated modeling exercise to identify key problems and determine restoration priorities. On the other hand, use of the model gave more credibility to those conclusions, giving them political momentum and making it easier to raise funding for restoration activities. Although the Conservation District had reached the same conclusions much earlier, the modeling exercise gave the Army Corps of Engineers confidence in those conclusions.

Tension and disagreements between the Conservation District (with some management responsibility for the area and a great deal of local on-the-ground knowledge) and the Kohala Watershed Partnership (with significant political influence because of the breadth of the coalition) presented some challenges. These issues seemed primarily to have to do with turf, ownership, and credit. It's unclear if these tensions will persist and how they might impact implementation of the restoration efforts, but these problems underscore the value of prioritizing relationship building among key parties early in the planning process in order to minimize the risk that disagreements will undermine the adoption or implementation of a plan. Implementation of the management plan's recommendations will remain a significant challenge, but generally the implementation challenges are more financial in nature rather than political. Impacted landowners, for example, are not opposed to mitigations (e.g., revegetating riparian areas, fencing to exclude feral pigs from riparian areas) but will not themselves pay for these mitigations.

Key Observations and Lessons Learned:

- Scientific models like N-SPECT can have considerable value in a planning process by providing scientifically based outcomes predictions for different future scenarios. Even where model results are consistent with everyone's expectations, the process itself can give stakeholders greater confidence in those conclusions and provide external credibility as well.

- N-SPECT didn't model terrain and hydrology in Hawai'i as effectively as they had hoped, so use of the model required significant adaptations.

- There is a great deal of potential value in designing planning processes so that the key stakeholders are engaged, so that they all feel respected and their contributions valued, and so that they provide a good foundation for collaboration in implementing the plan. This can be important both for the planning process itself as well as for subsequent plan implementation.

- A solid plan originating from a planning process, particularly if developed in a manner that gives it political and scientific credibility, can be of significant value in subsequent efforts to fund plan implementation.

Case Study #5:
Long Island Coastal Hazard Mitigation and Biodiversity Conservation Plan (New York)

Basic Information

- *Project Name:* Demonstrating Ecosystem-Based Management on Long Island, New York: Decision Support for Coastal Hazard Mitigation and Biodiversity Conservation
- *Project Location:* A section of the southern coast of Suffolk County on Long Island, New York.
- *Project and Community Description:* More than seven million people live on low-lying Long Island, which is at risk of inundation from sea level rise and coastal flooding. Barrier beaches, dunes, and wetlands provide critical habitats for natural communities, while also serving as buffers against storm surge for human communities. The region faces significant and growing threats tied to climate change, including hurricanes, storm surges and flooding, and rising sea levels. Despite a growing recognition of the reality of sea level rise and its associated hazards, most local communities lack capacity for climate-change adaptation. Little action has been taken to enhance safety and to protect infrastructure and natural resources from climate-related impacts.
- *Start Date:* October 2007.
- *Status/End Date:* June 2009.

Tools

- *Tool(s) Used:* Coastal Resilience (a newly developed interactive decision support system)
- *How the Tool(s) Were Used:* The purpose of the Coastal Resilience project was to provide communities with easy access to information to assist in coastal planning and management decisions regarding resources at risk from sea level rise and coastal hazards. The Coastal Resilience tool makes relevant information accessible through an interactive decision support system (DSS). The DSS includes a Future Scenarios Mapper, which enables users to characterize current conditions and visualize the ecological, social, and economic impacts of reasonable future flooding scenarios.

Stakeholder Engagement

- *Stakeholders:* Municipal government staff and elected officials in towns along southern coast of Suffolk County, state-level planners (e.g., New York State Sea Level Rise Task Force), and non-government organizations engaged in natural resource conservation on Long Island (e.g., Nature Conservancy). It also included similar stakeholders outside the Long Island area (nationally and internationally) because the project was a proof-of-concept intended to be transferred to other geographies.
- *Stakeholder Engagement Methods:* The project was developed with extensive stakeholder input from many decision-makers, including coastal planners, managers, and elected officials. Three workshops were held at the beginning, middle, and toward the end of the project to gather input. Extensive trainings on the Coastal Resilience framework and its underlying approaches were conducted throughout Long Island and through in-person and webinar

trainings in the U.S. (including many state and federal agency partners), the Caribbean, and the Indo-West Pacific.

Outcomes

1) The Nature Conservancy on Long Island is using the DSS to prioritize marshes for land acquisition and restoration projects.
2) The Town of East Hampton on Long Island has used the DSS in evaluating revetment applications.
3) The Town of Southold on Long Island is working with The Nature Conservancy to use the DSS to bring sea level rise adaptation into their ongoing Comprehensive Plan development project.
4) The New York State Sea Level Rise Task Force (SLRTF) adopted the Coastal Resilience DSS as the protocol for vulnerability mapping throughout its project area. The SLRTF's Natural Resources Working Group has used the DSS in (1) evaluating the prospective utility of state and local wetlands code in the face of sea level rise and (2) identifying characteristics of communities that support retreat-oriented policies.
5) The Peconic Estuary Program on Long Island has commissioned the team to extend the proof-of-concept project to the Peconic Estuary.
6) The Coastal Resilience partnership received initial funding to extend the project into Long Island Sound and expressions of interest in applying the framework in California, the Eastern Caribbean, Bahamas, Mexico's Yucatan Peninsula, the Gulf of Mexico, the Solomon Islands, and Indonesia.
7) The Hudson River National Estuarine Research Reserve has expressed interest in extending the DSS to the Hudson Estuary as well.
8) The National Oceanic and Atmospheric Administration's Coastal Services Center is working with The Nature Conservancy on incorporating the DSS in local planning efforts, using the Roadmap for Adapting to Coastal Risk framework.

Key Observations and Lessons Learned

1) Early stakeholder engagement played an important role.
2) One factor in the project's success was the cross-disciplinary nature of the team from NGOs, academia, state and federal agencies.
3) Limitations in the available data and models influenced where and how the tool was implemented.
4) Some use of iterative evaluation and feedback mechanisms during the process can be very valuable for making adjustments. Through a formal technical evaluation and usability test of the finished tool, the project partners were able to refine and improve the tool.
5) The project required much more dedicated staff time than had been anticipated.

Project Details

- *Project Website(s):* http://coastalresilience.org/ and http://futurescenariosmapper.org/
- *Project Partners:* The Nature Conservancy, NOAA, Association of State Floodplain Managers (ASFPM), Columbia Center for Climate Systems Research and NASA–Goddard, University

of California Santa Barbara (UCSB), University of Southern Mississippi (USM), Pace University Land Use Law Center.

- *Project Contact:* Sarah Newkirk, The Nature Conservancy on Long Island
- *Project Contact Email:* coastalresilience@tnc.org
- *Project Contact Phone:* (631) 367-3225

Narrative

Around the world, coastal towns and cities are seeking ways to adapt to the imminent threats associated with climate change, particularly sea level rise and increasing storm activity. These forces will cause flooding and inundation of shoreline areas, threatening human safety, infrastructure such as buildings and roads, and natural habitats, species, and ecosystems. In the United States, municipal governments bear much of the responsibility for adapting to climate change using land-use zoning and other planning, management, and regulatory mechanisms that occur at the local scale. Despite a growing recognition of the reality of sea level rise and its associated hazards, most local communities lack capacity for climate-change adaptation.

One particular challenge is simultaneously addressing multiple management objectives. The Coastal Resilience project was designed to demonstrate how decision support tools can help local stakeholders meet multiple objectives related to climate change in an ecosystem-based management framework.

The primary products of this project were (1) an interactive decision support system called Coastal Resilience and (2) the partners' associated work with stakeholders and decision-makers in the development, rollout, training, and ongoing implementation to ensure that the information in Coastal Resilience is used to inform coastal management decisions.

Coastal Resilience is a unique, interactive, web-based decision support system that provides three types of information to help local communities and decision-makers address inundation and flooding from sea level rise and storms. Coastal Resilience allows the communities and decision-makers to:

- Visualize scientifically credible scenarios of inundation and flooding from climate change on their coasts.
- Examine the potential ecological, social, and economic impacts of these changes.
- Identify reasonable alternatives that reduce losses and vulnerability of coastal communities for people and ecosystems.

The project partners provided interactive decision support for local governments on Long Island, New York, to enhance community resilience and meet management objectives for coastal hazard mitigation and biodiversity conservation while accounting for future sea level rise and storm scenarios. Coastal hazard mitigation and biodiversity protection objectives have rarely been considered together, but the social and economic needs of human communities can be closely aligned with ecosystem protection in this context.

For several reasons, the southern shore of Long Island was selected as the site for this project:

- New York State is a leader in the development of ecosystem-based management.
- The New York State Legislature had recently created the Oceans and Great Lakes Ecosystem Conservation (OGLEC) Council, whose charge was to put EBM on the ground and in the water.
- The Long Island Chapter of The Nature Conservancy was already working with the OGLEC Council, town officials, the NY Department of State and Department of Environmental Conservation, and a wide range of stakeholders to apply EBM concepts to Long Island's Great South Bay.

In addition, The Nature Conservancy (TNC) is a significant owner of lands both above and below water, and therefore a stakeholder with significant investments on Long Island. TNC has been engaged in conservation work on Long Island for nearly 50 years and has developed diverse, deep and positive partnerships. The pre-existing local presence and support of one of the project's lead partners was a major factor in the success of the project.

Long Island, with considerable coastal development, faces a substantial combined threat from sea level rise and increased storm intensity and frequency. Long Island's south shore also has some of the most highly developed lands in the coastal zone, much of which is private property only inches above sea level. Even a moderate sea level rise will result in a significant increase in the likelihood of flooding. There was an 81% chance of a category three, four or five hurricane striking the East Coast of the U.S. during the year prior to the project, compared with a 52% average annual likelihood over the last century.

One particular challenge of natural resource, land use, and hazard mitigation planning is the ability to visualize the projected impacts and to identify and evaluate projected outcomes associated with alternative management scenarios, particularly around complex issues like sea level rise and storm surges. One focus of the project was to provide a centralized, online location to do just this: provide local communities with easy access to this central web mapping application and enable them to understand spatial relationships among ecological, social and economic factors in the geographic area.

The project partners chose coastal hazards and biodiversity conservation as the focal issues because they saw potential for important win-win solutions if these sectors were managed with a multi-objective approach. Other management sectors, such as fisheries, offer less potential for win-win solutions when managed jointly with biodiversity conservation. The partners wanted this project to demonstrate not only the trade-offs between management sectors but also the potential for mutual benefits through EBM. The partners recognized that there would be trade-offs between the two focal objectives, but through better decision support they sought to maximize opportunities to meet each objective while minimizing adverse impacts across multiple objectives.

Rather than presenting users with a pre-defined set of alternative solutions, the Coastal Resilience DSS enables community members and decision-makers to learn about and explore the issue of climate change in an interactive fashion. While the current version of the Coastal Resilience DSS

does not explicitly quantify and analyze tradeoffs between planning objectives, this functionality could be added to the DSS.

One factor in the project's success was the cross-disciplinary team of partners from NGOs, academia, state and federal agencies. The team included seasoned practitioners in government and conservation; tool developers and trainers; and distinguished scientists. The partners participated regularly in the outreach sessions, and all partners contributed to the end products:

- Staff from the NOAA Coastal Services Center played critical roles throughout the project, in particular in the development of the social vulnerability analyses, the storm surge estimates, and the design of the interactive decision support system.
- NASA-Goddard staff provided the locally adjusted sea level rise estimates associated with future Intergovernmental Panel on Climate Change (IPCC) emissions scenarios.
- ASFPM staff ran FEMA's hazards model (HAZUS) to estimate future economic impacts from inundation.
- USM staff provided programming expertise to develop the interactive Future Scenarios Mapper.
- The server and other computer hardware are housed and maintained at UCSB.
- Pace University staff reviewed municipal policies nationwide to identify common and current best practices for addressing hazards from sea level rise.
- The Nature Conservancy managed the whole project, provided ecological and GIS expertise, ensured stakeholder involvement, and led on the rollout of, training for, and implementation of the project.

The target audience for the Coastal Resilience project was municipal government staff, local elected officials, community groups, and individual citizens. To ensure that the DSS would be easily accessible to this audience, the DSS collaborators created a web-based tool that operates in ordinary web browsers with no special hardware, software, or skills. Built with widely available technology, the Coastal Resilience DSS could be transferred relatively easily to other geographic areas, target audiences, and computing environments.

Some of the partners found that implementing this project took even more time than they had anticipated, particularly for coordinating the efforts and engaging stakeholders.

The project partners sought to be ambitious but practical during development of the Coastal Resilience DSS. For example, they decided to use existing models of storm surge inundation – despite their known shortcomings – because obtaining more sophisticated projections was unrealistic within the project budget and would not have provided a large benefit for this initial, proof-of-concept version of the DSS. For the same reason, they did not attempt to model the potential migration of marsh habitats in response to sea level rise, which would have been possible with tools such as the Sea Level Rise Affects Marshes Model (SLAMM). The partners decided that the adopted level of technical sophistication was appropriate to the goals of the project, particularly as it was the first iteration of the DSS and stakeholders were just becoming familiar with the information. Adding more sophisticated models may be desirable and feasible in future iterations of the DSS.

The partners found that effective outreach to the target audience was critical. It would not have been sufficient to simply release information and tools and then wait for local decision makers to act. One challenge with their approach was that they include multiple communities from the beginning of the project with varying degrees of commitment to the project. One of the project partners suggested that it might have been useful to start working with one town that had a critical mass of people strongly interested in these issues, and then accomplishments in the first town could have been used to engage other towns.

Data limitations were an important factor in how the project developed. High-resolution elevation data, such as LIDAR data, are essential but were not available for many coastal areas in New York and elsewhere. Also, New York's regulatory wetland layer dates from 1974, so it no longer accurately depicts where wetlands actually exist. But because it is the official regulatory layer, it was the layer used in the Coastal Resilience DSS. Other desirable data layers, such as locations of shoreline armoring, simply did not exist. When pursuing this type of project, participants should recognize at the outset that there will almost always be a gap between the data that ideally would be used and the data that are actually available.

Finally, the project partners conducted a formal technical evaluation and usability test of the completed tool, in which a technical reviewer brought the tool to local planners and other people in the target audience for testing sessions. The review revealed how people used the site, what was difficult to use, and where they tended to go first on the site versus where the project team wanted users to go. This type of follow-up review fuels iterative development and refinement of the tool, and was extremely important for evaluating whether the tool actually did what it was supposed to do. Usability testing is standard practice in commercial technology development, but many people working in the field of EBM tools are unaware of the entire field of usability testing and that there are people with expertise in the practice of usability testing.

Key Observations and Lessons Learned:

- Early stakeholder engagement played an important role. The investments in building relationships with stakeholders were as important as the technical work. The Nature Conservancy's long-standing presence and relationships on Long Island contributed to the success of the project.

- One factor in the project's success was the cross-disciplinary nature of the team from NGOs, academia, state and federal agencies. The team included seasoned practitioners in government and conservation; tool developers and trainers; and distinguished scientists.

- There was a significant gap between the desired datasets and the datasets that were actually available. Limitations in the available data and models influenced where and how the tool was implemented.

- Some use of iterative evaluation and feedback mechanisms during the process can be very valuable for making adjustments. Through a formal technical evaluation and usability test of

the finished tool, the project partners were able to refine and improve the tool.

- The project team underestimated the time required for the process.

Case Study #6:
Sanford Conservation Plan (Maine)

Basic Information

- *Project Name:* Sanford Conservation Plan
- *Project Location:* Sanford, Maine
- *Project and Community Description:* The Sanford Conservation Plan was developed for the Sanford Planning Board by members of the Sanford and Springvale community with help from a number of regional conservation partners. The Plan focused on the conservation goals of the Sanford Comprehensive Plan, and it "outlines goals and strategies for achieving open space and resource protection in the natural areas and working landscapes of Sanford."
- *Start Date:* Spring 2008.
- *Status/End Date:* The second draft of the Plan was released in June 2009, and a final version was adopted by the Planning Board in July 2009.

Tools

- *Tool(s) Used:* CommunityViz and the underlying GIS technology, keypad polling, and stakeholder/community engagement tools like the "Collaborative Learning" approach and the use of "Sanford Conservation Dollars" to prioritize among values.
- *How the Tool(s) Were Used:* Keypad polling, "Collaborative Learning," and the use of "Sanford Conservation Dollars" were used to identify and prioritize among potential conservation values. Conventional GIS software was used to create maps of assets and values. CommunityViz was used to combine and weight all of the input to produce draft and final "Conservation Resource Maps" and the final Conservation Plan.

Stakeholder Engagement

- *Stakeholders:* There were 15 local stakeholders, including local land trust representatives, a local farmer, a member of the Sanford Town Council, two representatives of the Sanford Water District, two members of the Sanford Trails Committee, a developer, a representative of Maine Healthy Partnerships from the Goodall Hospital, a local resident who is also the Director of Planning in a nearby community, and two Town of Sanford staff members (the Director of Parks, Recreation, and Public Property and the Code Enforcement Officer). The stakeholder engagement was facilitated by a ten-member Steering Committee composed of five staff from the Wells National Estuarine Research Reserve, a GIS consultant, three Town of Sanford staff members (the Director of Planning, the Director of GIS/IT, and the Assistant Engineer), and a senior planner with the Southern Maine Regional Planning Commission.
- *Stakeholder Engagement Methods:* A ten-member Steering Committee facilitated the preliminary work: stakeholder assessment, understanding issues, making sure key individuals knew about and understood the project, and engaging the town staff and Planning Board. This Steering Committee was composed of five staff from the Wells National Estuarine Research Reserve, a GIS consultant, three Town of Sanford staff members (the Director of Planning, the Director of GIS/IT, and the Assistant Engineer), and a senior planner with the

Southern Maine Regional Planning Commission. Based on all of this work, the Steering Committee identified local and regional stakeholders and invited them to an initial workshop. Based on stakeholder feedback and values identification and on various data sources, the Steering Committee created maps and data layers of the water resources and the core conservation values which formed the basis of the second workshop. These stakeholders helped identify additional stakeholders that were invited to the second workshop, at which the group reviewed and refined all of the GIS maps and ranked and ultimately weighted priorities among possible conservation values. Based on this analysis, the Steering Committee created a new iteration of maps and conservation strategies, which were reviewed and finalized at the third workshop. The Steering Committee and stakeholders presented their draft plan to the Planning Board, engaged in several months of discussions, and produced a final version that the Planning Board adopted.

Outcomes

1) The conservation plan adopted by the Planning Board enjoyed broad community and stakeholder support as well as the support of an initially skeptical Planning Board.
2) The process resulted in a conservation plan consisting of a) recommended management practices, b) resource maps, and c) delineated special areas of high value and high sensitivity. Because the plan was only adopted recently it is too soon to assess the extent to which the plan's elements are implemented and its goals achieved.

Key Observations and Lessons Learned

1) Digitize all the important information early.
2) The suite of tools generally seemed appropriate for the range of process elements with CommunityViz as the one exception. Although the team included significant GIS expertise, the learning curve for CommunityViz was steep enough that they were unable to use many of its more powerful features. They might have either selected a different visualization and optimization tool or found better ways to overcome the steep barriers to effectively using CommunityViz.
3) CommunityViz and the underlying GIS software and other tools interoperated well. The team was able to use CommunityViz to combine and weight input from the "Sanford Conservation Dollars" exercise (ranking potential priorities), community member comments, and keypad polling results.
4) A high level of attention to engaging a broad range of stakeholders paid off.
5) There can be an important key trade off between a "softer" plan with no mandates but more political support versus a more prescriptive plan that may more clearly require appropriate on-the-ground steps but have less support.
6) The credibility of important data sources can be an important factor.

Project Details

- *Project Website(s):* http://www.sanfordmaine.org/index.asp?Type=B_BASIC&SEC={BD2508AE-1857-40DD-93D8-9E50F3C033DF}&DE={3573E5B4-F06A-437E-BEA3-E2EC6939F90B}
- *Project Partners:* Wells National Estuarine Research Reserve, Town of Sanford, Southern

Maine Regional Planning Commission, Cooperative Institute for Coastal and Estuarine Environmental Technology (NOAA and the University of New Hampshire).

- *Project Leader:* Dr. Christine Feurt, Wells National Estuarine Research Reserve
- *Project Leader Contact Email:* cfeurt@wellsnerr.org
- *Project Leader Contact Phone:* 207-985-4686

Narrative

The Sanford Conservation Plan was developed for the Sanford Planning Board by members of the Sanford and Springvale community with help from a number of regional conservation partners. The Plan focuses on the conservation goals of the Sanford Comprehensive Plan, and it "outlines goals and strategies for achieving open space and resource protection in the natural areas and working landscapes of Sanford."

The effort was initiated by a community member who secured funding for development of a conservation plan and ultimately persuaded the Town Council and Planning Board to become partners. It is important to note that in Maine the planning boards (which are appointed by the town councils) have a great deal of land use authority that is independent of the town councils, consequently requiring some degree of cooperation from both entities.

The Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), a partnership between NOAA and the University of New Hampshire, funded the project. The Wells National Estuarine Research Reserve (WNERR) did the preliminary work before the official project launch: stakeholder assessment, understanding issues, making sure key individuals knew about and understood the project, and engaging the town staff and Planning Board. They also helped drive the coalition effort throughout the process, including connecting the CICEET funding to a locally generated request from Sanford for assistance with their Conservation Plan.

The process was facilitated by a ten-member Steering Committee composed of five staff from the Wells National Estuarine Research Reserve, a GIS consultant, three Town of Sanford staff members (the Director of Planning, the Director of GIS/IT, and the Assistant Engineer), and a senior planner with the Southern Maine Regional Planning Commission.

The Steering Committee launched the process by identifying stakeholders, both local and regional, and inviting them to an initial workshop in April 2008. At the first workshop, the stakeholders identified the community's key conservation values, especially relative to the conservation goals of the Sanford Comprehensive Plan. They focused largely on water quality and watershed protection, specifically targeting "conserving wetlands, vegetated buffers along waterways and drinking water aquifers" (Conservation Plan p. 6). The Steering Committee then created maps and data layers of the water resources and the core conservation values. As the draft Plan explains about this first workshop, "stakeholders created a 50-year conservation vision for the future of Sanford. That vision included five core conservation values that participants identified as important aspects of Sanford's character and quality of place" (Conservation Plan p. 6). Those five values were water, productive land, wildlife habitat, scenic/recreation, and public health and safety.

Stakeholders at this first workshop were also asked to invite additional stakeholders to the next workshop the following month. Ultimately the process included 15 local stakeholders, including local land trust representatives, a local farmer, a member of the Sanford Town Council, two representatives of the Sanford Water District, two members of the Sanford Trails Committee, a developer, a representative of Maine Healthy Partnerships from the Goodall Hospital, a local resident who is also the Director of Planning in a nearby community, and two Town of Sanford staff members (the Director of Parks, Recreation, and Public Property and the Code Enforcement Officer).

At the second workshop in May 2008, the group reviewed and refined all of the GIS maps based on local knowledge and experience. They also ranked possible priorities using "Sanford Conservation Dollars." The group then used CommunityViz to combine and weight all of the input to that point, including community member comments, keypad polling results, and value percentages. The CommunityViz process ultimately produced the final Sanford Conservation Resource Maps.

During this time, the team made two additional presentations to key business-oriented community groups, one to the Rotary Club and another to the Kiwanis Club. In these presentations, they provided an overview of the project and solicited additional feedback on the conservation values through keypad polling.

At the third workshop in September 2008, the group reviewed the final maps, discussed conservation strategies to protect areas of conservation value identified on the maps, and created the draft Conservation Plan, including implementation recommendations. The draft plan identified five "areas of special significance" (also known as "Focus Areas") based on the presence of multiple conservation values. Although the draft plan identified places and recommended steps, it didn't require any action; in order to effectively implement the plan the Planning Board and other entities would need to take additional subsequent steps.

In March 2009 the Steering Committee and stakeholders presented the draft Sanford Conservation Plan to the Sanford Planning Board. The planning team for the project and the Planning Board spent the next four months refining the plan and addressing various concerns about the plan, particularly related to the linking of ecosystem services values with economic development goals and conservation objectives. The Planning Board subsequently voted unanimously to accept the refined draft plan as an appendix to the Sanford Comprehensive Plan.

Key tools in the process included both low-tech and high-tech elements: CommunityViz and the underlying GIS technology, keypad polling, and stakeholder/community engagement tools like the "Collaborative Learning" approach and the use of "Sanford Conservation Dollars" to prioritize among values.

CommunityViz was a particularly important tool in the process but it also presented some challenges. The team relied on CommunityViz "to create scenarios that provide a spatial comparison among what community members consider important conservation values, where those

values manifest in the landscape in the form of ecosystem services provided by natural systems and the patterns of development expected from current zoning and land use policy."[7] The tool was extremely difficult to use, however, and despite having a great deal of available GIS expertise they were unable to use the buildout scenario tool and some of CommunityViz's other functionalities because of the steep learning curve.

The process employed by the early champions and eventually the Steering Committee appears to have been quite effective at engaging the right people in the right ways to identify shared values and priorities, develop an appropriate plan, and secure the necessary political support. The extent to which the plan will be implemented, and its effectiveness at achieving the community's conservation goals, are two critical remaining questions. The plan, its recommended best practices and other recommendations, and its maps are now available to the Planning Board and other municipal groups as a tool for future land-use decision processes.

Key Observations and Lessons Learned:

- Because CommunityViz privileges digital information, it was extremely important to identify key sources of non-digital data early, digitize them, and incorporate them early (see, e.g., March 2009 Progress Report). In the Sanford process, for example, one of the local land trusts had critical information about priority conservation areas (unique species assemblages and rare and endangered species) on hand-drawn maps. Because they digitized this information it was available during the process.

- The costs associated with using CommunityViz and keypad polling presented real barriers, barriers that will be particularly pronounced in small communities without substantial grant funding support like Sanford had: ". . . the ability of others to adopt our approach is severely constrained by the costs associated with bridging the expertise gap and the time required by local experts to input local data to make a tool relevant. Rapidly developing rural areas like Maine are the places where improved decision-making can make a difference in environmental outcomes that prevent loss of rather that try to restore ecosystem services. These places are frequently the places where the financial resources required by complex tools are unavailable. The financial disparity between the budgets of local land use planning offices and the costs associate with importing outside expertise is staggering."[8]

- They were unable to exploit all of CommunityViz's potential because neither the town's staff, the regional partners, nor anyone else involved had sufficient expertise to do so. Inputting all of the local data into CommunityViz and learning to use its functionalities was extremely difficult; simply becoming operational at a basic level took a long time and a great deal of effort. The primary casualty was the ability to do a buildout scenario (demonstrating the look, feel, and impacts of buildout at current zoning and code), but they were limited in their ability to compare other scenarios as well. The issue wasn't GIS expertise, which was present in significant quantities among the participants, but expertise in and the learning curve for CommunityViz. One reflection by a participant: they should have hired a good CommunityViz consultant and done the buildout scenario up front. And while doing that

may have improved the use of the tool in the process, it probably wouldn't have changed the ongoing inability of the Sanford community to use the tool in the future.

- The politics and the process mattered, and the Steering Committee's success in establishing a stakeholders group of sufficient breadth (including a range of key community thought leaders and old-timers) was probably critical to their ability to persuade the Planning Board to adopt their draft plan. Their success in identifying key stakeholders early in the process mattered a great deal, their ability to identify the Planning Board chair's concerns early enough to work through them (and finessing some language along the way), and their inclusion of a key developer all enhanced their ability to secure approval.

- The fact that the plan doesn't require any action and relies on willing sellers for property acquisitions made it easier to secure adoption by the Planning Board. This tradeoff boiled down to a weaker plan in exchange for a better chance of adoption. The critical questions still to be answered have to do with implementation: does it get implemented, does it guide land use and other decisions in a meaningful way, and does it produce the desired outcomes?

- No one challenged the data or maps on which the process, analysis, and conservation plan were based. This may have partly been the result of the project's reliance on data and information from "Beginning with Habitat," a credible, well-known program in Maine for identifying habitat areas (to which they added data on water source protection and riparian buffers). It is unclear if there were people who objected to the use of those data and maps at all, if there were but they weren't part of the process, or if there were participants who objected but choose not to express those concerns.

Conclusion

Ecosystem-based management offers a powerful approach to incorporating complicated scientific information into community planning processes. The approach emphasizes understanding complicated ecological systems, evaluating and comparing potential management scenarios, and effective stakeholder engagement.

In this report we evaluate six examples of EBM approaches to community plans. Our focus in this report is on the planning processes themselves, but while we didn't evaluate the on-the-ground results of plans after they are adopted, it is clear that community support has a real impact on whether and how such plans are actually implemented. For all of its promise, and despite its maturation as a field, the extent to which EBM approaches actually result in better ecosystem management is unclear. As Judy Layzer argues, ". . . scholars have been unable to document a causal relationship between collaboration and improved environmental conditions."[9] Even the more unequivocal supporters of an ecosystem-based management approach, such as Karen McLeod and Heather Leslie, acknowledge a range of very real challenges to on-the-ground environmental success in EBM efforts, including poor intergovernmental coordination, poor institutional capacity, and a lack of political will.[10]

We identified a number of important lessons for those pursuing EBM approaches:

1. Engage the stakeholders and other key individuals early.
2. Earn credibility for the scientific and/or technical tools.
3. Find a good balance between the precision of the tools and their accessibility and utility.
4. Maintain feedback loops throughout the process.
5. Watch out for exogenous factors that can dramatically impact the planning process.
6. Plan on the process requiring more time than you expect it should.

Our central insight, however, is woven throughout these six lessons: the politics of a community planning process – especially the extent to which such a process acquires political and scientific credibility – has a substantial impact on the success of the planning process and on the durability of plan implementation. In a sense, this issue is about identifying the constituencies in a given community plan context, and their motivations, and about how effectively this understanding is mapped onto the demands of the science-informed policy process. All community planning processes and decisions, not to mention subsequent implementation, are subject to the politics of their communities, and any EBM approach that fails to recognize this is much less likely to produce effective implementation of a scientifically appropriate plan.

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End Notes

[1] See, e.g., Layzer, Judy. "Natural Experiments: Ecosystem Management and the Environment."
[2] Ecosystem-Based Management Network. "Improving Coastal Land Use Planning Through the Application and Evaluation of the Interoperability of Three Decision Support Tools." Ecosystem-Based Management Tools Network Database, http://ebmtoolsdatabase.org/project/improving-coastal-land-use-planning-through-application-and-evaluation-interoperability-thre.
[3] The County Information Project, Texas Association of Counties, http://www.county.org/resources/countydata/.
[4] Headwaters Economics. "Potential for Future Development on Fire-Prone Lands."
[5] Cohen, Jack. "The Wildland-Urban Interface Fire Problem."
[6] Brenkert, Hannah, Patricia Champ, and Nicholas Flores. "Mitigation of Wildfire Risk by Homeowners."
[7] Feurt, Christine. "CICEET Progress Report for the period 9/01/09 through 2/15/09: Collaborative Learning and Land Use Tools to Support Community Based Ecosystem Management," p. 1.
[8] Feurt, Christine. "CICEET Progress Report for the period 3/01/09 through 8/31/09: Collaborative Learning and Land Use Tools to Support Community Based Ecosystem Management," p. 8.
[9] Layzer, Judy. "Natural Experiments: Ecosystem Management and the Environment."
[10] McLeod, Karen, and Heather Leslie. "Ecosystem-Based Management for the Oceans."