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Collaborative Learning and Land Use Tools to Support Community Based Ecosystem Management

A Final Report Submitted to

**The NOAA/UNH Cooperative Institute for Coastal and Estuarine
Environmental Technology (CICEET)**

Project Start Date: October 2007

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1. EXPANDED EXECUTIVE SUMMARY AND KEY FINDINGS

The Gulf of Maine watershed is the poster child for what the National Research Council (NRC) of the National Academy of Sciences calls the *Drama of the Commons*. In a 2002 report, the NRC characterized the tension between land use management and protection of common pool resources like water as a fundamental dilemma of environmental policy (NRC, 2002). The *Drama of the Commons* refers to the challenges associated with balancing sustainability goals for public assets like clean water with short term resource use, economic development and concern for property rights. The *Drama of the Commons* is powerfully played out in Gulf of Maine communities where municipal governance guides land use decision-making. Decisions affecting coastal and estuarine water quality can take place in Town Halls miles from the ocean.

This project developed a model conservation plan for local land use decision making that engaged diverse stakeholders in discussions about conservation values, ecosystem services and strategies to balance conservation and economic development. This locally focused action research case study tested the application of ecosystem based management (EBM), Collaborative Learning and land use technology tools to land use planning. Lessons learned were scaled up to create capacity building training for land use decision makers and coastal managers to increase interdisciplinary skills for implementing ecosystem based management.

Collaborative Learning and EBM Tools were tested and evaluated for their contribution to implementing EBM in the context of local land use. EBM is a holistic approach to managing coupled ecological and social systems that incorporates the knowledge and perspectives of diverse stakeholders into a shared vision of desired future outcomes (Meffee, et. Al 2002). The long term goal of EBM is to sustain the provision of valued goods and services provided by ecological systems (MacLeod and Leslie, 2009). Community based ecosystem management (CBEM) shares the principles and theoretical foundation of EBM with an added focus on actions that make the places where people live, work and play noticeable better today and in the future (Meffe et al., 2002). The place-based focus of CBEM combined with the stakeholder engagement practices of Collaborative Learning provided an adaptable and practical framework for development of *Headwaters – A Collaborative Conservation Plan for Sanford, Maine*.

The need to apply the principles and practices of EBM to coastal land use conflicts and to address challenges of adapting policy and management to environmental change has been recognized and strongly articulated (NRC, 2009; McLeod and Leslie, 2009; Pew Ocean Commission, 2003; US Commission on Ocean Policy, 2004; CEQ, 2010). Despite this, the practice of EBM remains elusive. The Gulf of Maine Council on the Marine Environment, the Communication Partnership for Science and the Sea (COMPASS), and the EBM Tools Network identified barriers to the practice of EBM and the need for training to help managers understand the conceptual framework for EBM and the approach for putting EBM in place (NOAA, 2008; Taylor, 2008). Identified needs for locally based case studies, and improved capacity to engage stakeholders in EBM are addressed by this project.

Key Findings
1. **Collaborative Learning facilitates community-based ecosystem based management.**

The Collaborative Learning approach (Daniels and Walker, 2001; Feurt, 2007; 2008) and the application of land use planning tools (EBM Network, 2011) connect the practice of community based ecosystem management to municipal land use decision-making. Desire to incorporate water quality and habitat protection into economic development strategies motivated the town of Sanford, Maine to examine existing resource conditions, ordinances, and Comprehensive Plan priorities and develop an innovative conservation plan. The Wells National Estuarine Research Reserve worked with partners to bring land use technology tools to the process and engage stakeholders through the Reserve's Coastal Training Program (Place Matters, 2010a).

2. **Land use technology tools combined with Collaborative Learning supports stakeholder engagement in EBM**

Geospatial tools, predictive models, and visualization technology were applied to synthesize existing information about the condition of water resources, productive lands, recreational resources and wildlife habitat in the town of Sanford, Maine. Stakeholder workshops were designed and implemented using the Collaborative Learning approach. Participants evaluated protection offered by current management practices and identified priorities for natural resource conservation. Decisions to balance economic and environmental concerns as well as tradeoffs between short term gain and resource sustainability were discussed as part of a Collaborative Learning process that resulted in an approved plan, *Headwaters – A Collaborative Conservation Plan for Sanford, Maine.* The Sanford conservation planning process became a model for a Collaborative Learning Training developed and tested as a course to improve the capacity for coastal managers to engage stakeholders in community-based EBM.

3. **Engaging potential technology tool users in demonstration projects and training design increases successful adoption of new collaborative approaches.**

This project piloted a series of trainings to bring technology based tools of land use planning to municipal officials and the people they interact with. The audience was composed of local, state and federal officials, consultants, academics, regional planning offices, NGOs and GIS specialists that provide support, and oversight to the municipal land use decision-making process. Training was developed with input from this target audience. Trainings based upon the EBM Network's *EBM Tools Database* (EBM Tools Network, 2011) were presented to managers and practitioners. The approach was designed to enhance the diffusion of land use tools into the system of land use planning in Maine by linking tool use to observable environmental outcomes and involving potential tool users in all phases of the project (Place Matters, 2010b).

4. **The "Collaborative Learning for Ecosystem Management" workshop addresses coastal managers' needs for skill development in stakeholder engagement methodologies to support collaborative research and EBM.**

Two aspects of the training and technology used in this project found an enthusiastic reception beyond the local region. A workshop on "Collaborative Learning for Ecosystem Management" and Key pad poling have been applied and adopted in a number of venues beyond the original scope of this project. Collaborative Learning is especially adaptable to existing Coastal Training Programs with the National Estuarine Research Reserve System as well as by Cooperative Extension and Sea Grant professionals already familiar with theories and practices of stakeholder engagement. What is different about this application of Collaborative Learning is the strong connections made with EBM and the ability of Collaborative Learning principles and

methodologies to facilitate the implementation of EBM (Feurt, 2007; Packard Foundation, 2010). Collaborative Learning is grounded in theory and principles of systems thinking, conflict resolution and adult learning. These attributes, along with its situational adaptability, contribute to its effective use as a framework for problem solving in the rapidly evolving fields of *coupled natural and social systems* and *sustainability science*. While the literatures of these newly emerging fields are distinct from much of the classic EBM literature, overlap emergences in many of the papers published in the open access online journal *Ecology and Society* (Resilience Alliance, 2010).

5. Key pad poling engages and is engaging.

Key pad poling technology used during the Sanford conservation planning process proved to be an innovative way to engage stakeholders in real time assessments to identify sources of agreement and conflict in the development of conservation priorities. The system was effectively used to collect demographic data, evaluate workshop effectiveness and get immediate feedback on the pulse of a group engaged in complex deliberations. Added to these pragmatic benefits is the entertainment value that participants experience when they are asked to weigh in on their opinions and can be honestly anonymous. Key pad poling training and technical assistance has been provided to NERR sites, municipalities and community groups as a result of this project. Coastal Training Program Coordinators in 3 NERRS sites have purchased systems for their training programs.

2. PROJECT DEVELOPMENT

Abstract

This collaborative research project integrates three critical elements of environmental management. The project developed and applied an innovative approach integrating (1) the interdisciplinary and systems orientation of ecosystem based management, (2) the information processing rigor of land use planning tools and (3) the communication facilitation principles and practices of Collaborative Learning to influence institutions responsible for the system of land use and water quality in the Gulf of Maine. At every stage of the project, the knowledge and experience of stakeholders actively involved with land use issues was engaged as a resource.

Coastal resource managers and environmental policy makers trained in disciplines grounded in the natural sciences learn quickly that some of the biggest challenges to the practice of ecosystem based management[1] (EBM) are social ones. While ecosystem theory provides a conceptual framework for integrating the ecological, socioeconomic, cultural and institutional elements of environmental management, the *practice* of ecosystem based management remains elusive (Taylor, 2008; NOAA/CSC, 2008). Collaborative Learning[2], presented here as an expert practice for implementing EBM, was used to design and implement an innovative stakeholder process that integrated principles of community based ecosystem management and traditional land use planning approaches to develop *Headwaters – A Collaborative Conservation Plan for Sanford, Maine*.

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[1] EBM and Community based ecosystem management (CBEM) share the same principles and theoretical grounding. CBEM is aligned more closely with the scale of land use (see Feurt, 2008).

[2] All references to Collaborative Learning that are capitalized refer to the theory, principles and methodology developed by Gregg Walker and Steven Daniels (2001) and adapted for the practice of community based ecosystem management by Christine Feurt (2007; 2008).

Municipal land use policy operates within the same interdisciplinary context as EBM. Decision-making that integrates diverse perspectives presents challenges to even the most seasoned professional. Traditional regulatory approaches and science translation with a *top down* orientation can fail to adequately address system complexity and long term consequences. Differences in institutional practices, language and culture can act as barriers to the diffusion and incorporation of scientific findings, software tools and environmental technology into municipal land use decisions and practices (Feurt, 2006 a; b). This project builds upon previous research that characterized the nature of science translation barriers in municipal watershed management. Results of that research and adaptations of the Collaborative Learning approach contributed to bridging similar science translation barriers encountered in the current project (Feurt, 2007; 2008).

In addition to the locally focused planning process, professional trainings to develop EBM skills were developed and implemented to build capacity and improve land use practices. Target audiences for these trainings included among municipal, state and federal government professionals, NGOs, undergraduate environmental majors and community groups. A variety of EBM tools (EBM Tools Network, 2008) developed to help coastal managers collect, visualize, and analyze information were evaluated. Community Viz, Key pad poling and Collaborative Learning emerged as the training topics most applicable for target audience members working to improve land use practices in the context of community based ecosystem management.

Introduction: The Search for New Tools to Facilitate Learning in Ecosystem Management

Global environmental change presents unprecedented challenges for 21st century scientists, policy makers and environmental managers (NRC, 2009). The complexity and interconnectedness of the social and ecological systems that underlie environmental change are forcing the redefinition of issues, fostering new liaisons that transcend traditional boundaries, and transforming environmental management (Gunderson and Holling, 2002). Nowhere is this change more evident than in coastal and estuarine systems. Here population pressure and the environmental waste outputs of human economic and social systems deposited into land, water and atmosphere are concentrated and delivered by the hydrologic cycle. Ecological systems responses include harmful algal blooms, eutrophication, hypoxia and accumulation of toxins, all of which reflect back to the human system through health effects, economic loss and consequences for future generations (Fluharty, et al, 2006; USCOP, 2004).

Integrative theories in ecology and ecosystem management propose frameworks that encompass understanding of ecological, economic and institutional systems and the dynamic, cross-scale interactions that contribute to unpredictability and complexity (Allen and Hoekstra, 1992; Meffe, et al., 2002; Gunderson and Holling, 2002). Recognition of the importance of resilience in ecosystems, and fluid, responsive institutions and management linked to learning evolve from practices aligned with these new theoretical frameworks (Lee, 1993; Machlis, et al., 1997; Wondolleck and Yaffee, 1994; Beatley, 2009). Trends in ecological research, ecosystem management and environmental policy increasingly incorporate systems approaches, adaptive management, and innovative policy strategies developed through collaborative processes (Allen and Hoekstra, 1992; Gunderson, et al., 1995; Berkes and Folke, 2000; NRC, 2002a & b; McLeod and Leslie, 2009). These trans-disciplinary approaches engage the people involved in environmental problem solving in deliberative processes to foster social learning and civic

science (Lubchenco, et al., 1998; Endter-Wada, et. al., 1998; Lee, 1993; NRC 1996; Boesch, 1999 & 2001; Costanza, et al.,1998; Visser, 2004).

The Action Research paradigm and methodology is particularly suited to trans-disciplinary situations (Greenwood and Levin, 1998). Action Research is embedded in the system where the research questions arise. The people with a stake in problem identification and solution are engaged in research that aims to better understand the root causes of a situation in order to develop effective solutions. The wisdom of the people closest to the situation is treated as a knowledge and problem solving resource. Ecosystem management benefits from this orientation to research. This case study demonstrates the Action Research paradigm and highlights the methodology for identifying, characterizing and engaging diverse stakeholders through the Collaborative Learning approach.

Learning through adaptive management is the cornerstone for theories and practices that embrace uncertainty by framing policy and management decisions as experiments (Lee, 1993; Gunderson, et al., 1995; Holling, 1978 & 1995; Walters and Holling 1990; Gunderson and Holling, 2002). In his essay on learning in the edited volume *Barriers and Bridges to the Renewal of Ecosystems and Institutions* (Gunderson, et al., 1995), social psychologist Donald Michael calls for *profound learning* that includes an examination of the role that beliefs, unconscious needs and motives play in personal, organizational and social change directed toward the goal of environmental sustainability (Michael, 1995).
Learning through adaptive management is difficult. Research examining the application of adaptive management in watershed management and in business practice identifies both individual and institutional resistance to underlying premises and theory. Adaptive management seems to be easier said than done (Allan, 2004; Allan & Curtis, 2005; Argyris & Schon, 1996). Genuine learning associated with adaptive management is constrained by strongly entrenched habits of practice, or what Allan (2004) calls "imperatives." Imperatives include an orientation to action and progress over reflection, the need to control and simplify complex human and social systems, and self-deception to maintain the status quo rather than challenge established practices. An example of an "imperative" guiding water researchers is the strongly held idea that biophysical scientific documentation of water quality degradation communicated to municipal officials will result in changes in policy and behavior. A busy Town Manager who has been the recipient of a number of such reports pleaded, "Just tell me what you want me to do!" His more immediate need was for prescriptive knowledge about actions to be taken and, just as importantly, the ability to find resources to build municipal capacity to implement those actions (Feurt, 2007). This project addressed both of needs.

Bringing Theories and Principles of Ecosystem Management "Home"

This action research case study focuses on learning in the decision-making arena of coastal watershed management in the Gulf of Maine. The Gulf of Maine shares management challenges common in watersheds across the United States. Municipal officials, environmental management agencies and the public make land use decisions that affect coastal waters. Local land use practices and development contribute to coastal ecosystem degradation from non-point source pollution caused by sediment, nutrients, toxins and microbial contaminants (Fluharty, et al, 2006; USCOP, 2004). This coupling of land use and coastal water quality provides a litmus

test for land management and locally instituted environmental practices. Ecosystem management offers an interdisciplinary approach to sustaining ecosystem structure, function and services. The communication of scientific findings to decision makers is considered vital to the practice of ecosystem management (Lubchenco, et al, 1998, Meffe, et al., 2002; Fluharty, 2006).

Institutions, like the NERRS, generating science-based information focus attention on municipalities and local governments in an effort to foster the incorporation of ecosystem management principles and science into decision-making and policy. Scientists, technology developers, regulators and environmental non-governmental organizations (NGOs) have information and prescriptions for effective local action. Municipal officials can feel bombarded by these prescriptions when they are added to the already overwhelming task of "running their towns" (Feurt, 2007).

Differences in institutional practices, language and culture can act as barriers to the diffusion and incorporation of scientific findings and environmental technology into municipal land use decisions and practices. This project builds upon previous work that characterized the nature of science translation barriers in this region and applied innovative adaptations of the Collaborative Learning approach with community based ecosystem management to bridge those barriers (Feurt, 2006a; b).

Geospatial tools, predictive models, and visualization technology are attractive tools for enhancing the limits of human cognitive processes. These tools enable people to understand land use issues from different temporal and spatial scales. The degree to which these technologies contribute to land use policy that results in progress toward goals of ecosystem management depends upon mechanisms used to link the technologies to existing social networks, governance structures and institutional practices (Stern et al., 2002). This project uses Collaborative Learning to make that link. GIS, Community Viz, and Key Pad Poling were introduced, applied and evaluated as land use technology tools.

Architecture of the Project

Because municipal land use occurs within a system that includes oversight and support by state and federal agencies and dependence upon outside consultants for specialized expertise (Feurt, 2006b) this project used a two tier approach to understand how technology tools could be applied to improve outcomes for coastal ecosystems and communities.

Tier I of the project applied land use technologies including geospatial tools and visualization technology to the development of a *Headwaters – A Collaborative Conservation Plan for Sanford, Maine*. The municipal focus of this part of the project was both strategic and fortuitous. The town planner of Sanford approached the Wells NERR with a request for assistance at the same time the RFP for this project was released. Funding allowed the Wells NERR to increase capacity for the Coastal Training Program to respond to Sanford's request. Strategically, water from Sanford's five watersheds is less than a day's journey from three estuaries in two states. Sanford contains the headwater streams for two public drinking water sources. Maine Department of Environmental Protection (DEP) lists four of the five rivers that flow through Sanford on the priority list for nonpoint source pollution due to contamination or vulnerability as

source water (Maine DEP, 2006). Land use in Sanford affects waters that drain to two National Estuarine Research Reserves, a National Wildlife Refuge and significant wildlife habitat managed by the Maine Department of Conservation and the Nature Conservancy.

Tier II of the project included the development and piloting of regional trainings for use of Ecosystem Based Management Tools (EBM Tools Network, 2006) for land use planning. The Wells NERR partnered with members of the EBM Tools Network and NOAA's Coastal Services Center to develop and pilot training for GIS program managers, municipal, state and federal government staff involved in land use decision making, and consultants and academics interested in increasing the application of EBM tools in their work.

Synthesis of Tier I and II projects and results of formative evaluations during the project resulted in additional outcomes. Two undergraduate environmental courses were developed at the University of New England: Ecosystem Management and Environmental Communication. The "Collaborative Learning for Ecosystem Management Workshop" was developed and tested with national audiences beyond the Gulf of Maine region. The Collaborative Learning for EBM approach is currently being applied to develop the Salmon Falls Watershed Collaborative in Maine and New Hampshire. Collaborative Learning has been incorporated into a successfully funded National Science Foundation program, the Maine Sustainability Solutions Initiative, through a University of New England and Wells NERR partnership project on the Saco River Estuary.

Objectives

Overall goal of the project

This project combines the interdisciplinary framework of ecosystem based management, the information processing rigor of land use planning tools and the communication facilitation principles of Collaborative Learning to influence the institutions responsible for the system of land use and water quality in the Gulf of Maine with the goal of sustaining ecosystem services that communities value.

Objectives for Tier I: An Action Research Case Study to Develop a Conservation Plan for Sanford, Maine

1. As a consequence of applying geospatial tools, predictive models, and visualization technology, in the context of planning processes using Collaborative Learning, municipal decision makers in Sanford will understand and discuss spatial and temporal aspects of land use decisions that relate to the sustainability of water resources, habitat and biodiversity identified as valuable by the community.
2. Using products generated by land use planning tools, the Comprehensive Plan and other resources, Planning Board members, land trust members, municipal staff and other citizens will develop a Conservation Plan. The plan will identify opportunities for mutually beneficial regional collaboration on land use issues and consider appropriate strategies such as zoning; ordinance development and transfer of development rights to achieve plan goals.

3. Collaborative Learning methodology will facilitate municipal efforts to identify ways to incorporate resource protection strategies into economic development decisions. Including relevant stakeholders, providing multiple opportunities and venues for collaboration and implementing a transparent process for developing the Conservation Plan for Sanford, will accomplish this.
4. The Sanford project will serve as a case study/demonstration site for the Coastal Training Program of the Wells NERR. Lessons learned will be used to design future land use trainings and workshops. Participants in the Sanford project will be involved in the delivery of training. This objective is critical to the diffusion of new technologies.

Objectives for Tier II: Develop and Pilot Ecosystem Based Management Tools Training

1. Increase the land use technology knowledge, skills and abilities of local, state and federal government staff, academics, consultants and NGOs providing support and oversight to land use decision making.
2. Involve a steering committee of land use decision makers, government staff, consultants, academics and NGOs in the adaptation and design of training using the *Ecosystem Based Management Tools Database*.
3. Conduct and evaluate regional training in the use and applications of the resources of the *Ecosystem Based Management Tools Database* related to land use planning.
4. Adapt the pilot training to for presentation to additional audiences nationwide as a result of this project

Methods and Results[3]

Collaborative research and project planning team members constituted an interdisciplinary team guiding the Sanford conservation planning process:

Wells NERR
Chris Feurt: Coordinator Coastal Training Program, Principle Investigator. Design, facilitate and implement Collaborative Learning and key pad poling workshops, code and synthesize workshop data. Write Sanford Conservation Plan.

Zack Steele: Coastal Training Program Associate. Implement Collaborative Learning workshops, present Key Pad Poling Trainings, develop GIS resources for the plan. Write Sanford Conservation Plan.

Tin Smith: Stewardship Coordinator. Engage municipalities, land trusts and conservation organizations in collaborative strategic planning, implement Collaborative Learning workshops. Write Sanford Conservation Plan.

Sue Bickford: GIS Specialist. Develop GIS layers for final plan.
Town of Sanford
Jim Gulnac: AICP, Director of Planning and Community Development.

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[3] Method and Results section have been combined to reflect the structure of Action Research and the nature of this project in that **the method is the result.**

Project advisor and responsibility for implementation of Sanford Conservation Plan.

Mike Casserly: Town Engineer, liaison to Planning Board and Public Works Department.

Bill Botting: Information Technology Director, provide GIS resources and maintain planning documents on town website.

Southern Maine Regional Planning Commission
Jamie Oman-Salt Marsh: Develop Community Viz and GIS resources for workshops and the plan. Present GIS resources to stakeholders and planning team.

Project Partners:
Town of Sanford, Maine
EBM Tools Network
NOAA Coastal Services Center
Southern Maine Regional Planning Commission
Spatial Alternatives
Laudholm Trust
Maine Coastal Program/Maine State Planning Office
Wells National Estuarine Research Reserve

Methods and Results Tier I. Development of Sanford Conservation Plan

Existing collaborative partnerships facilitated an early start to the project.
The Southern Maine Regional Planning Commission (SMRPC) and Wells NERR collaborated with municipal officials, citizens and land trusts in Sanford to conduct a series of Collaborative Learning workshops to develop, *Headwaters – a Collaborative Conservation Plan for Sanford, Maine*. The plan development process was intended to address conservation issues within the town's jurisdiction and to encourage consideration of the ways water and habitat issues are linked beyond town boundaries. A project Steering Committee consisting of Wells NERR and SMRPC staff and the Sanford Town Planner met in Spring 2007, as soon as the grant was awarded but before funding was in place in November, to review the timeline for the project and identify other potential members of the Steering Committee. The expanded steering committee identified key stakeholders whose participation was critical to the success of the workshops. Stakeholders included participants from diverse town committees, interest groups and community leaders as well as representatives from regional conservation organizations.

Collaborative Learning methodology guided the stakeholder engagement portion of the conservation plan development process.
The project followed the five-step process of Collaborative Learning: assessment, training, design, implementation and evaluation (Daniels and Walker, 2001)[4]

1. Assessment of the system within which Collaborative Learning will occur

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[4] For a summary of the Collaborative Learning approach used in this project see the Collaborative Learning for Ecosystem Management Guide (Feurt, 2008) available from
http://swim.wellsreserve.org/ctp/Collaborative%20Learning%20Guide.pdf

2. Training of stakeholders in the techniques and principles of the Collaborative Learning process
3. Design of the Collaborative Learning events
4. Implementation/Facilitation of the events
5. Evaluation of the process

The five phases are integrated. For example, assessment, training of stakeholders and evaluation are tightly linked, iterative and adaptive. This aspect of Collaborative Learning mirrors the core principle of adaptive ecosystem management. During the early months of the project activities in the assessment phase facilitated an understanding of the land use system in Sanford, identification of key stakeholders working on conservation issues in the town, identification of important conservation values and understanding of some of the conflicts associated with land use and conservation.

The following tasks contributed to the Assessment phase:

1. Meetings with Sanford Town Planner and Sanford Town Council to review goals of the grant and secure elected official approval for the project. Town Council voted unanimously to participate in the project and made specific suggestions for project implementation. The Town Council presentation and discussion was broadcast on public access TV to town residents. Newspaper coverage of the project resulted from the presentation to Town Council.

2. One on one and small group interviews with the Town Manager, Town Planner, Town Council and Planning Board to develop the scope of the project. Additional interviews with land trusts, citizen groups and other community members were scheduled based upon recommendations from the first round of interviews.

3. The planning team for the project was established. This team includes members from Sanford's planning, information technology and public works departments, a senior planner with Southern Maine Regional Planning Commission (SMRPC), and Wells National Estuarine Research Reserve (WNERR) staff including the Coastal Training Program (CTP) Coordinator, Stewardship Coordinator, GIS Specialist, and CTP Associate. Additional support for the project during 2008 included an Americorps intern funded by Laudholm Trust.

4. Stakeholder interviews with key conservation leaders in Sanford included members of the two local land trusts and the trails committee.

5. Stakeholder interviews with conservation partners included the Maine Department of Inland Fisheries and Wildlife's *Beginning with Habitat* Program and the Trust for Public Land's Maine office working on *Green Infrastructure*.

6. Review of existing planning documents, organizational missions and previously completed conservation planning for Sanford was completed.

7. Identify and accumulate existing land use layers for use in the GIS layers and Community Viz process.

8. The project leveraged participation by the Maine State Planning Office (SPO) and a leading land use technology planning firm in Maine. Because the project used Community Viz and GIS technology there were opportunities for professional staff working at SPO, SMRPC, the town of Sanford and Wells NERR to upgrade their skills and ability to use these technologies. This on-the-job technology training was incorporated into the planning process for the Sanford Conservation Plan. Funding from the Maine SPO supported the involvement and training provided by Spatial Alternatives and increased land use planning technology among the four organizations involved in the project. Technology training for the planning team, embedded in the project, was an unanticipated benefit during the project. This aspect of the Sanford Land Conservation Plan project contributed to objectives of Tier 2 of the project.

9. A protocol for recording progress on project goals was established. Agenda and minutes of each planning team meeting were produced, emailed to team members for approval and finalized as a record of action items, responsibilities and concerns. This protocol was adapted for the stakeholder meetings minutes and outcomes.

The following tasks contributed to the Training and Design phases:

1. Stakeholders for the Conservation Plan development process were identified and invited to the first workshop of the process. The stakeholder list included 20 community representatives identified by the Sanford Planner and key conservation leader interviews. The stakeholder list also included conservation partners who contributed to Sanford's planning process.

2. Three workshops were developed and scheduled during 2008. The first Conservation Plan Development Workshop was held in April. The second workshop to review GIS layers was held in May and the final workshop to develop conservation strategies was held in September. Agendas for each workshop appear in Appendix I.

3. Minutes of the workshops, flip charts created and stakeholder feedback from key pad poling questions were used to document the meetings. All media were typed and filed in the project data base. Minutes of the meeting were emailed to all participants for approval and finalizing after the comment period closed. Stakeholders knew they would have this opportunity to review the outcome of each meeting.

4. The Wells NERR planning team met weekly during the month before a workshop. The larger planning team met two weeks before a workshop and the week following a workshop. Additional meetings, such as meeting to locate and resolve GIS data issues were called as needed.

5. Materials needed for the Community Viz application were identified and collected. SMRPC developed the Community Viz materials for the workshops. The senior planner

from SMRPC accumulated and synthesized the data layers and GIS resources needed to develop the models for the Community Viz process scheduled for the May workshop.

10. GIS layers representing each of the five conservation values were created for the second workshop. Layers are those that include elements of the conservation values identified during the stakeholder Collaborative Learning workshops. A matrix of the GIS layers used and the scoring system applied to the layers in Community Viz is included in the Appendix to this report. GIS identification and mapping of wetlands, riparian, headwater and 1st and 2nd stream corridor resources and aquifers comprised the water resources data layer. The Maine Department of Conservation's Beginning with Habitat Data, Three River Land Trust Focus Areas and Mousam Way Land Trust information was used for the habitat layer. GIS layers of steep slopes and drinking water sources comprised the public health and safety layer. Map used for the Sanford Trails committee was used for the scenic and recreation layer. Agricultural soils and areas classified in tree growth were used for the productive lands areas. Sanford's GIS resources were compatible with the Community Viz software and the staff member responsible for Information Technology served on the planning committee. This strong connection between town IT staff and SMRPC facilitated the development of maps for the second workshop.

6. The Training phase of Collaborative Learning took place at the first workshop when participants were introduced to the principles and practices of the Collaborative Learning approach. Key elements of the approach are reviewed before each workshop. These key elements include: respect for diverse perspectives, sharing of knowledge, active listening, and opportunities to discuss issues of conflict. Additional elements included a transparent process for how information will be used, feedback collected and how the group generated information would be used to create the final Conservation Plan. Evaluation questions for each workshop asked participants to rate how well the workshop accomplished the key elements of Collaborative Learning.

The following tasks contributed to the Implementation and Evaluation phases of three Collaborative Learning Workshops:

Workshop #1 Identification of Conservation Values
Participants worked in small groups to identify important qualities of Sanford that they would like to see preserved as part of a conservation vision for the town. Participants were asked to look ahead in time 50 years and describe the qualities associated with natural landscapes that were important to conserve. What are the places important to conserve? What condition should those places be in? What kinds of human experiences in these places were important to preserve? Members of the Steering Committee facilitated work at individual tables and recorded ideas on flip charts. Members of each table shared key ideas with the larger group and flip chart pages were posted around the room. Participants were asked to review the collected ideas to see if everyone's ideas were captured.

After the workshop all of the flip charts were typed and coded to determine the most important categories of conservation values articulated by participants. Water quality, productive lands,

wildlife habitat, scenic and recreational areas and lands supporting public health and safety were important to the stakeholders present at the first workshop. The five categories of stakeholder values were used to build GIS layers for use with Community Viz. This information was used to design the GIS component of the second workshop.

<u>Workshop # 2 Presentation of Maps for Stakeholder Review and Value Voting for Conservation Priorities</u>

Using the conservation vision priorities identified during the first workshop, the Steering Committee generated GIS layers to map the places in the town where the values identified by stakeholders occurred. Results of the GIS mapping of conservation values were presented to stakeholders working in small groups. Each table in the room was devoted to one of the conservation values. People circulated and discussed each map with a facilitator. Comments were recorded in minutes and on the maps. People had a chance to comment in an open forum with all participants about their concerns and about missing elements or improper locations on the maps.

Stakeholders participated in a Value Voting Exercise to prioritize conservation areas in the town. The Steering Committee created "Sanford Money" with locally relevant photos on the bills. Each stakeholder was given a budget of $100,000 to spend on the five categories (see Appendix I). The results of the value voting appear below.

Category	**% of Total Received**
Water Quality	29
Land Productivity	22
Scenic and Recreation	20
Wildlife habitat	19
Health & Safety	10

The value voting percentages were used with Community Viz to adjust the GIS maps to reflect stakeholder priorities. Stakeholder decision-making related to value voting was captured on comment sheets and through an evaluation conducted using key pad poling. Stakeholder comments on the first round of maps were recorded for use in map revisions.

Process evaluation questions developed for the first workshop were repeated for the second workshop. Following this workshop minutes were prepared, reviewed and finalized. The steering committee met to review the maps and feedback and changes were made to the base maps to reflect participant comments.

<u>Workshop #3 Presentation of Final Maps and Review of Conservation Strategies</u>

Stakeholders reviewed the final five GIS maps of conservation values and the combined maps showing the co-occurrence of conservation values across the landscape. These "hot spots" became the conservation focus areas for the plan. The value voting priorities established in Workshop #2 were applied to the maps and the group discussed differences that they observed

with those priorities. Most participants agreed that they could not detect differences in the co-occurrence map when the value voting priorities were applied.

The group was then asked to identify, discuss and prioritize conservation strategies that would work in Sanford. The goal of these strategies was to protect the places in the landscape associated with conservation values that had been identified in the first workshop and mapped in the second workshop. Wells NERR Stewardship Coordinator, Tin Smith facilitated this discussion. He presented the seven most frequently used approaches and asked the group to think about and discuss how each approach would be implemented in Sanford, what challenges might arise in the town, and who would be responsible for implementation. Participants were encouraged to be open about concerns and help the planning team understand which strategies were best for Sanford so that the final plan would be based upon realistic assessments drawn from local knowledge. The seven strategies for land conservation discussed in the third workshop were:

1) Easements: donated or purchased
2) Conservation Subdivision
3) Fee Ownership
4) Tax programs like current use
5) Zoning/ Resource Protection
6) Municipal funding
7) State & federal funding

Headwaters – A Collaborative Conservation Plan for Sanford **was prepared by Wells NERR and members of the planning team, reviewed by the Sanford Planning Board and adopted unanimously to become part of the town Comprehensive Plan**

Maps created as a result of the stakeholder process became the basis for identification of conservation focus areas. These focus areas were identified as priority areas for conservation based upon the high co-occurrence of stakeholder conservation values in those places. Areas outside of the conservation focus areas where conservation values were expressed in the landscape (identified in individual GIS layers) were identified as part of the green infrastructure for the town, providing important ecosystem services identified as valuable by workshop stakeholders.

The Green Infrastructure concept was adopted for the Conservation Plan to achieve two important objectives. The concept captures the connection between stakeholder identified conservation values and the places in the landscape that contribute to providing valued services. The green infrastructure concept also bridges these conservation values and valued places with the more dominant and economically appreciated concept of municipal infrastructure such as roads and bridges. The plan described the ecosystem services provided by each of the five conservation value categories and connected the idea of ecosystem services to conservation values using the language stakeholders used to identify what mattered most to them.

Science-based best management practices for protecting green infrastructure and ecosystem services were incorporated into the plan. The practices used in the plan drew from scientific research synthesized for land use managers by the Center for Watershed Protection (Schueler & Holland, 2000) and Maine's *Beginning with Habitat* program (Maine IFW, 2008). Practices associated with maintaining productive agricultural lands drew from Maine's Farm Action plan (Maine Department of Agriculture, 2003). The GIS layers themselves were drawn from existing science based data currently accepted by state and federal land use and water quality managers.

The reader is referred to the conservation plan for details on green infrastructure, ecosystem services and science-based best practices connected to Sanford's conservation values (Wells NERR, 2009). The plan is written in non-technical language in a style designed to resonate with community members like the stakeholders whose ideas are represented in the plan. Time spent engaging with stakeholders during interviews, meetings and workshops from 2007 through 2009 contributed to understanding and adaptation of the communication style appropriate for the final plan. Especially critical were final reviews of the draft plan by the Chairman of the Planning Board and Planning Board members where legal requirements of plan language were reconciled and confusing technical language was clarified.

Summary of Sanford Conservation Planning Process

1. Community conservation values associated with land use in Sanford were revealed in existing planning documents, through dialogues conducted as part of the assessment phase, and during Collaborative Learning Workshops.
2. Conservation values identified through the project were organized into five categories:
   Water quality
   Productive lands
   Wildlife habitat
   Scenic and recreational areas
   Lands supporting public health and safety
3. Participatory GIS using existing and available data layers was used to locate and map conservation values in real places in Sanford's community landscape.
4. Stakeholders reviewed GIS maps for accuracy in capturing conservation values.
5. Value voting and Key pad poling were used to prioritize categories of conservation values and to evaluate the fairness of the participatory GIS and Collaborative Learning aspects of the project.
6. Conservation focus areas were identified as priorities for conservation based upon co-occurrence of conservation values.
7. Areas outside of focus areas with conservation values mapped on individual GIS layers were identified as the green infrastructure providing ecosystem services for the town. Concepts of green infrastructure and ecosystem services were presented in plain language connected to values and ideas articulated by stakeholders.
8. Existing science-based best management practices were incorporated into the plan as strategies for maintaining the ability of green infrastructure to continue to provide ecosystem services identified as valuable by stakeholders.
9. The Draft Plan was reviewed and revised by the Sanford Planning Board. The final plan was approved unanimously as an amendment to the Sanford Comprehensive Plan.

10. Through their vote, the Planning Board recommended acceptance of the plan to the elected officials on the Town Council who provide the final endorsement of the document as a component of the Town's governance structure.

The time from project genesis to final plan acceptance was two years.

Methods and Results for Tier II:

Develop and Pilot Ecosystem Based Management Tools Training

The training design process followed the Project Design and Evaluation Protocols developed by NOAA's Coastal Services Center (NOAA, CSC, 2002). This process of training design is known as the ADDIE process and was implemented as follows:

- **A**ssessment of selected coastal decision makers in the Gulf of Maine for EBM Tools
- **D**esign of Training Curriculum
- **D**evelopment of EBM Tools Training
- **I**mplementation of EBM Tools Training
- **E**valuation of Training

The Wells Reserve facilitated the work of a steering committee of land use decision makers, government staff, consultants, academics and NGOs collaborated in the adaptation and design of training using the *Ecosystem Based Management Tools Database*. The EBM Tools Network team met in summer 2007 at the Wells NERR with the steering committee to conduct a needs assessment with a representative sample of the training audience. During this meeting, the EBM Tools Network training team learned about priority management issues for the area, the technical capacity and data available for using tools, and potential tool needs. This information enabled the EBM Tools Network to select the most appropriate tools for the multi-day training.

The Steering Committee collaborated with the EBM Tools Network to host a pilot workshop to provide local resource managers with information and training on a variety of ecosystem-based management (EBM) tools applicable to local management issues. Specific goals of the training included:

- Provide an overview of the types of tools that can be used for EBM in coastal and marine environments
- Describe the capabilities and limitations of technology tools
- Provide guidance for how to integrate tool use into an effective public process
- Describe projects that have used tools effectively
- Provide guidance on how to select an appropriate tool or tools for a project given time, financial, and technical capacity constraints
- Provide an overview of specific tools relevant to local management issues and processes (the land use planning tool Community Viz, and stakeholder engagement tool keypad polling)

The first half-day of training acquainted municipal officials and program managers with the capabilities of EBM Tools and allowed consultants, GIS specialists and others to interact with potential clients about their land use planning needs and challenges. The remainder of the 2-day training involved the participants in using land use planning tools and providing feedback to the EBM Tools Network Team.

The pilot training was used to assess the need for EBM Tools training for mid-career, professionals working with land use policy in the course of permitting, project oversight, and plan review. One of the biggest challenges to these professionals is the inability to assess cumulative impact of individual decisions. The training identified barriers to use of tools including steep learning curves, time and money needed to input locally relevant data and difficulty communicating the uncertainty inherent in activities like scenario building with Community Viz to non-GIS experts.

Results discussion
Collaboration with stakeholders defined the project locally in the development of the Sanford Conservation Plan and regionally through the development of EBM Tools training. The Collaborative Learning approach was applied to formal workshops engaging stakeholders to develop the conservation plan and engaging managers in learning and evaluating EBM tools technology. Collaborative Learning was also used to engage members of the steering committees working with both tiers of the project. Social capital functions to build interdisciplinary understanding, create innovative solutions, manage conflict and build capacity for the long term engagement required for complex environmental management. Collaborative Learning principles and practices used in this project contributed to the building of the social capital of ecosystem management.

The Sanford Conservation Planning process engaged community members unfamiliar with GIS Technology, Community Viz and Key Pad poling in a new experience that connected their values for conserving attributes of the town with science based information that mapped the locations of the places they valued in the landscape. The concepts of green infrastructure and ecosystem services were also new ideas to the group. Explaining the new concepts by connecting them to existing values was possible because of understanding about community values developed through stakeholder engagement.

The Sanford Conservation Planning process demonstrated the complexity and effort required to adapt scientific information to land use planning processed that support community based ecosystem management. The science based information took the form of the GIS maps and the best practices represented by the Center for Watershed Protection and Beginning with Habitat best practices. These practices were developed from scientific research and translated into management practices for land use. Connecting those science based practices to Sanford's plan was based upon (1) knowing stakeholder conservation values, (2) relating those values to ecosystem services and places in the landscape with the green infrastructure providing those services, and (3) identifying the science based management actions that protect and maintain the valued services. This may sound simple and obvious, but there is a critical difference between going to a town and giving a presentation about this information and engaging community members is the process of identifying the values and discussing the ideas over a series of workshops with fellow community members. The face time builds the social capital that lends

credibility to the plan. The inside cover of the Conservation Plan identifies the community members who contributed to the plan.

Through our experience with the EBM Tools Network, we are impressed with the commitment to spread knowledge about the range and scope of EBM tools. The website, database and listserve provide regular updates and the ability to learn "what EBM tools are and what they can do". That said, we were fortunate to secure outside funding and support from the EBM tools network to pursue the adoption and application of two specific tools. Without outside funding, our organization and the towns, non-profits, institutions and government agencies we serve, often find the charges for expert services associated with the use of EBM Tools prohibitive. As a result of this project we increased local capacity to use EBM tools during the project. The Wells Reserve and Southern Maine Regional Planning Commission developed expertise in Community Viz and Key Pad Poling. Unfortunately, the Community Viz expertise developed during the project was lost when the people who worked with the software left their positions in southern Maine. Key pad poling technology was easier to learn and that expertise has been maintained at the Wells Reserve and spread regionally and nationally through the National Estuarine Research Reserve System.

As a boundary spanning organization facilitating EBM, the Wells Reserve could do more if the costs associated with linking outside expertise to local needs could be reduced. We have diffused lessons learned from this project regionally and nationally but the ability of others to adopt our approach is severely constrained by the costs associated with securing expertise and the time required by local experts to input local data (again a funding issue) to make a tool relevant. Rapidly developing rural areas like Maine are the places where improved decision-making can make the greatest difference in environmental outcomes. These places are frequently the places where the financial resources required by complex tools are unavailable. Bridging this gap is a challenge that the EBM Tools Network recognizes and is addressing.

3. STATE OF THE TECHNOLOGY, DEMONSTRATION AND APPLICATION

Training Course for Coastal Managers and Scientists
The use of Collaborative Learning to facilitate application of land use tools in the context of EBM was developed as a result of this project. Collaborative Learning training for coastal managers has been piloted nationally with coastal managers at CZ 09, at a national meeting of the NERRS and with coastal managers in South Carolina and Georgia. A copy of the workbook developed for this training is included in the Appendix of this report.

Presentations to Professional Audiences at Conferences
The Sanford Conservation Planning process and the use of EBM Tools and Collaborative Learning has been presented to coastal management and research audiences at national and international conferences. These presentations are documented in the Appendix.

University Courses for Undergraduates
Two university undergraduate classes were developed as a result of this project. Ecosystem Management and Environmental Communication have been piloted, evaluated and added to the permanent course offerings in the Department of Environmental Studies at the University of New England. The goal of these courses is to train the next generation of environmental

professionals in the theories, principles and practices associated with Collaborative Learning and ecosystem management.

Application in Three On-going Projects
The Collaborative Learning approach and use of Key Pad Poling for stakeholder engagement have been incorporated into two additional community based EBM projects. As part of the University of Maine's statewide Sustainability Solutions Initiative (SSI) (2009 – 2014), the Wells NERR and University of New England Center for Sustainable Communities are implementing a collaborative research program for the Saco River Estuary and surrounding communities that use the technology and Collaborative Learning approach developed by this project. This National Science Foundation (NSF) funded project has garnered recognition for its stakeholder engagement techniques and has been acknowledged as a leader among Maine based academic institutions engaged in the SSI (UNE, 2011).

 The Collaborative Learning approach with Key Pad Poling technology is also the cornerstone of the development of the Salmon Falls Watershed Collaborative begun in 2009. The Piscataqua Region Estuary Partnership (PREP) formed the Collaborative and contracted with the Wells NERR Coastal Training Program for project management, development of a workshop and an action plan based upon stakeholder input. This interstate partnership engages diverse stakeholders at all levels of government, NGOs, community based organizations, water districts and academia in development of an action strategy for improving water quality in the region (Salmon Falls Watershed Collaborative, 2011).

The Wells Reserve received a NERRS Science Collaborative grant for a collaborative research project based upon the approach described in this report. This project examines the ecosystem services provided by riparian areas and willingness of residents to support policies aimed at preserving those services (Wells NERR, 2010).

Key Pad Poling Technology Spreads
Key Pad poling technology has been adopted by a number of Coastal Training Program Coordinators in the NERRS including Padilla Bay, the Gulf Coast Alliance Reserves, Hudson River and Jacques Cousteau. The Wells Reserve serves as a regional resource for use of this technology and has been instrumental in its use engaging diverse audiences in environmental problem solving.

Project Showcased in National Report and Website
The Sanford Conservation planning process received national attention and was included in an EPA website about protection of healthy watersheds (see Appendix VII) and in a national synthesis of the application of technology tools to EBM (Place Matters, 2010a).

4. NEXT STEPS
Next steps in application of this technology are outlined in section 3 above. In addition, interest in the Collaborative Learning for Ecosystem Management training and methodology described in this report has been identified as a need by the NERRS. A pilot project is underway to conduct a needs assessment to determine the specific needs of NERRS sites and sectors. Dr. Feurt will design and deliver Collaborative Learning for Ecosystem Management trainings upon request. These trainings are adapted to fit the needs of the requesting site.

Application of the approach documented by this report is facilitated by the connection of the PI and members of the team with the Coastal Training Program of the NERRS. CTP is tightly linked with coastal management stakeholders and serves as a bridge connecting these stakeholders with the research community. This report documents a research role for CTP and demonstrates the potential for stakeholder and process focused research to increase understanding of the nature of the interface between science and management. This "research at the bridge" can influence both the uptake of science by the management community and the design of research to address pressing management issues (Packard Foundation, 2010; Place Matters, 2010; Roux, et al., 2006)

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Appendices Table of Contents

Appendix I. Agendas for Sanford Collaborative Learning Workshops

Sanford Conservation Plan Workshop #1
Saturday April 5, 2008
9 am – 1 pm lunch included
Sanford Town Hall
Council Chambers Third Floor of Town Hall Annex

Time	Activity	Notes
8:30	**Check-in**	
9:00 – 9:15	**Welcome**	**Jim Gulnac,** Sanford Town Planner
9:15 – 9:30	**Project Partners, Scope, and Timeline**	**Tin Smith,** Wells National Estuarine Research Reserve (Wells NERR) Develop a Conservation Plan that complements the Comprehensive Plan
9:30 – 10:15	**Generating a Conservation Vision for Sanford**	**Chris Feurt,** Wells NERR Individual introductions by participants. What qualities of place do you value? What is your conservation vision for Sanford?
10: 15 – 10:30	BREAK	
10: 30 – 11:15	**Bringing the Vision into Focus** Participants work to prioritize conservation values and criteria.	**Chris Feurt & Steering Committee Members** <u>Generate criteria for evaluating conservation options</u> *For example*: Compliance with Comp Plan. Inclusive of existing land trust priorities. Protecting the economic value associated with natural resources (water, soil, forests, farms). Based upon sound science. Respects landowner rights. Fairness to future generations.
11:15 – 12:00	**Moving from Values to Action**	**Jamie Oman-Salt Marsh** Southern Maine Regional Planning Commission **& Judy Colby-George** Spatial Alternatives GIS and Community Viz Introduction
12:00 – 12:10	**Evaluate the Day Prizes Awarded for Full Participation!**	Announce Meeting Dates for May and September and Opportunities for Conservation Activities and Events
12:10	LUNCH	
1:00 Adjourn	THANK YOU!	

This workshop is the first of three planned to develop a Conservation Plan for Sanford. Workshops are planned for May 29 and September 9.

Objectives for the April 5th Workshop include:

1. Participants will understand the overall goal of the planning process to produce a Conservation Plan that complements Sanford's Comprehensive Plan.

2. Participants will understand the connections among the project partners, the scope of the grant funding the project and their role and time commitment to the process.

3. Participants will understand the role of innovative land use planning technology (Community VIZ) that will be used in the development of the Sanford Conservation Plan.

4. Participants and the Steering Committee will recognize the diversity of viewpoints represented by participants.

5. Participants will identify conservation and land use values important to guide conservation efforts in Sanford.

6. Participants will understand and provide input into the project timeline, including additional events or activities that support plan development.

7. The Steering Committee will capture participant ideas and concerns about the planning process and the scope of Sanford's Conservation Plan to guide subsequent meetings and to report to the Sanford Town Council.

Sanford Conservation Plan Workshop #2 Agenda

May 29th, 2008
Sanford Town Hall
Council Chambers Third Floor of Town Hall Annex

5:30 – 6:-00   Where do you live?
Dot map of town for people to locate their residence

                  Dinner/Conversation

6:00 – 6:20   Opening/Intro/Why do open space planning? (Chris)
                  Purpose of Meeting (Jamie)
                  Keypad polling: general demographic questions (Judy)

6:20 – 7:00   Data Review (Jamie)
                  Display each functional map and discuss general concepts and some specific data
                  Discuss model

7:00 – 7:30   Small Group Discussion of Values

7:30 – 7:45   Value Voting

7:45 – 8:00   Model with Value Voting

8:00 – 8:15   How will Model be Used?

8:15- 8:30   Review/Keypad Polling
Meeting Review

Value Voting Exercise

In order for the Town of Sanford to identify priority conservation areas, we must assign levels of importance to each conservation value: Health and Safety, Water Quality, Land Productivity, Scenic/Cultural/Recreational, and Habitat. This will be accomplished through an exercise called Value Voting, where each participant assigns priority to each value by spending play money.

Imagine that you are the Planning Board for Sanford. You have been given a budget of $100,000, in twenty $5000 increments, and you have to decide how to prioritize your budget between the 6 conservation values. Maps have been produced that show the areas of Sanford that correspond to each value. Each Value has a list of associated Factors that contribute to it. For example, Factors that contribute to Land Productivity are: Forest Land, Farm Land, and Agricultural Soils. Use the list of Factors that contribute to each value to help determine where you wish to spend your money.

Instructions:

1. 20 custom made $5000 bills. Please count to make sure you have exactly 20 of these finely minted conservation bucks.

2. Value Maps. Examine the maps at your tables. Each one represents the areas of priority for each value. Use the maps to help decide where to spend your money.

3. Vote. Take your $5000 bills and place them in the Value boxes based on your priorities for conservation.

At the end of the Value Voting exercise the money will be counted. The totals will be used to assign priority to each Value in Community Viz. The software will then generate a map that reflects the priorities.
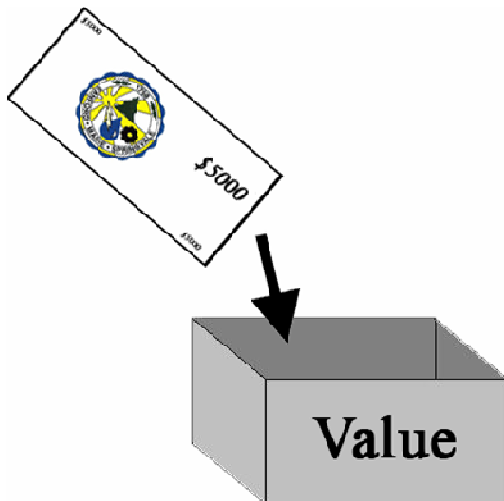
Sanford Conservation Plan Workshop #3 Agenda

Tuesday, September 9, 2008
Sanford Town Hall
Council Chamber Third Floor of Town Hall Annex
5:30 Dinner is served 6:00 Meeting begins

This is the third stakeholder meeting to develop the Sanford Conservation Plan. Your participation is very important in this final stakeholder meeting. At this meeting we will need your input on the revised maps. We want to hear your perspective on the challenges to achieving the goals of the plan. We will ask you to evaluate a number of options for protecting the most valuable places in Sanford. After your input at this meeting, we will be making a series of public presentations to share the results of your work with a larger audience. Please help us make the maps and ideas we will share reflect what is most important to the larger community. Please RSVP with Zack Steele at zsteele@wellsnerr.org or 646-1555 X157 by Thursday, September 4th.

Agenda

5:30   Dinner is served

6:00   Welcome and Overview of Meeting Goals   Chris Feurt

6:15   Sanford Conservation Success Stories

6:45   Review of Community Viz Process to   Jamie Oman-Saltmarsh
        Create and Revise Conservation Values Maps

7:15   Next Steps for Conservation in Sanford   Tin Smith
Moving from Plan to Reality
What are the options for conserving land?

7:30   Which Conservation Strategies will work best in Sanford? Group Discussion
        What are the biggest challenges to conservation?

8:10   Survey - using keypad poling to evaluate conservation strategies   Zack Steele

8:30   Adjourn   THANK YOU

Appendix II: Needs Assessment and Agendas for EBM Tools Skills Training

Needs Assessment for EBM Tools Skills Training

Ecosystem Based Management Tools Training Planning Workshop
Friday, November 9, 2007
9am-1pm Lunch Included
Wells National Estuarine Research Reserve
Mather Auditorium
342 Laudholm Farm Road
Wells, ME 04090

Invitation to Planning Team: You are invited to join the Wells National Estuarine Research Reserve and the Ecosystem Based Management Tools Network to develop training for local managers to improve skills for ecosystem based management.

Training Objective: To increase the land use technology knowledge, skills and abilities of people involved in all aspects of land use decision making and community based ecosystem management.

Your Role: Because of your knowledge of land use planning technology tools or your knowledge about the people and groups who will benefit from these tools, we would like you to participate in the design of this training. You will participate as a member of a focus group to evaluate the relevance and applicability of a set of ecosystem based management tools to land use. You will provide feedback about effective ways to design and implement training that fosters the use of relevant tools that support community based ecosystem management that balances conservation and development priorities.

Who will benefit from the training that you help to design? People whose work makes use of technology to support land use decision making, policy and oversight at the local, state and federal levels. This training will also benefit the groups who provide technology services to governments and communities including: academics, consultants and NGOs, regional planning commissions and GIS specialists.

Outcomes of the Ecosystem Based Management Tools Training that you will help design:

1. Presentation of 2-day Ecosystem Based Management Tools Training at the Wells Reserve during 2008.
2. Increase the land use technology knowledge, skills and abilities of local, state and federal government staff, academics, consultants and NGOs providing support and oversight to land use decision making and community based ecosystem management.
3. Diffusion of Ecosystem Based Management Tools through networking by training participants and the Wells Reserve GIS Center.
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Background Information on Project

The Wells National Estuarine Research Reserve is working with the Ecosystem Based Management Tools Network to pilot a national training course designed to facilitate the adoption of technology based tools relevant to land use planning and community based ecosystem management. Because of your knowledge of land use planning technology tools or your knowledge about the people and groups who will benefit from these tools, we would like you to participate in the design of this training. This planning workshop is by invitation only.

The training that you will help develop focuses on the needs of people working in coastal areas. Land use at the local scale can be influenced by principles and practices of ecosystem-based management (EBM). This requires the *integration* of information about a vast array of environmental and human systems. A variety of software tools have been developed to help land use decision makers and managers collect, visualize, and analyze information and engage stakeholders in the decision-making process.

Existing EBM tools can:
- predict ecosystem response to natural disturbances in watersheds and the marine environment
- select optimal areas for conservation, restoration or development
- help managers and stakeholders visualize the impact of development and resource-use scenarios on an ecosystem
- collect local knowledge about a resource or a place
- facilitate stakeholder dialogue and voting on management alternatives

Geospatial tools, predictive models, and visualization technology help people see patterns and make connections about actions and consequences across space and time. These technologies can contribute to land use policies that result in progress toward goals that balance conservation and development at the local community level. This training will be designed to facilitate the application of these technologies to help people do their jobs more effectively.

This project is partially funded by a grant from the Cooperative Institute of Coastal and Estuarine Environmental Technology (CICEET). CICEET is a partnership of the National Oceanic and Atmospheric Administration (NOAA) and the University of New Hampshire. This project is one of thirteen funded nationwide to improve land use decision making in ways that contributes to clean water and resilient coastal communities.

Websites providing more information:
Wells National Estuarine Research Reserve   http://www.wellsreserve.org/
Ecosystem Based Management Tools Network   http://www.ebmtools.org/
CICEET   http://ciceet.unh.edu/

Objectives and Participants - November 2007 Training Design Meeting at Wells NERR:

1. Establish Current Issues for Advancing Coastal Ecosystem Management and Coastal Land Use Planning is the Wells Region
2. Determine Content for Two Day Training Event to Advance Coastal Land Use Planning Capacity
3. Determine Available Tools, Technologies, and Case Study Information
4. Draft a Plan for Training Event Development
5. Discuss Training Audience

Participants and Organizations Represented:

1.	Bethany Atkins	ME Beginning with Habitat
2.	Sue Bickford	Wells NERR GIS
3.	Sara Carr	EBM Tools Network
4.	LaMarr Clannon	ME Nonpoint pollution Education for Municipal Officials
5.	Judy Colby-George	Spatial Alternatives Inc.
6.	Susan Crow	Place Matters
7.	Cayce Dalton	Town of York Shoreland Resource Officer
8.	Dan Dorfman	EBM Tools Network
9.	Chris Feurt	Wells NERR CTP & University of New England
10.	Zac Hart*	NOAA Coastal Services Center (CSC)
11.	Robert McGuinn*	NOAA CSC
12.	Jamie Oman-Saltmarsh	SMRPC
13.	Peter Rogers	University of New England GIS Professor
14.	Brian Smith*	NOAA CSC
15.	Zack Steele	Wells NERR CTP

*on conference call

The representation on the planning team included members of the target audiences envisioned for the training: federal, state and municipal staff, technology consultants, academia, Maine GIS Center staff, and regional planning staff. Members of this initial planning team stayed engaged in the assessment and design process by email and conference calls through February, 2008. Additional stakeholders were included on the project email list to receive updates.

A protocol for recording progress on project goals is established. Agenda and minutes of each planning team meeting are produced, emailed to team members for approval and finalized as a record of action items, responsibilities and concerns.

Two training frameworks were selected for the formal EBM Tools Training.

1. A four hour workshop for managers, policy makers and non-technical professionals who would identify the need for GIS and technology tools in their work domain. These people would be potential drivers of the adoption of land use technology tools even if they were not the people using the tools themselves. This training was scheduled for October 2008.

2. A two – three day skill training for users of land use technology including consultants, GIS specialists, academics who use technology in their research and educate the next generation of tool users. These are the professionals who have a basic understanding of GIS tool use and plan to use the new tools to enhance their professional practice in land use decision making and research. This training was scheduled for November 2008.

The planning team identified four technology tools for inclusion in the training. The proposed tools are: Community Viz, Nature Serve's Vista, Habitat Priority Planner (HPP) and Key Pad Polling. The choice of these technology tools was based upon the following factors:

- Applicability to land use issues currently important in Maine
- Availability of Maine examples of application of the technology
- Assessment of the capacity and state of the knowledge of land use planning practitioners in Maine

A webinar highlighting features of Nature Serve Vista was hosted for the planning team in February 2008. Patrick Crist of Nature Serve explained the ways Vista could be used in land use planning. The planning team was interested in this tool which was not currently being applied to Maine land use and conservation issues. This was not one of the tools selected for the final training.

EBM Tools Skill Trainings Agendas

Overview
Local expertise played a role in EBM Skills Training. Members of the Steering Committee for the Sanford Conservation Plan project participated in the design of the EBM tools training conducted in Fall 2008. The Sanford Conservation Plan Steering Committee members developed skills using Community Viz and key pad polling technology. The Wells NERR GIS Center, Stewardship and Coastal Training Program staff were involved in adapting these two technologies to land use decision making. Members of the Maine State Planning Office, Southern Maine Regional Planning Commission and Town of Sanford increased knowledge and skills related to these tools as a result of this project. The Maine Geological Survey, Maine Coastal Program, Town of York, and Maine Department of Conservation *Beginning with Habitat* program participated in the focus group meetings to develop the agenda for two EBM Tools Trainings. These two regional training courses attracted participants from the regional target audience. Agendas for each course are included below.

Forty-eight people attended **The Practice and Potential of Ecosystem Management** workshop on October 22, 2008. The objectives and agenda for the workshop are included below.

AGENDA AND TRAINING ANNOUNCEMENT

The Wells National Estuarine Research Reserve,
Maine Coastal Program, Maine Sea Grant and
University of New England Center for Sustainable Communities
invite your participation in a workshop

The Practice and Potential of Ecosystem-Based Management
Applying lessons from land use and coastal management in Maine

Wednesday October 22, 2008 8:30 a.m. - 3:30 p.m.
Abromson Center, University of Southern Maine

This workshop is designed to bring together people who are working to sustain the natural systems that support the quality of life in Maine. The focus of this workshop is the application of ecosystem-based management to improve environmental outcomes associated with land use and coastal management. People representing diverse agencies and organizations, all levels of government and a variety of professions are invited to take part in this day devoted to sharing and building expertise for ecosystem-based management in Maine.

As a result of participating in this planning workshop:

➢ You will learn how Maine managers, planners, scientists, consultants, educators and policy makers are using interdisciplinary approaches to improve land use, develop municipal conservation planning tools, and engage stakeholders to prepare for climate change.

➢ You will help identify strategies for adapting ecosystem-based management to improve environmental outcomes relevant to land use in Maine.

➢ You will receive resources about the case studies and learn about upcoming opportunities to improve your skills and share your expertise.

8:30   Check-in

9:00- 9:15   Welcome
              Paul Dest, Wells National Estuarine Research Reserve (NERR)

9:15 - 9:30   Recognizing Ecosystem Based Management
              Introducing the Case Studies
              Chris Feurt, Wells NERR and UNE

9:30 - 10:00   Watershed Management, Land Use Regulation and Headwater Stream
                Conservation
                Steve Burns Community Development Director, York, Maine

10:00 - 10:30   Coastal Resiliency, Science, and Community Planning for Sea Level Rise and the
                Perfect Storm
                Peter Slovinsky, Senior Geologist, Coastal Marine Geology Section, Maine
                Geological Survey

Break 10:30- 1050

10:50- 11:20   Community Viz and Municipal Conservation Planning
                Judy Colby-George, Principal, Spatial Alternatives, Yarmouth Maine

11:20 - 11:50   Beginning with Habitat: Challenges and Tools for Statewide Biodiversity
                Conservation
                Steve Walker, Beginning with Habitat Program Manager, Maine Department of
                Inland Fisheries and Wildlife

11:50 - 12:30   A Model for Science, Stewardship and Adaptive Management
                in Taunton Bay , Maine
                John Sowles, Marine Habitat and Aquaculture Division Director, Maine
                Department of Marine Resources

12:30 - 1: 15   LUNCH

1:15- 1:40   Collaborative Learning for Stakeholder Engagement
Social science and ecosystem-based management
Chris Feurt, Coordinator Coastal Training Program Wells NERR
Director, Center for Sustainable Communities, UNE

1:40 - 3:00   Facilitated Group Discussion

                Working session to identify strategies for improving the practice of ecosystem-
                based management in Maine.

3:00 - 3:30   Future directions   Keypad polling activity
                Plans for future trainings and capacity building will be presented and evaluated
                using Keypad polling technology

3:30   Adjourn

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Tools to Support Community Based Ecosystem Management

Skill building training for 27 EBM professional occurred on November 19 and 20, 2008. This training was developed with EBM Tools Network member Ken Snyder of Place Matters and Judy Colby-George of Spatial Alternatives, a Maine-based consulting firm. This training focused on capacity and skill building for Community Viz and keypad polling. These technologies emerged from the Sanford Conservation planning process and the needs assessment of coastal managers and land use planners as important land use decision-making tools relevant to issues in Maine. Community planners, resource managers and GIS specialists need tools that support stakeholder participation. They also need tools that assess complex land use decisions in ways that increase transparency and improve understanding of the cumulative impacts of decisions. Community Viz software, linked with keypad polling technology, supports processes that engage stakeholders and improve decision making in these ways.

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Text of Training Announcement and Course Agendas

Wells NERR, in collaboration with Place Matters and Spatial Alternatives, Inc. is offering two days of training on how to use keypad polling and GIS scenario planning tools in Community Based Ecosystem Management.

These trainings will demonstrate the use of keypad polling as well as the scenario-planning tool Community Viz. Keypad polling is an interactive technology that allows participants to vote on a variety of questions anonymously and see the results instantaneously. Easy-to-use keypads gather opinions, share them with the audience, and facilitate an iterative process to reach consensus. Keypad polling can also be integrated with visualization and maps to allow for more complex analyses.

Community Viz community planning software provides real-time interactive 3D visuals, intelligent maps and dynamic analysis tools. The trainings will instruct attendees in the use of this tool, which is employed by hundreds of communities and organizations in their decision-making around land use, transportation, and ecosystem-based management.

Day 1: The first day of training will provide managers, GIS specialists and planners basic training in the use of keypad polling and Community Viz, and examples of the ways these technologies can be used to support land use, ecosystem based management and transportation projects. We will present case studies that highlight the use and integration of scenario planning and public engagement tools on the ground.

Day 2: The second day of training will build participant skills in the use of Community Viz applications including conducting dynamic planning and suitability analysis; using Community Viz's Build Out, Time Scope and Common Impacts Wizards; and integrating Land Use Designer and 3D Sketch Tools into GIS.

Agenda for November 19th

Using Key Pad Polling for Public Participation and Stakeholder Engagement

8:30   **Registration** – Coffee, Tea, and Juice
8:50   **Welcome**

9:00   **Keypad Polling**
- Live Demo
  - Ice Breaker
  - Who's in the Room
  - Have you used keypads before
- Principles of public participation
- The four main uses of keypads
- The dynamics of small group and large group exercises
- Tips on real-time interactive brainstorming/keypad polling
- Additional do's and don'ts of keypad polling
- Interoperability with other public participation tools
- Live demonstration: wrap-up
  - Prioritize top uses
  - Level of interest in current work
  - Evaluation

10:45 Break
11:00   **Case Studies in Interdisciplinary/Multijurisdictional Land Use, Transportation, and Ecosystem Based Management Projects**.
- The Berkeley/Dorchester/Charleston Tri-County EBM Demonstration Project
- The Mission-Aransas NERR project

12:00   Lunch

1:15   **Community Viz 101**
- Using GIS in Land-Use Planning and Ecosystem Based Management
- The art and science of scenario planning
- Viewing and Exploring Existing Analyses
- Opportunities to tie CommunityViz analyses with other decision support tools

3:30   Break

3:45   **The Rapidly Changing World of Technology and Its Potential Impact on Land Use Planning, Transportation Planning, and Ecosystem Based Management**
- The ultimate goal of real-time planning with public participation and interoperability among decision support tools

4:30   Adjourn for the day

Agenda for November 20th

Using Community Viz as a Tool for
Community Based Ecosystem Management

8:30   **Registration – Coffee, Tea, and Juice**

9:00   **Community Viz 201 Training**
- Review Arc Map basics and Scenario 360 user interface components.
- Dynamic Analysis
  - What are attributes? What is a dynamic attribute?
  - Introduce formula creation options for attributes.
  - Adding assumptions.

- Indicators
  - Indicators versus attributes.
  - Creating indicator formulas.
  - Using charts to display indicators.
  - Adding alerts to an analysis.

10:45 BREAK

- Setting up a Complete Analysis
  - Exploring analysis components.
  - Deciding the methodology for problem solution:
  - Create new components for the analysis using

12:00 LUNCH
- Walkthrough of components of Build-Out Wizard and show examples
- Walkthrough and run the Time Scope Wizard.

1:00   **Community Viz Afternoon Session**
- Suitability Analysis
  - Define suitability analysis and identify factors which impact suitability.
  - Run the Suitability Wizard and review the results.

- Common Impacts
  - Walkthrough and run the Common Impacts Wizard.
  - Explore results via indicators, charts and assumptions.

- Land Use Designer and Sketch Tools
  - Explore the Style Manager, Painter Tool, and SiteBuilder 3D
  - Explore Google Earth Export settings and options.

3:30   Adjourn

Appendix III: Sample Agenda
Collaborative Learning - An Expert Practice for Implementing Ecosystem Management

What is Collaborative Learning?

Collaborative Learning is an approach to building effective partnerships among researchers, managers, policy makers and government officials who are committed to maintaining the qualities and values of healthy ecosystems considered vital by communities dependent upon them. Collaborative Learning includes a robust set of principles and practices. These principles and practices can be applied to build capacity among diverse stakeholders for identifying and analyzing complex situations, developing and evaluating strategies for improving situations of mutual concern and supporting the implementation of group generated solutions. Drawing from social science research on decision making in complex systems, conflict resolution, and principles of adult and organizational learning, the Collaborative Learning approach synthesizes a robust body of research into a set of practical techniques that can be applied and adapted as an essential tool supporting the practice of ecosystem management.

What is Ecosystem Management?

A Marine Perspective:

Ecosystem-based management (EBM) is an integrated approach to management that considers the entire ecosystem, including humans. The core goal of EBM is to sustain the long-term capacity of these systems to deliver a range of ecosystem services, with a focus on ecosystem health and human well-being. EBM differs from current approaches that usually focus on a single species or type of activity. Instead, management plans and strategies incorporate the cumulative impacts of multiple activities on entire ecosystems. Ultimately, EBM requires: (1) A common, overarching, ecosystem-level goal, (2) Explicit ways of assessing tradeoffs among multiple objectives, and (3) Opportunities for learning and adaptation. (*Ecosystem-based Management for the Oceans*.McLeod, K. and H. Leslie, eds. 2009)

A Conservation Biology Perspective:

Ecosystem management is an approach to maintaining or restoring the composition, structure and function of natural and modified ecosystems for the goal of long term sustainability. One goal is to make the places where we live, work and play, noticeably better today and in the future. It is based on a collaboratively developed vision of desired future conditions that integrates ecological, socioeconomic and institutional perspectives applied within a geographic framework defined primarily by natural ecological boundaries. (Ecosystem Management: Adaptive, Community-Based Conservation by Meffe et al., 2002)

Who will benefit from this workshop?

Researchers, managers, outreach professionals, planners and government officials who regularly work in partnership to accomplish shared goals for sustaining coastal resources.

Workshop Objectives:
1. Participants will develop practical skills for incorporating Collaborative Learning principles and practices into their work within an ecosystem management framework.
2. Participants in this workshop will learn how Collaborative Learning can be used to build stakeholder teams for problem solving, support policy analysis and adaptive

management, facilitate science translation and implement the goals of systems approaches to environmental management.

3. Drawing from personal work experiences participants will practice each phase of Collaborative Learning to identify ways to incorporate elements of the approach into their work.
4. Using the Collaborative Learning approach, participants will identify opportunities for and barriers to applying this methodology to improve ecosystem management in the region.

Day One
9:30 am   Welcome & Workshop Overview
Introductions
Collaborative Learning – An approach to problem solving in complex
        systems
Collaborative Learning and Ecosystem Management

10:50   Break

11:00   Phase I: Collaborative Learning Stakeholder Assessment
        Understanding the *Kaleidoscope of Expertise*

Activity – Conducting a stakeholder assessment

  i.   Understand and clarify the nature of the problem
  ii.   Identify potential stakeholders and listen to different Perspectives on the Problem
  iii. Create and Synthesize Situation maps that capture the diversity of perspectives
  iv.   Complete the assessment matrix to organize knowledge about the system within which the Collaborative Learning project will occur

Skills: Interviewing, Thematic Analysis, Stakeholder and Conflict
        Analysis
12:00 Lunch

1:00   Phase II: Designing a Collaborative Learning Process

  i.   Confirm the problem statement and purpose of the process in the invitation to participate
  ii.   Design to engage the kaleidoscope of expertise
  iii. Develop facilitation and knowledge management skills
  iv.   Situation Mapping

Day Two
9:30 am Now that you've "slept on it" - Recap, Review, Reflect

9:45 Local examples of collaboration in action to achieve ecosystem management objectives

10:50 Break

11:00 Phase III: Implementation - Collaborative Learning Techniques
1. Provide orientation to: purpose, process, outcomes
2. Establish relevance to work
3. Connect to values
4. Build shared understanding – *Concept mapping*
5. Generate individual issues of concern
6. Evaluate issues of concern – small group
7. Develop improvement analysis – small group
8. Share improvements
9. Develop action strategy – who will do what and when?
10. Develop accountability

   Implementation Worksheets
   Key Pad Poling – Audience Engagement Devices

12:00 Lunch

1:00 Phase IV: Evaluation and Adaptive Management

1. Tracking improvement toward ecosystem management goals
2. Documenting learning conflicts and ideas through meeting minutes
3. Soliciting feedback through participant surveys and dialogue

2:00 Break

2:15 Barriers and Bridges to moving forward with Collaborative Learning in the region

3:30 Workshop Evaluation and Adjourn

Appendix IV: Workbook for Collaborative Learning:
An Expert Practice for Implementing Ecosystem Management

December 2010

A Coastal Training Program Workshop

Presented by Wells National Estuarine Research Reserve

Prepared by
Christine Feurt, Ph.D.

Workbook for Collaborative Learning:
An Expert Practice for Implementing Ecosystem Management
Wells National Estuarine Research Reserve Coastal Training Program
December 2010

Materials have been adapted from:

- *Working through Environmental Conflict a Collaborative Learning Approach* by Steven Daniels and Gregg Walker (2001)

- *The Fifth Discipline Field Book* by Peter Senge et al. (2004)

- *Ecosystem Management – Adaptive Community-based Conservation* by Gary Meffe et al. (2002)

- *Ecosystem-Based Management for the Oceans* by Karen McLeod and Heather Leslie (2009)

The practitioner guide *Collaborative Learning for Ecosystem Management* is designed to support this workshop and is available for download
http://swim.wellsreserve.org/ctp/Collaborative%20Learning%20Guide.pdf

For more information contact Dr. Christine Feurt, Wells National Estuarine Research Reserve
cfeurt@wellsnerr.org or University of New England cfeurt@une.edu

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THE COLLABORATIVE LEARNING PROCESS

Assessment

Design

Implementation

A Terrestrial Definition of Ecosystem Management

Ecosystem management is an approach to maintaining or restoring the composition, structure and function of natural and modified ecosystems for the goal of long term sustainability. One goal is to make the places where we live, work and play, noticeably better today and in the future. It is based on a collaboratively developed vision of desired future conditions that integrates ecological, socioeconomic and institutional perspectives applied within a geographic framework defined primarily by natural ecological boundaries.

**Ecosystem Management: Adaptive, Community-Based Conservation
by Meffe et al., 2002**

WHAT IS ECOSYSTEM-BASED MANAGEMENT?

Ecosystem-based management (EBM) is an integrated approach to management that considers the entire ecosystem, including humans. The core goal of EBM is to sustain the long-term capacity of these systems to deliver a range of ecosystem services, with a focus on ecosystem health and human well-being. EBM differs from current approaches that usually focus on a single species or type of activity. Instead, management plans and strategies incorporate the cumulative impacts of multiple activities on entire ecosystems.

UTIMATELY, EBM REQUIRES:

(1) A common, overarching, ecosystem-level goal,
(2) Explicit ways of assessing tradeoffs among multiple objectives, and
(3) Opportunities for learning and adaptation.

There are many "right ways" to move forward. EBM will be implemented differently in different historical, social, and ecological contexts. It's possible to move forward with EBM even in situations with little information or minimal management or governance already in place.

• **EBM can be implemented at any spatial scale,** from local, site-based efforts to entire large marine ecosystems. In many cases, management plans will need to include multiple scales, due to the ecological and human connections among different places.

• **EBM will change management, but isn't more work.** Managing the full array of human activities in the ocean and explicitly considering tradeoffs among them is a fundamentally different way of doing business. While this shift will require new personnel and funding, EBM may help ease workloads by leveraging resources and reducing redundancy.

• **EBM is more than marine reserves.** While no-take reserves and other types of marine protected areas are important EBM tools, particularly for biodiversity conservation, EBM requires a mix of strategies to allow for both protection and multiple uses.

• **EBM is happening right now.** Key elements of EBM are already being implemented in many locations around the world, such as Chesapeake Bay; Elkhorn Slough, CA; Florida Keys; Great Barrier Reef, Australia; Great South Bay, NY; Massachusetts; Morro Bay, CA; Port Orford, OR; Puget Sound, WA; Eastern Scotian Shelf, Canada; and Gulf of California, Mexico

McLeod, K. and H. Leslie, eds. 2009. *Ecosystem-based Management for the Oceans*. Island Press: Washington DC. Overview available at: http://www.compassonline.org/pdf_files/EBM_Book_Flyer_Final.pdf

Collaborative Learning Overview
An Expert Practice for Implementing Ecosystem Management

The Collaborative Learning approach applies rigorous theories and practical methods to create interdisciplinary and multi-stakeholder teams to:

- Accomplish the objectives of ecosystem-based management.
- Conduct collaborative research
- Build capacity for development & implementation of science based plans
- Evaluate "state of the science"
- Build capacity for collaborative problem solving

Phase I: Assessment
1. Understand and clarify the nature of the problem.
2. Identify potential stakeholders and listen to different perspectives on the problem.
3. Complete the Progress Triangle and Conflict Assessment worksheets to organize knowledge about the system within which the Collaborative Learning project will occur.

Phase II: Designing a Collaborative Learning Process
1. Complete the Role Assessment worksheet
2. Confirm the problem statement and purpose of the process in the invitation to participate.
3. Develop facilitation and knowledge management skills.

Phase III: Implementation - Collaborative Learning Techniques
11. Provide orientation to: purpose, process, outcomes
12. Establish relevance to work
13. Connect to values
14. Build shared understanding – Create and synthesize situation maps that capture the diversity of perspectives.
15. Generate individual issues of concern (worksheet)
16. Evaluate issues of concern – small group
17. Develop individual improvement analysis (worksheet)
18. Develop Critical Concerns Improvements – small group (worksheet)
19. Improvements analysis(worksheet)
20. Develop action items with measures of success and accountability

Phase IV: Evaluation and Adaptive Management
4. Track improvement toward ecosystem management goals
5. Document learning, conflicts and ideas through meeting minutes
6. Solicit feedback through participant surveys and on-going dialogue

The Ladder of Inference
Senge, et al., 1994. The Fifth Discipline Field Book

I take **Actions** based on my beliefs

I adopt **Beliefs** about the world

I draw **Conclusions**

I make **Assumptions** based on the meanings I added

I add **Meanings** (cultural and personal)

I select **"Data"** from what I observe

Observable "data" and experiences (as a videotape recorder might capture it)

The reflexive loop (our beliefs affect what data we select next time)
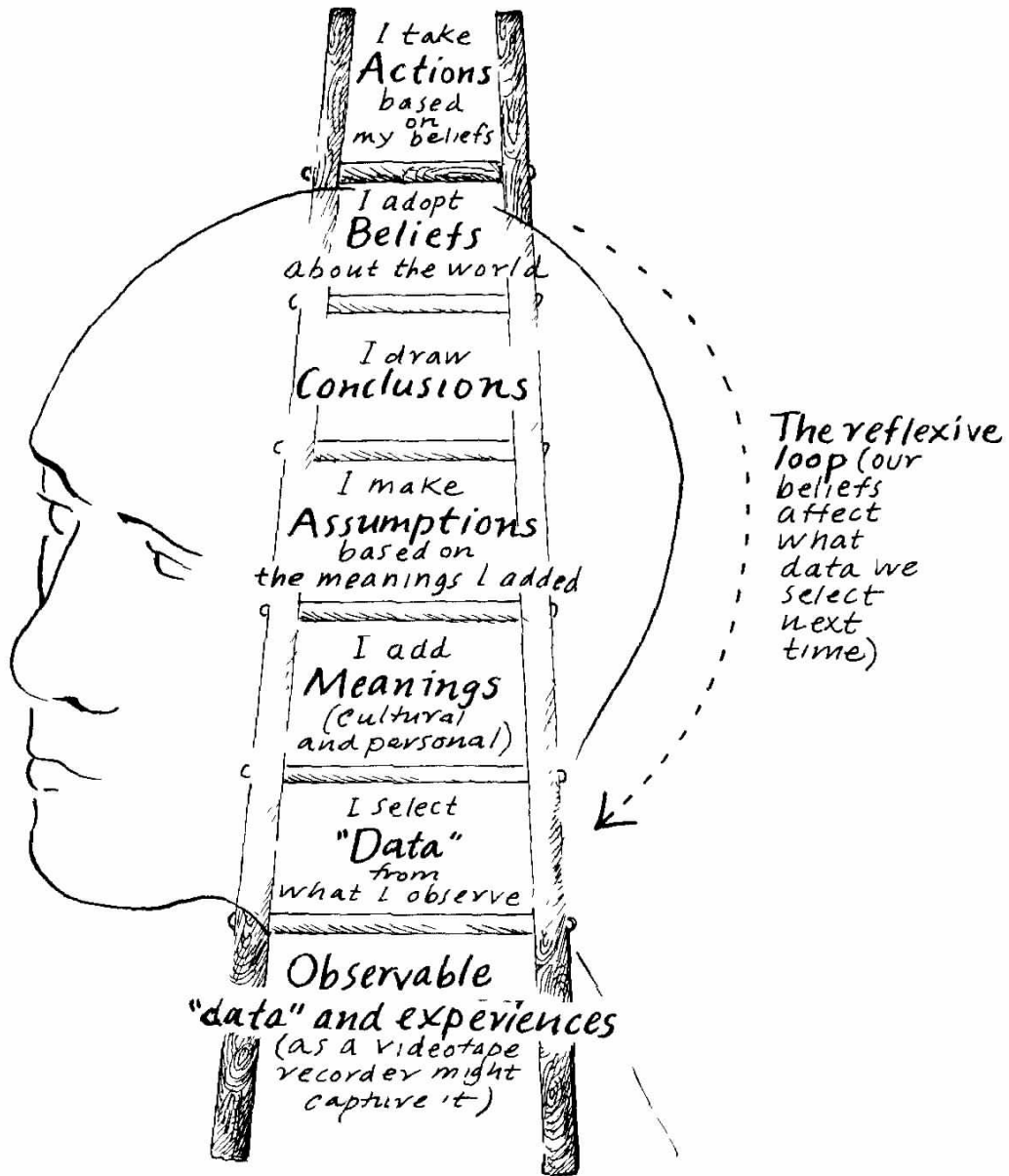
System Assessment:
<u>**Progress Triangle Collaborative Assessment Worksheet:**</u>
(Adapted from Daniels and Walker, 2001)
Will Collaboration Work?
Select a situation that is important to you that you feel can benefit from collaboration. Use this worksheet to personally assess the situation according to its relationship, procedural and substance dimensions.

Step One: Describe the Situation.

Step Two: Evaluate the Relationship Dimension of the Situation
Who are the primary parties directly involved? What are their skills and level of knowledge of the situation?

Are these parties willing to collaborate? To what extent? Can parties opposed to collaboration be persuaded to try?

What is the history among the major parties?

What is the degree of trust among the parties and how might it be improved?

Who are the essential decision makers? What do you know about their values, concerns and fears?

What are the power relationships, sources of conflict and incentives to collaborate?

Step Three: Evaluate the Procedural Dimension of the Situation

What methods other than collaboration might the parties use to pursue their goals? Are there traditional approaches to problem solving that support or conflict with a collaborative approach?

Can decision-making about this situation be shared? Are there jurisdictional, legal or organizational duty aspects of the situation that affect the degree to which collaborative decisions can be developed and implemented?

Are there sufficient resources of time, staff, expertise and money to conduct a Collaborative Learning process? Are there needs for design and facilitation by an impartial party?

What are alternative methods that might be used that include key parties and require less resource use?

Step Four: Evaluate the Substance Dimension of the Situation

What are the issues important to this situation?

Do the issues vary among the parties?

Which of the issues are tangible?

Which of these issues are primarily symbolic?

Are there differences in how the major parties understand the situation, define the issues, and prioritize the issues?

What are the parties interests and concerns about the issue?

What policies or actions have been tried in the past to deal with this situation?

What are the key information needs (data) or information gaps that should be addressed as part of the process? Is the information accessible and understandable?

Step Five: Will Collaborative Learning Get the Job Done?

Conflict Assessment
What is really going on?!

FACTS: What is true, accurate, reality?

VALUES: What should be the determinants of a decision? (criteria, basis, priority)

INTERESTS: Who will get what in the distribution of scarce resources, both tangible and intangible?

JURISDICTION: Who has authority, standing and legitimacy in the situation?

PERSONALITIES: Disagreement over personal styles

PLACES/VENUE: Problems with the choice of setting, place, room layout

HISTORY: Disagreement over the history of the issue, the conflict, the conflict relationship as perceived by the parties in conflict.

CULTURE: Disagreements that stem from cultural orientations, worldviews and identities. This can include the under appreciated differences in the culture of scientists and managers.

Conflict Assessment Worksheet
What is really going on?!

FACTS

VALUES

INTERESTS

JURISDICTION

PERSONALITIES

PLACES/VENUE

HISTORY

CULTURE

Designing a Collaborative Learning Process
Roles in a Collaborative Learning Process
Participant
Has an interest but no strong position. A participant wants to be involved but is not a primary voice for a particular point of view or outcome.

Advocate
Holds a strong position on one or more of the major issues, generally a primary stakeholder who is prepared to support a specific policy decision.

Representative
Participates for or advocates on behalf of a group or organization, may or may not have decision authority.

Decision maker
Has the authority to make and implement a decision. Establishes decision parameters and decision space (how much of the decision authority can be shared).

Information Provider
Provides data or information pertaining to issues in the situation, may be a technical expert or source of local knowledge.

Initiator
Identifies the need for a Collaborative Learning process, may then become the convener or sponsor.

Convener
Brings parties together and provides a venue, may also participate in process design.
Internal organizational support for the Collaborative Learning process is critical.

Sponsor
Provides public support for the Collaborative Learning process or may provide resources.
Internal organizational support for the Collaborative Learning process is critical.

Designer
Designs Collaborative Learning process.

Facilitator
Guides the process in an impartial manner, may be internal member of a convening organization or an external consultant.

Evaluator
Evaluates the Collaborative Learning process.

Role Assessment Worksheet (adapted from Daniels and Walker, 2001)
Describe the Collaborative Learning situation you are working with in the space below, then complete the role assessment worksheet for your situation:

Stakeholder Or Party	Intended Role	Expected Role	Goals	Interests

Checklist of Roles:

Initiator		Participant		Designer	
Convener		Advocate		Facilitator	
Sponsor		Representative		Evaluator	
		Decision Maker		Information Provider	

Skills for Implementing Collaborative Learning

THE TEN COMMANDMENTS OF ACTIVE LISTENING

1. Listen opening and actively

2. Withhold judgment until the other person's view is understood

3. Ask questions for understanding before responding

4. Give everyone equal opportunity to speak

5. Focus on concerns and interests rather than positions

6. Examine future improvements rather than dwelling on the past

7. Emphasize the situation rather than the people

8. Value disagreement and constructive argument

9. Look for ways to achieve mutual gain.

10. Regard one another's views as legitimate and deserving respect.

"Americans think the opposite of speaking is
waiting to speak"

Skillful Discussion to Support Collaborative Learning
(Adapted form *The Fifth Discipline Fieldbook* by Senge et al., 1994)

The ability to conduct a skillful discussion supports the generation of action strategies and the implementation of tasks to improve the situation. Effective discussion requires an even playing field where all participants treat each other as colleagues. Openness and trust depends upon group members feeling secure enough to speak freely without fear of ridicule or ramifications. Groups can agree to keep discussion content within the confines of the group process. The exchange of points of view and new perspectives should take precedence over the "selling" of new ideas.

Plan the agenda, time and context to allow skillful discussion to happen. Less than two hours is unacceptable. Make sure every participant expects to talk about the same subject.
The intent of Skillful Discussion is decision-making on actions to move the group forward.
People will leave the skillful discussion with priorities for action and a time table for progress.

Pause to Reflect

Protocols for Skillful Discussion

1. Pay attention to my intentions: What do I want from this conversation? Am I willing to be influenced?

2. Balance advocacy with inquiry: What led you to that view? What do you mean by that statement?

3. Build shared meaning: When we use the term _____, what are we really saying?

4. Use self-awareness as a resource: What am I thinking? What am I feeling? What do I want at this moment?

5. Explore Impasses: What do we agree on, and what do we disagree on?

Balance advocacy with inquiry

> *Testing: Here's what I say. What do you think of it?*

HIGH ↑	**TELLING** Asserting: Here's what I say and here's why I say it. Explaining: Here's how the world works and why I can see it that way Dictating: Here's what I say and never mind why. (dysfunctional)	**GENERATING** Skillful Discussion: Balancing advocacy and inquiry, genuinely curious makes reasoning explicit, asks others about assumptions without being critical or accusing. Dialogue: Suspending all assumptions, creating a container in which collective thinking can emerge. Politicking: Giving the impression of balancing advocacy and inquiry, while; being close-minded (dysfunctional)
A D V O C A C Y ↑ **LOW**	**OBSERVING** Sensing: watching the conversation flow without saying much but keenly aware of all that transpires Bystanding: Making comments which pertain to the group process but not to the content Withdrawing: Mentally checking out of the room and not paying attention (dysfunctional)	**ASKING** Interviewing: Exploring others points of views and the reasons behind them. Clarifying: what is the question we are trying to answer Interrogating: why can't you see that your point of view is wrong (dysfunctional)

LOW ⟶ **INQUIRY** ⟶ HIGH

Implementing a Collaborative Learning Process

STEP 1: Issues of Concern Worksheet (Adapted from Daniels and Walker, 2001)

Name _____Phone _____ Email _____

Concerns and Interests

Think about the current challenges of _____situation, as portrayed by the map we have just created and discussed. Look at the areas of the Situation Map that are important to you.

1. What part of the Situation Map is important to you? What issues are involved?

2. What are your specific concerns and interests about these issues? Why are these issues important to you?

3. What other parts and issues of this situation must be considered when designing improvements related to this part of the situation map?

4. What people or views must be considered when designing improvements related to this issue or area of concern?

STEP 2: Improvements Worksheet (Adapted from Daniels and Walker, 2001)

Name _____ Phone _____ Email _____

Improving the _____ Situation

Think about the concerns and interests you have just written about. With those concerns and interests in mind, identify an improvement in the _____situation. An improvement may be an action, project, or management approach that you think would be both desirable and feasible.

1. How could the _____ situation be improved? It this a short-term or a long-term improvement? Describe the improvement; be as specific as possible.

2. Why is this improvement desirable?

3. How is this improvement feasible? For example, who might be responsible for implementation? How might your improvement be funded? Be as specific as possible.

4. What obstacles currently stand in the way of making this improvement? How might those obstacles be overcome?

5. How does this improvement relate to other parts and issues of the _____ situation?

STEP 3: Critical Concerns Improvements Worksheet
(Adapted from Daniels and Walker, 2001)

Improving the _____ Situation

Critical Concern(s) _____

Think about the critical concern(s) your group has selected. Identify up to three improvements that address the concerns. This can be an action, a project, or a management approach that is both desirable and feasible. A policy change improvement can either add to or subtract from the present situation. A policy improvement could also be an extension or refinement of a current policy.

What improvements address your group's critical concern (s)? Describe each improvement.

Improvement One:

Improvement Two:

Improvement Three:

STEP 4: Improvements Analysis Grid Worksheet (Adapted from Daniels and Walker, 2001)

Analyzing Improvements – Consider your team's list of improvements selected from your individual or group worksheets. Analyze each improvement in the following areas:

Implementers	Affected Parties	Key Players	Values and Beliefs	Outside Forces
Who will implement your improvements? Who will administrate? What people, groups, organizations?	What people, groups or organizations will benefit from your improvements? What people, groups or organizations believe they will be hurt or lose from improvements?	Who are potential Blockers? What parties may have the desire and/or power to block your improvements? Who are potential Supporters? What parties can provide key support for your improvements?	What mind sets, values and beliefs are important to consider when implementing the improvements?	What factors should be considered as "givens" in the situation that pertains to your improvements but seem outside or external to your list?

| 1 | 2 |

Ten-Minute Priorities Worksheet[5]

| 1 | 3 | 2 | 3 |

| 1 | 4 | 2 | 4 | 3 | 4 |

| 1 | 5 | 2 | 5 | 3 | 5 | 4 | 5 |

| 1 | 6 | 2 | 6 | 3 | 6 | 4 | 6 | 5 | 6 |

| 1 | 7 | 2 | 7 | 3 | 7 | 4 | 7 | 5 | 7 | 6 | 7 |

| 1 | 8 | 2 | 8 | 3 | 8 | 4 | 8 | 5 | 8 | 6 | 8 | 7 | 8 |

| 1 | 9 | 2 | 9 | 3 | 9 | 4 | 9 | 5 | 9 | 6 | 9 | 7 | 9 | 8 | 9 |

| 1 | 10 | 2 | 10 | 3 | 10 | 4 | 10 | 5 | 10 | 6 | 10 | 7 | 10 | 8 | 10 | 9 | 10 |

Alternative Strategies	A Your Points	B Your Priorities	C Group Totals	D Group Priorities
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

In each small square above circle the number corresponding to the strategy you prefer.
Enter the number of times you voted for each strategy in Column A.
In Column B rank the strategies based on your points giving the most points a rank of 1.
Add the group's points from Column A and list in Column C.
In Column D rank the strategies based on points in Column C giving the most points a 1.
Column D gives the group's decision, but column C tells you how wide the gaps were between the top ranked and bottom ranked choices. You may see, for example, that the top three choices stand out as the only ones worth considering.

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[5] Adapted from *The Fifth Discipline Fieldbook* by Senge, et al. 1994.

Audience Response Systems as a Tool for Collaborative Learning

- **Collect demographic information**
- **Evaluate the Collaborative Learning process**
- **Gather feedback on participant values, attitudes, preferences**
- **Engage group members**
- **Pre and post evaluation for community education**
- **Select and prioritize strategic planning actions**

Example: Turning Point

http://www.turningtechnologies.com/

TurningPoint audience response system integrates 100% into Microsoft® PowerPoint® and allows audiences and students to participate in presentations or lectures by submitting responses to interactive questions using a ResponseCard™ keypad or other hand-held/computer devices.
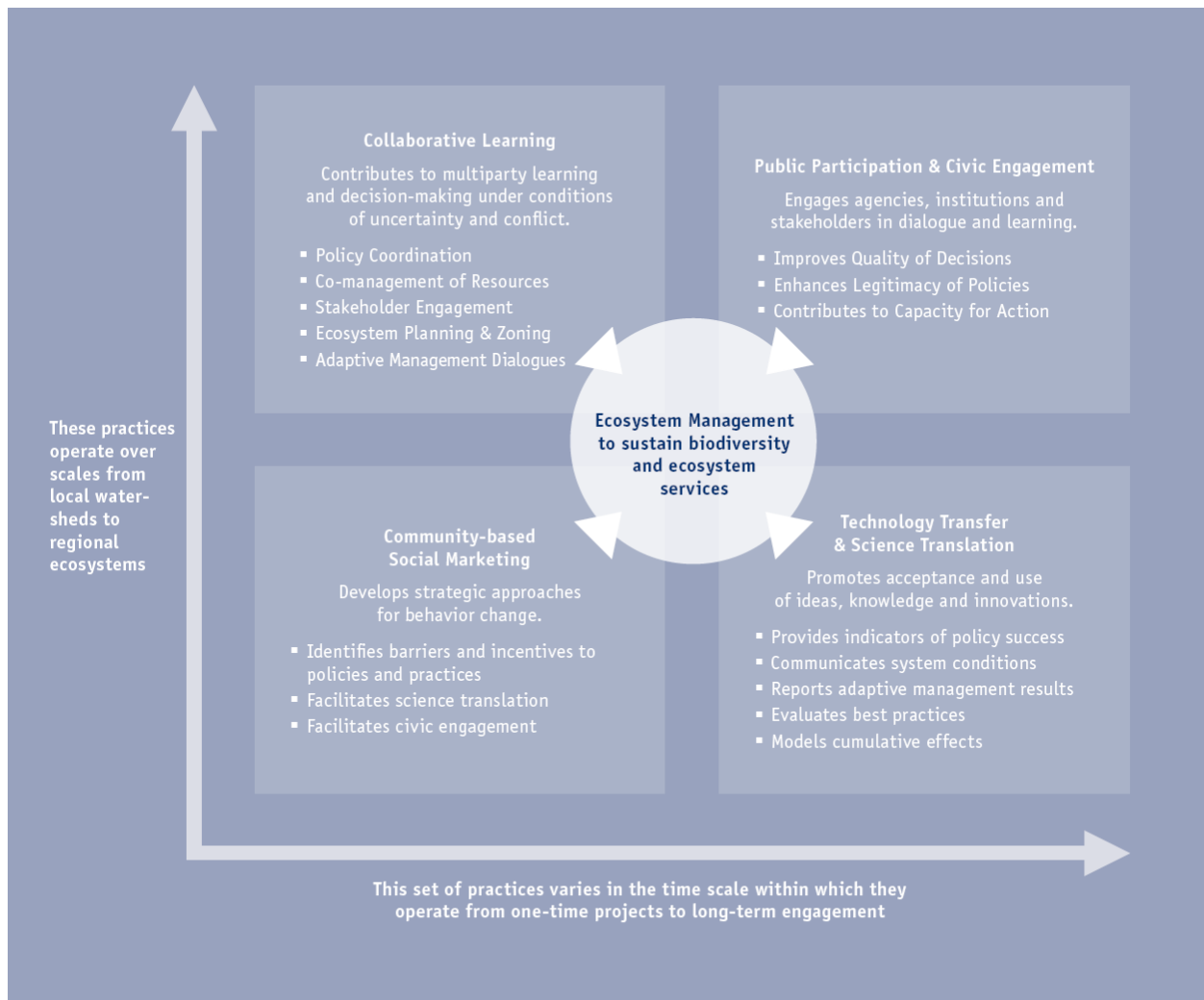
Using a TurningPoint audience response system, your PowerPoint presentations become powerful data collection and assessment tools that collect real-time audience responses and dramatically improve productivity and results for your business or educational organization. Author, deliver, assess and report without ever leaving PowerPoint.

Comparison of Social Marketing and Collaborative Learning[6]

Attributes	Community-based Social Marketing	Community-based Collaborative Learning
Expert practices based upon social science theories	Social Psychology Theories (Environmental Psychology)	Systems Theory Conflict Theory Adult Learning Theory (Environmental Communication)
Initiatives at the community level are more effective	Behavior change	Actions to improve a situation
Practical yet rigorous	Research based v. *Hunch* based	Research based v. *Hunch* based
Clearly defined process	4 step process	4 step process
	1. Identify barriers and benefits	1. Assessment
	2. Develop strategy to use tools of behavior change	2. Design based upon procedural, relationship and substance aspects
	3. Pilot the strategy	3. Implement
	4. Evaluate	4. Evaluate
Differences	*MARKETING*	*LEARNING*
Goal	Specific behavior change goal	Group generation of actions to improve a situation
Nexus of control	External A clear behavior change goal frequently initiated by an entity "outside the system" aiming to change behavior "within the system"	Internal Engages members of the system in a process to develop a shared view of the situation, shared meanings and group generated actions to improve the situation
Communication structure	Campaign	Engagement Process

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[6] Based upon Daniels and Walker, 2001 and Mckenzie-Mohr & Smith, 1999

Collaborative Learning

Contributes to multiparty learning and decision-making under conditions of uncertainty and conflict.

- Policy Coordination
- Co-management of Resources
- Stakeholder Engagement
- Ecosystem Planning & Zoning
- Adaptive Management Dialogues

Public Participation & Civic Engagement

Engages agencies, institutions and stakeholders in dialogue and learning.

- Improves Quality of Decisions
- Enhances Legitimacy of Policies
- Contributes to Capacity for Action

Ecosystem Management to sustain biodiversity and ecosystem services

Community-based Social Marketing

Develops strategic approaches for behavior change.

- Identifies barriers and incentives to policies and practices
- Facilitates science translation
- Facilitates civic engagement

Technology Transfer & Science Translation

Promotes acceptance and use of ideas, knowledge and innovations.

- Provides indicators of policy success
- Communicates system conditions
- Reports adaptive management results
- Evaluates best practices
- Models cumulative effects

These practices operate over scales from local watersheds to regional ecosystems

This set of practices varies in the time scale within which they operate from one-time projects to long-term engagement

Excerpt from: Feurt, C. 2008. Collaborative Learning for Ecosystem Management available from http://swim.wellsreserve.org/ctp/Collaborative%20Learning%20Guide.pdf

Internet Resources Supporting
Collaborative Learning for Ecosystem Management

The EBM Tools Network   www.ebmtools.org/

*Changing*Minds   http://changingminds.org/explanations/theories/a_motivation.htm

The Learning Theory into Practice Database   http://tip.psychology.org/backgd.html

The Ecosystem Management Initiative http://www.snre.umich.edu/ecomgt/

Learning from Experience, a website of natural resource collaboration case studies
http://www.partnershipresourcecenter.org/resources/publications/index.php

COMPASS the Communication Partnership for Science and the Sea
http://www.compassonline.org/marinescience/ecosystem.php

Land-Ocean Interactions in the Coastal Zone (LOICZ) provides the knowledge, understanding and prediction needed to allow coastal communities to assess, anticipate and respond to the interaction of global change and local pressures which determine coastal change.
http://www.loicz.org/mediacentre/heritage_lectures/index.html.en
http://www.loicz.org/imperia/md/content/loicz/print/rsreports/34_the_analysis_of_governance_responses_to_ecosystem_change.pdf

Marine Planning Practical Approaches to Ocean and Coastal Decision-making
http://marineplanning.org/index.html

Ecosystem Management UNEP program
http://www.unep.org/ecosystemmanagement/Home/tabid/163/Default.aspx

The Economics of Ecosystems and Biodiversity (TEEB) study http://www.teebweb.org/

University of Texas – Marine EBM Tools Project
http://www.utmsi.utexas.edu/about-the-institute/mission-aransas-nerr/stewardship/ecosystem-based-management-tools-project.html

The Millennium Ecosystem Assessment http://www.maweb.org/en/index.aspx

Bridging the Science to Management Divide http://www.ecologyandsociety.org/vol11/iss1/art4/

Appendix V
Presentations and Trainings at Conferences for Diffusion of EBM Tools & Collaborative Learning for Ecosystem Management Approach

Using EBM tools, Collaborative Learning and social science research from this project, the Wells NERR Coastal Training Program, made presentations to educate and facilitate adoption of an ecosystem-based management approach to coastal and watershed management to over 1,200 managers, policy makers and interdisciplinary scientists at regional, national and international conferences described below. Sample abstracts are included for the first two papers.

Northeast Section Geological Society of America and Maine Water Conference
March 24, 2009 Portland, Maine
50 attendees: water program managers, outreach specialists and government water regulators

From the Headwaters to the Sea, Implementing a Watershed Approach in Southern Maine
Abstract
Watersheds in southern Maine connect coastal and inland communities where diverse land use practices and land conservation strategies create a complex mosaic of policies affecting water quality and quantity. This presentation shares lessons learned from a project designed to improve land use decision making and overcome barriers to implementing a watershed approach in southern Maine watersheds.

The watershed approach mirrors the principles and practices of community-based ecosystem management. This project integrated the process of Collaborative Learning and land use planning tools developed by the Ecosystem Based Management Network to connect the practice of ecosystem management to municipal land use decision-making. Desire to incorporate water quality and habitat protection into economic development strategies motivated the town of Sanford, Maine to examine existing resource conditions, ordinances, and Comprehensive Plan priorities. The Wells National Estuarine Research Reserve secured grant funding to support Sanford's efforts as part of a national project to improve land use planning in coastal watersheds. Sanford's five watersheds are significant coastal headwaters that drain to two National Estuarine Research Reserves, one National Wildlife Refuge and a National Estuary Partnership. The source waters for a regional water district originate in Sanford. This collaborative partnership connected international and national scale initiatives with place based efforts to conserve land and protect water quality.

This project used Collaborative Learning to guide stakeholder engagement and use of geospatial tools and Community Viz technology to develop a Conservation Plan for Sanford that considered the value of headwater streams, aquifers and riparian buffers for water quality and quantity protection. Watershed values were considered along with habitat, recreation and land productivity values. Stakeholder engagement was supported by the use of key pad poling to gather information on community priorities.

This presentation addresses challenges and successes associated with the application of land use technology tools to improve decision making at the watershed scale and linking land conservation goals with water quality protection.

New England Interstate Water Pollution Control Commission (NEIWPCC) Conference
Portland, Maine May 19, 2009
40 Attendees: Water managers and watershed outreach professionals
From the Headwaters to the Sea, Implementing a Watershed Approach in Southern Maine
Abstract
Coastal watersheds in southern Maine connect coastal and inland communities where diverse land use practices and land conservation strategies create a complex mosaic of policies affecting water quality and quantity. This presentation shares lessons learned from a project designed to improve land use decision making and overcome barriers to implementing a watershed approach in southern Maine watersheds.

The watershed approach mirrors the principles and practices of community-based ecosystem management. This project integrated Collaborative Learning and land use planning tools developed by the Ecosystem Based Management Network to connect the practice of ecosystem management to municipal land use decision-making. Desire to incorporate water quality and habitat protection into economic development strategies motivated the town of Sanford, Maine to examine existing resource conditions, ordinances, and Comprehensive Plan priorities. In addition, Sanford's five watersheds drain to significant coastal areas including two National Estuarine Research Reserves, one National Wildlife Refuge and the area included in a National Estuary Partnership.

This project used the Collaborative Learning approach to guide stakeholder engagement and use of geospatial tools and Community Viz technology to develop a Conservation Plan for Sanford that considered the value of headwater streams, aquifers and riparian buffers for water quality and quantity protection. Watershed values were considered along with habitat, recreation and land productivity values.

This presentation will address challenges and successes associated with the application of land use technology tools to improve decision making at the watershed scale, including stakeholder identification and engagement, techniques to enhance public participation, developing priorities for watershed management and linking land conservation goals with water quality protection goals.

The 8th Bay of Fundy Science Workshop   May 29, 2009
Acadia Center for Estuarine Research, Wolfville, Nova Scotia
25 Attendees: Canadian governmental officials, watershed NGOs, Canadian academics
From the Headwaters to the Sea, Implementing a Watershed Approach in Southern Maine

NERRS CTP Sector Meeting Mission Aransas NERR, Texas, March 2009
Presentation to Coastal Training Program Coordinators demonstrating the use of key pad poling technology and collaborative learning approach used in the Sanford Conservation Plan process.

Collaborative Learning Presentations Coastal Zone 09 Boston, MA
July 25, 2009 Session Title: Measuring and Communicating the Value of Collaboration in Coastal Management (35 coastal managers) *Barriers and Bridges to Ecosystem Management - Using Collaborative Learning to Define and Measure Progress*

July 25, 2009 Session Title: Land Use Innovations (30 coastal managers) *Headwaters, Crafting a Collaborative Conservation Plan for Sanford, Maine*

July 19, 2009 *Collaborative Learning for Ecosystem Management - A Short Course*
8 coastal managers, including 2 international participants

"Collaborative Learning for Ecosystem Management Training Workshop" course presented to National Estuarine Research Reserve System (NERRS) Coastal Training Program Coordinators and NOAA Estuarine Reserves Division (ERD) staff at NERRS/NERRA Annual Conference in San Diego, November 8, 2009.

Developed and piloted "Ecosystem Management" course for University of New England in partnership with the UNE Center for Sustainable Communities. Fall Semester 2009.
The course engaged 15 undergraduate Environmental and Marine Biology majors in a semester long course focusing on ecosystem management in the Gulf of Maine. The course used Collaborative Learning, EBM tools and social science research techniques to develop profiles of local ecosystem managers and scientists and their work connected to land use decision-making in southern Maine watersheds.

500 copies of *Collaborative Learning for Ecosystem Management* Guide distributed to local, national and international coastal managers and scientists through trainings, conferences and meetings. Part of a previously funded CICEET project on Collaborative Learning and Community Based Ecosystem Management, this practitioner's guide for education and outreach professionals was combined with the outreach and training for the current project. The guide presents a practical method for implementing ecosystem based management using Collaborative Learning. Distribution of the guide at meetings and conferences and through on line requests is paired with current project objectives to combine technology tools and participatory processes to facilitate community based ecosystem management. Electronic copy of plan remains available on the Sanford, Maine town website and Wells NERR website.

Wells NERR CTP **technical expertise with key pad poling and design of participatory processes** developed through this project is increasingly being requested for municipal land use planning and decision making processes. Requests for demonstrations, training and partnerships during 2009 & 2010 have come from municipalities, state agencies and the NERRS.

Plenary Address New Hampshire Joint Water and Watershed Conference Concord, New Hampshire November 20, 2009: *The Language of Water – Why Wisdom Sits in Places.*
Audience of 250 people included federal, state, and local government, watershed organizations from New England region.

Ogunquit River Conference, Sept. 26, 2009, 6 hours, 42 people, Target Audience: Watershed Residents and Members of Local NGO's. Conference to focus attention on protecting shellfish resources, maintaining healthy beaches, and examining impacts of development on beaches and the business community with time for networking and action planning.

Sanford Regional Community Development Collaborative, Sept.-Oct. 2009, 20 Hours. Key pad poling and consultation with the Sanford Maine's Resource Conservation and Development Commission to investigate stakeholder values in a consensus building exercise as follow up work to the Sanford Conservation Plan developed in 2009 w/ CICEET Grant. 15 people.

Mapping with Google Training, Oct. 20th, **2009** 15 people Target Audience: State & Local Government Agencies, Non-profits. Computer based hands on technical training to introduce free Google Earth and Google Maps tools to produce basic GIS maps for print and online.

Maine Coastal Waters Conference, Oct. 28th, 2009 8 hours, 200 people. Audience: Coastal Management Professionals with Government Agencies, Universities, and NGOs. A Statewide Coastal Management Conference focused on Climate Change, Coastal Economics, and Community Participation in coastal management.

The Summit at the Summit. November 2, 2009, 4 hours Wells NERR. Meeting of regional partners working with environmental issues in southern Maine to increase understanding of program scope, target audiences and potential for synergies among the organizations. 10 people.

Mapping with Google, Nov. 3, 2009 13 people Target Audience: State & Local Government Agencies, Non-profits. Computer based hands on technical training to introduce free Google Earth and Google Maps tools to produce basic GIS maps for print and online.

Mapping with Google, Dec. 15, 2009, 9 people Target Audience: State & Local Government Agencies, Non-profits. Computer based hands on technical training to introduce free Google Earth and Google Maps tools to produce basic GIS maps for print and online.

Mapping with Google Webinar in partnership with EBM Tools Network, October, 27, 2009 161 people. Target Audience: International Coastal Decision Makers interested applying free GIS tools. Online seminar designed to demonstrate potential uses of Google Earth and Google Maps to create, collaborate, and share Geographic Information.

Science Communication Workshop with the Integration and Application Network, January 11-12, 2010, 20 people. Target audience: federal, state and municipal decision makers, NGOs, academia. Skill building workshop on use of computer generated conceptual diagrams and In Design software to develop and deliver science concepts to policy makers, hosted with the University of New England Center for Sustainable Communities.

University of Maine Natural Resources Program Seminar September 14, 2009. Orono, ME: *"Protecting Our Children's Water" Using Collaborative Learning to Frame and Implement Ecosystem Management.* 35 people.

University of New Hampshire Research Seminar October 1, 2009, Durham, NH: *Headwaters – Developing a Collaborative Conservation Approach to Support Land Use Decision-Making.* 20 people.

Gulf Of Maine Conference Gulf of Maine Symposium Advancing Ecosystem Research for the Future of the Gulf, St Andrews, New Brunswick Canada October 6, 2009: *What would Don Quixote Do? Exploring New Paradigms in Ecosystem Management.* 200 people.

Maine Municipal Association- Oct. 8, 2009 Presentation for municipal staff on using Key-Pad Polling for building consensus among stakeholders for effective grant writing. 30 people

Maine Coastal Waters Conference October 28, 2009 Lincolnville, ME. *From the Headwaters to the Sea Tools for Implementing a Watershed Approach in Coastal Watersheds.* 50 people.

University of New England State of the Science Saco River Estuary. December 1, UNE: facilitated session with 10 interdisciplinary researchers working to identify research in progress with application to land use decision making.

108th American Association of Anthropology Annual Conference – The Ends of Anthropology December 5, 2009, Philadelphia, PA. *Protecting Our Children's Water Using Cultural Models and Collaborative Learning to Frame and Implement Ecosystem Management.* 50 people.

Papers presented and trainings given January - December 2010 by Dr. Feurt at seminars, trainings, conferences and symposia about the Sanford Conservation Plan process and the use of Collaborative Learning and EBM tools for stakeholder engagement, including 6 regional, national and international events reaching a combined audience of 182 interdisciplinary researchers, students, policy makers and managers:

- UNE Course ENV 399A Environmental Communication Class: focusing on Collaborative Learning. Twenty undergraduate students developed and presented a Collaborative Learning Workshop "Sustaining the Saco" for 20 community members on April 28, 2009.
- Workshop on the Economics of Ecosystem Based Management, February 8 – 9, 2010, Boston, MA. *Understanding Barriers to the Incorporation of Economics in Community Based Ecosystem Management*. 45 people. (not included in previous progress report)
- Lecture presented to UNE Undergraduate Research Course. February 22, 2010. *Protecting Our Children's Water - Using Cultural Models and Collaborative Learning to Frame and Implement Ecosystem Management. 50 people.*(not included in previous progress report)
- National Estuarine Research Reserve Research and Coastal Training Program Annual Sector Meeting, Woods Hole, MA. March 2, 2010. Meeting session facilitation: *Fostering Collaborative Research and Environmental Communication Partnerships*. 27 people.
- Training Workshop for Knox and Lincoln County U Maine Cooperative Extension Agents, March 8, 2010, Waldoboro, ME. *Collaborative Learning and Social Marketing: Expert Practices for Fostering Community Sustainability Two Approaches to Changing Behavior*. 10 people.

- Open Space Conference: Land, Parks and Trails for Biddeford's Future. May 6, 2010, UNE Biddeford, Maine *Protecting Our Children's Water-Engaging the Kaleidoscope of Expertise to Conserve Land and Protect Water Quality.* 45 people.
- Joint scientific conference Canadian and United States estuarine scientists. ACCESS/NEERS, 14 May 2010 St. Andrews by-the-Sea, New Brunswick, Canada. *Collaborative Learning Strategies to Overcome Barriers to Ecosystem Management in Coastal Watersheds of the Gulf of Maine*. 50 people.
- NERRS Science Collaborative Web Conference, 8 September, 2010 - Collaborative Learning and Land Use Tools to Support Community Based Ecosystem Management. 20 people.

- Collaborative Learning Training for Salmon Falls Watershed Collaborative Planning Team, September 20, 2010. (12 people)

- *Collaborative Learning – An Expert Practice for Implementing Ecosystem Management* September 22 & 23, 2010. Training at ACE Basin NERR for South Carolina Coast Managers, outreach specialists and researchers: *(35 people)*

- Presentation about Sanford Conservation planning process to National NEMO Conference Sept 30 – October 1, 2010 (40 people)

- Presentation to the Regional Association for Research in the Gulf of Maine (RARGOM): *Sustaining Quality of Place in the Saco River Estuary, Understanding Stakeholder Roles, Values and Concerns* October 6, 2010 (45 people)

- Northern New England Chapter of the American Planning Association Conference (NNECAPA) *From the Headwaters to the Sea, Using Integrated Watershed Planning Approaches in Southern Maine as a Framework for Sustainability, O*ctober 7, 2010 (35 people)

- NERRS Annual Meeting, *Ecosystem Management – a Role for the Coastal Training Program in the National Estuarine Research Reserve System, October 11, 2010 (25 people)*

- NERRS Annual Meeting: presentation, Implementing Collaborative Science in the NERRS October 13, 2010, (40 people).

- Application of Collaborative Learning approach and Key Pad Poling to Salmon Falls Watershed Collaborative Workshop October 27, 2010, (84 people)

- Collaborative Learning and Sanford Conservation Plan Webinar EBM Tools Network
- December 1, 2010, (45 people)

Appendix VI
Collaborative Learning for Ecosystem Management framework adapted to UNE-Wells NERR partnership on the Saco River Estuary Part of the Maine Sustainability Solutions Initiative[7]

"Sustaining Quality of Place in the Saco River Estuary
through Community-Based Ecosystem Management"

Phase I (Fall 2009 – Summer 2010): Bridging Community Goals for Quality of
Place and Scientific Knowledge of Ecosystem Structure and Function through
Collaborative Learning

The Collaborative Learning for Ecosystem Management framework served as the basis for a new partnership with Wells NERR Research, GIS and CTP and the University of New England departments of Environmental Studies, Biology, Marine Biology and Business. This five year effort will focus on understanding the effects of increasing coastal development on the health of the Saco River Estuary, and on ways to mitigate these effects. It will employ the methods of social sciences in understanding management and policy challenges, and in examining existing gaps in scientific knowledge required to address these challenges. It will also use the methods of the natural sciences to develop ecological indicators that reflect the extent and impacts of coastal development. This project is a first step in achieving the long-term goal of sustaining the structure and function of the Saco River Estuary, and could serve as a model for bringing scientists and stakeholders together to achieve similar goals.

The Saco River watershed, 20 miles north of the Wells NERR estuaries, is the largest watershed in southern Maine, encompassing more than 1,500 square miles. The estuarine portion of the river lies below the first dam on the river, and includes a variety of coastal habitats, including rocky intertidal, sandy beaches, mudflats and salt marshes. This stretch of the river is bordered by the town of Saco and the city of Biddeford. The University of New England (UNE) is located in the city of Biddeford, at the mouth of the Saco River.

The Wells NERR and student researchers at UNE conducted a stakeholder assessment for the project using social science research techniques developed as part of a previous CICEET funded project on cultural models and collaborative learning. The social science methodologies used included internet/web inventory of groups, participant observation at meeting, interviews and coding and synthesis of qualitative data. The stakeholder inventory appears in Appendix C. The two workshops described below adapted the Collaborative Learning for Ecosystem Management course to achieve the goals of this project. The "Sustaining the Saco" workshop was designed and implemented by UNE students in collaboration with Dr. Christine Feurt and Zack Steele. Key pad poling technology was incorporated into the workshop. Goals and objectives of the Saco River estuary project are in alignment with the goals of the NSF funded Maine Sustainability Solutions Initiative and are providing a model for other members of this statewide partnership.

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[7] An NSF funded program through the University of Maine. The Sustainability Solutions Initiative is profiled at http://www.umaine.edu/sustainabilitysolutions/about/index.htm

"Sustaining the Saco" - Student Led Collaborative Learning Workshop
April 29, 2010   6:00 - 9:00 pm, UNE (30 people)

Using ethnographic research methods, students from ENV 398A Environmental Communication have identified and characterized Saco River stakeholders whose work on municipal boards, committees, community groups and governments demonstrates stewardship of the river. Incorporating knowledge about the work and concerns of these stakeholders, students introduced five ecosystem health issues for the Saco River: climate, water quality, biodiversity, wetlands and ecosystem services. Students used the Collaborative Learning approach to engage stakeholders and UNE faculty in dialogue about these issues and the potential to use indicators to assess and monitor the condition of the estuary. The style of the meeting was participatory, allowing stakeholders to identify important values and evaluate preferred strategies for maintaining ecosystem health. Audience poling devices were used as teaching aides to introduce ecosystem concepts and reinforce key concepts from student-generated Power Points, GIS and visuals.

Charting a Course for the Saco - Bridging Community Goals for Quality of Place and Scientific Knowledge of Ecosystem Structure and Function through Collaborative Learning May 18th 9:30 am – 2:00 pm UNE (15 people)

Drs. Christine Feurt, Michele Dionne (Wells NERR) and Pam Morgan (UNE) facilitated a dialogue among UNE researchers and Saco River Watershed stakeholders to increase understanding of the state of the science in the Saco estuary, identify management and policy challenges influencing sustainability of ecosystem health and to identify and prioritize research needs for the coming four years of the Saco River Estuary project. Stakeholder assessment research conducted by Dr. Feurt and the students in UNE's Environmental Communication course informed the design of this workshop.

Shoreland Zoning Boat Trip – August & September, 2010, These two boat trips for researchers, policy makers and planners used the perspective from the water toward the shoreline to prompt frank discussions of the reality and challenges of shoreland zoning as a tool for protecting estuarine water quality.

List of Stakeholders Engaged in Saco Estuary Project

Collaborative Learning Assessment
Stakeholders Engaged by student researchers in ENV 398 Environmental Communication
Citizens of Biddeford
Citizens of Saco
Saco Planning Board
Saco Comprehensive Committee
Saco Conservation Commission
Biddeford Conservation Commission
Heart of Biddeford
Saco Valley Land Trust
Biddeford Open Space Committee
Biddeford Planning Board
Saco River Salmon Club
Saco River Coordinating Committee
Biddeford Pool Land Trust
Friends of Wood Island Lighthouse
Biddeford Pool Improvement Association
Biddeford Chamber of Commerce
Blandings Park Wildlife Sanctuary
Biddeford Environmental Board
Saco Coastal Waters Commission
UNE Waste Water Treatment Facility

Stakeholders Engaged in Collaborative Learning Workshops, Meetings and Field Trips
Saco River Corridor Commission
Cumberland County Soil and Water Conservation District
Maine Department of Health and Human Services, Drinking Water Program
National Estuary Program –Piscataqua Regional Estuary Partnership
US Fish and Wildlife Service - Rachel Carson National Wildlife Refuge
Maine Nonpoint Source Pollution Education for Municipal Officials
Mt Agamenticus to the Sea Conservation Initiative
Maine Department of Environmental Protection
U ME Cooperative Extension and Maine Sea Grant
Portland Water District
Saco Bay Trails
Marston's Marina
City of Biddeford Shellfish Commission
Wells National Estuarine Research Reserve
City of Saco Planner
City of Biddeford Planner
Southern Maine Regional Planning Commission
Maine Geological Society

Appendix VII
Sanford Conservation Plan Featured in National Guide for Healthy Watersheds.

The Sanford Conservation Plan was selected by the U. S. Environmental Protection Agency for inclusion in "A Technical Guide for Identifying and Protecting Healthy Watersheds" as an example of innovative watershed assessment and conservation approaches being used throughout the nation.

The text of the request and purpose of the guide is below.

Hello Dr. Feurt,

The U.S. Environmental Protection Agency (EPA) is in the process of launching a new "Healthy Watersheds" initiative. In support of the Healthy Watersheds initiative, my firm (The Cadmus Group, Inc.) is providing EPA with support in the development of A Technical Guide for Identifying and Protecting Healthy Watersheds. The purpose of the Guide is to promote a holistic, ecosystem-based approach to assessing and protecting healthy watersheds and intact components of other watersheds. The Guide will present innovative watershed assessment and conservation approaches being used throughout the Nation.

We would like to include a brief summary (draft is attached) of the Town of Sanford Conservation Plan entitled "Headwaters".

Regards,
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Headwaters: A Collaborative Conservation Plan for the Town of Sanford, ME
http://swim.wellsreserve.org/results.php?article=828

The Town of Sanford, ME is located at the headwaters of five critically important watersheds in southern Maine and New Hampshire. Using community input and science-based conservation principles to implement the conservation goals of its comprehensive plan, the town is protecting these regional resources. Over the course of three stakeholder workshops designed in cooperation with the Wells National Estuarine Research Reserve, and using innovative GIS and keypad polling techniques, the community developed the following core conservation values:

- Water quality protection
- Conserving productive land for agriculture
- Conserving significant wildlife habitat and biodiversity
- Protecting human health and safety through conservation of floodplains, water supply buffers and wetlands
- Conserving scenic, cultural and recreational resources

The community recognizes that these values are provided by Sanford's green infrastructure. Using a GIS software program called Community Viz, the community mapped the green infrastructure that is important for protecting each of these values. Once this community-based assessment phase was completed, the town developed recommendations and strategies for conserving each of the five conservation values. One of these strategies was to identify "focus areas" by considering the relative importance placed on each conservation value by community members. These high-priority conservation sites were evaluated for the amount of protected land that they currently contain and the specific threats posed to each focus area by human activities. These focus areas are considered the priorities for conservation action.
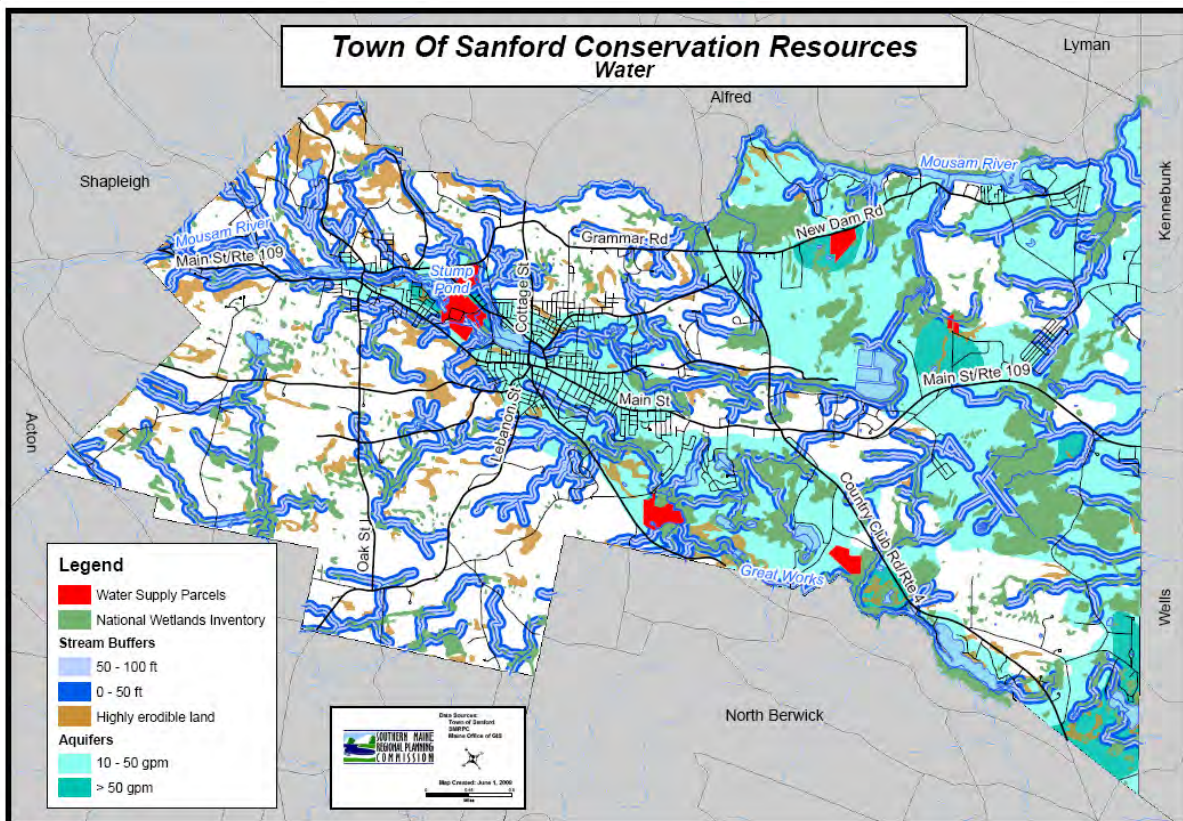

Figure 1. Green infrastructure identified for water quality protection.

Outside of the focus areas, there are additional locations that contain one or more of the five conservation values. These areas were prioritized for protection based on a ranking of land parcels according to their relative value. For example, a parcel containing both exemplary wildlife habitat and water resources would receive a higher priority for protection than a parcel that only contains wildlife habitat.

The following strategies were identified as options to implement the Sanford conservation plan:

- Fee simple purchase
- Conservation easements
- Conservation subdivisions
- Current use program
- Land use ordinances
- Community education and outreach

Responsibilities for implementation of the plan were assigned to each participating stakeholder group, funding sources were identified, and a monitoring and evaluation process was included to ensure effectiveness of the plan.

For more information contact Dr. Christine Feurt cfeurt@wellsnerr.org

Appendix VIII
Salmon Falls Watershed Collaborative Planning Team and
Project Goals and Objectives

Berwick Water Department
Granite State Rural Water Association
Maine Drinking Water Program
Maine Nonpoint Education for Municipal Officials (NEMO)
Maine Rural Water
New Hampshire Department of Environmental Services
New Hampshire Source Water Protection Program
Piscataqua Region Estuaries Partnership
Salter Mitchell EPA Contractor
Somersworth Planning Department
South Berwick Water District
Southeast Watershed Alliance
The National Source Water Collaborative
U.S. Environmental Protection Agency
U.S. Forest Service
Wells National Estuarine Research Reserve

Goals of the Salmon Falls Watershed Collaborative:

1. Protect water supply sources in the Salmon Falls River watershed through coordinated land and water conservation, planning and management.
2. Develop and sustain mutually beneficial partnerships to accomplish shared goals for clean water.

Objectives and Outcomes of the October 27th Workshop:

Workshop participants will:
1. Recognize the network of partnerships responsible for protecting water supplies and water resources in the watershed.
2. Identify actions that can be taken to improve water protection through collaboration with partners.
3. Prioritize short term projects for action during 2011.
4. Identify long term strategies for accomplishing shared goals for water protection.

Following the workshop the planning team will:
1. Develop a report summarizing the results of the workshop (February 2011).
2. Select and implement source water protection actions based on stakeholder priorities identified through the workshop.

Appendix IX: Template for Green Infrastructure Text[8]

Conserving Sanford's Water Resources (excerpt from plan)

A 50 Year Vision for Sanford's Water Resources

Sanford continues to act to protect watersheds taking a leadership role in the region. Clean water remains unpolluted. Degraded waters are restored. Healthy drinking water flows from town and private wells. New development does not pollute or degrade watershed green infrastructure. The quality of life for Sanford families and businesses is enriched by free local access to beautiful waterways and healthy recreational experiences.

> We will encounter wildlife, enjoy fishing, boating and swimming with our grandchildren in the places our grandparents shared with us.

(Vision developed from Stakeholder comments at the April 5, 2008 Workshop)

Sanford's Water Resources

Five watersheds
Rivers, streams, ponds, lakes
Wetlands- forests, marshes
Aquifers
Groundwater
Springs
Public drinking water sources
Private wells

Mapping Sanford's Water Assets using GIS

These are the individual map layers that were combined to create the Sanford Water Resources Map: Beginning with Habitat Water Resource Layers
Aquifer recharge areas:
- high yield
- low yield

Land next to streams:
- 0-50 ft
- 50-100 ft
- 100+ ft

Land next to lakes, ponds and rivers:
- less than 100 ft
- 100-250 ft
- 250-600 ft
- 600-1,000 ft

Highly erodable soils
Wetlands
Public water supply source

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[8] Full plan available from
http://swim.wellsreserve.org/ctp/Sanford%20Conservation%20Plan%2009.pdf

Sanford's Green Infrastructure of Watershed, Wetland and Clean Water Services

Service #1: Removal and filtration of pollutants by buffers, wetlands and the water cycle
- Maintain drinking water quality in public water sources and private wells
- Process sewage
- Cycle nutrients and transport organic mater
- Retain sediment
- Filter runoff and stormwater

Service #2: Flood reduction
- Storage capacity to reduce downstream flood volume
- Slow flow to reduce peak discharges and
- Slow flow to encourage sediment to settle out
- Protect downstream property
- Protect public safety

Service #3: Groundwater and aquifer recharge
- Maintain baseflow conditions in streams
- Recharge public water supplies
- Recharge private wells
- Maintain water levels in lakes and ponds

Service #4: Shoreline protection
- Fringe wetlands provide vegetative bank protection
- Absorb energy of floodwaters

Service #5: Wildlife habitat
- Water is essential for all life
- Habitat for breeding, feeding and migrating
- Provide corridors connecting different habitats

Service #6: Recreation, education and aesthetics
- Fishing/hunting
- Wildlife watching
- Hiking and walking
- Boating
- Science curriculum/research opportunities

Service #7: Business, industry, and commercial
- Provides clean, abundant water to support economic prosperity
- Increases property values
- Attracts business

Conserving Sanford's Watershed Green Infrastructure

Overarching Conservation Objective:
Use the Eight Tools of Watershed Protection[9] as a framework for protection of watershed green infrastructure.

Action Plan:
1. Continue to practice municipal watershed stewardship through existing land use planning and zoning strategies, public works *Best Management Practices* and initiatives for stormwater management and erosion control, and code enforcement relating to water quality protection (including on-site waste water systems, shoreland zoning).

2. Treat watershed green infrastructure as an integral part of economic development. Clean water is good business and Sanford is "asset rich" with water.
Responsibility for maintaining Sanford's watershed green infrastructure is shared by municipal government, private landowners, businesses, and citizens. Conservation-focused organizations like those who participated in the development of this plan can play a leadership role implementing the eight tools of watershed protection as they relate to their individual missions.

3. Establish Sanford as a Regional Model for Watershed Protection in southern Maine. Enlist supporting partners[10] and grant writing resources to expand Sanford's successful efforts with CICEET, Project Canopy, Goodall Brook, Brownfields Restoration, Sanford Regional Airport, Land for Maine's Future.

4. Evaluate the success of actions to protect green infrastructure and adapt practices to protect green infrastructure to achieve Sanford's 50-year vision for conserving water.

The Eight Tools of Watershed Protection
Adapted from the Center for Watershed Protection
The eight tools of watershed protection provide a framework for holistic and proactive strategy to protect green infrastructure. The tools are designed to link conservation and economic development. The rights of property owners and businesses to develop land are connected to strategies for development that reduce pollution and the loss of irreplaceable water resources. These strategies are designed to protect the values associated with clean water and reduce the costs to municipalities and citizens of pollution clean-up and
replacement of green infrastructure services. The complete guide to using the eight tools of watershed protection is referenced in the resources section of this plan.

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[9] Schueler,T. and H. Holland eds. *2000. The Practice of Watershed Protection- The Tools of Watershed Protection, Chapter 2 from The Rapid Watershed Planning Handbook Article 27.*
Center for Watershed Protection. Ellicott City, MD. Available from:
http://www.cwp.org/Resource_Library/Center_Docs/PWP/ELC_PWP27.pdf

[10] Potential external partners include the Wells National Estuarine Research Reserve, York County Soil and Water District, Maine Association of Conservation Commissions, Trust for Public Land, Piscataqua Regional Estuary Partnership. Internal partners include local land trusts and watershed associations.

THE EIGHT TOOLS OF WATERSHED PROTECTION

1. **Land Use Planning**, is perhaps the most important because it involves making decisions about the amount and location of development (and new impervious cover) that occurs in a watershed. Land use planning techniques, such as watershed planning, watershed-based zoning, overlay zoning, and urban growth boundaries, are used to redirect development, preserve sensitive areas, or reduce impervious cover in a given portion of the watershed.

2. **Land Conservation,** involves choosing the most critical areas in a watershed to conserve in order to sustain the integrity of aquatic and terrestrial ecosystems. Critical habitats for endangered species, aquatic corridors, hydrologic reserve areas, contiguous forests and wetlands may be important conservation areas, and can be protected via land acquisition and conservation easements, to provide permanent protection from development.

3. **Aquatic Buffers** are the third tool, and involves making choices on how to maintain the integrity of streams, shorelines, and wetlands, and protect them from encroachment. Buffers are recommended along aquatic corridors to physically protect and separate water resources from disturbance and pollution from adjacent land.

4. **Better Site Design**, which seeks to design development sites to create less impervious cover, conserve more natural areas, and use pervious areas to more effectively treat stormwater runoff. Better Site Design affords greater protection to water resources by reducing both storm water runoff volume and pollutant loads to downstream waters.

5. **Erosion and Sediment Control** deals with the clearing and grading stage in the development cycle, when storm water runoff can deliver high sediment loads to downstream waters. This tool reduces the impact of sediment by requiring specific temporary practices to be installed at construction sites that reduce erosion and prevent sediment from entering downstream waters.

6. **Storm Water Management**, identifies how, when, and where to provide storm water management within a watershed, and which combination of storm water treatment practices will best meet watershed objectives. Storm water treatment practices compensate for the hydrological changes caused by new and existing development by reducing runoff volume and improving water quality.

7. **Non-Storm Water Discharges**, involves making decisions on how to control discharges from waste water disposal systems, illicit connections to storm water systems, pollution from household and industrial products, and other point sources of water pollution.

8. **Watershed Stewardship**, involves creating programs to promote private and public stewardship to sustain watershed quality. The goal of watershed stewardship is to increase public understanding and awareness about watersheds, promote better stewardship on private lands, and develop funding to sustain watershed management efforts.