REPORT AND PROCEEDINGS

Best Education Practices (BEPs) Symposium
for Water Outreach Professionals:

Defining BEPs, Refining New Resources and
Recommending Future Actions

June 2 – 4, 2004

Pyle Conference Center
University of Wisconsin, Madison

Cosponsored by:

University of Wisconsin – Extension

University of Wisconsin – Madison,
College of Agricultural and Life Sciences – Environmental Resources Center

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To learn more about the Water Outreach Education Project, to view the Proceedings online, or to order a copy, please go to our Web site at:

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http://wateroutreach.uwex.edu

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FORWARD

In June 2004, natural resource professionals from around the country attended the Symposium, *Best Education Practices (BEPs) for Water Outreach Professionals: Defining BEPs, Refining New Resources and Recommending Future Actions*, at the University of Wisconsin in Madison. We convened the Symposium to build knowledge among natural resources agencies and professionals that the application of BEPs in outreach efforts is an effective tool for accomplishing water management objectives. The Proceedings describe this gathering and the lessons learned about best practices in water outreach and education.

The success of water management strategies is strongly linked to our effectiveness at facilitating changes in behavior among targeted audiences. Education research offers tested theories and principles for how to assist individuals to think critically about new issues and/or to effect change. These principles, as found in areas of study such as *environmental education*, *communication, social marketing*, and *diffusion of innovation theory*, are the basis for the human dimensions work that has gained much attention within USDA Cooperative Extension and other natural resource agencies over the last few years. We anticipated that Symposium findings and recommendations, combined with resources from our Water Outreach Education Project, would help educators more effectively guide water organizations and agencies to integrate the use of BEPs into water management strategies.

The Symposium was one of five major objectives of a large national initiative, the Water Outreach Education Project, which provides tools for helping natural resource professionals choose and use education principles more easily and effectively. Project activities synthesized the applicable education theories and principles into simplified language; made BEP recommendations for target audiences; collected water education materials that correspond to instructional strategies and the Cooperative Extension's water management topics; and developed the pilot National Extension Water Outreach Education Web site (http://wateroutreach.uwex.edu) to provide access to our work.

We held this national symposium to:

1. Advance the dialogue about best practices for water outreach education.
2. Introduce Water Outreach Project products.
3. Showcase current water management research that illustrates our BEP recommendations.
4. Engage national Extension water quality coordinators and key stakeholders in fine-tuning Project products and marketing plans.

Presentations covered research about audience specific BEPs, case studies about successful application of BEPs, and topic-specific water outreach resources. Throughout a variety of Symposium activities, we expected participants to demonstrate their knowledge of BEPs and how to apply them, and to recognize that how BEPs are applied could contribute to achieving a water management strategy. In return, we expected that participants would help identify and analyze gaps in BEPs for target audiences. They were asked to make recommendations for future work to facilitate the use of BEPs, to develop BEPs for underserved target audiences, and to increase broad recognition of the value of education to water management strategies. Finally, we asked participants to use their understanding to advise us about the Water Outreach Education Web site design and content. These proceedings represent the review and analysis of the thinking and discussion that occurred.

Since the Symposium, we have worked, and will continue to work, to implement suggestions solicited through Symposium evaluations of the Water Outreach Web site and of the project in general. We look to Symposium participants to build on their connection with this project to promote use of BEPs among natural resources professionals in their organizations and to become conduits for collection of additional target audience case study resources. Eventually, through promotion of the Symposium outcomes and other project products, we expect agency partners to provide institutional support/funding for application of BEPs within their own work.

PLANNING COMMITTEE

Members of the BEP Project Advisory Team helped plan Symposium goals and objectives, and participated as presenters and facilitators during the event. We thank them for their hard work and good cheer throughout.

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Kate Reilly, Project Coordinator and Outreach Specialist

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AGENDA

Wednesday, June 2, 4:30 – 9:00 PM

Welcome

Keynote Address: *Education – An Essential Ingredient for Successful Water Management*
Kevin Coyle, President of National Environmental Education Training Foundation (NEETF)

Dessert Reception and Poster Viewing

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Thursday, June 3, 7:30 AM – 5:30 PM

Plenary Welcome and Orientation: *Defining BEPs: What Are Good, Better, and Best Practices?*

Case Study Presentation: *Making Our Nonpoint Source Pollution Programs Effective*
Andy Yencha, Coordinator, Multi-Agency Land and Water Education Grant Program, UW Extension and WI DNR, and Kevan Klingberg, UW Extension Discovery Farms Program

Panel Discussion: *Framing the Dialogue - BEP Target Audience Success Stories*

Breakout Session: *Critical Thinking about BEPs in Water Outreach*

Plenary Session: *Introducing and Demonstrating BEP Project Products*

Lunch and Poster Presentations: Review posters for target audience education practice and measures of success.

Research Presentations: *Audience Specific BEPs*

Breakout Session: *Gap Analysis of Target Audience BEPs*

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Friday, June 4, 7:30 AM – 1:30 PM

Plenary Panels: *Moving Water Education to the Forefront of Water Management Strategies*

Panel Discussion: *Report on Target Audience Research Gaps*

Panel Discussion: *Promotion and Communication: Moving Water Outreach and Education from Backwater to Mainstream*

Plenary Activity: *Promoting BEP's – Challenges for Future Action*

- Refining and Promoting Project Products
- Building a Plan to Add Resources to the Web Site
- Recommending Future Actions

Lunch and Closing Address:
Education - Is It an Essential Ingredient for Community-Based Water Management?
Closing Speaker: Cornelia Flora, Charles F. Curtiss Distinguished Professor of Agriculture and Sociology and Director of the North Central Regional Center for Rural Development, Iowa State University

EXECUTIVE SUMMARY

I. Symposium Purpose and Process

Natural resource professionals apply best *management* practices (BMPs) when planning water management strategies because BMPs are time-tested and have been shown to be successful. Similarly, when best *education* practices (BEPs) are applied in outreach efforts, the resulting education can be an effective tool for accomplishing water management objectives. This, according to Symposium Keynote Speaker, Kevin Coyle, "… is because there is a growing body of evidence that education works in a practical sense and produces results both by itself, and as an added measure, in the larger natural resource and water management arenas." Mr. Coyle emphasized that *education* is needed as part of the current scenario of water management because:

- Water management principles and practices are complex, and that complexity is rapidly increasing.
- Complex surface and groundwater dynamics at the urban-rural interface impact how water stewardship is shared among groups of people.
- Citizen knowledge of environmental subjects, including how water bodies become polluted, is relatively low.

The Best Education Practices Symposium was a working meeting attended by 93 participants from 31 states and a Canadian province. These educators included national Extension water quality coordinators and key stakeholders who contributed to the Symposium by attending a combination of panel and paper presentations, small and large group discussion sessions, poster viewing, and Web site evaluation. The Symposium explored the application of BEPs and investigated ways educators can help guide water organizations and agencies to integrate the use of BEPs into water management strategies more effectively. We looked to these educators to consider complex questions such as:

- Can we achieve improved water management without stronger education?
- Does the information to be imparted require simple awareness or deeper education?
- Should educators focus their work on community leaders and "influentials"?

We also asked presenters and participants to consider BEPs as they helped us to identify what we know about audiences of particular interest to water educators and to identify gaps in our knowledge about target audiences.

To organize the Symposium agenda, the presentations were set up to highlight target audiences in one of three groupings:

Group One:	Farmers, decision makers, leaders, and community organizations
Group Two:	Households, neighborhoods, and landowners
Group Three:	Youth, youth educators, and volunteers

Post-symposium analysis of the presentations unveiled additional audiences and led us to regroup our findings into the following nine categories:

- Conservation professionals
- Decision makers, leaders, and community groups
- Ethnic groups
- Farmers, producers
- Households and neighborhoods
- Landowners
- Recreational water users
- Volunteers
- Youth and youth educators

II. Recommendations

The Symposium planning committee developed an iterative series of discussion questions designed to provide participants with a framework for analyzing their experiences after each major segment of the Symposium. After some initial "warm up" discussions, participant responses to each discussion were recorded. The results are summarized in this report.

Participant recommendations address seven areas of emphasis:

- Understand the BEP concept itself.
- Apply BEPs for target audiences.
- Integrate the use of BEPs into water management.
- Advise funders and policy makers about BEPs.
- Make water education and actions part of the mainstream of community life.
- Understand why structures and actions are in place that lead to ecosystem degradation and identify the best ways to change those structures and actions.
- Consider BEPs as critical components of a water management strategy.

Recommendations are too numerous to list in the Executive Summary, but highlights are identified below. Audience BEPs and participant recommendations are provided in further detail in the "Symposium Summary and Findings" section (p. 13).

Understand the BEP concept itself.

Throughout symposium presentations, participants were asked to judge whether proposed education or outreach strategies applied BEPs. This led to critical thinking among participants about the BEP concept itself. Participants recommended that educators:

- Improve our understanding about the need for gathering exemplary practices; identify professional development needs and strategies that will improve outreach effectiveness.
- Build a common understanding of BEPs, and especially, find a way to articulate the theory that supports the practice in the minds of the practitioner.
- Promote rigorous social science research and evaluation methods to build the body of literature about and for BEPs.
- Identify BEPs through research and test them in practice.

Apply BEPs for target audiences.

The Proceedings editors sorted presentation findings according to the nine audiences selected for Symposium attention, and by six themes: *audience information*, *message content*, *message delivery vehicle*, *outreach strategies and methods for teaching*, *supporting and motivating professionals*, and *evaluation*. The editors incorporated participant comments, along with their own review, to identify gaps in our knowledge about applying BEPs with these target audiences.

Strengths in presentation findings
Research and case studies provided:

- Gems of advice for each of nine featured audiences and for six themes, indicating a strong understanding about effective techniques among outreach professionals.
- Comprehensive BEPs for outreach with *households* and *neighborhoods*.
- Comprehensive BEPs about *outreach strategies and methods for teaching*, for all nine audiences.
- Combined recommendations for each audience to provide a more holistic picture of water outreach that enables us to see what works with specific audiences.

Gaps in presentation findings
Research and case studies did not address:

- BEPs for landowners, recreational water users, and volunteers.
- BEPs for the outreach themes: *message content*, and *supporting and motivating professionals*.
- Studies about scientists, hydrologists, and engineers as partners for collaborative learning about water; groundskeepers and facilities managers; planners and design professionals; policy makers and influentials; socio-economically underserved; minorities; recreational water users; ranchers and irrigators.

Integrate the use of BEPs into water management.

Based on their Symposium experiences, participants made recommendations for how to move water education to the forefront of water management strategies and how to promote BEPs in their work.

- Encourage education-related professional development among natural resource professionals or "accidental educators."
- Analyze project focus on education, as opposed to communication or community development, and our assumptions about "good," "better," and "best" education. Be open to new visions.
- Acknowledge cultural differences within BEP recommendations.
- Clearly link social marketing concepts to BEP recommendations.
- Provide models of successful BEP applications (models for how to go from *good* to *best*) as well as evaluation templates.
- Provide more training, networking, and work groups.
- Investigate long-term evaluation of changes achieved by applying BEPs.
- Encourage representatives from federal agencies and national program leaders from USDA Cooperative Extension to investigate concepts proposed in the Symposium.

Advise funders and policy makers about BEPs.

An important element of integrating BEPs into water management relies on decisions by funders and policy makers. The following "top ten" list of recommendations is a synopsis of about 75 participant responses:

- Education or outreach programs, if based on sound education principles, lead to citizens who know how to make informed decisions and will take actions that have a positive or desired impact on the community.

- Clearly state *the issue*, or provide detail about the issue, that would benefit from attention by outreach or education.
- Ask questions before funding. Clearly state *the standard* required for each educational strategy, practice, or program.
  - Ask what combinations of BEPs are proposed?
  - How does the grantee defend or support the use of BEPs?
- Post education practice standards so that educators can compare their programs to see if they are meeting standards.
- Reach out to audiences beyond youth, farmers and households.
- Identify the target audience. Market segmentation research and identification of relevant BEPs provides “more bang for the buck.”
- Study audiences carefully, including the influential leaders among target audience members. Train educators to address what the target audience knows and needs to know, and to require quality programs and methodology.
- Share BEPs for specific audiences among agencies.
- Stay the course. It takes time for outcomes to occur.
- Accept behavioral change resulting from BEPs as a proxy for future water quality improvements.

Make water education and actions part of the mainstream of community life.

Effectively integrating water education into water management strategies requires educators and their supervisors to take time to address the bigger picture.

- Value a team effort and coordinate the team through a variety of activities.
- Establish baseline information about water education needs to improve ability to show progress and to help establish outreach priorities.
- Build citizen and group skills to ask the right questions.
- Provide avenues for communication among groups.
- Build program acceptability, especially through encouraging decision makers and partners to tell the story of the program and to publicize impacts.

Understand why structures and actions are in place that lead to ecosystem degradation: Identify the best ways to change those structures and actions.

This is a challenging perspective for educators who are more familiar with the comfortable role of the neutral or a focus on providing “awareness” or “personal steps.” Exactly how the application of BEPs meshes with an understanding of societal structures is the subject for another symposium. What we can do now is to perform well within the structures and settings where citizens or democratic rule have provided clear goals for change or improvement.

Consider BEPs as critical components of a water management strategy.

“Is education an essential ingredient for community-based water management?” This question was answered with a resounding YES from Symposium speakers and participants:

- Participants provided examples of BEPs in practice with specific audiences, and they provided recommendations for building the BEP concept and promoting the use of BEPs.
- Suggestions for new directions include the following:

- Refine the concept of BEP.
- Encourage and disseminate research-based information about target audiences.
- Provide training and networking among water educators.
- Promote the value of applying BEPs among agencies and funders.
- Provide models and evaluation templates for measuring whether we have achieved BEPs and to determine if they have the effect we predict.

Symposium activities also produced recommendations for how to work most effectively with the nine target audiences listed above. BEPs were identified for each of these audiences. Findings were also grouped across audiences to describe effective strategies for each of six important outreach themes:

- Audience information
- Message content
- Message delivery vehicle
- Outreach strategy/method of teaching
- Supporting and motivating professionals
- Evaluation

Detailed recommendations for outreach themes can be found on page 25 of the "Symposium Summary and Findings" section.

SYMPOSIUM SUMMARY AND FINDINGS

I. Framing the Dialogue

The Best Education Practices Symposium engaged national Extension Water Quality Program coordinators and key stakeholders in investigating ways educators can help water organizations and agencies integrate Best Education Practices (BEPs) more effectively into management strategies. This working meeting brought together 93 participants from 31 states and a Canadian province. The group included:

- Agency educators
- Extension educators
- Extension National Water Quality Program coordinators
- Natural resources professionals
- U.S. EPA staff
- Water education providers
- Agriculture and recreational business
- Decision makers
- Representatives of proposed target audiences
- Policy makers
- University/College researchers
- Water organizations

We invited presenters and participants to reflect on the BEP concept, to highlight what we know about audiences of particular interest to water educators, and to identify gaps in our knowledge about selected audiences. We organized a combination of panel and paper presentations, small and large group discussion sessions, poster viewing, and Web site evaluation to inspire thought and discussion. We looked to these educators to consider complex ideas and questions:

- Can we achieve improved water management without stronger education?
- Does the information to be imparted require simple awareness or deeper education?
- Should educators focus their work on community leaders and "influentials"?

Searching for New Ideas

The Water Outreach Education Project collects audience-specific BEPs and topic-specific water outreach resources. Expansion of the collection hinges on identification of relevant research, discovery of links to published information about water management topics, and access to case studies that demonstrate BEPs. The Symposium provided one opportunity to build the collection and to learn about new ideas that may have been tested, but where findings were not published.

Our search for Symposium presentations on audience specific BEPs started with a national call for research papers and target audience case studies. We sought:

- <u>Papers</u> that reviewed and summarized multiple studies of audience-specific BEPs
- <u>Papers or posters</u> that reported on research about audience-specific BEPs
- <u>Posters</u> that described a case study where BEPs have been applied

We looked for papers and posters about research that focused on identifying BEPs for one of the target audiences listed in Table 1. We also sought case studies that referred to an education/ outreach purpose, one of the theories that contribute to BEPs, or both, as described in Table 1. Some authors were specifically invited to submit paper proposals.

Proposed abstracts were subjected to a rigorous review by the planning committee. Symposium paper and poster presentations were eventually selected to showcase water management research projects and programs that have successfully incorporated BEPs with target audiences. These presentations provided the foundation of our Symposium discussions.

Panel presentations also contributed to information that participants used to help guide recommendations. Panelists were personally invited based on their work that specifically related to Symposium goals and criteria for excellence. Panel content is also integrated into Symposium findings.

The papers and poster abstracts are provided in the second part of these Proceedings, along with PowerPoint slides from the panel presentations. All Symposium content, including these Proceedings and conference posters are available on the National Extension Water Outreach Education Web site, http://wateroutreach.uwex.edu.

Table 1. *Paper and Poster Solicitation Criteria: Did the work address one or more of the following?*

Audiences	Purposes	Theories Contributing to BEPs
Local Decision and Policy Makers Agency Partners Industrial Water Users Recreational Water Users Recreational Businesses (water-related) Retailers of Water Recreation Equipment Agricultural Commodity Groups Farmers Landowners Households Homeowners Neighborhood Organizations Service Clubs Environmental/Conservation Nongovernmental Organizations Soil and Water Conservation Districts Specific Ethnic Groups	Information (one way) Communication (two way) Education (formalized process with a goal) Capacity building (community management of the environment)	Development Theory Principles of Adult Education Principles of Youth Education Technology Transfer and Diffusion of Innovation Social Marketing Civic Empowerment Communication Leadership Citizen Participation/Community Involvement Non-economic Social Sciences

An Overview of Outreach Education and Best Education Practices (BEPs)

> *Outreach education relies on the existence of a body of knowledge, which is not only transferred to the individual but is instrumental in transforming the individual. In other words, the individual has to actively receive the knowledge and know how to use it* (Andrews, 2000).

Underlying the questions that Symposium participants were asked to explore is the need for a fundamental understanding of what is meant by *outreach*, and specifically outreach undertaken for the purpose of improving citizen stewardship and management of water. Cooperative Extension, government agencies, and water educators have been grappling with this question for a decade of meetings, symposia, and conference presentations (e.g. Andrews, Hawthorne, & Pickering, 1996). Discussions have led to broad agreement that sophisticated outreach initiatives are important to water management, and that outreach planning that follows key steps increases the likelihood of a successful effort.

This advice from the U.S. Environmental Protection Agency's (EPA) *Getting in Step* characterizes the relationship between water management and outreach.

> Watershed citizens must be informed about basic water quality problems. Stakeholders must be told about the process and encouraged to get involved. Elected officials will want to know what's happening and how they can support the initiative. And, finally, those who are contributing to water quality degradation by engaging in practices that increase polluted runoff will need to be informed, engaged, and motivated to adopt more appropriate behaviors.
>
> As you progress through your watershed management process, your outreach objectives and activities will change. For example, during the early stages it might be necessary to generate basic awareness on watershed issues, but as problems are identified your objectives will focus on educating your target audiences on the causes of the problems. Finally, during the implementation phase of your watershed planning and management process, your objectives will focus on action by your target audience to reduce adverse water quality impacts (MacPherson & Tonning, 2003).

As indicated in the quote above, designing effective outreach education depends on following steps that have been outlined by experienced educators, such as those listed in Table 2. These planning tips both include and imply the use of BEPs, particularly as they focus on selecting and understanding one or more target audiences, engaging the audience in planning, and matching education activities to audience needs.

Preparation for the Symposium included clarifying what we meant by "best education practices" and planning Symposium activities that would allow us to consider in more detail the potential for education to impact water management. We shared our thinking with Symposium participants, both to provide a foundation for their work during the Symposium and to ask them to critique our thinking.

Table 2. *Tips for Planning*

1.Determine the type of outreach or education effort that you will emphasize:
- Provide information
- Educate
- Communicate
- Build capacity

2. Familiarize yourself with the "community of interest." Link your effort to local issues and activities.
3. Assess and define the target audience(s).
4. Define clear goals and objectives in cooperation with stakeholders and target audience.
5. Inventory resources and constraints, and adapt your initiative to capitalize on results.
6. Design your initiative with a focus on your goals, audience characteristics, and resources.
   - Match to resources and audience characteristics.
   - Identify education or outreach knowledge areas relevant to the topic and use BEPs for each.
   - Actively engage target audience.
7. Pilot test and modify.
8. Implement, deliver, or disseminate.
9. Evaluate and revise.

Education – An Essential Ingredient for Successful Water Management

To kick off the Symposium, we invited Kevin Coyle, President of the National Environmental Education and Training Foundation (NEETF), to paint a broad picture of the need for quality water education. Mr. Coyle's presentation was based on findings from years of Foundation investment in understanding and promoting citizen environmental literacy.

Mr. Coyle emphasized that reports and studies support the idea that it is possible to extend the concept of Best Management Practices to education because there is a "growing body of evidence that education works in a practical sense and produces results both by itself and as an added measure in the larger natural resource and water management arenas." Education is needed as part of the current scenario of water management because:

- Water management principles and practices are complex and that complexity is rapidly increasing.
- Complex surface and groundwater dynamics at the urban-rural interface impact how water quantity and water quality stewardship is shared among groups of people.
- Citizen knowledge of environmental subjects, including how water bodies become polluted, is relatively low.

Mr. Coyle described three levels of learning about the environment that lead to three levels of impact. Learning at the *awareness* level can lead to public support, but lack of understanding of details can foster misunderstandings. Learning at the *personal steps* level has been shown to change behavior, but may not be durable. This type of knowledge needs constant updating and reminders. Learning at the *literacy* level means knowing and understanding underlying environmental principles, and being able to analyze and apply them. One potential goal for outreach education is to build environmental literacy among community "influentials" who are actively involved in the community and "constantly making decisions on every aspect of community life."

NEETF funded research suggests several questions that educators could ask to determine whether their initiatives have the potential for success. The following points, as outlined in the keynote address, could contribute to assessing the quality of BEPs for water outreach.

1. Can we achieve improved water management without stronger education?
2. Does the information to be imparted require simple awareness or deeper education?
3. Do the BEPs that are delivered adhere to other basic rules of pedagogy?
4. Does the instruction teach skills and application?
5. Will BEPs aim at community leaders or "influentials"?

Target Audiences and "Best" Education Practices

We constructed the Symposium to allow participants to answer questions, like those posed by Mr. Coyle, as they delved into details about effective use of education practices in outreach initiatives. We asked participants to help us assess the use of *best* education practices, with a particular emphasis on how well presenters seemed to understand and apply information about the *target audience* in their outreach plan.

As we focused on **target audiences** we were referring to a segment of the population that has a *specific opportunity to take action* on the identified problem, or to a group *specifically affected* by the identified problem. For example, the target audience for our Water Outreach Education Project is natural resource management and outreach professionals. We invited *our* target audience to help us review project products and help guide project recommendations. Research and case studies presented at the Symposium summarized results of work with one or more specific audiences.

In general, to find out whether an education technique is a *best* practice, we apply a selected education technique and study the outcome using research methodologies. A best practice is one that is shown to be equally effective in multiple cases with like audiences.

To call an education practice a *best education practice* is to say that it is better than all other practices to which it has been compared using some standard or criterion of comparison. To fully specify the relative quality of a practice requires that its value be described in the educative context. Not only must the claims of "best education practice" be shown to hold in comparison to other practices, the claim must narrow its recommendations to also describe the contexts and audiences for which the practice is shown to be the best. Therefore, all claims that an education practice is a best education practice require consideration of the following questions:

- Relative to what?
- In what circumstance?
- With what audience?

To the extent that research-based information is available, the Water Outreach Education Project strives to present *best* practices. Where research-based information is not available, we have worked to identify case studies and the best available information, or *good* practices. *Good* practices are widely established practices, applied by experienced educators, but which may not have been subjected to researched comparisons. Table 3 lists the definitions of good, better, and best education practices used in the Water Outreach Education Project.

We undertook the Symposium and a related project, a target audience literature review, because of our perception that there is a gap in the assessment of the application of education practices with target audiences of strategic interest to water educators. While many environmental education research papers recommend education practices, few of these papers focus on adult audiences, and few identify education practices that are best for specific audience groups. Few resource management papers test specific education practices, relying instead on the admonition that good resource management needs to be accompanied by outreach to the public or to a target audience.

In our call for research papers, we looked specifically for research that applied outreach and education practices with target audiences that are not well represented in the literature: farmers, producers, local decision makers, policy makers, households, neighborhoods and landowners. Published studies about youth water outreach education are more common, but invited Symposium papers summarized unique developments for work with youth audiences. We planned to integrate Symposium research paper findings with other project research findings.

Table 3. *Definitions of Good, Better, and Best Education Practices*

Good Education Practice	An education practice that yields desired outcomes when applied under a certain set of conditions with the appropriate audience (after Holsman, 2001, p. 2).
Better Education Practice	A good education practice that has been shown, through research, critical reflection, or both, to be more effective in achieving intended changes than some other education practice or practices.
Best Education Practice (BEP)	"…a program or practice that has been clearly defined, refined through repeated delivery, and supported by a substantial body of research" (Fedler, 2001, p. 7).

Essential Best Education Practices

Prior to the Symposium, we summarized an extensive review of education theory in a form we call *Essential Best Education Practices* (See Appendix A, p. 35). These are important not only because they provide a digest of a lot of research about how people learn, but also because we can use them as a guide for comparing target audience findings.

Essential Best Education Practices address typical educator challenges for generalized or broad audiences:

- Every education or learning situation
- The individual
- The class or group
- Web-based learning
- The community
- Beyond the community

This list of essential practices was derived primarily from references that summarized major ideas from many authors in the fields they describe. Sources include, for example, the American Distance Education Consortium's *ADEC Guiding Principles for Distance Teaching and Learning* (2003) and the American Psychological Association Board of Educational Affairs' *Learner-Centered Psychological Principles* (1997).

We present these practices as a foundation that outreach professionals can use to gauge what they know and don't know about how to create effective education strategies. The *Essential BEPs* help professionals determine design considerations to improve their efforts in "transforming" individuals in their target audience so that they are able to use new information and skills.

Research about outreach with target audiences amplifies these theoretical findings with concrete examples. During the Symposium, participants practiced the process of identifying BEPs from theory and research. This experience contributed to participant ability to develop advice about project initiatives.

Participant Activities

The three-day Symposium was designed to include a combination of panel and paper presentations, small and large group discussion sessions, poster viewing, and Web site evaluation. The Symposium planning committee developed an iterative series of discussion questions designed to provide participants with a framework for analyzing their experiences after each major segment of the Symposium. After some initial "warm up" discussions, participants' responses to each discussion were recorded. The results are summarized in this report.

Group Activities and Discussion

We invited symposium papers, posters, panelists and speakers to help us do two things:

1. Identify what we know about audiences of particular interest to water educators.
2. Identify gaps in our knowledge about target audiences. Symposium presentations highlighted audiences in one of three groupings:

   Group 1: Farmers, decision makers, leaders, and community organizations
   Group 2: Households, neighborhoods, and landowners
   Group 3: Youth, youth educators, and volunteers

Post-symposium analysis of the presentations unveiled additional audiences and led us to regroup our findings into the following nine categories:

- Conservation professionals
- Decision makers, leaders, and community groups
- Ethnic groups
- Farmers, producers
- Households and neighborhoods
- Landowners
- Recreational water users
- Volunteers
- Youth and youth educators

Speakers and panelists were also asked to make their presentations in such a way as to build participant skills. Their objectives were to help participants:

- Identify the target audience(s) for any outreach activity.
- Identify the type of education practice that is or could be used with the target audience.

- Determine whether the education practice is a good, better, or best practice based on whether the practice has been repeatedly tested and evaluated.
- Identify standards/benchmarks for measuring the success of any particular education practice.

To begin each day of the Symposium, we engaged one or more well-know water outreach educators to help participants focus their thinking about the quality and content of the Web site, about marketing Web site tools, and about providing advice for policy development.

Participants then listened to presentations, viewed posters, and read abstracts to help develop recommendations regarding strengths and gaps for audience information. Their recommendations about missing audiences, barriers to studying audiences or best practices, and advice to funders and policy makers about best practices are reported later in this summary.

We launched the first full-day by asking participants to reflect about good, better, or best education practices. A case study that incorporated each of the four features of our proposed model (above) set the stage for discussion about BEPs. *Making Our Nonpoint Source Pollution Programs Effective*, the featured case study presentation, described results from a water outreach research project that have been used to guide Wisconsin education efforts (Shepard, 1999).

> The study compared the rate of adoption of nutrient management strategies by farmers in two Wisconsin watersheds over the same five-year period. The educator for one watershed relied on a diffuse communication campaign; the educator for the other relied on one-on-one information transfer techniques. Results supported use of a diverse set of educational approaches and discouraged over-reliance on diffuse information dissemination. Guidance from these findings has been incorporated in forty Wisconsin projects working with over three hundred farmers. Each project uses a comprehensive pre-survey to help segment the audience, followed by conservation planning, soil tests, workshops, and farm visits by educators during the growing season.

Following the plenary, a panel focused on the target audience portion of the outreach equation. Panelists included representatives from two nongovernmental organizations, and two state natural resources agencies. The audiences for their work included youth, county soil and water conservation professionals, businesses, industry, and agency water education professionals. Panel presentations show-cased a variety of techniques for working with these selected target audiences.

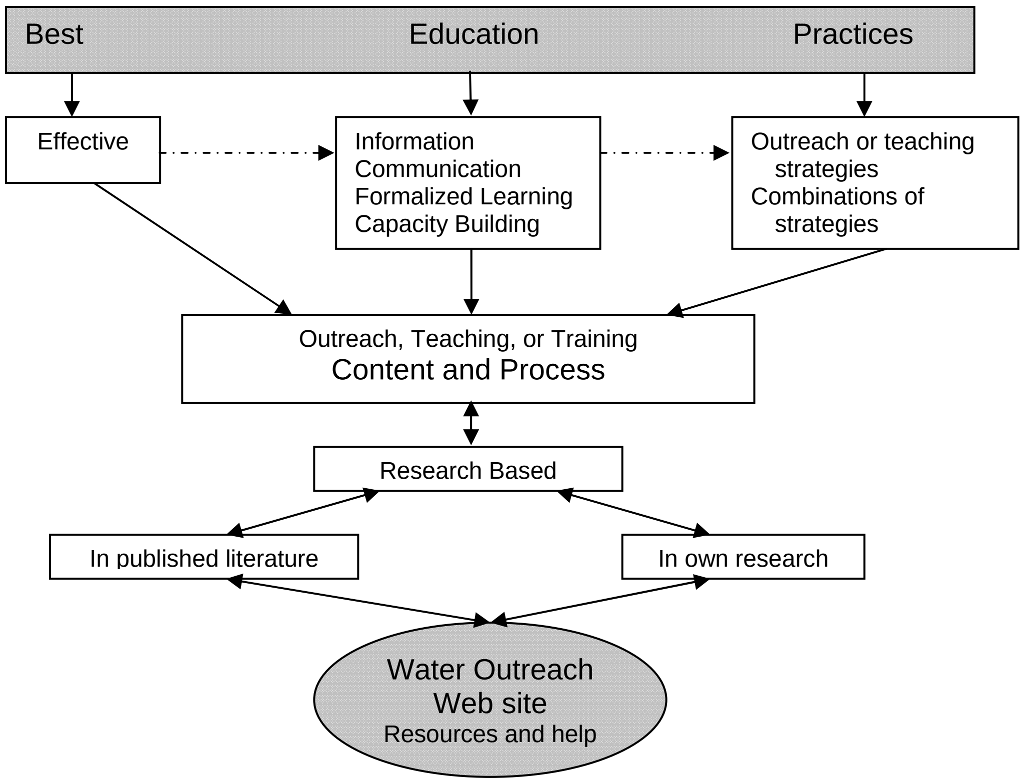
We followed the panel with a small group session where participants were asked to reflect on their own situation. Participants summarized education practices that they used in their work; talked about whether they thought the practices were good, better, or best practices, according to our definitions; and explained how they made their determination. This led to some lively discussions.

Participants spent the remainder of the first full-day reviewing posters and the Web site, attending paper presentations, and participating in a small group discussion about gaps in target audience research. The second day focused on participant response to paper, poster, and panel presentations. Based on their Symposium experiences, participants considered how to move water education to the forefront of water management strategies and how to promote BEPs in our work.

Response to the BEP Framework

Participant discussion groups deconstructed BEPs to mean: Effective – Information, Communication, Formalized Learning, or Capacity Building – Practices, as illustrated in Figure 1. “Practices” refer to application of a teaching or outreach practice, or a combination of practices. Resources on the Water Outreach Education Web site contribute to the educator’s ability to use BEPs, but are also built by educator research and case study applications.

Figure 1. The Best Education Practices concept, deconstructed



Participants also identified a number of questions about applying BEPs, which are listed in Table 4. These are considered in the Symposium recommendations.

Target Audience Case Studies

The 51 presentations made throughout the Symposium are summarized by category in Table 5. Research papers, poster papers and abstracts, and panel presentation slides are provided in the printed proceedings and on the Water Outreach Education Web site, http://wateroutreach.uwex.edu. Symposium posters are only available for viewing on the Web site.

Table 4. *Participant Questions about the Concept of Best Education Practices (BEPs)*

1) How do we and where do we find BEPs?
2) How do we move our work from good to best?
   a) Encourage projects to publish outcomes and impacts: Contribute to the profession of water outreach and education.
   b) Provide administrative support.
   c) Disseminate research standards.
   d) Provide resources for quality education – time, money, staff.
3) Can we take the BEP concept to the next step and develop a model that frames "best" for program planning and implementation?
4) How do we sustain education programs through changes in budgets, government, etc.? Is that part of the "best" model?
5) How do we decide when to apply BEPs? Consider:
   a) How the quality of the practice is determined
   b) How the practice should be delivered
   c) How the practice relates to:
      i) Audience
      ii) Strategies
      iii) Accessibility
      iv) Context
      v) Efficiency
   d) Whether the practice has long-term applicability, based on its:
      i) Flexibility
      ii) Adaptability
      iii) Replicability
      iv) Sustainability
      v) Life cycle

Table 5. *Symposium Presentation Types*

Presentation Type	Number of presentations
Research paper	17
Poster	19
Poster paper	6
Panel presentation	9
TOTAL	**51**

After the Symposium, presentation highlights and target audience recommended practices were compiled for every Symposium paper, poster, and panel presentation (Appendix B). The editors applied the meta-analysis process developed for our target audience literature review to interpret data from the research and case studies presented (Stevens & Andrews, 2006). Recommended practices represent a collection of good, better, and best education practices, based on Table 3 definitions.

We also looked at each paper, poster, and panel presentation for specific recommendations related to the water outreach planning *themes*. These themes are listed below. Analysis by theme is described later in this report.

Water Outreach planning themes:

- Audience information
- Message content
- Message delivery vehicle (a special case of outreach strategy)
- Outreach strategy/method of teaching
- Supporting and motivating professionals
- Evaluation

Evaluating the Water Outreach Web Site Resources, Beta version

The National Extension Water Outreach Education Web site, http://wateroutreach.uwex.edu, includes resources that create access to, build on, and link to education research, water management research, and water management information. Project activities focus on building a repository of audience-specific BEPs, and on providing access to those and to other water education resources. Recommended BEPs integrate education theory and water management research, and answer questions about effective water outreach practices.

Over the course of the Symposium, participants were invited to investigate Web site resources and organization. In addition to a large group feedback opportunity on the last day of the Symposium, participants were asked to complete a Web site evaluation. Appendix C (p. 61) provides details about Web site content. Findings were used to revise the draft Web site.

II. Presentation Analysis and Target Audience Recommendations

To identify and explore strengths and gaps in target audience information, the editors applied a meta-analysis process developed for our target audience literature search (Stevens & Andrews, 2006). Presentation highlights and the resulting education recommendations are summarized in Appendix B, p. 39. We then sorted presentation descriptions and recommendations from Appendix B in two ways. Tables 7-15 (Appendix D, p. 63) summarize recommendations by audience for each of nine audiences featured in symposium presentations. Tables 16-22 (Appendix E, p. 75) reconfigure the arrangement, presenting recommendations according to the six outreach themes.

Recommendations by audience

Recommendations for *households* and *neighborhoods* provide the most comprehensive advice of all the groups gathered for the Symposium (Table 11, p. 68). Recommendations for *landowners*, *recreational water users*, and *volunteers* were informative, but were the least comprehensive because there were fewer presentations for these audiences (Tables 12, 13, and 14, pp. 70-72). The lack of Symposium recommendations for these three audiences could be interpreted as a gap, since these audiences were listed in the call for presentations and proposals on these topics were carefully considered by the selection committee (although *volunteers* were not singled out by name from broader categories of organizations and clubs).

A Summary of Recommendations for Each Target Audience

(See Appendix D, p. 63, for a full description of recommendations for each audience studied.)

Conservation professionals

Provide professionals with autonomy in determining content and timing for their own training and enable them to personalize their training objectives. Direct application to work responsibilities, networking, and moral support are keys to learning new outreach or education skills for this audience. (Table 7, p. 64)

Decision makers, leaders, and community groups

Use the internet to provide leaders with access to data and relevant interpretations. Encourage community groups to develop their own environmental assessments and to develop their own outreach strategies. Build community-wide program acceptability. (Table 8, p. 65)

Ethnic groups

Carefully identify education needs that are specific to the group. Apply *place-based* teaching strategies so that education has a direct bearing on the well-being of the places people actually inhabit. (Table 9, p. 66)

Farmers, producers

Emphasize local, direct farmer contact. Use in-depth discussion and interviews to learn about farmer interests and management preferences. (Table 10, p. 67)

Households and neighborhoods

Generate local and detailed information about audience attitudes, interests, and needs with the help of a regional team, if available. Support and rely on stakeholder groups that already have a relationship with the target audience. Test education materials for their applicability with the audience of interest. Provide practical techniques and home assessments for households to apply with help from a trained volunteer to develop new practices. (Table 11, p. 68)

Landowners

Provide landowners with hands-on, practical training in a supportive atmosphere. (Table 12, p. 70)

Recreational water users

Train recreation professionals about water management in collaboration with their professional associations. (Table 13, p. 71)

Volunteers

Tell the story of the program and publicize impacts. (Table 14, p. 72)

Youth and youth educators

Use education materials that are relevant and easy to adapt to the school situation. Use field-based and service-learning experiences to provide problem-solving experiences, interaction with real things, learning that can be applied throughout life, and practice for environmentally responsible behaviors. (Table 15, p. 73)

Recommendations by theme

In Tables 16-22 (Appendix E, p. 75), we sort presentation recommendations by six themes. These themes also either encompass or describe BEPs. This enables us to look broadly at the type of advice available for the educator. Most presentation recommendations address the theme *outreach strategies and methods of teaching* (Tables 19 and 20). Recommendations for *message content* and *supporting and motivating professionals* were the least comprehensive, although informative (Tables 17 and 21). The lack of Symposium recommendations for these themes could be interpreted as a gap. For each of the other three themes there were recommendations for at least four of the nine audiences.

A Summary of Recommendations for Each Theme

(See Appendix E, p. 75, for a full description of recommendations summarized by theme.)

Audience information

Prior to designing the program, implement a system to investigate the interests and needs of the stakeholders and target audience. Tailor materials to address identified needs. Identify barriers and benefits to recommended behaviors. (Table 16, p. 76)

Message content

Provide clear messages that have immediate utility for the program goal. Assure that different groups and agencies provide consistent messages. (Table 17, p. 77)

Message delivery vehicle

Message vehicles may be people, opportunities, or things. Work with a collaborative, a professional association, or youth leaders to deliver information. Time a message to coordinate with heightened awareness resulting from other public events. Be creative in delivering messages, through vehicles such as Web sites, youth awards, video and audio communication, handbooks, calendars, plants and landscape design, rain barrels, and bus tours. (Table 18, p. 78)

Outreach strategy/method of teaching

We grouped the large number of findings for this theme into two major subthemes: *outreach design components* and *outreach implementation*. Outreach design (Table 19, p. 79) was further subdivided into quality, stability, access, connection, program, and marketing. Outreach implementation (Table 20, p. 82) was subdivided into management, relevant instructional strategies, and recognition of contributors. Subthemes and divisions were selected based on previous work to outline standard elements of success for this theme and are reported on the Water Outreach Education Web site (National Extension Water Outreach Education. 2004).

The richness of recommendations for all but one design and implementation component, *marketing*, indicates a strong understanding among outreach professionals for effective techniques. Consistent application of these recommendations will influence the quality of efforts.

Supporting and motivating professionals

Build skills among conservation professionals to apply best communication practices. Build skills among land use professionals to ask the right questions. (Table 21, p. 85)

Evaluation

Encourage policy makers and stakeholders to report outcomes. Use follow up visits/calls, comparison crop strips, and pre and post surveys to evaluate impacts. Assure that program resources actually reach the targeted audience. (Table 22, p. 86)

III. Identifying Gaps in Target Audience Research

Goals for the Symposium were: to develop recommendations about the gaps in BEPs for target audiences, to make recommendations for proposed future work to facilitate the use of BEPs, and to increase recognition of the value of education to water management strategies. **This section summarizes gaps in information about target audiences identified by the Proceeding's editors as well as those identified by participants.** A summary of strengths and gaps is followed by broader recommendations for next steps. Discussion also highlighted gaps or needs related to the BEP concept itself. Recommendations relate to the need for professional development about the concept and the need for building the validity of the concept.

Project analysis of gaps

Symposium presentations provided outreach recommendations for nine audiences, broadly representing the sixteen audiences originally identified by the Advisory Committee. We were not successful in finding any presentations about *industrial water users*. Recreational water-related businesses or retailers generated only one study (Waltz). Another study about boating and fishing education (Levin) was comprehensive, but related more closely to other studies and reports about work with conservation educators.

Recommendations also broadly addressed all six outreach themes. Those for *message content* and *supporting and motivating professionals* were the least comprehensive, although informative. Their lack of representation in the work, however, could be interpreted as a gap. Apparently, our hand-picked presenters did not focus their work on these themes. There were recommendations for at least four of the nine audiences for each of the other three themes. The richness of recommendations about *outreach design components* and *outreach implementation* indicates a strong understanding of effective techniques among outreach professionals. Consistent application of these recommendations will influence the quality of efforts.

Even from this limited effort to identify audience-specific recommendations based on recognized education principles, pooled findings created gems of advice for each of the nine featured audiences and for the six themes. Our theory is that these well-grounded recommendations for conducting water outreach have been developing for the last decade or more. This Symposium may be one of a very few times, however, when the wisdom of these water professionals has been combined to create unique advice. **The power of the recommendations lies, in part, in their combination with others for the same audience. Together they provide a more holistic picture of water outreach that enables us to see what works.**

Participant analysis of gaps and recommendations

Following paper and poster presentations, participants were asked to start identifying gaps through small group discussion sessions. We prepared participants by asking them to observe certain features about each poster and paper presentation they attended:

- What audiences did the presentation address?
- What education practices were recommended?
- Were the education practices good, better, or best practices?

Facilitators led small groups through a number of questions about their day-long experience, supporting the group while it processed a large amount of information. We asked facilitators to answer three specific questions in their group report:

1. What audiences are important that were not included in presentations?
2. Why didn't we hear about certain audiences? Are there barriers?
3. What advice would you give to funders and policy makers on how to reach selected target audiences with our BEPs to improve information and understanding of water management strategies?

The BEP concept

Participant discussions led to questions and discussion about the BEP concept itself. Participants developed their own analysis and questions about the concept earlier in the meeting, as presented in Figure 1 (p. 21) and in Table 4 (p. 22). Discussion also produced a number of significant recommendations important for improving our understanding about the need for gathering exemplary practices and important for framing professional development needs and strategies that will improve outreach effectiveness.

Participants' recommendations:

- Build a common understanding of BEPs, and especially, find a way to articulate the theory that supports the practice in the minds of the practitioner.
- Encourage education-related professional development among natural resource professionals, and especially help professionals create clearly defined learning objectives.
- Promote rigorous social science research and evaluation methods to build the body of literature about and for BEPs, including the requirement that claims of cause and effect are well supported.
- Assure that BEPs identified through research are tested in practice.

Missing audiences

Participants identified many audiences they felt were not addressed during the Symposium. This should provide researchers and educators plenty of latitude in thinking about what groups they may have missed in their work. More published studies are needed for:

- *Scientists, hydrologists,* and *engineers,* in their roles as partners for collaborative learning about water
- *Groundskeepers* and *facilities managers,* including city/public works staff, golf course and park managers, and commercial landscape maintenance professionals
- *Planners* and *design professionals,* including architects, engineers, city planners, developers, builders, zoning officials
- *Policy maker*s and *influentials*, including journalists, media, legislators
- *Underserved audiences,* including Latinos, non-English speakers, socioeconomic underserved, minorities
- *Recreational water users,* including anglers, golfers
- *Ranchers* and *irrigators*

Barriers to studying audiences or best practices

Responses to this question went beyond the traditional "not enough time," "not enough money." Time was certainly a concern, but groups also identified lack of professional training, inadequate access to information and research about target audiences, and the fact that there are no BEPs that fit every situation. Participants asked, "How do we make training within our organizations palatable?"

Participants pointed out that state agencies can't keep track of who is being educated and that all the work we do is in a context that is a moving target (as referenced by MacPherson and Tonning [2003] earlier in this section). There was particular interest in stakeholders, both to actively include them and to understand conflicts in their interests. Participants recommend that journalists become partners in the water outreach enterprise, for example. Gaps in information about audiences could be addressed if agency administrators encouraged managers to carry out more rigorous program evaluations.

Advice to funders and policy makers

We didn't ask participants to couch their recommendations in a sound bite, or a one-minute presentation, but the quality of their answers had that effect. Participants identified needs according to several themes.

The following list of "top ten" recommendations is a synopsis of about 75 suggestions participants had for funders and policy makers. The entire list of recommendations is found in Appendix F.

- Education or outreach programs, if based on sound education principles, lead to citizens who know how to make informed decisions and who will take actions that have a positive or desired impact on the community.
- Clearly state *the issue* or provide detail about the issue that would benefit from attention by outreach or education.
- Ask questions before funding. Clearly state *the standard* required for each educational strategy, practice, or program. Ask what combinations of BEPs are proposed? How does the grantee defend or support their use?
- Post education practice standards so that educators can compare their programs to see if they are meeting standards.
- Reach out to audiences beyond youth, farmers, and households.
- Know who the target audience is. Market segmentation research and identification of relevant BEPs to provide "more bang for the buck."
- Study audiences carefully, including the influential leaders. Train educators to address what the target audience knows and needs to know, and require quality programs and methodology.
- Share BEPs for specific audiences among agencies.
- Stay the course: It takes time for outcomes to occur.
- Accept behavioral change resulting from BEPs as a proxy for future water quality improvements.

IV. Challenges for Future Action

We ended the Symposium with a focus on the future from the perspectives of water outreach organizations and agencies, Symposium participants, and a national expert in community-based natural resource management.

Panel Presentations: Facilitating Community Action

To further prepare participants to offer recommendations, we provided one more piece to the outreach puzzle. The last panel session, *Moving Water Outreach and Education from Backwater to Mainstream*, focused on how to apply BEPs for water management in a broader context: How do we make water education and actions part of the mainstream of community life? Panelists provided four examples: Master Watershed Stewards (Godwin); Nonpoint Education for Municipal Officials or NEMO (Liukkonen); a multi-state outreach initiative (Mahler); and USDA Volunteer Water Quality Monitoring National Facilitation Project (Stepenuck).

These presentations offered important insights for how the work of the individual educator relates to the larger questions of making changes in community or group actions. Panelists outlined basic pieces for "making the leap." These included:

- Value a team effort and coordinate the team through a variety of activities.
- Establish baseline information about water education needs to improve ability to show progress and to help establish outreach priorities.
- Build citizen and group skills to ask the right questions.
- Provide avenues for communication among groups.
- Build program acceptability, especially through encouraging decision makers and partners to tell the story of the program and to publicize impacts.

Participants' Advice

Panel presentations were followed by a round-robin opportunity for small groups to provide advice about four points. In this scenario, participants read comments provided by a previous group before adding their own. This reduces duplication and often clarifies points made by an earlier group. The resulting recommendations for each question were superb and are provided as their own resource in Appendix F (p. 87). As we hoped, participants provided a list of suggestions that will keep the project team working hard. We summarize a few main points here.

General comments, suggestions, and reactions to the Symposium

The group agreed with the concept that natural resource professionals, or "accidental educators," need education training. Some went so far as to suggest that a natural resources education master's degree would be useful. There were many discussions about the BEPs themselves. One person suggested renaming the concept, PEPs, for Proven Education Practices in order to provide a more complimentary status for *good* and *better* practices. The group encouraged the Water Outreach Education Project staff to analyze our focus on education, as opposed to communication or community development, and our assumptions about good, better, and best education. Participants also encouraged us to be open to new visions. There was interest in how to acknowledge cultural differences within BEP recommendations and how to link social marketing concepts. Participants requested models of successful BEP applications and examples of how to go from *good* to *best*. The need for *sharing* opportunities also emerged as a theme. Participants suggested regional conferences, regional work groups, and e-mail postings. Finally representatives from federal agencies and national program leaders from USDA Cooperative Extension were encouraged to investigate concepts proposed in the Symposium.

Water Outreach Education Project products: Refinement and promotion

The group viewed the Web site at a draft stage. Following the Symposium, a considerable amount of material was added to the Web site, taking advantage of recommendations where possible. A number of excellent suggestions are, as yet, unmet. Themes from the discussion suggested the following:

- Develop a market plan.
- Provide a discussion or message board, and feed-back opportunities.
- Promote interconnectivity and provide users with a way to ask for help.
- Announce newly updated information on the Web site.
- Add interactive features and condensed histories of lessons learned.
- Enable users to search information by audience, such as youth, urban, farm, and organizations.
- Ask non-educators to review the site for usability.

Submissions for the water education collection

How do we encourage researchers and educators to submit resources to the Web site database? In addition to standard recommendations like working with state water quality coordinators and posting the opportunity in standard journals, participants suggested a number of other ideas that focused on providing submitters with feedback about their efforts. Participants suggest that the call for submissions emphasizes a “What’s in it for me?” message: How will submitting an item help me? Providing a clear message for what is needed would also make it easier for educators to respond. People submitting materials need feedback about their submittal. Suggestions included: a pop-up thank you box; a submission acknowledgement that states the number of the submission (this is submission number 143, etc.); a list of other items in the database similar to the item submitted; a message to the author about the number of “hits” on the item. We were encouraged to use the Project’s WaterEducatorsUSA listserv, https://lists.uwex.edu/mailman/listinfo/watereducatorsusa, to provide a monthly update of topics submitted.

Recommendations for future actions

Comments in this section mirrored the general comments. An emphasis on more training, networking, and work groups emerged. Participants are looking for program models and evaluation templates. They would like training on related topics such as program design tools and techniques, and consensus building. Long term evaluation of changes achieved by applying BEPs is an important next step. In searching for how to describe the experience one participant suggested, philosophically, that a lack of clarity experienced by participants probably reflected a growth process for our profession.

Education: A Key Component of Water Management Strategies

The Symposium was designed to bring a diverse group of experienced outreach professionals together to investigate opportunities for applying BEPs and for improving access to resources for professional development. Following a day and a half of critiquing exemplary programs and philosophizing, it was time to bring the discussion back to the concrete challenge about whether education is an essential ingredient for community-based water management. Kevin Coyle kicked off the Symposium by affirming the relevance of water education and by providing some checks that educators could use for answering this question. In the closing address, *Education – Is It an Essential Ingredient for Community-Based Water Management?*, Dr. Cornelia Butler Flora provided a final opportunity to explore how education can play a pivotal role.

Dr. Butler framed her recommendations in terms of *capitals*: natural, cultural, human, social, political, financial, and built. In her words, “Capitals are resources invested to create new resources over a long time horizon." Educators should maintain a balance among the capitals in their work. In her view, *a lack of knowledge* may be only a small obstacle in moving toward a more sustainable ecosystem and therefore educators need to focus on the "pyramid of social control." We need to understand why structures and actions are in place that lead to ecosystem degradation and identify the best ways to change those structures and actions.

Our concern as water educators is to understand why people act in the public interest. Educators provide citizens with information that helps them do the ecologically responsible thing. If citizens don't know how, then our job is to provide technologies and skills that enable them to perform the responsible actions successfully. Accompanied by sound environmental education practice to foster decision-making skills and civic investment, these steps lead citizens to the literacy level described by Mr. Coyle in the kick-off address.

The next level is to support groups that share values, or to expand *social capital*. Ultimately the educator helps citizens and groups to develop *political capital*, the ability to mobilize in a democratic forum. As Mr. Coyle describes, a potential goal is to build environmental literacy among community influentials who are actively involved in the community and who are "constantly making decisions on every aspect of community life."

These are challenging concepts for educators more familiar with the comfortable role of the neutral or who focus on providing awareness or "personal steps." Exactly how the application of BEPs meshes with an understanding of societal structures is the subject for another symposium. What we can do is to perform well within the structures and settings where citizens or democratic rule have provided clear goals for change or improvement. BEPs apply, no matter where the educator is positioned – with individuals, homeowners, neighborhoods, groups or leaders, and policy makers. Use of BEPs will contribute to building environmental literacy among all members of a community.

The answer to Dr. Cornelia Flora's question "Education – Is it an essential ingredient for community-based water management?" is a resounding YES from Symposium speakers and participants. Participants provided examples of BEPs in practice with specific audiences. They also provided recommendations for building the BEP concept and promoting the use of BEPs.

New directions for the Water Outreach Education Project will include:

- Refining the concept of BEPs, and providing training and networking among water educators.
- Promoting the value of applying BEPs to agencies and funders.
- Providing models and evaluation templates to measure whether we have achieved BEPs and to determine if they have the predicted effect.

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VI. Appendices

APPENDIX A

Essential Best Education Practices

FOR EVERY EDUCATION OR LEARNING SITUATION

The learning experience:

- Is specifically designed to maximize the type of outreach or education effort selected:
    - Information (one-way communication)
    - Communication (two-way communication)
    - Education (formalized learning process)
    - Capacity building (enhance group or community skills)
- Contributes to meeting learning goals:
    - Knowledge – the development of intellectual skills, such as recall of data, comprehension, application, analysis, synthesis and evaluation
    - Attitudes – the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and ways of thinking
    - Skills – physical movement, coordination, and use of motor-skill areas

FOR THE INDIVIDUAL

The learning experience:

- Has a clear purpose with tightly focused outcomes and objectives.
- Is learner centered, and consequently:
    - Assesses the learner in order to set appropriately high and challenging standards.
    - Relates to the individual's level of physical, intellectual, emotional, and social development.
    - Can be adapted to individual differences in learning strategies and approaches.
    - Relates to personal interests and provides for personal choice and control.
    - Encourages the learner to set meaningful learning goals and to take personal responsibility for their own learning.
- Promotes active engagement and real world problem solving.
- Enables the learner to link new knowledge to their existing knowledge in meaningful ways.
- Builds thinking and reasoning skills – analysis, synthesis, evaluation, and problem solving – that learners can use to construct and apply their knowledge.
- Presents a new behavior or skill by:
    - Demonstrating its similarity to a current behavior or skill.
    - Relating the new behavior to current social practices.
    - Demonstrating ease of adoption in terms of time, effort and money.
- Provides a *nurturing context* for learning, with attention to: cultural or group background and influences, the physical environment, and the use of tools or practices appropriate to learner skills and abilities.
- Provides opportunities for extended effort and practice.
- Builds on positive emotions, curiosity, enjoyment, and interest.
- Allows a learner to interact and collaborate with others on instructional tasks.

FOR THE CLASS OR GROUP

The learning experience:

- Is based on and shaped by some form of needs assessment and use of a planning model (such as the logic model).
- Is designed to focus on a targeted audience and is built on an understanding of audience skills and interests.
- Content and delivery is determined in cooperation with the target audience and stakeholders.
- Is relevant to and accessible by people with diverse backgrounds and influences.
- Presents accurate and balanced information, incorporating many different perspectives.
- Incorporates methods for assessing the value of the experience, especially as it relates to desired outcomes.
- Is facilitated by quality instructors who have been trained in effective teaching methods and are supported by the program sponsor.
- Uses creative approaches.
- Values lifelong learning.
- Builds environmental literacy:
    - Questioning and analysis skills
    - Knowledge of environmental processes and systems
    - Skills for understanding and addressing environmental issues
    - Personal and civic responsibility
- Builds from key principles underlying environmental education:
    - Systems and interdependence are characteristics of the biological and natural order.
    - Natural sciences, social sciences, and humanities disciplines contribute to understanding of the environment and environmental issues.
    - Learner connections to immediate surroundings provide a base for understanding larger systems, broader issues, causes and consequences.

FOR WEB-BASED LEARNING

The learning module:

- Addresses a specific topic that is narrow in scope.
- Follows a logical hierarchy of skill and knowledge development.
- Moves from knowledge transmission to learner-controlled systems.
- Is self-directed and self-contained (students can progress through the material on their own and all materials are readily accessible as part of the course).
- Has clear and concise directions on how to complete the module.
- Chunks the content into manageable “bites.”
- Provides a complete demonstration of the concept.
- Provides detailed and consistent feedback for practice opportunities.
- Makes appropriate use of a variety of media.

FOR THE COMMUNITY

The learning experience:

- Evolves from work with a coalition or group.
- Supports a person who takes responsibility for managing or leading the process, and relies on quality group planning and facilitation techniques.
- Relates to long-term community vision and goals.
- Takes into consideration the community as a whole, including: socio-political, economic, historical, and cultural influences.

- Builds on locally existing skills and resources.
- Is flexible in response to both process and conditions.
- Generates and makes use of data about the local condition.
- Provides training to increase skills needed to accomplish goals identified by the group.
- Takes place close to the location where people practice a behavior of concern.
- Builds effectiveness through linkages to other communities, partners, and resources.
- Reaches people in multiple ways.
- Provides participants with feedback about the results of their actions.

BEYOND THE COMMUNITY

The learning experience:

- Builds value for education as part of policy development and implementation.
- Builds skills for flexibility and responsiveness to environmental issues and for facilitating community engagement.
- Concerning a particular topic – consolidates the <u>learning goals</u> for all levels of responsibility, but not the <u>teaching methods</u>, which are adapted for the target audience.
- Matches the target audience to the scale of the problem.
    - For example, related to a particular problem, watershed council staff receives training about a locally significant topic, while agency staff receives training about how information about several related topics informs policy development.
- Offers avenues for participation which are competent, fair, and enhance involvement for all levels of responsibility.

References

Essential Best Education Practices were primarily derived from the following resources. Some references summarize major ideas from multiple authors.

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Andrews, E., Stevens, M., & Wise, G. (2002). A model of community-based environmental education. In T. Dietz & P.C. Stern (Eds.), *New tools for environmental protection: Education, information, and voluntary measures* (pp. 161-182). Washington, DC: National Academy Press. Chapter 10, A Model of Community-Based Environmental Education, describes an education model that builds on findings of a national study and the work of over 90 authors. It incorporates community development; environmental education; adult and youth education; public participation and empowerment; social marketing; and technology transfer theory.

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University of Wisconsin Extension, Program Development and Evaluation. (2002-2005). *Logic model.* Retrieved June 2004, from http://www.uwex.edu/ces/pdande/evaluation/evallogicmodel.html. Planning models, such as this Logic Model, are available from a variety of sources. This advice is based on the version used by the University of Wisconsin Cooperative Extension.

APPENDIX B: *Summary of Findings by Primary Target Audience*

Recommended education practices for each paper, poster, and panel presentation are described according to the following categories: Audience information; Message content; Message delivery vehicle; Outreach strategy/method of teaching; Public participation; Supporting and motivating professionals; Evaluation

**Indicates findings from a research-based paper. Other findings are derived from case studies.*

Conservation professionals			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Bonnell and Baird *Research paper*	Environment/ conservation NGOs [Watershed coordinators; and watershed planning volunteers] Soil and water conservation professionals Local decision makers [Planners]	Study of the target audience lead to these conclusions: 1. Provide face-to-face meeting opportunities: to allow for learning from others and to provide camaraderie (networking and moral support). 2. Provide course activities with direct application to work responsibilities (appropriate to local context). 3. Provide instructor feedback. 4. Enable students to personalize their education objectives (through pre-course interviews). 5. Provide students with autonomy in determining content and timing of learning activities. 6. Adapt course design over time using multiple feedback methods.	**Outreach strategy/method of teaching** • Provide face-to-face meeting opportunities: to allow for learning from others and to provide camaraderie (networking and moral support).* • Provide course activities with direct application to work responsibilities (appropriate to local context).* • Provide instructor feedback.* • Enable students to personalize their education objectives (through pre-course interviews).* • Provide students with autonomy in determining content and timing of learning activities.* **Evaluation** • Adapt course design over time using multiple feedback methods.*
Cantrell *Panel*	County conservationists; natural resource professionals	Ohio DNR, the Ohio Federation of Soil and Water conservation Districts and NRCS created a conservation partnership. The purpose of the project was to build capacity for SWCD to deliver effective education, “we are all educators”; “we are all responsible for outreach”. Best practices = provide area workshops; practice what we preach; provide follow-up; encourage peer teaching; ongoing professional development.	**Outreach strategy/method of teaching** • For conservation professionals: o Provide area workshops. o Apply environmental education principles in training events. o Provide follow-up. o Encourage peer teaching; ongoing professional development.

			Evaluation • Evaluate conservation professionals' effectiveness in using models and demonstration tools and in their use of skills taught in the workshops.
Dobrowolski *Poster*	Agencies Soil and Water Conservation Districts	US Forest Service watershed restoration short course Presentation and field experiential learning focuses on upstream-downstream and upslope-downslope relationships. Classroom exercises and visual examples are followed by field application. Activities and evaluation help identify barriers and verify success. One-year follow-up evaluation showed that 62% of contacted participants used course materials, referred to course notes or field experiences or altered some aspect of how they viewed, defined or applied restoration efforts.	**Outreach strategy/method of teaching** • Follow classroom exercises and visual examples by field application. **Evaluation** • Use activities and evaluation to help identify barriers and verify success.
Levin and O'Malley *Research paper*	Agencies Environment/ conservation NGOs Recreational businesses Service clubs	Comparative literature review about fishing and boating education that led to: 1. Overall guiding principles from 9 relevant disciplines 2. Basic practices for: o Program planning o Program development and implementation o Professional development o Evaluation o Research See Tables 1 – 5 in the paper. Many of these principles and practices have already been integrated into the *Essential Best Education Practices* provided in Appendix A of the Symposium Proceedings and on the Water Outreach website.	**Outreach strategy/method of teaching** • Follow these basic outreach practices:* o Program planning o Program development and implementation o Professional development o Evaluation o Research
Wilbur *Panel*	Water educators and professionals	The *Getting in Step* guide to conducting watershed outreach campaigns features the following components: define driving forces, goals, and objectives; identify and analyze the target audience; create the message; package the message; distribute the message; evaluate the outreach campaign.	**Support and motivate professionals** • Train water education professionals to apply these steps when designing an outreach program: o Define driving forces. o Define goals and objectives. o Identify and analyze target audience.

			o Create the message. o Package the message. o Distribute the message. o Evaluate the outreach campaign.
Decision makers. leaders, and community groups			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Edwards *Research paper*	Local decision makers Neighborhood organizations Policy makers	With appropriate instruction, students and volunteers can identify aquatic insects accurately enough for use in professional biological work. Program strengths include: 1. Learning to recognize key features, via narrated slide discussion 2. Availability of a live insect for reference	**Outreach strategy/method of teaching** • To teach recognition of key aquatic insects use narrated slide discussion and provide a live insect for reference.*
Hagley *Poster*	Local decision makers Policy makers	DuluthStreams.org provides web-based delivery of real-time automated data for understanding urban stormwater and water quality issues. Data is linked on-line to GIS land use maps, other data, text and photos. The website provides stream and watershed specific data and supports use by specific target audiences such as students, property owners and contractors. Linking observed phenomenon with photos and simple explanations is an important feature of this resource. Website resources are complemented by outreach with schools and municipal officials, including adopt a stream and NEMO.	**Outreach strategy/method of teaching** • Provide web-based delivery of real-time automated stormwater and water quality data. • Link data about observed phenomenon with photos and simple explanations in a web-based delivery. • Use website resources for outreach with schools and municipal officials.
Herpel *Panel*	Community	Groundwater Guardian provides a framework to protect local water sources. Over 300 communities have participated since 1994. Groups include citizens, business, agriculture, education, local government, public health and youth representatives. The purpose is to: assess source water by understanding and completing data; to prioritize threats; and to develop and implement action strategies. Outreach strategies include:	**Outreach strategy/method of teaching** • Encourage community groups to assess source water in order to prioritize threats, and to develop and implement action strategies. • Encourage community groups to develop outreach strategies such as: public awareness campaigns, water conservation campaigns, pollution prevention activities (such as

		public awareness campaigns, water conservation campaigns, pollution prevention activities (such as household hazardous waste collection), application of BMPs on farms, public policy protection strategies.	household hazardous waste collection), application of BMPs on farms, public policy protection strategies.
Langston *Poster*	Agencies Local decision makers Policy makers Soil and Water Conservation Districts	A Missouri Extension capacity building initiative supports 20 watershed-planning groups that want to or are required to focus on their water resources. The effort engages citizens in controlling their destiny and takes a holistic approach looking at all aspects of the watershed including: human resources, economic development, environmental quality, infrastructure, and public safety. Findings: • People will become involved if they understand the problem/situation. • People need assistance from agencies to do the work. The initiative outlines appropriate roles for citizens and agencies.	**Outreach strategy/method of teaching** • Involve citizens in a watershed planning group by facilitating their understanding of the problem/situation. • Support watershed planning groups with assistance from agencies.
Lawrence and Koontz *Research paper*	Local decision makers Policy makers	Local officials' survey: Findings present information about what local officials knew about storm water management based on an unknown source of training. 1. Local officials in Ohio had a good understanding of their communities' storm water management plan. 2. Officials felt they had sufficient information to make informed decisions about storm water management. 3. Most officials did not see a role for local watershed groups in water quality monitoring, stormwater management planning, plan implementation, compliance monitoring or environmental stewardship. This shows that local officials do not understand the potential role for education, including community involvement strategies.	**Audience information** • Before designing training, survey local officials to learn if they: o Have a good understanding of their communities' storm water management plan.* o Feel they have sufficient information to make informed decisions about storm water management.* o See a role for local watershed groups in water quality monitoring, stormwater management planning, plan implementation, and compliance monitoring or environmental stewardship.*
Liukkonen *Panel*	Planners	Project NEMO (nonpoint source pollution education for municipal officials) application in Minnesota: The purpose of this education resource is to enable local land use officials to ask the right questions. Challenges	**Supporting and motivating professionals** • Build skills to ask the right questions about land use. • Build land use training program acceptability

		include the need to demonstrate impacts, availability of staff and funding resources, need to provide repeated education for new decision makers, need to keep the science current.	by: o Demonstrating impacts o Making staff and funding resources availability o Providing repeated education for new decision makers o Keeping the science current
Maben *Poster*	Agencies Local decision makers Policy makers	The WEF Water Leaders Class focuses on building water leadership capacity in California among young professionals, especially: members of minority and ethnic communities, engineers, law professionals, environmental planners, and public interest advocates.	**Outreach strategy/method of teaching** • Build water leadership capacity among young professionals, especially: o Members of minority and ethnic communities o Engineers o Law professionals o Environmental planners o Public interest advocates
Maben *Panel*	Policy makers Decision makers	The WEF Board is made up of stakeholders. This water policy organization provides: a bi-monthly magazine, special publications, broadcast features, policy briefings, reports, stakeholder symposia, and tours focus on audience specific interests.	**Outreach strategy/method of teaching** • In water-related organizations, include stakeholders as Board members.
Struss *Poster*	Agencies Households Neighborhood organizations	A storm water education initiative strives to provide a consistent storm water message and support the twin cities and their neighborhoods in implementing outreach. Educators formed a stormwater collaborative that supported mass media campaigns and messages; provided convenient access to storm water educational materials across neighborhoods in a large city.	**Message vehicle** • Work with a collaborative to provide consistent storm water message across neighborhoods in a large city.

Ethnic groups			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Magee *Poster*	Youth Teachers Specific ethnic groups	Team WET Schools is an urban water quality education program that serves minority and economically disadvantaged students. Team WET implementation practices build capacity among schools to deliver water education effectively and with a community-based focus. Features include: a nationally tested curriculum linked to national and state academic standards; local partner, volunteer, and expert networks; training workshops; service learning opportunities; program evaluation procedures. Teachers, volunteers and community leaders receive extensive training and support. Student-led projects are encouraged.	**Outreach strategy/method of teaching** • To build capacity among urban schools to deliver water education effectively and with a community-based focus, provide: o A nationally tested curriculum linked to national and state academic standards. o Training workshops for local partner, volunteer, and expert networks. o Training and support for teachers, volunteers and community leaders. o Service learning opportunities. o Program evaluation procedures. o Encouragement for student-led projects.
Marzolla *Research paper*	Specific ethnic group: Latino youth Latino families	Literature review and application to new Latino youth curriculum 1. Community-based science program is constructivist education in practice, allowing participants to apply their learning to a wide variety of home, neighborhood and community situations. Constructivist education, which views direct experience as being antecedent to learning, is applied to encourage youth to solve problems grounded in real-world contexts and requires complex problem solving skills. 2. Place-based pedagogies are needed so that the education of citizens might have direct bearing on the well-being of the social and ecological places people actually inhabit (Grunenewald). 3. Place-based education can lead to civic engagement and help overcome the exclusion of Latinos and other under-represented ethnic groups.	**Outreach strategy/method of teaching** • With Latino youth programs, use place-based pedagogies so that the education of citizens might have direct bearing on the well-being of the social and ecological places people actually inhabit.* o Allow participants to apply their learning to a wide variety of home, neighborhood and community situations.*
McCowan, Smolen *Research paper*	Households Specific ethnic group: Underserved	Pilot study of drinking water education in two counties with predominately low income and minority populations. Findings:	**Audience information** • Identify specific education needs, for example the percent of households with drinking water

	minorities	1. Identified specific education need – more than 1/3 of the drinking water did not meet public health standards. 2. Identified specific education need – learning materials had to be tailored to learning style, educational level and vision problems of relatively uneducated, elderly audience. 3. Education outreach initiatives are carried out through community-based organizations that already have a relationship with the target audience. 4. New education materials are field tested by lead community-based organizations. 5. New drinking water data is collected and mapped by paraprofessionals. Household education takes place during personal data collection and reporting visits. 6. Local information is generated and used as the basis for local public education programs. 7. Program success is evaluated as paraprofessionals provide individual follow up to check if household problems have been corrected.	that does not meet public health standards.* • Tailor drinking water education materials to the learning style, educational level and potential vision problems of a relatively uneducated, elderly audience.* **Outreach strategy/method of teaching** • Carry out education outreach initiatives through community-based organizations that already have a relationship with the target audience.* • Field test new education materials with a lead community-based organization.* • Generate local information and use it as the basis for local public education programs.* **Evaluation** • Evaluate program success by following up with household to check if problems have been corrected.*

Farmers

Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Bianchi *Poster*	Agricultural commodity groups Farmers	Monterey Bay National Marine Sanctuary area Farm Quality Planning Short Course – farmers develop individual water quality management plans. Course is offered to Watershed Working Groups staffed by County Farm Bureaus. Peer information exchanged was highly valued by participants.	**Outreach strategy/method of teaching** • Facilitate farmers developing their own water quality management plans. • Emphasize, peer information exchange in farm quality planning.
Bird *Research paper*	Farmers	Partnerships for Livestock Environmental Management Systems: Goals were to build understanding of the concept, provide for stakeholder input and conduct assessments and action planning. The project identified approaches to: recruiting participants and working directly with	**Outreach strategy/method of teaching** • Tailor materials to details of the farm operation.* • Work with farmers to compare farm records related to environmental management over

		producers. 37 assessment tools were tested in part or in total in nine states. Findings: An evaluation of participants in Georgia gave high marks to the training and resources, and intent to implement recommendations, but half of participants were unsure of how to reduce identified risks. Pennsylvania had similar results, but had some complaints about lack of the relevance or difficulty in using some tools. Virginia poultry operators found the tools less helpful. New York and Wisconsin operators liked the support and the tools, but felt that the procedure was too lengthy. The study also evaluated Idaho, Montana, Iowa, and Texas participants. Recommendations included the need to tailor materials to details of the operation, support comparison of records over time, and the need for real life examples. The study produced extensive recommendations for how to teach about this topic. Positive findings: o Quality training and resources o Materials well received o Showed intention to implement Negative findings: o Unsure how to reduce identified risks o Lack of relevance of some tools o Difficulty of using some tools o Procedure too lengthy Recommendations: o Tailor materials to details of the operation o Support comparison of records over time o Provide real life examples	time.* • Provide farmers with real life examples for new ideas.*
Everett *Poster paper*	Farmers	The delivery of nutrient and manure management Extension training programs was timed to couple education with heightened awareness surrounding new regulations and their application. Finding: Heightened awareness, created by press coverage of rules release, public hearings and a compliance deadline, resulted in farmer participation at a	**Message vehicle** • Time education with heightened audience awareness created by press coverage of rules release, public hearings and a compliance deadline.

		substantially higher rate than experienced with previous manure management education programs. Timing education with heightened audience awareness can be a key strategy in education program design.	
Farrell, Holsman, Krueger *Research paper*	Agricultural commodity groups Farmers	Groundwater technicians conduct voluntary and confidential assessments on individual farms culminating with an "Improvement Action Plan". Findings: 1. More than half of farms with high-risk groundwater conditions made recommended changes. 2. A significant number of farmers made changes in selected stewardship practices.	**Outreach strategy/method of teaching** • Conduct voluntary and confidential assessments on individual farms, in cooperation with groundwater technicians.* • Develop an "Improvement Action Plan" for individual farms.*
Fisher *Poster*	Agricultural commodity groups Farmers	The Montana Beef Environmental Management Systems project Stakeholders group chose "self-assessment" as the most effective approach to environmental assessment on the ranch. Findings: Pilot testing had mixed success. Pilot testing resulted in new relationships and energizing of partnerships, particularly with NRCS. Livestock owners were willing to mitigate risks through implementation of best management practices. But producers were intimidated by "high risk" designations and failed to determine whether it was related to an environmental priority.	**Audience information** • Check with stakeholders concerning which approach to environmental assessment on the ranch they perceive as most effective.
Green *Poster*	Agencies Agricultural commodity groups Farmers Environment/ conservation NGOs Soil and Water Conservation Districts	This project links economic risk to over application of nutrients, a common practice for ensuring maximum yield. The farmer works with a crop advisor to develop a nutrient management plan and checks with a comparison strip. Findings: Reduced nutrient applications resulted in as high or higher yields. This process effectively addresses perceived economic risk barrier to applying BMP applications of nitrogen, phosphorus, and potassium.	**Message content** • Link economic risk to over-application of nutrients, a common practice for ensuring maximum yield. **Evaluation** • Use a comparison strip to provide the farmer with opportunity to make their own evaluation of pros and cons of a new procedure.

Shepard (for Yencha presentation) *Research paper*	Farmers, corn	This paper reports research comparing the rate of adoption of nutrient management strategies by farmers in two different Wisconsin watersheds over the same five-year period. The research compared impacts of a (1) diffuse communication campaign effort vs. (2) one-on-one information transfer techniques. Results supported an integration of a diverse set of educational approaches and discouraged over-reliance on diffuse information dissemination. 1. Educator emphasis on local, direct farmer contact produced greatest changes in fertilizer application behavior. This was carried out through on-farm visits, small group demonstrations, and workshops. 2. Educator identified key target audiences. 3. Targeting of key audiences allowed educator to acknowledge individual grower characteristics, perceptions of problems, current use of practices, and preferences for educational formats. 4. Program changes were tracked through a comprehensive pre-treatment survey and follow up surveys. 5. Program resources were deployed in ways that insure that they actually reached targeted audiences.	**Audience information** • Identify key target audiences and acknowledge individual grower characteristics, perceptions of problems, current use of practices, and preferences for educational formats.* **Outreach strategy/method of teaching** • Provide on-farm visits, small group demonstrations, and workshops emphasizing local, direct farmer contact.* **Evaluation** • Track program changes through a comprehensive pre-treatment survey and follow up surveys.* • Assure that program resources actually reached targeted audiences.*
Shepard, Yencha, Klingberg *Panel* See Research paper summary	Farmers	This panel presentation describes a land and water education grant program focused on general education, nutrient management, and rotational grazing. 40 projects have worked with over 300 farmers. The program uses a comprehensive pre-survey; conservation plans, soil tests, workshops, farm visits during the growing seasons.	**Audience information** • Use a comprehensive pre-survey; conservation plans, soil tests, workshops, and farm visits during the growing seasons as a basis for developing relevant land and water education programs.
Vickery *Research paper*	Farmers	This study applied a combination survey and focus group methodology to learn about Minnesota farmer education content and delivery preferences. Study results support initial expectations that learning target audience interests and preferences about farm management topics is a complex process which may require in-depth discussion and interviews to provide a useful finding. 1. Found this method of studying the target audience to	**Audience information** • Use in-depth discussion and interviews to provide a useful finding about target audience interests and preferences about farm management topics.*

		provide reliable and nuanced results. 2. Highly ranked survey preferences did not indicate that farmers would choose that preference, but instead showed that it was the best choice among the survey options. 3. Complex farm management topics, such as nutrient management, led to complex responses depending on how the question was asked. Respondents preferred farm tour/demonstrations in the survey, but in the focus group said they wouldn't attend. But on further exploration of a specific problem – lack of implementation of recommended practices – respondents both expressed doubt that practices could work and suggested that more demonstrations were needed.	
Households and neighborhoods			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Dietz, Clausen, Filchak *Research paper*	Homeowners	This paired watershed study investigated whether stormwater quality could be improved by educating homeowners and implementing best management practices in a suburban neighborhood. 1. Researchers trained volunteers to perform household site assessments. 2. The trained volunteers met with individual homeowners to assess the site and make specific recommendations for reducing bacteria and nitrogen runoff. 3. 35% of lots adopted some BMP following education efforts. 4. A 75% reduction in nitrate+nitrate and a 127% reduction in fecal coliform concentrations occurred.	**Outreach strategy/method of teaching** • Assist individual homeowners to assess their site using trained volunteers, and make specific recommendations for reducing bacteria and nitrogen runoff.*
Ingram *Poster*	Landowners Households Urban landscapers	This project focused on application of fertilizers and pesticides on lawns. Used a social marketing approach to understand and redesign educational outreach	**Audience information** • To encourage sustainable practices in application of fertilizers and pesticides on

	Urban watershed organizations	strategies. Identify barriers and benefits to the use of IPM by paid landscape managers. Landscape and watershed organizations helped to set project goals.	lawns, use a social marketing approach to understand and redesign educational outreach strategies. • Identify barriers and benefits to the use of IPM by paid landscape managers. **Outreach strategy/teaching method** • Rely on landscape and watershed organizations help to set project goals.
Kauffman *Poster*	Homeowners	Christina Basin Clean Water Strategy – Delaware, Maryland, Pennsylvania: The Christina Basin Partnership was one of 20 watersheds from throughout the USA (from a pool of 170 applications) that received a $1 million Watershed Initiative Grant from the USEPA. Public outreach efforts including: distribution of native plants, non-chemical landscape design, and rain barrels; bus tours, and information dissemination.	**Message delivery vehicle** • Communicate information about a watershed initiative by: o Distributing native plants o Providing non-chemical landscape design advice and rain barrels o Arranging bus tours o Disseminating information
Hargrove *Poster paper*	Homeowners Households	Tennessee funded a variety and sequence of outreach activities designed for the target audience: media releases, base-line survey, youth recognition, stakeholder meetings, website resources. *WaterWorks!* models social change through focused marketing to an audience of Tennessee households and homeowners, with specific components designed to promote and reinforce the message of individual responsibility. Project components: • Video and audio messages using entertaining approaches to communicate simple messages. • Partnership with a state broadcast association to assure dissemination of video and audio messages. • Statewide survey to determine citizen perceptions and knowledge about water quality. • Youth water projects were eligible for cash awards and “Stream Saver” status. • Website provided group connections and watershed resources.	**Audience information** • Conduct a survey to determine citizen perceptions and knowledge about water quality. **Message delivery vehicle** • Provide awards for youth water projects. • Use entertaining approaches to communicate simple messages in video and audio communication materials. • Partner with a state broadcast association to assure dissemination of video and audio messages. • Use a website to provide group connections and watershed resources.

Mahler *Panel*	Citizens	Focus on water education needs in the Pacific northwest: This project formed a regional team representing colleges, universities, EPA, and NRCS. The project used a regional survey to establish priorities and to set baseline information. The group has offered an annual satellite conference, a domestic water handbook, a “riparian” concept campaign, and water quality monitoring workshop. The group provides a theme based fact sheet or report twice a month for stakeholders and policy makers.	**Outreach strategy/method of teaching** • Form a regional team to determine water education needs. • Use a regional survey to establish priorities and to set baseline information about regional water education needs. • Coordinate team outreach efforts through a variety of techniques: o An annual satellite conference o A domestic water handbook o A “riparian” concept campaign o A water quality monitoring workshop o A semi-monthly theme based fact sheet or report for stakeholders and policy makers
Mahler, Simmons, Sorensen *Research paper*	Homeowners Households	This program designed a survey to assess public attitudes and interests. Findings: 1. Resident interest focused on drinking water and human health; water quantity and policy; and watershed management. 2. A low percentage of residents were interested in workshops or short courses as a way to learn about the general topics presented in the survey. Most preferred the media as a source of information.	**Audience information** • Implement a program design survey to assess public attitudes and interests about water.*
McCowan, Smolen *Research paper*	Households Specific ethnic group: Underserved minorities	Pilot study of drinking water education in two counties with predominately low income and minority populations. Findings: 1. Identified specific education need – more than 1/3 of the drinking water did not meet public health standards. 2. Identified specific education need – learning materials had to be tailored to learning style, educational level and vision problems of relatively uneducated, elderly audience. 3. Education outreach initiatives are carried out through community-based organizations that already have a relationship with the target audience.	**Audience information** • Identify specific education needs, for example the percent of households with drinking water that does not meet public health standards.* • Tailor drinking water education materials to the learning style, educational level and potential vision problems of a relatively uneducated, elderly audience.* **Outreach strategy/method of teaching** • Carry out education outreach initiatives through community-based organizations that

		4. New education materials are field tested by lead community-based organizations. 5. New drinking water data is collected and mapped by paraprofessionals. Household education takes place during personal data collection and reporting visits. 6. Local information is generated and used as the basis for local public education programs. 7. Program success is evaluated as paraprofessionals provide individual follow up to check if household problems have been corrected.	already have a relationship with the target audience.* • Field test new education materials with a lead community-based organization.* • Generate local information and use it as the basis for local public education programs.* **Evaluation** • Evaluate program success by following up with household to check if problems have been corrected.*
Mecke *Poster*	Households Irrigation districts Soil and Water Conservation Districts	West Texas water conservation outreach initiatives: Key components include: focus on sustainability; stakeholder involvement in program development; support for stakeholder groups, especially those with similar missions; workshops and seminars on key topics and for key audiences such as: rainwater harvesting, riparian management, rangeland “rescue”, golf course management, and youth education; demonstration sites featuring practical techniques for conserving water and energy in rangeland situations; and applied research and outreach on relevant questions.	**Outreach strategy/method of teaching** • Rely on these outreach components for a conservation initiative: o Stakeholder involvement in program development. o Support for stakeholder groups, especially those with similar missions. o Workshops and seminars on key topics and for key audiences such as: rainwater harvesting, riparian management, rangeland “rescue”, golf course management, and youth education. o Demonstration sites featuring practical techniques for conserving water and energy in rangeland situations.
Roffe, Bauder, Pearson *Research paper*	Homeowners Private well owners	Montana conducted a voluntary, private well water test program to educate the public about water quality issues, as well as improve decision-making skills of private well owners. The evaluation will help guide new drinking water education programs. Specific changes supported by the impact evaluation include the need: • To target specific educational resources • To specify audiences by need • To structure programs to address the educational level of audiences • To provide information that has immediate utility to the	**Audience information** • Specify audiences by need.* **Message content** • Provide information that has immediate utility to the program.* **Outreach strategy/method of teaching** • Target educational resources to meet specific needs.* • Structure programs to address the educational

		program. Drinking water program impact assessment questionnaires results: 1. Concern about family health and curiosity about the quality of water were cited as the most important reasons for participating. 2. Perceived benefit from the program appeared to be its cost effective test results and the immediate usefulness of information to the participant based on survey results and information about short term and long term participant expenses on wells and point-of-use water treatment equipment. 3. Printed text and communication with the county agent were the preferred form of education delivery.	level of audiences.*
Severtson *Poster paper*	Households Agencies Environment/ conservation NGOs	Research investigated **how** a Wisconsin arsenic well testing program was working and those elements of the program that have stronger associations with outcomes. Findings indicate that program impact may increase if: 1. Information is publicly available from a variety of sources. Residents who opt to test privately need easy access to accurate information. Awareness is the first step in identifying a problem. People in high awareness communities use more information and have higher levels of risk recognition than participants in low awareness communities. 2. Well water testing information is offered locally on an ongoing basis. Participants in a community offering yearly well testing: rated information as more useful, selected a lower arsenic safety threshold, disagree that the threshold 10 ug/L was too strict and had more confidence in how their town government is dealing with arsenic than participants in a high publicity community. High publicity was related to information use and ability to recognize risk, but education seemed to be a factor in the adoption of a lower drinking water standard. Community education may be a better strategy than increased publicity.	**Message content** • Provide clear information. • Accompany findings or data with information and especially information which emphasizes the meaning of the results. • Provide information about the pros and cons of control methods and which are most effective. • Assure that different agencies provide consistent messages. • Design and deliver information based on communication and health behavior theories. **Message vehicle** • Make information publicly available from a variety of sources. **Outreach strategy/method of teaching** • Offer well water testing information locally on an ongoing basis.

		3. People test their water for arsenic. Participants who didn't test or who didn't know the results of their test had a weaker sense of risk. 4. People who have not tested get clear information describing that their household is at risk for having elevated levels of arsenic and that a well test is the only way to know their level of arsenic. 5. Arsenic level findings are accompanied by information about the meaning of the results and information about the inability to perceive arsenic tainted water (and many other contaminants) with the senses. 6. The meaning of arsenic test results is emphasized (low risk, high risk, etc.). Test **meanings** are better remembered than the actual test results. People need information about how drinking water standards are developed and how they can be applied to understand test results. 7. People feel **certain** about which control methods are most effective. Provide information about the pros and cons of control methods. 8. Different agencies provide consistent messages about how to identify an arsenic problem, its timeline, causes of arsenic in well water and of arsenic exposure, consequences of and how to reduce arsenic exposure, and appropriate policies that address root causes of arsenic in well water. 9. Information about arsenic is designed and delivered based on communication and health behavior theories. The common sense model may be a useful theory for understanding and designing outreach programs.	
Tang, Murray *Poster*	Homeowners	Residential yard and garden practices to minimize urbanization effects on a lake in Washington State: Property owners were provided with a Lake-Friendly Gardening Kit that included coupons for lake-friendly gardening products. Recipients were surveyed three months later. Findings: Of those who responded, more than half changed their	**Evaluation** • Provide property owners with do-it-yourself kits and coupons for environmentally friendly products.

		lawn care and pest management practices and almost half shared what they learned with someone else.	
Landowners			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Burkett and Blickenderfer *Research paper*	Landowners Neighborhood organizations	Findings: Hands-on, practical training about individual property management choices set in the context of information about broader ecosystem science and impacts resulted in a high percentage of skill development and sensitivity to the benefits of applying skills taught in the session.	**Outreach strategy/method of teaching** • Provide landowners with hands-on, practical training about individual property management choices set in the context of information about broader ecosystem science and impacts.*
Janowitz *Poster*	Developers Real estate sales people Real estate brokers Real estate appraisers	Water resource education for real estate professionals: This poster describes a course developed in response to a needs assessment. Real estate professionals were identified as an under-served audience. Experts gave presentations designed to put real estate professionals at ease, accompanied by a field trip. Attendees receive continuing education credit toward professional license recertification. Over 600 professionals in the South Puget Sound region have attended one or more courses. Findings: Evaluation showed an increase in knowledge, high number of repeat attendees, positive response from attendees.	**Outreach strategy/method of teaching** • Provide training for real estate professionals in a supportive atmosphere accompanied by a field trip.
Smith, Johnson *Poster paper*	Landowners	Tennessee Agricultural Extension Service provides landowners with a BMP handbook and a calendar to convey information on a large variety of best practices for farming and forestry via photographs.	**Message delivery vehicle** • Provide landowners with information using a handbook and a calendar, making good use of photographs.

Recreational water users			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Waltz, Carrow, Duncan *Poster paper*	Recreational water users Recreation business	University of Georgia turfgrass faculty developed a water conservation training program for golf course superintendents, in cooperation with the Golf Course Superintendents Association of America. While program impact is yet to be tested, the program incorporates design measures worthy of mention. The course: 1. Was developed in cooperation with students. 2. Was actively promoted by the professional association. 3. Is readily accessible to superintendents: via an on-line introductory course followed by a class-room type seminar with a workbook held at the annual professional conference. For two months following the workshop, instructors are available via a list serve to help participants develop water conservation BMPs for their golf course. The association hosted this technical service.	**Message delivery vehicle** • Work in collaboration with the professional association to publicize a course for golf course managers. **Outreach strategy/method of teaching** • Engage golf course conservation superintendents in developing a course on turf grass management. • Make turf grass management courses readily accessible to golf course managers and provide instructor support for completing assignments and application to their own golf course.

Volunteers			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Godwin *Panel*	Watershed groups Households Volunteers	Master Watershed Steward volunteer training program: The training program includes 8 training sessions and a 40 hour service project. Projects include: enhancement, monitoring, management planning, team building, and education. Success includes telling the story of the program and publicizing impacts. Include county commissioners, stakeholders, and partners in reporting outcomes. Master Watershed Stewards serve their communities by completing a project with assistance from OSU Extension, resource agencies or watershed councils, and becoming points of contact for their communities. http://seagrant.oregonstate.edu/wsep/	**Evaluation** • Tell the story of the program and publicize impacts. • Encourage county commissioners, stakeholders, and partners in reporting outcomes.

Stepenuck *Panel*	Volunteers	The purpose of the Volunteer water quality monitoring – USDA national facilitation project is to identify current Extension programs; develop multi-media training materials; offer training; develop internet tools; and increase collaboration. There are 38 programs in 27 sites, an interactive website, and a listserve. Target audiences include: conservation groups, general public, civic groups, youth, farmers, and underserved audiences. Sharing success stories and communication is a major feature of this coordination effort.	**Message delivery vehicle** • Facilitate volunteer water quality monitoring efforts through sharing success stories and communication among groups using an interactive website and listserve.
Youth			
Author	**Target audience(s)**	**Descriptions**	**Recommended education practices**
Madzura *Poster paper*	Youth Agencies Citizen-based watershed groups Farmers Natural resource interest groups	The University of Missouri Extension Water Quality program, through the Missouri Watershed Information Network (MoWIN) Project, provides internet resources for school-based watershed education programs.	**Message delivery vehicle** • Facilitate school-based watershed education programs through interactive resources and communication among groups using an interactive website.
Noel *Poster*	Youth Homeowners Households Local decision makers Policy makers	University of Vermont Watershed Alliance sponsors youth water monitoring and service learning that provides local water quality assessment data and outreach to the community. The Alliance is working to address a public education problem that arises when audiences are geographically scattered and resources are limited. The goal of the program is to prepare youth to inform and engage communities.	**Message delivery vehicle** • Prepare youth to inform and engage communities about watershed information as a mechanism for reaching audiences who are geographically scattered when resources are limited.
Ponzio, Enfield *Research paper*	Youth leaders Neighborhood organizations and service clubs with applied education components	1. Water education activities can support the goal of reconceptualizing the role of young people in modern democratic societies to build social and economic capital within our society. 2. Situated problem-solving teaches learners skills that translate to workforce skills – learners possess both	**Outreach strategy/method of teaching** • Use water education activities to provide “situated problem-solving” practice that can translate to workforce skills.* • Teach water science through “service-learning” experiences that apply principles of

		the technological skills and capacities to be productive in organizations and the social skills to be effective participants in organizations and society. 3. A successful educative experience includes both interaction and continuity. 4. Academic learning can be more authentic and visible using “service learning” principles and adding depth through applying principles of interaction and continuity.	interaction and continuity: both significant features of education that leads to learning.*
Rager *Poster*	Youth Agencies Environment/ Conservation NGOs Natural resource professionals	Best practices for environmental field days organized for 4th through 6th grade youth: Best practices were derived from a literature review and practical experiences of the University of Minnesota environmental science education working group.	**Outreach strategy/method of teaching** • Use best education practices in organizing environmental field days for youth.
Seavey *Poster*	Teachers	Findings: A survey of teacher perceptions of Iowa Project WET workshops showed that educators were likely to use Project WET activities and related water curricula if they were able to: experience activities first-hand; interact with other educators; and learn about the materials. Survey data showed that teachers selected activities to meet curriculum goals and used activities to meet multiple goals.	**Supporting and motivating professionals** • Provide teachers with an opportunity to experience activities first-hand; interact with other educators; and learn about the materials. • Provide teachers with activities that meet one or more curriculum goals.
Tramontana *Poster paper*	Agencies Landowners Environment/ conservation NGOs Service clubs	The St. Johns River Water Management District “Legacy” program for schools: This program links educators, students and District staff with public lands activities. Findings: Professional evaluation of the program demonstrates increased student performance and interest in school, increased student concern for protecting and conserving the environment, and increased educator motivation.	**Outreach strategy/method of teaching** • To increase student performance and interest in school, student concern for protecting and conserving the environment, and educator motivation, provide educators, students and District staff with opportunities to participate in public lands activities.
Walker *Poster*	Teachers	Quality watershed education teacher manuals were adapted to address barriers to implementation. The	**Outreach strategy/method of teaching** • When developing watershed education

		process included: identifying goals; identifying obstacles through a survey and interviews; working with partners to produce a quality product and to raise visibility and approval for the effort. Materials were adapted to directly address needs – development of a curriculum that uses activities described in the manual, aligning the curriculum with 9th grade earth systems science standards, and involving the Utah Office of Education and other stakeholders in the revision process. The Governor's Watershed Initiative endorsed the final product. Developers propose to evaluate knowledge change and teacher training elements as a next step.	teacher manuals, identify barriers to implementation and adapt materials to respond to identified needs. • Adapt watershed education teaching materials to align with grade-appropriate science curriculum standards. • When developing watershed education materials involve the state office of education and other education stakeholders in the revision process.
Zint, Kraemer, Northway, Lim *Research paper*	Teachers Youth	Pre and post surveys evaluating the impact of youth education initiatives in the Chesapeake Bay area. Initiatives included a 2-week field trip, a 3-day field trip, a 1-day field trip, a shad restoration project, and classroom use of a curriculum. 1. Findings seem to confirm that education programs need to be focused, provide multiple experiences over extended periods of time, and be coordinated with other interventions to reach their full potential in promoting Environmentally Responsible Behaviors (ERB). 2. Each of the nine ERB characteristics. (knowledge of issues, skill in actions, knowledge of ecology and actions, group locus of control, intention to act, environmental sensitivity, personal responsibility, individual locus of control) was affected by at least one of the five programs, with all groups increasing in knowledge of issues. 3. Curriculum groups scored higher than comparison groups on only knowledge of issues. This result may be explained in part by the fact that teachers used only about one third of the recommended activities and few implemented the recommended service-learning project. 4. Programs that showed an impact with a large number of ERB characteristics should have also led to an	**Outreach strategy/method of teaching** • Build student environmental stewardship motivation and competencies by focusing on the characteristics of environmentally responsible behavior -- knowledge of issues, skill in actions, knowledge of ecology and actions, group locus of control, intention to act, environmental sensitivity, personal responsibility, and individual locus of control.* • Build environmentally responsible behavior among students through field-based experiences and service-learning.*

		increased intention to act, but not all did. This suggests that further research is needed to test the Hungerford and Volk model (1990). 5. Personal responsibility and locus of control improved only among field trip participants. This suggests that programs are not providing youth with enough opportunities to develop self-confidence in their abilities. 6. It is likely that some youths' ERB increased as a result of participation in outdoor programs, but the results are less clear for the curriculum and restoration project youth. 7. Teachers who participated in the 5-day field inservice improved in all ERB characteristics. Teachers who participated in the 2-day curriculum inservice improved in all ERB characteristics except environmental sensitivity, not surprising given the indoor setting of the workshops.	

APPENDIX C

Water Outreach Education Web Site Resources

Education theory, water research, and high quality education materials are linked together through the following unique tools:

- The *Best Education Practices (BEP) DECISION TREE* is set up like a field guide key. The TREE leads to answers for common water outreach problems through a series of yes or no questions. Ultimately, the user connects to BEP advice with links to specific applications, tips, and resources that apply to situations that we commonly face in our work as natural resource professionals. For instance, do you want:

  Tree 1 – To tackle a *specific* water use or management problem?
  Tree 2 – To increase *public awareness* or help the community meet a water goal?
  Tree 3 – To build *community capacity* to manage water use and environmental impacts?

- *USE BEPS* helps the educator to analyze the situation, determine the "hook" or the "teachable moment," and use communication and teaching skills to accomplish objectives. Selections lead the educator through a process to:
  - Clarify what they want to accomplish.
  - Choose a strategy to decide exactly what type of outreach effort is appropriate to the situation.
  - Plan using recognized program design and communication strategies.
  - Identify BEPs that will help accomplish the objective.
  - Assess the program.
  - Learn from others.

- *TOOLS FOR TEACHING* provides quick access to tips and techniques for implementing successful teaching or training initiatives. Resources range from tips about how to facilitate or how to make a presentation, to helpful advice about planning a typical outreach event.

- *SEARCH RESOURCES* allows the user to find high quality water education resources that are linked to the new educational strategies you've learned about on the Web site and want to use to meet your water management goal.

- *BEP RESEARCH* tells the story behind education practice recommendations. This section includes the research bibliography, a research summary for specific target audiences, and background about important areas of education theory we call knowledge areas. Table 1 shows examples of the knowledge areas and target audiences that we address on the Web site.

Table 1. *Web Site Knowledge Areas and Target Audiences*

Knowledge Areas	Target Audiences
Adult education principles	Agricultural commodity groups
Communication principles	Environmental/ Conservation NGOs
Citizen participation/ Community involvement principles	Farmers
	Government agencies
Education planning	Homeowners
Leadership development principles	Industrial water users
Learning theory	Landowners
Social marketing principles	Land development businesses
Technology transfer/ Diffusion of innovation theory	Local decision and policy makers
	Recreational water users
Youth education principles	Specific ethnic groups

APPENDIX D

Recommendations Summarized by Target Audiences: Tables 7 – 15

Table 7. *Conservation Professionals*: Symposium Recommended Best Education Practices

Audience Description	Professionals who apply natural resources training and skills to water management, including: county conservationists, soil and water conservation professionals, watershed coordinators, and other natural resource professionals who interface with the public
Sources	Findings for this audience are based on the results of two research papers, one poster, and two panel presentations. *Indicates findings from a research-based paper. Other findings are derived from case studies.

Outreach Themes	Recommendations
Audience information	No examples available
Message content	No examples available
Message delivery vehicle	No examples available
Outreach strategy	• Provide face-to-face meeting opportunities: to allow for learning from others and to provide camaraderie (networking and moral support).* • Provide course activities with direct application to work responsibilities (appropriate to local context).* • Provide instructor feedback.* • Enable students to personalize their education objectives (through pre-course interviews).* • Provide students with autonomy in determining content and timing of learning activities.* • Follow classroom exercises and visual examples by field application. • For conservation professionals: o Provide area workshops. o Apply environmental education principles in training events. o Provide follow-up. o Encourage peer teaching; ongoing professional development. • Follow these basic outreach practices:* o Program planning o Program development and implementation o Professional development o Evaluation o Research
Supporting and motivating professionals	• Train water education professionals to apply these steps when designing an outreach program: o Define driving forces. o Define goals and objectives. o Identify and analyze the target audience. o Create the message. o Package the message. o Distribute the message. o Evaluate the outreach campaign.
Evaluation	• Evaluate conservation professionals' effectiveness in using models and demonstration tools and in their use of skills taught in the workshops. • Use activities and evaluation to help identify barriers and verify success. • Adapt course design over time using multiple feedback methods.*

Table 8. *Decision-makers, leaders, and community groups*: Symposium Recommended Best Education Practices

Audience Description	People who provide recognized leadership in the community whether in elected, appointed, salaried, or volunteer positions
Sources	Findings for these audiences are based on the results of two research papers, four posters, and three panel presentations. *Indicates findings from a research-based paper. Other findings are derived from case studies.
Outreach Themes	**Recommendations**
Audience information	• Before designing training, survey local officials to learn if they: o Have a good understanding of their communities' storm water management plan.* o Feel they have sufficient information to make informed decisions about storm water management.* o See a role for local watershed groups in water quality monitoring, stormwater management planning, plan implementation, and compliance monitoring or environmental stewardship.*
Message content	No examples available
Message delivery vehicle	• Work with a collaborative to provide consistent stormwater message across neighborhoods in a large city.
Outreach strategy	• To teach recognition of key aquatic insects use narrated slide discussion and provide a live insect for reference.* • Use website resources: o To provide web-based delivery of real-time automated stormwater and water quality data. o To link data about observed phenomenon with photos and simple explanations. o For outreach with schools and municipal officials. • Encourage community groups o To assess source water in order to prioritize threats, and to develop and implement action strategies. o To develop outreach strategies such as: public awareness campaigns, water conservation campaigns, pollution prevention activities (such as household hazardous waste collection), application of BMPs on farms, public policy protection strategies. • In water-related organizations, include stakeholders as Board members. • Involve citizens in a watershed planning group by facilitating their understanding of the problem/situation. • Support watershed planning groups with assistance from agencies. • Build water leadership capacity among young professionals, especially: o Members of minority and ethnic communities o Engineers o Law professionals o Environmental planners o Public interest advocates.
Supporting and motivating professionals	• Build skills to ask the right questions about land use. • Build land use training program acceptability by: o Demonstrating impacts o Making staff and funding resources availability o Providing repeated education for new decision makers o Keeping the science current
Evaluation	No examples available

Table 9. *Ethnic groups*: Symposium Recommended Best Education Practices

Audience Description	A population from a specific ethnic or cultural group
Sources	Findings for these audiences are based on the results of two research papers and one poster. *Indicates findings from a research-based paper. Other findings are derived from case studies.

Outreach Themes	Recommendations
Audience information	• Identify specific education needs, for example the percent of households with drinking water that does not meet public health standards.* • Tailor drinking water education materials to the learning style, educational level and potential vision problems of a relatively uneducated, elderly audience.*
Message content	No examples available
Message delivery vehicle	No examples available
Outreach strategy	• To build capacity among urban schools to deliver water education effectively and with a community-based focus, provide: o A nationally tested curriculum linked to national and state academic standards o Training workshops for local partner, volunteer, and expert networks o Training and support for teachers, volunteers and community leaders o Service learning opportunities o Program evaluation procedures o Encouragement for student-led projects • With Latino youth programs, use place-based pedagogies so that the education of citizens might have direct bearing on the well-being of the social and ecological places people actually inhabit.* o Allow participants to apply their learning to a wide variety of home, neighborhood and community situations.* • Carry out education outreach initiatives through community-based organizations that already have a relationship with the target audience.* • Field test new education materials with a lead community-based organization.* • Generate local information and use it as the basis for local public education programs.*
Supporting and motivating professionals	No examples available
Evaluation	• Evaluate program success by following up with household to check if problems have been corrected.*

Table 10. *Farmers*: Symposium Recommended Best Education Practices

Audience Description	People who work on the land to grow and produce food, animal feed, or other consumer products; and business professionals who support agricultural production
Sources	Findings for these audiences are based on the results of four research papers, three posters, one poster paper, and one panel presentation. *Indicates findings from a research-based paper. Other findings are derived from case studies.

Outreach Themes	Recommendations
Audience information	• Check with stakeholders concerning which approach to environmental assessment on the ranch they perceive as most effective. • Identify key target audiences and acknowledge individual grower characteristics, perceptions of problems, current use of practices, and preferences for educational formats.* • Use in-depth discussion and interviews to provide a useful finding about target audience interests and preferences about farm management topics.* • Use a comprehensive pre-survey; conservation plans, soil tests, workshops, and farm visits during the growing seasons as a basis for developing relevant land and water education programs.
Message content	• Link economic risk to over-application of nutrients, a common practice for ensuring maximum yield.
Message delivery vehicle	• Time education with heightened audience awareness created by press coverage of rules release, public hearings and a compliance deadline.
Outreach strategy	• Provide on-farm visits, small group demonstrations, and workshops emphasizing local, direct farmer contact.* • Tailor materials to details of the farm operation.* • Provide farmers with real life examples for new ideas.* • Conduct voluntary and confidential assessments on individual farms, in cooperation with groundwater technicians.* • Work with farmers to compare farm records related to environmental management over time.* • Facilitate farmers developing their own water quality management plans. • Emphasize, peer information exchange in farm quality planning. • Develop an “Improvement Action Plan” for individual farms.*
Supporting and motivating professionals	No examples available
Evaluation	• Use a comparison strip to provide the farmer with opportunity to make their own evaluation of pros and cons of a new procedure. • Track program changes through a comprehensive pre-treatment survey and follow up surveys.* • Assure that program resources actually reached targeted audiences.*

Table 11. *Households and Neighborhoods*: Symposium Recommended Best Education Practices

Audience Description	Personal space of individuals and families
Sources	Findings for these audiences are based on the results of four research papers, five posters, three poster papers, and one panel presentation. *Indicates findings from a research-based paper. Other findings are derived from case studies.

Outreach Categories	Recommendations

Audience information	• Specify audiences by need.*
	• Implement a program design survey to:
	  o Assess public attitudes and interests about water.*
	  o Determine citizen perceptions and knowledge about water quality.
	• Tailor materials and programs to the learning style, educational level and potential vision problems of the audience.*
	• Identify specific education needs, for example, identify the percent of households with drinking water that does not meet public health standards.*
	• To encourage sustainable practices in application of fertilizers and pesticides on lawns:
	  o Use a social marketing approach to understand and redesign educational outreach strategies.
	  o Identify barriers and benefits to the use of IPM by paid landscape managers.

Message content	• Provide clear information.
	• Accompany findings or data with information:
	  o That emphasizes the meaning of the results.
	  o About the pros and cons of control methods and which are most effective.
	• Assure that different agencies provide consistent messages.
	• Design and deliver information based on communication and health behavior theories.
	• Provide information that has immediate utility to the program.*

Message delivery vehicle	• Make information publicly available from a variety of sources.
	• Use a website to provide group connections and watershed resources.
	• Provide awards for youth water projects.
	• In video and audio communication materials,
	  o Use entertaining approaches to communicate simple messages.
	  o Partner with a state broadcast association to assure dissemination.
	• Communicate information about a watershed initiative by:
	  o Distributing native plants
	  o Providing non-chemical landscape design advice and rain barrels
	  o Arranging bus tours
	  o Disseminating information

Outreach strategy	• Form a regional team to determine water education needs and coordinate team outreach efforts through a variety of techniques:
	  o An annual satellite conference
	  o A domestic water handbook
	  o A “riparian” concept campaign
	  o A water quality monitoring workshop
	  o A semi-monthly theme based fact sheet or report for stakeholders and policy makers

- Support stakeholder groups:
  - Rely on stakeholder involvement in program development.
  - Rely on landscape and watershed organizations help to set project goals.
  - Support groups, especially those with similar missions and those that already have a relationship with the target audience.*
- Generate local information:
  - Use a regional survey to establish priorities and to set baseline information about regional water education needs.
  - Use local information as the basis for local public education programs.*
- Test new educational materials:
  - Target educational resources to meet specific needs.*
  - Field test new education materials with a lead community-based organization.*
- Rely on these outreach components for a conservation initiative:
  - Workshops and seminars on key topics and for key audiences such as: rainwater harvesting, riparian management, rangeland “rescue”, golf course management, and youth education
  - Demonstration sites featuring practical techniques for conserving water and energy in rangeland situations
  - Individual homeowners make site assessments with help from trained volunteers who make specific recommendations for reducing bacteria and nitrogen runoff*
  - Awards for youth water projects
  - Well water testing information locally on an ongoing basis

Supporting and motivating professionals

No examples available

Evaluation

- Evaluate program success by following up with household to check if problems have been corrected.*
- Provide property owners with do-it-yourself kits and coupons for environmentally friendly products.

Table 12. *Landowners*: Symposium Recommended Best Education Practices

Audience Description	People who own property and use it for residential, recreational, forestry, or agricultural purposes. People who work the land, such as farmers or loggers, are described as separate target audiences
Sources	Findings for this audience are based on the results of one research paper, one poster, and one poster paper. *Indicates findings from a research-based paper. Other findings are derived from case studies.

Outreach Themes	**Recommendations**
Audience information	No examples available
Message content	No examples available
Message delivery vehicle	• Provide landowners with information using a handbook and a calendar, making good use of photographs.
Outreach strategy	• Provide landowners with hands-on, practical training about individual property management choices set in the context of information about broader ecosystem science and impacts.* • Provide training for real estate professionals in a supportive atmosphere accompanied by a field trip.
Supporting and motivating professionals	No examples available
Evaluation	No examples available

Table 13. Recreational water users: Symposium Recommended Best Education Practices

Audience Description	Adults and youth who engage in fishing, boating, and other recreational activities on or near bodies of water
Sources	Findings for this target audience are based on the results of one poster paper. *Indicates findings from a research-based paper. Other findings are derived from case studies.

Outreach Themes	Recommendations
Audience information	No examples available
Message content	No examples available
Message delivery vehicle	• Work in collaboration with the professional association to publicize a course for golf course managers.
Outreach strategy	• Engage golf course conservation superintendents in developing a course on turf grass management. • Make turf grass management courses readily accessible to golf course managers and provide instructor support for completing assignments and application to their own golf course.
Supporting and motivating professionals	No examples available
Evaluation	No examples available

Table 14. *Volunteers*: Symposium Recommended Best Education Practices

Audience Description	Citizens who voluntarily gather and organize data about a local watershed
Sources	Findings for this audience are based on the results of two panel presentations. *Indicates findings from a research-based paper. Other findings are derived from case studies.
Outreach Themes	**Recommendations**
Audience information	No examples available
Message content	No examples available
Message delivery vehicle	• Facilitate volunteer water quality monitoring efforts through sharing success stories and communication among groups using an interactive website and listserve.
Outreach strategy	No examples available
Supporting and motivating professionals	No examples available
Evaluation	• Tell the story of the program and publicize impacts. • Encourage county commissioners, stakeholders, and partners in reporting outcomes.

Table 15. *Youth*: Symposium Recommended Best Education Practices

Audience Description	Young people engaged in informal, nonformal, or formal, elementary and secondary education programs
Sources	Findings for these audiences are based on the results of two research papers, four posters and two poster papers. *Indicates findings from a research-based paper. Other findings are derived from case studies.
Outreach Themes	**Recommendations**
Audience information	No examples available
Message content	No examples available
Message delivery vehicle	• Facilitate school-based watershed education programs through interactive resources and communication among groups using an interactive website. • Prepare youth to inform and engage communities about watershed information as a mechanism for reaching audiences who are geographically scattered when resources are limited.

Outreach strategy	• When developing watershed education *teacher manuals*, identify barriers to implementation and adapt materials to respond to identified needs.
	• When developing watershed *education materials*:
	  o Adapt watershed education teaching materials to align with grade-appropriate science curriculum standards.
	  o Involve the state office of education and other education stakeholders in the revision process.
	• Use best education practices in organizing environmental field days for youth.
	• Use water education activities to provide “situated problem-solving” practice that can translate to workforce skills.*
	• Teach water science and build environmentally responsible behavior among students through “service-learning” experiences that apply principles of interaction and continuity: both significant features of education that leads to learning.* For example,
	  o Provide educators, students and District staff with opportunities to participate in public lands activities. This experience has been shown to increase student performance and interest in school, student concern for protecting and conserving the environment, and educator motivation.
	  o Focus on the characteristics of environmentally responsible behavior – knowledge of issues, skill in actions, knowledge of ecology and actions, group locus of control, intention to act, environmental sensitivity, personal responsibility, and individual locus of control – to build student environmental stewardship motivation and competencies.*

Supporting and motivating professionals	• Provide teachers with an opportunity to experience activities first-hand; interact with other educators; and learn about the materials. • Provide teachers with activities that meet one or more curriculum goals.
Evaluation	No examples available

APPENDIX E

Recommendations Summarized by Outreach Themes: Tables 16 – 22

Table 16. *Audience information*: Symposium Recommended Best Education Practices

***Audience information* Theme Description**	Development and use of information about a target audience *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
Conservation professionals	No examples available
Decision-makers, leaders and community groups	• Before designing training, survey local officials to learn if they: o Have a good understanding of their communities' storm water management plan.* o Feel they have sufficient information to make informed decisions about storm water management.* o See a role for local watershed groups in water quality monitoring, stormwater management planning, plan implementation, and compliance monitoring or environmental stewardship.*
Ethnic groups	• Identify specific education needs, for example the percent of households with drinking water that does not meet public health standards.* • Tailor drinking water education materials to the learning style, educational level and potential vision problems of a relatively uneducated, elderly audience.*
Farmers	• Check with stakeholders concerning which approach to environmental assessment on the ranch they perceive as most effective. • Identify key target audiences and acknowledge individual grower characteristics, perceptions of problems, current use of practices, and preferences for educational formats.* • Use in-depth discussion and interviews to provide a useful finding about target audience interests and preferences about farm management topics.* • Use a comprehensive pre-survey; conservation plans, soil tests, workshops, farm visits during the growing seasons to develop relevant land and water education programs.
Households and neighborhoods	• Specify audiences by need.* • Implement a program design survey to: o Assess public attitudes and interests about water.* o Determine citizen perceptions and knowledge about water quality. • Tailor materials and programs to the learning style, educational level and potential vision problems of the audience.* • Identify specific education needs, for example, identify the percent of households with drinking water that does not meet public health standards.* • To encourage sustainable practices in application of fertilizers and pesticides on lawns: o Use a social marketing approach to understand and redesign educational outreach strategies. o Identify barriers and benefits to the use of IPM by paid landscape managers.
Landowners	No examples available
Recreational water users	No examples available
Volunteers	No examples available
Youth	No examples available

Table 17. *Message content*: Symposium Recommended Best Education Practices

Message content **Theme Description**	What information to provide *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
Conservation professionals	No examples available
Decision-makers, leaders and community groups	No examples available
Ethnic groups	No examples available
Farmers	• Link economic risk to over-application of nutrients, a common practice for ensuring maximum yield.
Households and neighborhoods	• Provide clear information. • Accompany findings or data with information: o That emphasizes the meaning of the results. o About the pros and cons of control methods and which are most effective. • Assure that different agencies provide consistent messages. • Design and deliver information based on communication and health behavior theories. • Provide information that has immediate utility to the program.*
Landowners	No examples available
Recreational water users	No examples available
Volunteers	No examples available
Youth	No examples available

Table 18. *Message delivery vehicle*: Symposium Recommended Best Education Practices

Message delivery vehicle **Theme Description**	How to effectively deliver information to the target audience *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
Conservation professionals	No examples available
Decision-makers, leaders and community groups	• Work with a collaborative to provide consistent stormwater message across neighborhoods in a large city.
Ethnic groups	No examples available
Farmers	• Time education with heightened audience awareness created by press coverage of rules release, public hearings and a compliance deadline.
Households and neighborhoods	• Make information publicly available from a variety of sources. • Use a website to provide group connections and watershed resources. • Provide awards for youth water projects. • In video and audio communication materials: o Use entertaining approaches to communicate simple messages. o Partner with a state broadcast association to assure dissemination. • Communicate information about a watershed initiative by: o Distributing native plants. o Providing non-chemical landscape design advice and rain barrels. o Arranging bus tours o Disseminating information
Landowners	• Provide landowners with information using a handbook and a calendar, making good use of photographs.
Recreational water users	• Work in collaboration with the professional association to publicize a course for golf course managers.
Volunteers	• Facilitate volunteer water quality monitoring efforts through sharing success stories and communication among groups using an interactive website and listserve.
Youth	• Facilitate school-based watershed education programs through interactive resources and communication among groups using an interactive website. • Prepare youth to inform and engage communities about watershed information as a mechanism for reaching audiences who are geographically scattered when resources are limited.

Table 19. *Outreach strategy/method of teaching* – <u>Outreach strategy</u>: Symposium Recommended Best Education Practices

Outreach strategy **Theme Description**	How to provide education that leads to measurable impacts *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
Conservation professionals	• Provide face-to-face meeting opportunities: to allow for learning from others and to provide camaraderie (networking and moral support).* • Provide course activities with direct application to work responsibilities (appropriate to local context).* • Provide instructor feedback.* • Enable students to personalize their education objectives (through pre-course interviews).* • Provide students with autonomy in determining content and timing of learning activities.* • Follow classroom exercises and visual examples by field application. • For conservation professionals: o Provide area workshops. o Apply environmental education principles in training events. o Provide follow-up. o Encourage peer teaching; ongoing professional development. • Follow these basic outreach practices:* o Program planning o Program development and implementation o Professional development o Evaluation o Research
Decision-makers, leaders and community groups	• To teach recognition of key aquatic insects use narrated slide discussion and provide a live insect for reference.* • Use website resources: o To provide web-based delivery of real-time automated stormwater and water quality data. o To link data about observed phenomenon with photos and simple explanations. o For outreach with schools and municipal officials. • Encourage community groups o To assess source water in order to prioritize threats, and to develop and implement action strategies o To develop outreach strategies such as: public awareness campaigns, water conservation campaigns, pollution prevention activities (such as household hazardous waste collection), application of BMPs on farms, public policy protection strategies • In water-related organizations, include stakeholders as Board members • Involve citizens in a watershed planning group by facilitating their understanding of the problem/situation. • Support watershed planning groups with assistance from agencies. • Build water leadership capacity among young professionals, especially: o Members of minority and ethnic communities o Engineers o Law professionals o Environmental planners o Public interest advocates.
Ethnic groups	• To build capacity among urban schools to deliver water education effectively and with a community-based focus, provide: o A nationally tested curriculum linked to national and state academic standards o Training workshops for local partner, volunteer, and expert networks o Training and support for teachers, volunteers and community leaders o Service learning opportunities o Program evaluation procedures. o Encourage student-led projects • With Latino youth programs, use place-based pedagogies so that the

Outreach strategy **Theme Description**	How to provide education that leads to measurable impacts *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
	education of citizens might have direct bearing on the well-being of the social and ecological places people actually inhabit.* o Allow participants to apply their learning to a wide variety of home, neighborhood and community situations.* • Carry out education outreach initiatives through community-based organizations that already have a relationship with the target audience.* • Field test new education materials with a lead community-based organization.* • Generate local information and use it as the basis for local public education programs.*
Farmers	• Provide on-farm visits, small group demonstrations, and workshops emphasizing local, direct farmer contact.* • Tailor materials to details of the farm operation.* • Provide farmers with real life examples for new ideas.* • Conduct voluntary and confidential assessments on individual farms, in cooperation with groundwater technicians.* • Work with farmers to compare farm records related to environmental management over time.* • Facilitate farmers developing their own water quality management plans. • Emphasize, peer information exchange in farm quality planning. • Develop an “Improvement Action Plan” for individual farms.*
Households and neighborhoods	• Form a regional team to determine water education needs. • Support stakeholder groups: o Rely on stakeholder involvement in program development. o Rely on landscape and watershed organizations help to set project goals. o Support groups, especially those with similar missions. • Generate local information: o Use a regional survey to establish priorities and to set baseline information about regional water education needs. o Use local information as the basis for local public education programs.* • Test new educational materials: • Target educational resources to meet specific needs.* o Field test new education materials with a lead community-based organization.* • Carry out education outreach initiatives through community-based organizations that already have a relationship with the target audience.* • Coordinate team outreach efforts through a variety of techniques: o An annual satellite conference o A domestic water handbook o A “riparian” concept campaign o A water quality monitoring workshop o A semi-monthly theme based fact sheet or report for stakeholders and policy makers. • Rely on these outreach components for a conservation initiative: o Workshops and seminars on key topics and for key audiences such as: rainwater harvesting, riparian management, rangeland “rescue”, golf course management, and youth education o Demonstration sites featuring practical techniques for conserving water and energy in rangeland situations • Assist individual homeowners to assess their site using trained volunteers, and make specific recommendations for reducing bacteria and nitrogen runoff.* • Provide awards for youth water projects. • Offer well water testing information locally on an ongoing basis.
Landowners	• Provide landowners with hands-on, practical training about individual property management choices set in the context of information about broader ecosystem science and impacts.*

Outreach strategy **Theme Description**	How to provide education that leads to measurable impacts *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
	• Provide training for real estate professionals in a supportive atmosphere accompanied by a field trip.
Recreational water users	• Engage golf course conservation superintendents in developing a course on turf grass management. • Make turf grass management courses readily accessible to golf course managers and provide instructor support for completing assignments and application to their own golf course.
Volunteers	No examples available
Youth	• Use water education activities to provide "situated problem-solving" practice that can translate to workforce skills.* • Teach water science through "service-learning" experiences that apply principles of interaction and continuity: both significant features of education that leads to learning.* • When developing watershed education *teacher manuals*, identify barriers to implementation and adapt materials to respond to identified needs. • When developing watershed *education materials*: o Adapt watershed education teaching materials to align with grade-appropriate science curriculum standards. o Involve the state office of education and other education stakeholders in the revision process. • Use best education practices in organizing environmental field days for youth. • To increase student performance and interest in school, student concern for protecting and conserving the environment, and educator motivation, provide educators, students and District staff with opportunities to participate in public lands activities. • Build student environmental stewardship motivation and competencies by focusing on the characteristics of environmentally responsible behavior – knowledge of issues, skill in actions, knowledge of ecology and actions, group locus of control, intention to act, environmental sensitivity, personal responsibility, and individual locus of control.* • Build environmentally responsible behavior among students through field-based experiences and service-learning.*

Table 20. ***Outreach strategy/method of teaching*** **– <u>Outreach design and implementation</u>: Symposium Recommended Best Education Practices**

Outreach design and implementation **Theme Description**	How to provide education that leads to measurable impacts *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
a. Quality – provide a clear purpose; pilot test	• Follow these basic outreach practices:* o Program planning o Program development and implementation o Professional development o Evaluation o Research • Field test new education materials with a lead community-based organization.* • Form a regional team to determine water education needs. • Generate local information: o Use a regional survey to establish priorities and to set baseline information about regional water education needs.* • Test new educational materials: o Target educational resources to meet specific needs.* o Field test new education materials with a lead community-based organization.*
b. Stability – frequent opportunities sustained over time	• Support watershed planning groups with assistance from agencies. • Offer well water testing information locally on an ongoing basis.
c. Access – inclusive, accessible, all interested audiences can participate	• Carry out education outreach initiatives through community-based organizations that already have a relationship with the target audience.* • Encourage community groups: o To assess source water in order to prioritize threats, and to develop and implement action strategies. o To develop outreach strategies such as: public awareness campaigns, water conservation campaigns, pollution prevention activities (such as household hazardous waste collection), application of BMPs on farms, public policy protection strategies. • Provide on-farm visits, small group demonstrations, and workshops emphasizing local, direct farmer contact.* • Make turf grass management courses readily accessible to golf course managers and provide instructor support for completing assignments and application to their own golf course.
d. Connection – involve stakeholders and partners	• In water-related organizations, include stakeholders as Board members. • Involve citizens in a watershed planning group by facilitating their understanding of the problem/situation. • Support stakeholder groups: o Rely on stakeholder involvement in program development. o Rely on landscape and watershed organizations help to set project goals. • Build water leadership capacity among young professionals, especially: o Members of minority and ethnic communities o Engineers o Law professionals o Environmental planners o Public interest advocates. o Support groups, especially those with similar missions • When developing watershed *education materials*: o Adapt watershed education teaching materials to align with grade-appropriate science curriculum standards. o Involve the state office of education and other education stakeholders in the revision process.

Outreach design and implementation **Theme Description**	How to provide education that leads to measurable impacts *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
e. Program – adapted to particular audience or topic needs	• Generate local information and use it as the basis for local public education programs.* • Tailor materials to details of the farm operation.* • Provide training for real estate professionals in a supportive atmosphere accompanied by a field trip. • Engage golf course conservation superintendents in developing a course on turf grass management. • When developing watershed education *teacher manuals*, identify barriers to implementation and adapt materials to respond to identified needs. • For conservation professionals: o Provide course activities with direct application to work responsibilities (appropriate to local context).* o Provide area workshops. o Apply environmental education principles in training events. o Provide follow-up. o Encourage peer teaching; ongoing professional development. • Use website resources: o To provide web-based delivery of real-time automated stormwater and water quality data. o To link data about observed phenomenon with photos and simple explanations. o For outreach with schools and municipal officials. • To build capacity among urban schools to deliver water education effectively and with a community-based focus, provide: o A nationally tested curriculum linked to national and state academic standards o Training workshops for local partner, volunteer, and expert networks o Training and support for teachers, volunteers and community leaders o Service learning opportunities o Program evaluation procedures. o Encouragement for student-led projects • Rely on these outreach components for a conservation initiative: o Workshops and seminars on key topics and for key audiences such as: rainwater harvesting, riparian management, rangeland “rescue”, golf course management, and youth education. o Demonstration sites featuring practical techniques for conserving water and energy in rangeland situations.
f. Marketing – how audiences know about the opportunity	No examples available
g. Management – to assure smooth operation	• Coordinate team outreach efforts through a variety of techniques: o An annual satellite conference o A domestic water handbook o A “riparian” concept campaign o A water quality monitoring workshop o A semi-monthly theme based fact sheet or report for stakeholders and policy makers.
h. Relevant instructional strategies	• Provide face-to-face meeting opportunities: to allow for learning from others and to provide camaraderie (networking and moral support).* • Provide instructor feedback.* • Enable students to personalize their education objectives (through pre-course interviews).* • Provide students with autonomy in determining content and timing of learning activities.* • Follow classroom exercises and visual examples by field application. • To teach recognition of key aquatic insects use narrated slide discussion and provide a live insect for reference.* • With Latino youth programs, use place-based pedagogies so that the

Outreach design and implementation **Theme Description**	How to provide education that leads to measurable impacts *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
	education of citizens might have direct bearing on the well-being of the social and ecological places people actually inhabit.* o Allow participants to apply their learning to a wide variety of home, neighborhood and community situations.* • Work with farmers: o Provide farmers with real life examples for new ideas.* o Conduct voluntary and confidential assessments on individual farms, in cooperation with groundwater technicians.* o Compare farm records related to environmental management over time.* o Facilitate farmers developing their own water quality management plans. o Emphasize, peer information exchange in farm quality planning. o Develop an “Improvement Action Plan” for individual farms.* • Assist individual homeowners to assess their site using trained volunteers, and make specific recommendations for reducing bacteria and nitrogen runoff.* • Provide landowners with hands-on, practical training about individual property management choices set in the context of information about broader ecosystem science and impacts.* • Use best education practices in organizing environmental field days for youth. • Use water education activities to provide “situated problem-solving” practice that can translate to workforce skills.* • Teach water science and build environmentally responsible behavior among students through “service-learning” experiences that apply principles of interaction and continuity: both significant features of education that leads to learning.* For example, o Provide educators, students and District staff with opportunities to participate in public lands activities. This experience has been shown to increase student performance and interest in school, student concern for protecting and conserving the environment, and educator motivation. o Focus on the characteristics of environmentally responsible behavior – knowledge of issues, skill in actions, knowledge of ecology and actions, group locus of control, intention to act, environmental sensitivity, personal responsibility, and individual locus of control – to build student environmental stewardship motivation and competencies.*
i. Recognition of contributors	• Provide awards for youth water projects.

Table 21. *Supporting and motivating professionals*: Symposium Recommended Best Education Practices

Supporting and motivating professionals **Theme Description**	How to help professionals to be more effective in water education work *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
Conservation professionals	• Train water education professionals to apply these steps when designing an outreach program: o Define driving forces. o Define goals and objectives. o Identify and analyze the target audience. o Create the message. o Package the message. o Distribute the message. o Evaluate the outreach campaign.
Decision-makers, leaders and community groups	• Build skills to ask the right questions about land use. • Build land use training program acceptability by: o Demonstrating impacts. o Making staff and funding resources availability. o Provide repeated education for new decision makers. o Keep the science current.
Ethnic groups	No examples available
Farmers	No examples available
Households and neighborhoods	No examples available
Landowners	No examples available
Recreational water users	No examples available
Volunteers	No examples available
Youth	• Provide teachers with an opportunity to experience activities first-hand; interact with other educators; and learn about the materials. • Provide teachers with activities that meet one or more curriculum goals.

Table 22. *Evaluation*: Symposium Recommended Best Education Practices

Evaluation **Theme Description**	How to develop and use evaluation to improve the quality of water outreach *Indicates findings from a research-based paper. Other findings are derived from case studies.
Audience	**Recommendations**
Conservation professionals	• Evaluate conservation professionals' effectiveness in using models and demonstration tools and in their use of skills taught in the workshops. • Use activities and evaluation to help identify barriers and verify success. • Adapt course design over time using multiple feedback methods.*
Decision-makers, leaders and community groups	No examples available
Ethnic groups	• Evaluate program success by following up with household to check if problems have been corrected.*
Farmers	• Use a comparison strip to provide the farmer with opportunity to make their own evaluation of pros and cons of a new procedure. • Track program changes through a comprehensive pre-treatment survey and follow up surveys.* • Assure that program resources actually reached targeted audiences.*
Households and neighborhoods	• Evaluate program success by following up with household to check if problems have been corrected.* • Provide property owners with do-it-yourself kits and coupons for environmentally friendly products.
Landowners	No examples available
Recreational water users	No examples available
Volunteers	• Tell the story of the program and publicize impacts. • Encourage county commissioners, stakeholders, and partners in reporting outcomes.
Youth	No examples available

APPENDIX F

Plenary Activity: Promoting BEPs and Challenges for Future Action

Comments, Suggestions, Reactions

A-1

- ❖ Need to make usable by locals and non-academics (whole concept).
- ❖ Compare and contrast with examples what moves from good, better, etc. Even an artificial example to clearly illustrate a particular technique.
- ❖ Be open to new visions of good, better, best. Inter-connections are encouraged among educators and community structures.
- ❖ Analyze assumptions of focus on education v. communication and anthropology.
- ❖ It's not just Extension; make applicable to non-Extension educators.
- ❖ Good facilitation (dot groups) to identify barriers to understanding BEPs (Thursday groups). Share information gathered from groups (email).
- ❖ Limited time for questions/interaction.
- ❖ Eliminate terminology "good and better" but keep "best". Too hard to differentiate between terms, but definitions of good and better are OK.
- ❖ Include all PowerPoints in conference materials we received. Please include on website.
- ❖ Research papers would have been easier to work through if they were compiled in order presentations were given. Summaries provided were good though.

A-2

- ❖ Awesome concept behind conference and overall done very well. Like working conference concept.
- ❖ Symposium has opened eyes to tools and processes to improve work plans and projects.
- ❖ May need a "non-working" regional conference to "bring tradition of extension people" into Education Practice emphasis. (Training based--identifying current trends and products).
- ❖ Develop regional work groups (web conferencing?) between national conferences to promote more interaction and participation.

- Better defined agenda and expectations from participants. If you intend us to work let us know ahead.

- Don't start conference on Monday, don't end on Friday.

- Liked to know hotel away from conference site. Didn't bring umbrella that could have been needed.

- Field trips as appropriate.

- More time for panel presentations.

- More program presentations.

- Pre-conference planning to link to state/regional issues.

- Need to broaden subject areas covered linked to regional/state priorities.

- More diverse audience (1890s to 1974s).

- Offer scholarships.

- Didn't understand what conference was--more pre-conference information.

A-3

- Like the idea that Natural Resource staff needs education training.

- Nice combination of academic and program people, but no tribal representation.

- More BEP evaluation models--how do you go from good to better to best?

- Talk about demographic, cultural, geographic differences. There will be specific standards for each group.

- Have full agenda to this type of gathering out earlier to encourage more non-academic attendance and help spread the word.

- Invite classroom teachers, field staff (non-educators) doing "education" as they see it, citizen monitors (representatives of target audiences), and wastewater treatment staff.

- Take advantage of resource out the window, i.e. pontoon boat ride to demonstrate a BEP or need for change. Make sure objectives are clear.

- Change name to PEP--Proven Education Practices (or you'll give impression that "best" is better than "good"). BEP evokes judgmentally rather than the learning process we're encouraging.

- Develop master's program in National Resource Education.
- Close the gap between delivery methods details and research/evaluation nuts and bolts practicality.

- Walk the talk--research based examples used.
- User fewer disposable products; plates, cups, lunch boxes, etc.

A-4

- What does CSREES mean?
- Define acronyms.

A-5

- This is an important effort--need to continue to promote education as valued tool, not fluff.
- More networking opportunities available with the ??? areas.
- More time for questioning panel, fewer breakouts. Time to network at specific topics.
- A tour of Lake Mendota shorelines and education practice. Tour limnology lab.
- Start with definitions of good/better/best E.P.s and role of participants. Consider how others will understand these terms outside this meeting.
- Extend these ideas to other outreach/education programs such as USFS, NPS, NERRS Sea Grant. Bring more to the table.
- EPA and CSREES National Program leaders should be here. And OMB.
- Stronger “connection” between “better” education and better end result or implementation/action reaffecting water quality with education.
- Include social marketing strategies and successes among the BEPs on the website.
- Create an education success story by utilizing this good, better, best concept. Give us tools to take home.

A-6

- Need to include water quantity issues (e.g. conservation).
- Could website include means to facilitate collaboration between participants?
- Links to successful projects or the opportunity to enter information about the success of me project (searchable DB).
- Pre-conference information didn’t let us know this was a “working conference.”
- Website needs to be grammar and spell checked.
- Need to model exemplary BEPs throughout conference: this activity is highly engaging. Lead some sessions outside; find innovative alternatives/BEPs for talking head PowerPoints. How about an icebreaker? Low waste lunches? Hands-on? Peer teaching?

- Start with a paper copy of a BEP definition and examples.
- Do this conference in each state through Cooperative Extension. Put on a “Road Show.”
- Don’t ask for questions without available time for discussion. Build time in for real group definition.

A-7

- Make time for review of web ??? products.
- Definition of good, better, and best and need for this framework still confusing and needs more group discussion.
- Yearly conferences in Hawaii, San Antonio, and Mexico.
- Too much/too short time issues. Plan for more networking and social events. Have break out sessions for regional groups.

What Can They Do To Refine and Promote Project Products?

B-1

- Send flier to watershed managers and other target audience; define target audience; send postcard or business card out with all mailings; list serves.
- Discussion board to easily post comments regarding website content. Networking opportunity?
- Survey monkey (online organization) to give feedback on specific questions.
- Take article from website and put in publications as articles. Journals?
- Make note of newly updated information; pay attention to flow of web traffic (where they leave the site); check spelling and grammar in articles; keep up to date.
- Online website evaluations.
- Posting regional conferences and workshops. Posting case studies and outcomes and real stories--success stories.
- “Are you interested?” button/database in water education conferences.
- Attend and present nationally and regionally--provide service to local state associations.
- Website--constantly make sure functions well and quick. Also make more visually appealing less extension looking or academic looking. View the website as a product--define target market, create marketing plan, get feedback.

- Good website counter so you can tell which pages get most hits. Include online evaluations. Get others to link to your site. Good editing process for all products--also way to submit corrections.
- Product easily printable--printer friendly.
- Work in interactive features.
- Pop-up online feedback opportunities (Usefulness? What questions has it answered? Not answered?)
- Promote interconnections among interested users--way to ask for help.

B-2

- Create marketing plan for BEP.
- Get feedback from non-educators.
- Condensed histories of lesson learned across ??? disciplines, etc. (Meta-analysis of education/evaluation).
- Promote to funders--what is BEP and what is not--are they funding poor education practice?

B-3

- Streamline website and materials so users are not overwhelmed. Less is more.
- Have succinct categories to browse, because the scope of this is so large. Make sure even in categories that there are subsets, i.e. youth--urban, farm, youth organizations/recreation.
- Make sure it's clear what the products are and what the goal of this whole project is.
- Advocate renewed interest in EE schools (Flagging. Waning.) Work with DPI.
- Get this URL hot-linked from other organizational websites. Use state WQ education coordinator to develop promotion plan using their intimate knowledge of their own site. Use existing state EE and watershed organizations, SWCDs, NGOs, NAAEE, and WQ educator list serves.
- Explore other state agencies with comparable focus and their networks/websites.
- Provide links to action programs such as WAV, etc. Make program descriptions brief and let people go to link to get more information if they are interested. Still many problems with the site crashing, opening documents, etc.

B-4

- Think nationally, act regionally, implement locally.

- Literature review on web should be helpful. This is how best practices are defined.
- List education strategies with “rating” (good--best) and literature that supports rating.
- Feedback form or message board. Self-evaluation of website developers to determine what information stays/goes.
- Links to “best” programs. Include grant sources for education programs. Programs/practices searchable by audience or issue (e.g. agriculture).
- Marketing the site, we’re assuming audiences will use this. Advertise on list serve.
- Short course--CEU/credits (online, distance learning, interactive, in-person).
- People as resource in the database. Method for networking.
- Organize by geographical districts to refer local projects to legislatures.
- Send out announcements about the website in our emailing lists/newsletters with a link.
- Materials used for grant writing.
- Analyze webpage hits to see the interest in topics and adapt information to match interests.

B-5

- How to replicate without duplication.
- Create our own language--stop co-opting “Biz Speak.” We need to describe our work in plain English!

B-6

- Monthly email highlighting web education--specific case study, BEP, education theory. Promote ideas, not just products.
- Send email on a weekly basis to potential contributors until they give in...
- Provide examples of “best” evaluations under this educational resource topic. Show how this example met the G/B/B criteria to be placed on this website.
- Provide basic information/introduction to Learning Theory: how people learn best and how BEPs are based on this research. Make this connection because it may not be obvious to non-educators.
- Publicize website in Journal of Extension, Western Water trade publications, EE newsletters and journals, etc.
- Links to and from other water websites.
- Make Google friendly. Make link friendly--accessibility.

- Make website with more graphics, learner style friendly, use graphics, tables, and graphs.
- Presentation of website at other conferences--NAI, NAAEE.
- Consider allowing website search by audience type--"I'm a high school teacher, where do I start?"
- Best acronym page--help us understand!

Recommendations for Future Actions

C-1

- Explaining the parallels and differences in education policy development.
- More information on the influences. Establish regional workgroups to continue work. Tell more stories. More emphasis on packaged, ready to go programs in a session.
- Hold training programs for practitioners on program design tools and techniques. Add another session--develop consensus building and future policy.
- Instead of national--series of regional meetings (greater input and ???). Also more stories collected.
- Trainer format for regional meeting. More training and definitions of good, better, and best--how this relates to program development and efficiency. How you use it--what level do you really need of good, better, best?
- Consistent message and materials and delivery of message.
- Provide seed money for innovative projects and proven projects. Promote collaboration on similar projects and programs.
- Get the website more meat, not enough to analyze. Promote dialogue of users of these programs who are non-educators. What are their thoughts?
- Provide examples of how you can do a best management practice for a project you will only do once. You won't be able to benefit from your own evaluation.
- Hold a future conference. Put model programs on the website. More networking opportunities. Link the website to library systems in order to link this database to a larger audience.
- Sessions on types of levels of evaluation and evaluation theory. Sessions on creative v. critical thinking to expand perspectives of educators.
- Team this conference up with "Tools for Non-Formal Educators"--just developed nationally.
- The term theory scares people.

C-3

- ❖ Tighten definition of good, better, best from the get-go so we don't spend so much time floundering. Due to lack of clarity, we're unsure of where to go next. Maybe this reflects a growth process for our profession.
- ❖ More discussion on how to reach "influentials." More definition of "influentials." Invite influentials and ask them. More discussion on reaching media.
- ❖ Get agenda out before the symposium. Have BEP II in Langston U/Oklahoma State U.
- ❖ Integrate learning from other education disciplines that've experienced similar struggles in articulating education goals. Don't reinvent the wheel. Maybe other professions have been there, too.
- ❖ Invite Doug Mackenzie. Mohr to another one.
- ❖ Make reasons why we want to do this clearer to web viewers.
- ❖ Take critical look at social marketing--if it's a good approach, make resources available. Take a critical look at BEPs.
- ❖ Off to a good start, but a long way to go. Publicize/link to websites where academic research can be found quickly.
- ❖ Provide PPTs in advance of presentations on website. Short course on education theory for "accidental educators." Could provide direction and validation and ability to perfect approaches.
- ❖ Help for topic experts who are called on to teach. Explore connections between fields of social psychology, marketing, education, group processes, and citizen involvement.

C-4

- ❖ Symposium that includes target audiences to provide feedback on their experiences with each described practice.
- ❖ Boundary workshop on water outreach between Canada and the U.S.
- ❖ Educational practices will not work in all cultural audiences. They need to have more input (cultural issue). Different culture audiences require different BEPs.
- ❖ In future distribute fragrance-free pens.
- ❖ Maintain a dialogue on the website for questions, sharing of ideas, or announcements.
- ❖ Focus on value--add programs for diversity. Use us as resources to identify key resource people for this topic.
- ❖ Post a simple list with hotlinks to successful outcome based project. Don't bury it in a bunch of academic clutter.

C-5

- Success must equal outcome of cleaner water, not numbers contacted, etc. Success equals a permanent change in behavior.
- Funding needed for long-term evaluation of changes achieved. Continue to emphasize documenting impacts, especially as a way to convince resource managers of value of education as a tool. (Give us more examples!)
- Give this group an opportunity to review changes made to website before going public. Email URL and password to participants.
- Consider information about education theory/learning styles on website--simple, understandable, applied.
- Develop evaluation templates.
- Tribal colleges are not represented--encourage more diversity.
- Bringing in people involved in social movements and environmental justice.
- Examine the consequences of bringing a sociological focus into water management when funding and time are already limiting.
- Bring education and sociology into the process, not us doing everything.

C-6

- Next year's conference should be at a spa or natural area. Immerse us in water, water, water!
- More work on website--expand definitions, examples of BEPs, assistance to research search engines, and examples of methods of conducting search strategies for improving results to narrow searches.
- Education theory--brief primer for natural resource professionals (on website?). Who's Dewey? Gardner? Others? What did he/she contribute to learning theory? Why is this important? How do we apply this to our water education?
- Schedule more time and space for poster viewing sessions.
- More networking time--scheduled or during the day rather than at the end.
- Protein at breakfast!
- Consider regional BEP conferences that provide training to water professionals from Extension, SWCD, and state and local agencies. Have examples of good/better/best BEPs and have participants determine why this will lead us to criteria/standards.
- Establishment of regional centers to disseminate information once the information is ready. The term BMP is behind the times, isn't it? Shouldn't BEP follow?

How to Encourage Resource Submissions on the Website?

D-1

- Call for resources in Journal of Ext. and other journals (Ed. Soil and Water, etc.).

Contact: 1. State Association for Environmental Education
2. Informal Educators
3. City Water Department and Associations, American Water Works Association, and Rural Water Works Association.

- Links to other educational websites. Work with University, School of Education and Natural Resources, and Environmental Educations Schools in group projects to use website resources.

- Make criteria and expectations very clear. Have State coordinators emphasize career ladder benefits. Build dossier and curriculum vitae.

- Go outside extension method. Many people in our state won't go through the extension to submit. Work with EE organizations and have a booth at conferences to advertise and bring publications to share.

- Extension monitors, solicits, facilitates getting groups in state to submit--reverse process.

- Incentives or prizes (money) for submissions--memory stick computer, posters, curricula, etc. Maybe something as simple as having their name picked to be the submitter of the month. Or a prize certificate for the "best" submitted project.

- Design a survey to determine gaps and challenge submissions to address gaps.

- Work through list serves.

D-2

- Develop strategy for submissions, BEP submissions relationship to existing websites.

- Identified resource to keep website updated over time. Website should be developed during the workshop/conference in order to become one of our significant resources.
- Send letters to Educators to invite them to submit especially in areas where there are gaps.

- Get feedback from end users of programs.

- It must be easy to submit! Allow you to edit entire submission easily before final submission.

- Make a Thank-You-Box to tell you what number your submission was.

- Personal note of thanks/recognition from Webmaster.

- Pop-up box telling you what other submissions are in the database that are similar to what you submitted.

- Pop-up box to automate an email to send a request that will be sent to colleagues to ask them to submit a resource to the database.

- Comment/Thank You box for submission so people can tell you it worked for them, too.

D-3

- Make direct invitations to key individuals (more effective to target busy people).

- Use existing list serves to give monthly update of topics/submitters recently added.

- Consider juried process v. catch-all. (We like boutiques, not Wal-Mart). Make submission easy and fast. Target specific gaps in literature.

- Another search category (scholarly research, program descriptions, books, scripts). Encourage more urban submissions via broader target audiences--need for rural, too.

- Explore overlays with US, EPA, NPS education coordination. Offer a free gift for submitters or a discount to BEP II Symposium. Market the website in general to get more submitters. Make it a mandatory requirement for grant recipients, e.g. CSRES, EPA, other feds, Watershed Academy, etc.

- Clarify goals and value of submission: “What’s in it for me if I submit?” Who will this potentially reach?

- Make it clear what kinds of submissions you want--what kinds of programs? Materials? Everything related to water or specific areas? How far out will this go? Are there limits (windsurfing, water references in the Bible, water park programs)?

- Policies needed relative to commercial products. Clarity in what is being sought and why.

D-4

- Continuing Education credits. Make site easier to navigate (didn’t find button to submit resources).

- Pre-submission review by peers. Involve people in the content/education group as reviewers for the website. Emphasize importance of submitting.

- Feedback to submitters about quality and quantity of visits to their submission.

- Marketing of site to others. Link to research on content issues like “meth labs.”

- Reduce the number of data entry cells for submitting--how about a place to insert you name, the project, and a hot link.

- Link to the resource sources--State programs, etc.

- Create a space for highlighting programs or where folks can suggest that a resource should be added.

- Identify clubs/organizations, universities, businesses, agencies, etc. and send announcements requesting they submit their resources. Distribute announcements to customers or constituents.

- Have a way to submit ideas, templates that others could adapt to their local context.

- How will you control for quality of resources? Will there be a physical library of resources?

- Make submission as easy as possible, including mailing in resources.

- Need a way to reference sources for materials to give credit.

D-6

- Record hits on individual resources and make available to authors. Include email contacts to author of people who download materials. Call individual and request materials.

- Offer opportunities for peer review abstracts. Offer opportunities for peer reviewed publications.

- Incentives (money, movie tickets, pencils).

- Subscription to update about new materials.

- Professional recognition/graduate credit for submission. Free credit for next year's conference.

- Bulletin board of submissions--main ideas, titles, sharing. "Ask the expert".

- Break submissions into more detailed/defined categories and divide into youth-adult categories. Refine "search" so that adult materials/sources don't come up when you search for youth resources, etc. Educator-parent-general citizens-industry-resource professional.

- Have author's email included if interest in contacting them/or other means of contact.

D-7

- Provide categories--practices, strategies, applies theory, publications, courses, etc. Collect examples (Show us what you want!) from JOE and other professional applied education journals.

- Contact information for water resource professionals (by state or region).

- Keep submissions simple!

PAPERS, POSTERS, AND PANELS

Keynote Address

Featured Case Study Presentation (Abstract)

Research Papers on Audience Specific BEPs (in alphabetical order by presenter)

Poster Abstracts and Papers on Target Audience Education Practices and Measures of Success (in alphabetical order by presenter)

Panel Presentations

Framing the Dialogue – BEP Target Audience Success Stories

Promotion and Communication – Moving Water Outreach and Education from Backwater to Mainstream

Closing Address

Keynote Address

Education – An Essential Ingredient for Successful Water Management

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The principle of using best management practices (BMPs) to conserve and improve natural resources is well established and time-honored in the resource field. It makes complete sense to take proven, exemplary approaches to land and water management and offer them as models for others. The BMP tradition helps millions of practitioners in agriculture, forestry, soil and water management and related fields to avoid "wheel reinvention." BMPs include outstanding methods, technologies and even rules of conduct. Importantly, they capture the state of the art and help the larger public understand how it too can contribute to water and natural resource management.

So can the BMP concept be extended to education by establishing a new set of "BEPs," best *education* practices for water? The quick answer is yes. If properly implemented, BEPs would likely become a significant and much-needed help in water resource management throughout the United States and elsewhere. That is because there is a growing body of evidence that education works in a practical sense and produces results both by itself, and as an added measure, in the larger natural resource and water management arenas. The signs are good that water management BEPs will become critically important.

For starters, we will need more of a focus on education because water management principles and practices are more complex today than they were 30 years ago and that complexity is rapidly increasing as scientists understand more about natural systems. Today's water management, for example, requires a grasp of watershed functions, geomorphology, nutrient transmission, seasonal flow regimes, surface and groundwater interfaces, patterns of polluted run-off, riparian resource and wetlands absorption, and more. Land managers may already have a significant grasp of many of these subjects but the future will require more public help to keep up. That is where BEPs come in.

Secondly, more complex and intense surface and ground water dynamics at the urban-rural interface place an additional burden on urban-dwelling people to more effectively share water resources with agricultural and natural resource managers, and vice versa. In many areas of the nation, balancing water consumption in the home, on the lawn and in business has never been so important. The reverse is true too. Rural land managers must better understand and mitigate their impact on urban water quality and quantity including potential pollution of drinking supplies, seasonal flow reductions, intensifying flood impacts and more.

Finally, nationwide population growth and redistribution will require more understanding of how truly finite our freshwater supplies are in America and throughout the world. To balance human needs with the needs of nature and establish more sustainable levels of water consumption will require greater per-capita knowledge of water resource basics and these can be well conveyed through water BEPs. But, the very idea of BEPs introduces a threshold question. How much will water education actually work to improve management?

How Are We Doing On Environmental Knowledge and Literacy?

From 1996 through 2002, the National Environmental Education & Training Foundation (NEETF) and the international survey research firm of Roper examined the state of simple environmental knowledge or awareness among adult Americans. The surveys found that, while awareness of environmental subjects is high and most people express significant support for environmental protection, their actual knowledge of environmental subjects is relatively low (see the *Roper Report Card* at http://www.neetf.org/roper/ roper.html). Lack of environmental knowledge and literacy is most pronounced with regard to meaningful comprehension of the cause/effect relationships implied in watershed management, ecosystem conservation, wetlands management, water supply, drinking water systems and so on.

This means a major hurdle for BEPs is that few Americans grasp that rainwater picking up pollutants on and running off the land and into our water bodies is the leading form of water pollution today. There are two main reasons for this lack of knowledge. First, people of all ages have learned that industry is the leading pollution source. But, this is mostly old news held over from the decades of the 1960s and 1970s. Secondly, having an understanding of run-off also means knowing a modicum of information about the cause/effect relationships between rainfall, land management, water flow patterns and water quality. This raises the specter of whether those who work in the professional environmental field overestimate how much people actually know and, therefore, do not take enough time to review and educate them on fundamentals including drainage and spatial relationships, ecological sensitivities, and such simple facts as drinking and irrigation supplies can sometimes become polluted. Also, in rural areas, there can be a higher level of understanding of watershed, water supply, and water quality issues but the difference in knowledge and awareness between urban and rural residents is negligible.

Three Levels of Environmental Learning: Three Kinds of Impact

An examination of research on the efficacy of environmental information, education, and outreach indicates that there are at least three levels at which people come to grasp environmental subjects and there are three kinds of results from that knowledge. They are as follows:

1. The "Awareness Level"

Environmental "awareness" basically means a person has "heard of" an environmental topic, knows it is a public concern, but actually knows very little else of its details. Public knowledge and opinion research shows that many people (some 50% to 85%) have awareness of several main environmental subjects but it rests on weak foundations and lacks depth. The key reason so many people are aware of environmental subjects is the media's broad reach. A majority of Americans have, for example, heard of air and water pollution issues, loss of species and habitat, solid waste disposal problems, and more. Such awareness has little effect on behavior but is often a powerful aid to public understanding of simple topics. Simplified information can often foster misunderstanding of the more complicated subjects, however. The key public benefit from widespread environmental awareness is public support for the government and large companies to regulate or invest in environmental improvements.

2. The "Personal Steps Level"

This involves the kind of simple and practical environmental knowledge needed by an individual to take pro-environment steps in the home, the workplace or as a consumer. It comes partially through schools and the media, and also through government and company outreach programs. It can also come from consumer education (such as labeling or advertising). Information on personal environmental actions or steps encourages recycling, saving water, reducing waste, economizing on fuels, and purchasing more environmentally friendly products. Research shows that environmentally informed Americans *can* absorb and *will* take many personal steps to help maintain the quality of the environment at home, work and in their community. The same research indicates that a person who is thus informed is anywhere from 10% to 50% more likely to act more environmentally responsible. But, serious environmental educators are also quick to caution that such behavior change is fairly temporary, and while effective information and education programs can change many people's behavior it will not be all that durable. It is also important that the actions people are asked to perform are within ongoing activities such as using water, gasoline, electricity or shopping. This type of knowledge needs constant updating and reminders.

Common Ingredients for Personal Steps Education

- Small changes in ongoing behaviors
- Very little "dot connecting"
- A sense of "togetherness"

Even still, NEETF estimates that instructing more people on such simple personal steps, more frequently and on a broader scale, could quickly bring about a $75 billion annual environmental improvement in saved water, energy, and improved health.

3. The "Environmental Literacy Level"

In the past three decades, the environmental education field has defined environmental literacy as knowing underlying principles, and being able to analyze and apply them. The field distinguishes media or other information and outreach programs from true environmental education (EE).

- **Youth foundations** – Recent examinations of the state of environmental literacy find that a small percentage of the public is prepared for the complex environmental issues and decisions of the future. At least part of this shortfall is due to the status of environmental education in school. Simply put, EE has not achieved "core subject" status in most of our schools. Though EE is a popular elective and supplemental effort in more than half of our schools, there is too little of it that actually gets delivered and it is poorly sequenced so that environmental learning does not effectively accumulate. We need to offer students a sufficient amount of sequenced environmental education to let them absorb and retain the basic definitions and principles of environmental science and systems, and to learn how to actually apply those principles. It would be a major breakthrough if a majority of students could reach this level by the time they complete high school. For water BEPs this would mean providing a basic knowledge of watershed science, management, and related resource fundamentals.

- **Adult leadership literacy** – All people in the home, workplace, and community impact the environment including water resources. Research shows, however, that leaders in business, government, and civic affairs lack basic environmental literacy and often either ignore environmental impacts and opportunities or address them solely through intuition.

Community leaders, in particular, need to be environmentally literate. They number in the tens of millions and are constantly making decisions on every aspect of community life from land development policy, to education, to waste removal. It is vitally important for adults in key positions and professions such as business, health, and education to make sound decisions about the environmental impacts of their decisions. We need mature and well-developed environmental literacy for a majority of those 30 million adults who comprise America's community and professional leaders – who our research partner Roper refers to as community "influentials."

By influentials, Roper means the one out of ten people living in American communities who get actively involved. They sit on planning boards and education boards, and participate in civic events. They are members of the PTA, the Lions club, and countless other civic organizations, and they are natural leaders in their towns and neighborhoods who are looked up to and respected by others. Importantly, many of these community influentials are highly curious and avid self-teachers, and learning about the environment is among their interests. In part that is because nearly one half of community influentials fall into what Roper classifies as the most environmentally disposed members of the public – the True Blue Greens. They are naturally civic-minded, educated, and willing to speak out for environmental management and stewardship in their communities. Further good news for achieving environmental literacy is the fact that the remaining group of influentials is also predisposed toward environmental management and protection.

Implications for BEP Program Design for Literacy

The above construct suggests a few basic "pointers" on how to create BEPs for water. We suggest that educators ask themselves a few simple questions about what and how they are teaching:

Can we achieve improved water management without stronger education?

Education will be a greater part of our water management future (not less) because of the growing need to address polluted run-off from its many sources, to handle intensifying competition between rural and urban water needs, and to lessen the impact of individual consumer activity on water quality and quantity. Moreover, as the American economy shifts toward smaller average enterprises a larger number of private sector companies are impacting water resources without the same level of knowledge, training, and expertise as larger counterpart companies.

Does the information to be imparted require simple awareness or deeper education?

Many environmental education programs err by assuming that the learner automatically understands underlying principles and definitions such as "watershed," "run-off," "non-point source pollution," "riparian zones," and "flow regimes." A well-developed program will spell out these basic concepts and display them in ways that the learner can understand and eventually apply. While it may seem obvious, those teaching BEPs for water resources must be keenly aware of the need to tailor their educational delivery and levels of detail to effectively accomplish the instructional task. It is critical that BEPs be appropriately adjusted to the complexity of the water subject being considered. Educators often overestimate what their students actually know by way of background and basic principles. An example would be for a lesson plan covering watersheds to fail to adequately explain the definition of a watershed or to depict the relationship of rainfall to the overall catch basin. Another example might be to discuss the water quality opportunities presented by maintaining riparian strips while assuming (incorrectly) that students already understand the filtering effect of streamside vegetation on run-off.

Do the BEPs that are delivered adhere to other basic rules of pedagogy?

BEPs that follow basic pedagogical rules would include providing a sufficient amount of instruction time, providing sequenced delivery of basic principles so they build upon each other, and recognizing that knowledge accumulates over time.

BEPs will also require careful use of sound instructional materials including ample use of graphics and forms of visual presentations. Visuals are particularly helpful in setting out complex causal relationships. Another way to effectively teach causal connections is through stories. Storytelling as a general rule is a highly effective tool for education.

Does the instruction teach skills and application?

A significant aspect of environmental and natural resource education is its implied relationship with application in the real world. Many educational subjects are presented for their knowledge value alone. Many BEPs will contain specific education regarding skill development and application.

Will BEPs aim at community leaders or "influentials"?

For those skeptics who wonder if measurable results really ever come from environmental education programming, recent research offers some answers and tremendous hope. It shows, for example, that the environmentally informed person is anywhere from 5% to 90% more likely to engage in a set of pro-environment activities (water and energy saving, recycling, green consumerism) than a person who is not informed on the environment. A simple 5% reduction in the amount of water used in the average home would save Americans more than $14 billion on their water bills and make millions of acre feet of water available for other uses including fish and wildlife management.

In addition to seeking measurable impacts on a majority of the adult public, certain Roper-defined segments of the adult population may offer the brightest hope of all. Notable among these are what Roper calls the community "influentials." They are the one in ten adult Americans who are effective (usually volunteer) leaders in our communities. They are members of parent-teacher organizations, Lion's clubs, volunteer fire departments and civic associations. They sit on town councils and planning boards, and are active in their communities.

Roper finds that the environment matters to the community influentials. Some 78% of them, for example, think that businesses should also consider what is good for society and not just what is good for profit. Influentials have in fact been pushing government and business hardest to improve the environment. A majority (52%) believes that laws to protect the environment have not gone far enough and many of them seem ready to do more than recycle their trash. They say they would pay more for green products such as autos, gasoline and electricity.

Percentage of influentials who are *moderately* or *very* interested in a topic (Keller, 2004):

- News and Current Events 96%
- Environment 92%
- Fitness and Health 87%
- Nature and Animals 87%

Roper feels these influentials have untapped potential as change agents on many public issues including the environment. They are early-adopters of many environmentally considerate products and practices, and exhibit a true openness to learning about the environment. They are curious and deliberate seekers of information and, with a stronger base of environmental literacy, could have an exponential effect on the stewardship of our communities, ecosystems, air, and water. Some 74% attended a public meeting on town or school affairs (compared to 16% for the total public). Fully 50% served on a committee of a local organization (7% for the general public), 40% wrote a letter to the editor (6% for the general public), 35% were active members of groups trying to influence public policy (5% for the general public), and 31% made a speech (4% for the general public). Other research underscores that influentials are highly active in their communities by being among the core of people who volunteer. More than 60% of influentials engage in volunteer work in a typical month.

In addition to reaching the general public and school students, BEPs targeted toward community influentials would have a lasting effect on their ultimate success and implementation.

Reference

Keller, E., & Berry, J. (2004). *The influentials*. New York: The Free Press.

Featured Case Study Presentation

Making Our Nonpoint Source Pollution Education Programs Effective

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Abstract

In Wisconsin, nonpoint source pollution has been identified as the greatest cause of water quality degradation affecting over 75% of inland lakes, many of the harbors and coastal waters on the Great Lakes, and substantial groundwater resources. The majority of this problem is attributed to agricultural land use. Pervasive water quality problems are the symptoms – the primary cause being the failure to implement existing remedial technologies. Although education is often a major part of watershed protection programs, education strategies vary greatly from project to project and from educator to educator. Educational programming, often referred to as information and education (I&E) strategies, provides information to landowners in order to promote environmentally beneficial actions such as the installation of best management practices on farms. Prior research in Wisconsin's Priority Watershed Program has shown that I&E strategies, especially those that seek to reduce nonpoint source pollution from agriculture, generally rely on a combination of two approaches: 1. Diffuse communication campaign efforts; 2. One-on-one information transfer techniques such as on-farm visits, individual farm trials, and individual farmer consultation. To assess the effectiveness of these two approaches, this research compares the rate of adoption of nutrient management strategies by farmers in two different Wisconsin watersheds over the same five-year period of 1990 to 1995. This research supports an integration of a diverse set of educational approaches such as on-farm visits, small group demonstrations, and workshops. An over-reliance on diffuse information dissemination may come at the expense of interpersonal information transfer through direct farmer contact.[1]

[1] Editor's Note: This paper was published previously (Shepard, 1999) and not available for publication as part of the Symposium Proceedings.

References

Shepard, R. (1999). Making our nonpoint source pollution education programs effective. *Journal of Extension*, *37*(5). Retrieved June 2004, from http://www.joe.org/joe/ 1999october/a2.html

Research Papers on Audience Specific BEPs

Livestock EMS Pilots: Lessons About Eduction Strategies

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Abstract

Globally, industries seek to meet the International Standard for Environmental Management Systems (ISO 14001). Increasingly, U.S. governmental agencies are promoting this standard to encourage firms to go beyond regulatory compliance. Are formal Environmental Management Systems (EMSs) useful to farmers and helpful to farm environmental protection? If so, this presentation aims to answer these questions for natural resource educators.

Partnerships for Livestock Environmental Management Systems (LEMS Project), have been exploring what educational strategies will most effectively assist farmers with implementation of continuous improvement environmental management systems. The Project has established a learning community of Extension educators led by Farm and Home Environmental Management Programs at University of Wisconsin-Madison and collaborators at the University of Nebraska and the University of Georgia. Objectives are to determine the following: 1. How can the EMS framework best fit diverse livestock producers' needs and constraints, and integrate with business management? The Project includes three state pilot projects each for dairy, beef and poultry producers, each led by an Extension professional. 2. What sort of educational interventions are most productive and amenable to livestock producers to induce EMS adoption? 3. What are the barriers to successful EMS implementation, and what incentives might be required? 4. What conditions do the EMSs need to meet to satisfy diverse stakeholder agendas?

Collaborators in each pilot include state agencies, commodity groups, stakeholder groups and other resource conservation professionals. The LEMS Project evaluation, conducted with an evaluation professional from the UW-Madison, Learning through Evaluation, Adaptation, and Dissemination Center (LEAD), compares the pilot states' approaches to assisting farmers with EMSs. The evaluation, which includes surveys and interviews with both participating producers and pilot states' project staff, will identify best education practices for engaging livestock producers in committing to and implementing continuous improvements in their environmental management systems. The intentions are to inform policy makers regarding appropriate uses of the EMS approach in agriculture and potential value for achieving environmental protection, and to inform educators about barriers and the most effective strategies to encourage and assist farmers with EMS implementation.

Applying Principles of Adult Education Theory to a Professional Development Program for Watershed Group Leaders

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Abstract

This paper addresses best education practices for building the leadership capacity of collaborative watershed management groups. We explore the results of applying principles of adult education theory to a distance education course for watershed group leaders. The Ohio Watershed Academy, in its fourth year, is designed to build the capacity of watershed group leaders to facilitate the development and implementation of community-based plans that address water quality impairments. Curriculum development and course design were based on four principles of adult education (Merriam & Caffarella, 1991):

- Life experience as a content/trigger to learning
- Self-direction and autonomy
- Self-reflection
- Expression of learning

The course design includes two major components: face-to-face workshops and web-based instructional modules. The workshops provide an opportunity for peer-teaching, based on student designed team learning projects. The web-based modules allow students to complete assignments from the office, but also require students to interact with stakeholders. Elements of adult education theory evident in the course design include:

- Entry interviews with students to assess and co-create learning objectives.
- Flexible scheduling and selection of assignments to match students' work experiences and learning objectives.
- Numerous opportunities for reflection on practice.
- Opportunities for peer teaching.

Data on student reactions and changes in knowledge, attitudes, and skills were collected through surveys and interviews over a three year period. We found gains in knowledge and skills were most evident in the area of stakeholder participation. Implications for course design include providing opportunities for peer interaction and student-designed learning activities.

Origins of the Ohio Watershed Academy

All across the United States, watershed collaboratives are forming to address water resource management issues. In Ohio, government agencies are encouraging the formation of watershed collaboratives for the purposes of developing and implementing comprehensive watershed management plans. In 2000, the Ohio Environmental Protection Agency (OEPA) and Ohio Department of Natural Resources (ODNR) created a grant program whereby watershed collaboratives could hire full-time Watershed Coordinators to lead local stakeholders in developing watershed management plans. Recognizing the need to provide some basic training in collaborative planning for these new positions, administrators from OEPA and ODNR approached Ohio State University Extension about creating a professional development course in collaborative watershed planning for Watershed Coordinators and other interested watershed group leaders and participants. The Ohio Watershed Academy was thus created with funding from OEPA using federal dollars under the Clean Water Act, Section 319.

Course Design

The purpose of the Ohio Watershed Academy is to develop the capacity of students to facilitate collaborative watershed planning efforts by introducing them to some of the basic elements of collaborative watershed planning. The following topic areas are covered in the course curriculum:

- Overview of watershed planning
- Group facilitation
- Running effective meetings
- Understanding water quality criteria
- Developing problem statements
- Creating a watershed inventory
- Designing effective outreach programs

The majority of coursework is conducted at a distance, with students working through a series of instructional modules, submitting assignments electronically via the Internet. They use a Web interface developed by technicians in the Section of Communication and Technology in the College of Food, Agricultural, and Environmental Sciences at The Ohio State University. Instructional modules and corresponding assignments are posted on the Ohio Watershed Academy Web site and include learning objectives, an introduction to the topic, required and recommended readings, and a description of the assignment(s) to be completed by the student. Instructional modules can be viewed on the Web at the following URL: http://ohiowatersheds.osu.edu/owa/lessons/.

In addition to the standard assignments, students also complete two in-depth learning projects during the five-month course. Students are encouraged to work in pairs or small groups on a watershed-related topic of their choice. Students develop their own learning objectives, activities, and products. A summary of the in-depth learning projects is presented to the class and posted to the Academy Web site.

The third component of the course involves face-to-face meetings where students have an opportunity to get together for presentations from invited speakers and share the outcomes of their in-depth learning projects. These meetings also provide students with time to build social networks and share experiences with peers.

The Audience

The first class of thirty-nine students began in December of 2000. A total of four classes (60 students) have since graduated from the Ohio Watershed Academy. A majority of the Academy students are full-time Watershed Coordinators who are required by their grant sponsors (OEPA and ODNR) to write a watershed action plan in collaboration with local stakeholders. Some students are not Watershed Coordinators, but are employed in teaching, soil and water conservation, planning, and other related professions. A few students are engaged in unrelated professions and became involved in watershed planning as volunteers. The age, years of resource management experience, and academic and professional background of the Watershed Coordinators vary widely. Some have retired from their first careers, while others are in their first professional position after college.

Curriculum Based on Principles of Adult Education

The curriculum and course design were developed by a team of staff at OSU Extension. An external multi-disciplinary and multi-stakeholder Advisory Committee provided feedback on course design and developed many of the instructional modules. Both the content and overall design of the course were created with the following four components of adult education in mind (Merriam & Caffarella, 1991):

- Life experience as a content/trigger to learning.
- Self-direction and autonomy.
- Self-reflection.
- Expression of learning.

Merriam and Caffarella (1991) proposed these four components based on a thorough review of adult learning theory in their book, *Learning in Adulthood*. Below, we provide a brief explanation of each principle and offer examples from the Ohio Watershed Academy.

Life Experience as a Content/Trigger to Learning

Adults bring a wealth of life experience to the learning environment. This can present both challenges and opportunities to the educator. On the one hand, adult students' experiences can enhance opportunities for peer teaching. On the other hand, students often come to the learning environment with widely varying levels of knowledge and skill. One of the challenges faced by the designers of the Ohio Watershed Academy was how to develop a curriculum that would be challenging for the more experienced students, without overwhelming the less experienced students. We also wanted to provide ample opportunities for peer-teaching to take advantage of the collective knowledge of the group.

Adults tend to seek learning experiences that increase their proficiency in their life roles (Knox, 1980). While some of the Academy participants were required to complete the course as a condition of the grants that funded their positions, we have never doubted that our students were motivated to be effective in their roles as leaders and facilitators of collaborative watershed planning efforts. We describe later in this paper how the Academy course was modified to allow students to personalize their own learning experience to match their work-related responsibilities.

Self-Direction and Autonomy

Knowles (1980) proposed that as learners mature, they become increasingly self-directed. According to Merriam and Caffarella (1991), the major motivators for engaging in self-directed learning are control, freedom, and flexibility. Adult learners prefer to set their own learning pace and experiment with alternative learning strategies. In designing the Ohio Watershed Academy we struggled to strike a balance between exposing students to a broad range of topic areas in a logical sequence on the one hand, and allowing students to select topic areas most relevant to their life experiences when those topics were most salient. As we discuss in a later section, we modified the course design over time to allow students more control and flexibility.

Self-Reflection

Some scholars, most notably Mezirow (1981) and Freire (1970), have posed that adult learners, more so than children, are capable of transforming their perspectives and assumptions about the world around them as an outcome of the learning experience. These new perspectives can lead the learner to develop new and more effective approaches to solving problems. We attempted to incorporate opportunities for self-reflection throughout the Academy curriculum. Many of the assignments encouraged the students to reflect on how their watershed group functioned, how decisions were made, and who was involved in those decisions. The instructors challenged students to consider their own biases and assumptions.

Expression of Learning

Adults often seek out learning experiences in order to be more effective in their life roles. It is therefore natural that adult learners would be anxious to express their new knowledge and skills through action. This is especially true when the subject area is directly and immediately relevant to the educational needs of the learner. In developing the Academy curriculum, we attempted to design the instructional modules so that, in the process of completing assignments, students would be creating products (e.g., lists of potential stakeholders, problem statements, and data collection goals) that would have immediate application to their watershed planning effort. Evaluations indicate mixed results with respect to direct application of learning to watershed planning efforts. More recently, we allowed students more flexibility in choosing which assignments to complete and in what order, and incorporated in-depth learning assignments that allowed students to design their own learning experience to address a work-related issue. We discuss these adaptations in greater detail in a later section.

Early Experiences: Academy Classes I-III

Between the spring of 2000 and summer of 2003, an extensive formative evaluation process was conducted on the first three Ohio Watershed Academy courses. Evaluation questions were developed by OSU Extension staff with input from an advisory group made up of representatives of funding agencies (OEPA, ODNR), other stakeholder groups (e.g., watershed collaboratives), and non-formal educators. Several methods were used to collect evaluation data, including written and on-line surveys, and phone interviews (see Appendix for sample questions). A total of thirty-two written surveys (89% response rate) were completed by students from the first two courses. Phone interviews were conducted after each of the first three Academy courses. A total of twenty-seven interviews were conducted with participants who volunteered to be interviewed.

An evaluation framework, based on Bennett's Hierarchy, a widely used Extension program evaluation and planning model, was used to generate evaluation questions. We were interested in learning not only how participation in the Academy affected students' knowledge, attitudes, skills, and aspirations, but also how the structure, design, and delivery of the program enhanced or detracted from the learning experience. In other words, we wanted to know if we were offering a quality learning experience. The following discussion highlights the evaluation findings from the first three Academy classes in relation to the four components of adult learning introduced earlier.

What Worked?

Overall, Academy students reported having a positive learning experience. One of the most popular aspects of the course was the opportunity to meet and network with peers (other watershed coordinators and watershed group leaders) during face-to-face meetings. Collaborative watershed planning is a relatively new field; there are no universal manuals or blueprints for success. Under such circumstances, learning from the trials and errors of others is a key learning strategy for many Academy students. Students also appreciated the camaraderie provided by the Academy meetings, as indicated in the following quotes taken from student questionnaires:

"I enjoyed having the opportunity to discuss topics with other coordinators. It gave me insight into the operations of other groups."

"I really think the networking/moral support was beneficial, especially as some of us work by ourselves."

One of our primary objectives in designing the Ohio Watershed Academy curriculum was to support the students in fulfilling their work responsibilities. Feedback from students indicated that assignments did have direct application for some students. For example, one student indicated, "Some of the instructional modules came at very good times where our organization was dealing with a particular topic related to the modules."

Another student benefited from the instructional module on running effective meetings:

"A lot was helpful, particularly the meeting facilitation agenda form. The first Board meeting after the assignment, the members noticed an increase in organization immediately."

Other students indicated that portions or all of some assignments would be used directly in their watershed plans or other reports.

When asked if the Academy addressed the students' most pressing professional needs, the majority of respondents indicated that it had. Some of the areas in which students reported the Academy was helpful included:

- How to get input from the public.
- Instilling leadership.
- Emphasizing the need for broader stakeholder involvement.
- Making progress on developing a watershed plan.

Gaining New Perspectives

One of the most interesting evaluation findings was evidence that participants in the Ohio Watershed Academy gained new perspectives on watershed planning through self-reflection and instructor feedback. Several students reported having gained an appreciation for the importance of involving more stakeholders, as expressed in the following quote:

"In my watershed … I'm looking at expanding the Board to include more stakeholder groups (e.g., health departments, chamber of commerce). These ideas came from the readings – the idea of a more diverse Board and the idea of an array of stakeholders in planning."

In providing feedback on written assignments, the instructors encouraged students to consider alternative viewpoints and reflect on their biases and assumptions. This feedback apparently had the desired effect for some students, as indicated in the following quotes:

"The instructor feedback was an essential part of the class where different points of view were made that may not have been this obvious."

"Feedback was very helpful for me to see the entire picture of watersheds."

"The Academy made [me] stop to evaluate myself as to where I was with the development of the watershed group."

In summary, students who participated in the first three Ohio Watershed Academy courses reported having a positive learning experience. In relation to Merriam and Caffarella's (1991) principles of adult learning, the Academy allowed students to use their professional situations as a trigger and content to learning. The Academy also provided students with an opportunity to reflect on and alter their perspectives on watershed planning in general and stakeholder involvement in particular. The direct application of some assignments to job responsibilities, in some instances, allowed students to express their learning through their professional roles. One component of adult learning that did not emerge as a strength from the evaluation results was autonomy, or self-direction in learning. This was one of the areas we sought to improve in the fourth Academy class.

Room for Improvement

Evaluation results from the first three Academy classes also turned up areas where there was room for improvement. Of greatest concern to the instructors was the number of students who withdrew or simply did not complete all the assignments – a requirement for graduation. Among the third class of twenty registered students, only eleven completed the course. In October of 2003, phone interviews were conducted with five (of a total of nine) Academy participants who interrupted participation before graduation (see Appendix A for example interview questions). Respondents' primary reason for not completing the Academy was lack of time, both for completing assignments and attending face-to-face meetings, which were held in the Columbus area. While participants who did not complete the Academy generally had favorable opinions of the course and many expressed an interest in completing the course at a later date, one respondent felt that the course content was tailored too much toward watershed projects still in the planning phase, and not enough toward projects that had moved into the implementation phase.

As mentioned in the introduction, students came to the Academy with widely varying backgrounds and levels of experience. Initially, students had very little flexibility in choosing which instructional modules (and corresponding assignments) to complete or the order in which they would be completed. As a result, some students found some of the modules to be too basic, while others found the same modules very challenging. Just as students enter the Academy at different stages of development as professionals, the watershed projects they are involved in are also in varying stages of development. By forcing students to complete the instructional modules sequentially, beginning with the basics of watershed planning, and ending with evaluation of project outcomes several months later, many students found that the assignments they were working on at any given time did not always coincide with their immediate work responsibilities. Referring to the instructional modules, one participant noted:

"The first half was great and relevant regardless of where a group was in the planning cycle. The second half was very dependent on where a group was in the cycle and was less directly useful if they did not correspond with where the group was."

Based on the feedback from students, several adjustments were made to the second and third Academy courses. In order to reduce the work load, the course was lengthened by a few weeks to allow the students more time to complete each assignment. To accommodate varying skill and knowledge levels, optional advanced assignments were added to some instructional modules. Evaluations from the third Academy class indicated that more radical changes were needed to address the issue of excessive time commitment and tailoring of the learning experience to meet professional demands. These changes were incorporated into the fourth Ohio Watershed Academy class and are described in the next section.

Academy IV: Moving Toward a More Learner-Centered Design

The fourth Academy course began in January of 2004 with a class of 27 students. Several months before the class began, OSU Extension staff reviewed the formative evaluation findings from the previous three classes. Two areas requiring significant adjustments were identified: 1) the workload was still too great for many students, and 2) participants were calling for more self-direction in choosing which assignments to complete and in what sequence to complete them. To address the first concern, the course was shortened from over six months to four. Also, students would no longer be required to complete all the assignments, but would choose ten of a total of nineteen assignments to complete, based on their personalized educational objectives. The objectives were co-created with the instructors during pre-course phone interviews. The pre-course phone interviews were adopted for the fourth class in an attempt to clarify expectations (e.g., time required, course content) on the part of both student and instructor before potential students committed to participating in the course.

Another innovation, developed to allow students more self-direction in creating their learning experience, was the in-depth learning project. The in-depth learning projects were designed by the students at the first orientation meeting and again at the second mid-term face-to-face meeting. The projects could be completed individually or in teams. Students worked with the instructors to identify learning objectives, activities, and outcomes (products in the form of presentations or materials that could be shared with the other students). Students presented the outcomes of their in-depth learning projects to their fellow students and invited guests at the mid-term and final face-to-face meetings. The purpose of the in-depth projects was not only to give students an opportunity to explore a topic of particular relevance to their current work responsibilities or interests, but also to give students an opportunity to express their learning through peer teaching. A brief description of the in-depth learning projects and the outcomes of those projects (e.g., slide presentations, summary findings) can be viewed on the Ohio Watershed Academy Web site at http://ohiowatersheds.osu.edu/owa/students/projects-2004.html

At the time this paper was written, the fourth Ohio Watershed Academy course was still one week from completion, but interim evaluation results indicate that students greatly appreciated the flexibility allowed in selecting assignments, both in terms of which assignments would be completed and the sequence in which assignments would be completed. Although students were required to select their assignments at the initial orientation meeting, several students made adjustments to that schedule throughout the course based on emerging issues in their work and in their watersheds. Interestingly, the percentage of students withdrawing from the fourth class remained relatively high (40%). Most of the students cited heavy workloads, busy lives, and job changes as reasons for withdrawing. No one cited dissatisfaction with the course as a reason for withdrawing, though a few did not communicate any reasons for withdrawing.

Conclusions

Educational programs that target water resource management professionals can be designed with the needs and characteristics of adult learners in mind. In designing the Ohio Watershed Academy, we have strived to:

- respect the pre-existing knowledge and life experiences of our students,
- provide them with opportunities to critically reflect on their practices and express their learning, and
- create opportunities for building professional relationships.

Evaluations from the first three classes provided us with valuable information about the program's strengths and weaknesses. Based on student feedback, the strengths included:

- Relevance of course content to professional roles.
- Exposure to new perspectives on watershed planning, particularly related to stakeholder participation.
- Opportunities to network and socialize with other watershed professionals.

Evaluation results also indicated that we needed to give students more flexibility in choosing which instructional modules to complete and give them more freedom to explore specific areas of interest. As a result, we allowed students in the fourth Academy class (January-May, 2004) to choose which instructional modules they would complete and in the order that would best match the content of the modules with their job responsibilities. We also added a new component to the course design: in-depth learning projects. In-depth projects allow each student, individually or as part of a team, to identify and explore topic areas of special interest and relevance to their role in watershed planning. Students presented the results of their projects to their peers at two face-to-face meetings.

Recommendations

Developing educational programs is similar to watershed planning in the sense that effective educational programs must be appropriate to local context and adapted over time based on trial and error. Therefore, our strongest recommendation for developing non-formal watershed education programs for adults is to design a thorough structure for formative evaluation using multiple methods to gather feedback from students on their experiences. Methods we have found useful include on-line feedback forms accessible every time the students submit an assignment, written forms completed at face-to-face meetings, and phone interviews. Over time, in response to evaluation results and our own self-reflection, we have attempted to provide our students with greater autonomy in determining the content and timing of learning activities. We have challenged them to question their assumptions about watershed planning and we have created more opportunities for students to identify and address their own educational needs through in-depth learning projects. In summary, we have attempted to create an educational program that will lead our students through a process of self-discovery and leave them with a greater capacity to address their own professional needs in the future. We also acknowledge that, as educators, our own process of self-discovery and learning is ongoing.

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APPENDIX (Bonnell & Baird)

Example Evaluation Questions

Phone Interviews

(Students were interviewed two months after the Academy had ended.)

- Please describe your experience with the Ohio Watershed Academy.
- What questions did you have during your experience?
- What was helpful?
- Was anything a hindrance?
- Do you feel the Academy helped build confidence and/or interest in your role as a watershed coordinator?
- What educational needs are not being addressed in the Academy?
- If you could go back and change anything about your experience, what would you change?
- Can you think of three things you learned during the course that helped you in your role as a watershed coordinator?

For participants who did not complete the course:

- What was the primary reason you were not able to complete the Academy?

On-line survey

(Students were given the opportunity to respond to the following questions after completing each instructional module.)

- Were the assigned readings sufficient for completing the assignment in this module?
- Were the instructions presented clearly?
- Do you feel the assignments in this module are helpful to you as a watershed coordinator?
- Do you feel that by completing this module, you are better equipped to make progress toward your watershed plan?

Formative evaluation (Students were asked mid-way through the Academy to write reflections about their experiences.)

- What is working about your Academy experience?
- What is not working about your Academy experience?

Appendix (continued)

Written survey

- Please describe your overall experiences with the Academy.

To what extent…	Not at all					Fully	Not Applicable
... did your Academy experience address your main educational need?							
... did the Academy assignments help you address your job responsibilities relative to watershed planning?							
... were you exposed to new ideas during the Academy?							
... did you experience belonging to a community of learners during the Academy?							
... did you experience a sense of collegiality with your fellow Academy students?							
... did the Academy provide you an opportunity to network?							
... did the Academy provide you with useful examples from other watershed groups?							
... did the format of the Academy provide you with sufficient flexibility?							
... did the Academy provide you with specific tools you were looking for?							

Appendix (continued)

- Please mark an X in the box that best represents your experience with the Academy assignments.(Note: Other, similar questions using a semantic differential were included in the written survey to measure participants' perceptions of readings, in-depth learning projects, face-to-face meetings, interactions with peers, and instructors. For an explanation of semantic differential scales, see Hopkins (1998).

Overall, assignments were…

Disorganized								Organized
Not informative								Informative
Not Helpful								Helpful
Waste of time								Worth the time
Not useful for my job								Useful for my job
Theoretical								Practical
Difficult								Easy

- As a result of your participation in the Academy, to what extent has the following expanded?

To what extent has the following expanded?	Not at all Expanded					Fully Expanded
a. My professional network						
b. My sense of belonging to a professional community						
c. My knowledge of resources available from OSUE (The Ohio State University Extension)						
d. My knowledge of resources available from OEPA (Ohio Environmental Protection Agency)						
e. My knowledge of resources available from ODNR (Ohio Department of Natural Resources)						
f. My knowledge of resources available from other organizations (other than OSU, OEPA, ODNR)						

- What was the most significant experience you had during the Academy?

- If you have established a new relationship as a result of your participation in the Academy, please describe the nature of the new relationship.

- What new skills did you gain as a result of completing the Academy, that have been **most useful or beneficial** to you (your work and/or life experiences)?

Appendix (continued)

- How would your plan or planning process be different without your participation in the Academy?

- Has the Academy helped your watershed group sustain itself organizationally and/or financially?

- Please, give one example of how you have used the products from assignments and in-depth learning project.

- Please, give one example of how you have brought the lessons learned from the Academy modules to the community.

Shoreland Revegetation Workshops Promote Environmental Stewardship

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Abstract

The University of Minnesota Extension Service offers a Shoreland Education Program to promote Shoreland Best Management Practices (BMPs). As part of this program, the Shoreland Revegetation Workshop Series was developed to increase participants' ecological knowledge and sensitivity, their ability to analyze and investigate shoreland issues, their practical skill level in addressing these issues, and their motivation to take action in promoting shoreland BMPs at the local and regional levels. The Hungerford and Volk (1990) environmental education model, identifying major and minor variables in environmental education, was used as a basis for evaluation of the effectiveness of the Shoreland Revegetation Workshop Series in making long-term participant behavior changes that promote protection of the shoreland environment. A survey tool was developed to measure program effectiveness at meeting these goals. Participants indicated significant increases ($p<0.005$) in knowledge of ecological systems (85% increase), environmental sensitivity (85% increase), in-depth knowledge of issues (92–98% increase), issue analysis and investigation (87–98% increase), citizenship skills (61–77% increase), and locus of control (61–77% increase), as a result of attending the Shoreland Revegetation Workshop Series. They specifically noted an increase in knowledge of the functions of shoreland vegetation, skill and experience of designing and implementing shoreland revegetation projects, and interaction with local units of government and natural resource agencies in affecting shoreland policy changes. These and other participant responses are being utilized in guiding future development of the Shoreland Education Program.

Background and Theory

Behavior is considered environmentally responsible when individuals or groups are capable of making sound decisions and are empowered to advocate for a sustainable environment (Sivek & Hungerford, 1989/1990). Important prerequisites of environmentally responsible behavior are for learners to think critically, to understand the consequences of the choices they make, to know how they impact the environment, and to then use decision-making and the right course of action in environmental stewardship (Siemer, 2001). The ultimate goal of environmental education is not only to create citizens who are knowledgeable of the biophysical environment and the problems affecting it, but also to develop skills and motivation to solve these problems (Stapp, 1969).

Two opposing theories of environmental education are the positivist and constructivist theories. In the positivist theory, it is assumed that providing information alone will influence individuals to change their behaviors. However, research has proven that information alone is not adequate to change learner behavior. In contrast, the constructivist theory takes into account that learners come to a learning task with different conceptions of the world, and that learning is a process of construing meaning and transforming understanding (Cranton, 1994).

Within the constructivist theory, several models of environmental education have been developed. In a more recently evolved model, Hungerford and Volk (1990) indicate three categories of variables contributing to environmentally responsible behavior: 1) entry-level variables, 2) ownership variables, and 3) empowerment variables (Figure 1).

Entry-level variables, according to Hungerford and Volk (1990) are good predictors of behaviors or ones that appear to be related to responsible citizenship behavior. A major entry-level variable is environmental sensitivity, knowledge about ecology, androgyny, and personal attitudes towards social and economic issues. Ownership variables are those that make environmental issues personal (i.e., the individual takes ownership of the issues). Ownership variables appear to be especially critical to responsible environmental behavior. Major ownership variables include in-depth knowledge and personal investment in issues.

Empowerment variables in this model are crucial in the training of environmentally responsible citizens. They bring a sense that individuals and groups can make a difference in helping to resolve environmental issues. Major empowerment variables include perceived skill in using environmental action strategies, knowledge of action strategies, locus of control, and the intention to act.

Hungerford and Volk (1990) ascertain that these variables flow in a linear progression from entry-level through empowerment, and that citizen behavior will more likely be pro-environment if all three levels are incorporated into environmental educational programs. They also believe that success will be greatest when done in a combination of formal and informal education learning environments.

Based upon their model, Hungerford and Volk (1990) identified six critical components that could maximize behavioral change when incorporated into the learning environment by educators:

1. Teach environmentally significant ecological concepts and the environmental interrelationships that exist within these concepts;

2. Provide carefully designed and in-depth opportunities for learners to achieve some level of environmental sensitivity that will promote a desire to behave in appropriate ways;

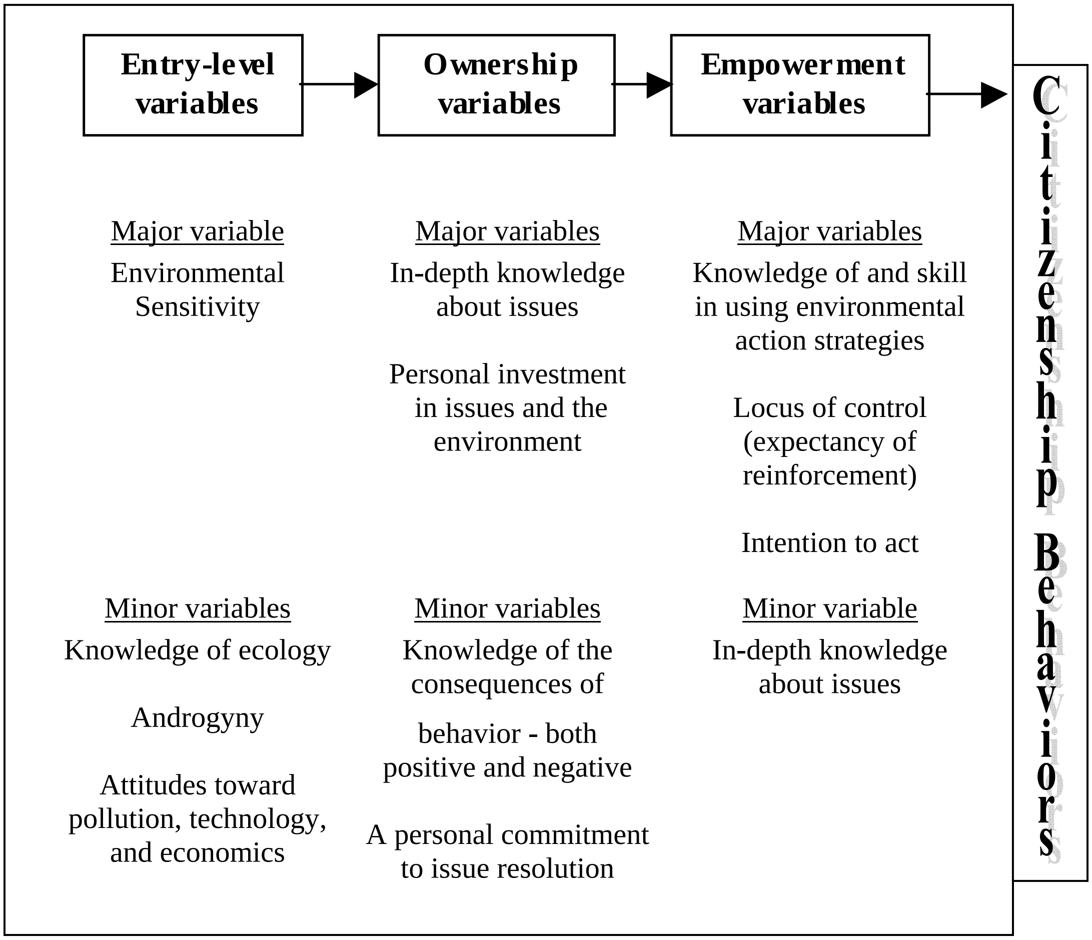
3. Provide a curriculum that will result in an in-depth knowledge of issues;

4. Provide a curriculum that will teach learners the skills of issue analysis and investigation as well as provide the time needed for the application of these skills;

5. Provide a curriculum that will teach learners the citizenship skills needed for issue remediation as well as the time needed for the application of these skills; and

6. Provide an instructional setting that increases learner's expectancy of reinforcement for acting in a responsible way; i.e., attempt to develop an internal locus of control in learners.

Figure 1. Major and minor variables in environmentally responsible behavior (Hungerford & Volk, 1990)



One should note that no one program will necessarily include all variables or critical components discussed here, but through reinforcement (experience of the concepts here mentioned, in different venues), learners will develop the skills needed for long-term behavior changes when facing critical environmental issues.

University of Minnesota Extension Service Shoreland Revegetation Workshop Series

Based on response to a needs assessment, the Shoreland Revegetation Workshop Series was initiated in 1999 to increase participant ecological knowledge and sensitivity, their ability to analyze and investigate shoreland issues, their practical skill level addressing these issues, and their motivation to take action in promoting Shoreland Best Management Practices (BMPs) at the local and regional levels. The workshop series evolved into a two-day classroom session followed by a one-day planting session that targets shoreland property owners, Master Gardeners, lake associations, local units of government, natural resource professionals, nursery and landscape industry professionals, realtors, and people interested in practicing or promoting shoreland stewardship.

Key teaching points include ecological aspects affecting water environments, rules and regulations, property owner needs, landscape design, erosion control, project planning, and project implementation. These concepts are presented through a variety of mediums including hands-on design and planting activities, small group problem solving and project development, instructor presentation and feedback, individual project development (take home assignment), guest expert and local resource presentations, participant presentations, and use of multi-media technology (videos, websites, shoreland CDs, databases, spreadsheets, PowerPoint etc). In addition workbooks, work sheets, fact sheets, contact list, native plant lists, local nursery lists, reference books and bioengineering samples are provided as resource materials.

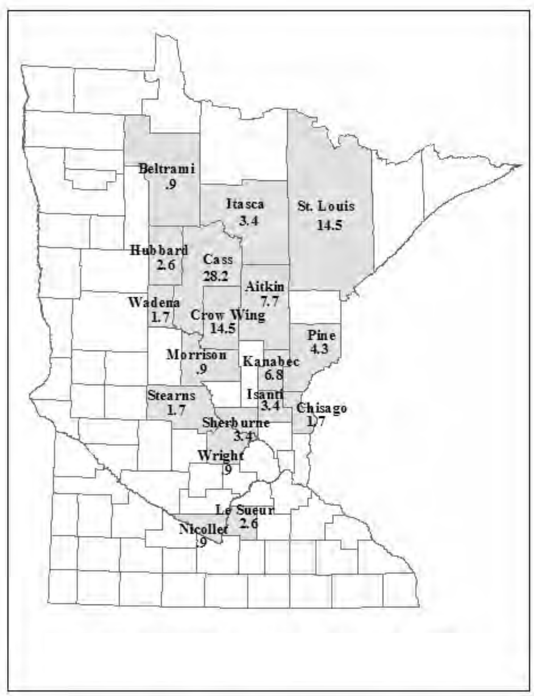
Program Evaluation

An evaluation of the effectiveness of the Shoreland Revegetation Workshop Series was used to determine the impacts on participant knowledge of ecological systems, environmental sensitivity, in-depth knowledge of issues, issue analysis and investigation, citizenship skills, and locus of control relating to shoreland issues, and to make recommendations for future workshops. The survey tool consisted of questions on demographic data, reflection on knowledge, and action and personal involvement before and after having taken the workshop series. It was sent to a random sample of 150 of 300 total participants who attended at least one session of the Shoreland Landscape Design Workshop Series, offered through the University of Minnesota Extension Service during 1999 – 2002. Sixty-three surveys were returned, resulting in a 42% response rate. Two of the returned surveys were not completed.

Demographic Data

Participants responding to this survey attended sessions of the workshop series in 19 counties. Figure 2 illustrates the workshop location in relation to percentages of respondents attending sessions.

Figure 2. Percent workshop attendance by county



Knowledge Gained, Actions Taken and Personal Involvement

A Likert scale was used for participants to rate the knowledge of ecological systems, environmental sensitivity, in-depth knowledge of issues, issue analysis and investigation, citizenship skills, and locus of control on a scale of 1 to 5, with 1 being low and 5 high. A summary of responses is shown in Table 1. Before and after data collected from these questions were analyzed using the Wilcoxon Signed Rank Test from the statistical analysis software SYSTAT 9.0.

Table 1. ***Reflective Survey Questions and Mean Change***

Question	Positive Change	No change	No response	M[1]
1. Why shoreland landscaping is important	85%	15%	0%	1.78*
2. How to design a shoreland-landscaping project	98%	2%	0%	2.11*
3. How to install a restoration project	92%	5%	2%	2.19*
4. Who to contact for help with a shoreland restoration project	93%	7%	0%	2.40*
5. How to acquire plants needed for a restoration project	90%	10%	0%	2.04*
6. Permits required for a project	87%	12%	1%	1.99*
7. Involvement with local shoreland policy or ordinances such as involvement in citizen groups or advisory committees	71%	29%	0%	1.13*
8. Interaction with agencies in community (i.e., DNR, SWCD, etc) on shoreland issues	61%	38%	1%	0.50*
9. Encourage others to use shoreland Best Management Practices	77%	23%	0%	1.63*
10. Assist others with projects (i.e., neighbors, friends, professional agencies, etc)	66%	34%	0%	1.00*
11. Use of shoreland Best Management Practices	71%	29%	0%	1.25*
12. Implement shoreland restoration projects	62%	37%	1%	0.88*

[1]*Calculations for* $M = (T_A - T_B)/n$
**Significant at* $p<0.0005$

Question 1 relates to environmental systems and sensitivity. Of respondents, 85% indicated a positive change with an average increase of 1.78 on a scale of 1–5. Questions 2 and 3 relate to in-depth knowledge of issues. Of respondents, 92–98% indicated a positive change with an average range of increase of 2.11–2.19 on a scale of 1–5. Questions 2 – 6 related to analysis skills. Of respondents, 87–98% indicated a positive change with an average range of increase of 1.99–2.4 on a scale of 1–5. Questions 7–10 relate to citizenship skills. Of respondents, 61–77% indicated a positive change with an average range of increase of 0.5–1.63 on a scale of 1–5. Questions 7–12 relate to internal locus of control. Of respondents, 61–77% indicated a positive change with an average range of increase of 0.5–1.63 on a scale of 1–5. The average increase for each of these questions is significant at p<0.0005.

Participant Recommendations

The survey also included two open-end questions asking participants which aspects of the workshop series they found most helpful and their recommendations to improve the workshop. Participant responses were favorable and varied greatly from specifics about the workshop series to comments overall about insights of environmental stewardship. Participant responses frequently noted the hands-on experience (offered both in the classroom and planting sessions) as being most helpful.

Examples of participant responses include:

> [Attending the entire workshop series] took me from a little knowledge to much more, the seminars were very good and the planting [session] finished the job.
>
> [I learned] that there is a compromise between still being able to use your shoreline yet designing a natural restoration that helps water quality.
>
> It opened a whole new aspect of landscape design for me. I don’t ever look at a lakeshore property in the same way now. It helped me to see the potential for improvement in almost all populated lakeshore areas.
>
> More opportunity for one on one as each shoreline is different.

Other comments included:

- Offer an Internet option
- A small group workshop leader evaluating a site and designing a project
- Refresher course
- Offer continuing education credits

Discussion

This study supports Hungerford and Volk’s (1990) model of major and minor variables in environmentally responsible behavior. The results of this study affirm that including a combination of entry-level, ownership, and empowerment variables in educational programming leads to environmentally responsible behavior. Respondents indicated positive change in behaviors representative of entry-level, ownership and empowerment variables and overall citizenship (See Appendix). Of respondents, 85% indicated an increase in knowledge of ecology and sensitivity (entry-level variables), 92 - 98% indicated an increase in in-depth knowledge of issues (ownership variables), and 61 – 98% indicated an increase in knowledge of and skill in using environmental action strategies and locus of control (empowerment variables). Finally, 61 – 77% of respondents indicated an increase in citizen involvement. The comparison in the appendix also illustrates parallels between Hungerford and Volk’s (1990) model, components of the Shoreland Revegetation Workshop Series, and selected “Essential Best Education Practices” of the 2004 Best Education Practices for Water Outreach Professionals Symposium (Andrews, 2004).

Siemer (2001) stated that the most difficult challenge facing the stewardship educator is creating the basis for long-term behavior change and is essentially an exercise in character education. As predicted by Siemer, the results from this study found a greater percentage of participants indicating a positive change related to entry-level, ownership and empowerment variables than in citizen involvement. One explanation for this difference may be that entry-level, ownership and empowerment activities involve participants in a passive way relative to the commitment and action required in citizen involvement. This recommendation is supported by Hungerford and Volk (1990) noting that educators must not assume that one course or one unit or one year of training will accomplish the task alone in creating environmentally responsible citizens.

In order to increase citizen involvement, the Shoreland Revegetation Workshop Series could incorporate additional strategies suggested by Siemer (2001) that directly address these objectives:

- Getting the learner to commit to doing some target behavior
- Getting the learner to select a personal or team goal related to a target behavior
- Engaging the learner in in-group competition related to a target behavior

In addition, participants could be encouraged to attend the Shoreland Volunteer training also offered through University of Minnesota Extension Service Shoreland Education Program. This training specifically develops skills to promote environmentally responsible behavior.

In summary, research shows that information alone does not change citizen behavior. In order to inspire environmentally responsible citizen behavior, curricula need to include ecological concepts, environmental sensitivity, in-depth knowledge of issues, issue analysis and investigation, locus of control, and citizenship skills. For long-term environmental citizenry, educational programs need to provide ongoing reinforcement through a variety of venues.

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APPENDIX (Burkett & Blickenderfer)

Comparison of Educational Components that Affect Behavioral Change

Citizen Behavior Change (Hungerford & Volk, 1990) [reference Figure 1]	**Critical Components to Maximize Behavioral Change** (Hungerford & Volk, 1990)	**Corresponding Components of *Essential Best Education Practices* for the Class or Group** (Andrews, 2004)	**Corresponding Components of the Shoreland Revegetation Workshop Series**	**Indicators of Success** (reference data analysis, Table 1)
Major and minor: *Entry-level variables*	Teach environmentally significant ecological concepts and the environmental interrelationships that exist within these concepts.	• Knowledge of environmental processes and systems • Systems and interdependence are characteristics of the biological and natural order.	• Plant ecology • Water cycle • Nutrient cycle • Disturbance ecology	Knowledge of environmental system: *85% of survey respondents indicated positive change.*
Major and minor: *Entry-level variables*	Provide carefully designed and in-depth opportunities for learners to achieve some level of environmental sensitivity that will promote a desire to behave in appropriate ways.	• Learner connections to immediate surroundings provide an immediate base for understanding larger systems, broader issues, causes and consequences.	• Real life examples of human activity and their ecological impacts	Environmental sensitivity: *85% of survey respondents indicated positive change.* Participant response: *It opened a whole new aspect of landscape design for me. I don't ever look at a lakeshore property in the same way now. It helped me to see the potential for improvement in almost all populated areas.*

Citizen Behavior Change (Hungerford & Volk, 1990) [reference Figure 1]	**Critical Components to Maximize Behavioral Change** (Hungerford & Volk, 1990)	**Corresponding Components of *Essential Best Education Practices* for the Class or Group** (Andrews, 2004)	**Corresponding Components of the Shoreland Revegetation Workshop Series**	**Indicators of Success** (reference data analysis, Table 1)
Major and minor: *Ownership and empowerment variables*	Provide a curriculum that will result in an in-depth knowledge of issues.	• Skills for understanding and addressing environmental issues • Natural sciences, social sciences, and humanities disciplines contribute to understanding of the environment and environmental issues.	• Ecological, political and social aspects of land and water use • Current research of land use and water quality	In-depth knowledge: *92-98% of survey respondents indicated positive change* Participant response: [I learned] *that there is a compromise between being able to use your shoreline yet designing a natural restoration that helps water quality.*
Major and minor: *Empowerment variables*	Provide a curriculum that will teach learners the skills of issue analysis and investigation as well as provide the time needed for the application of these skills.	• Questioning and analysis skills	• Site analysis, discussion of alternative solution and development of landscape design • Provide additional resource (professional contacts and materials/info lists).	Skill of issue analysis and investigation: *87-98% of survey respondents indicated positive change.*

Citizen Behavior Change (Hungerford & Volk, 1990) [reference Figure 1]	**Critical Components to Maximize Behavioral Change** (Hungerford & Volk, 1990)	**Corresponding Components of *Essential Best Education Practices* for the Class or Group** (Andrews, 2004)	**Corresponding Components of the Shoreland Revegetation Workshop Series**	**Indicators of Success** (reference data analysis, Table 1)
Major and minor: *Ownership and empowerment variables*	Provide a curriculum that will teach learners the citizenship skills needed for issue remediation as well as the time needed for the application of these skills.	• Personal and civic responsibility	• Identify environmental and social issues, and potential avenues for action. • Group problem solving and role playing with presentation experience	Citizenship skills result in citizenship involvement: *61-77% of survey respondents indicated positive change.*
Major and minor: *Ownership and empowerment variables*	Provide an instructional setting that increases learner's expectancy of reinforcement for acting in a responsible way; i.e., attempt to develop an internal locus of control in learners.	• The learning experience is learner-centered. • Promotes active engagement in real world problem solving. • Enables learner to link new knowledge to existing knowledge. • Provides *nurturing context* for learning. • Provides opportunities for extended effort and practices.	• Small group, jargon, challenge and problem solving • Large group reinforcement through presentations • Small group and large group discussions of issues, impacts and solutions using real life, local examples • Empowerment through hands-on design and planting experience	Positive experience translates into future action (locus of control): *61-77% of survey respondents indicated positive change.*

Education and Changes in Residential Nonpoint Source Pollution

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Abstract

Urban areas contribute pollutants such as excess nitrogen and bacteria to receiving water bodies. Branford River and Long Island Sound have experienced excess nutrient loading, low dissolved oxygen levels, and high bacteria levels, due partly to urban runoff. The objective of this project was to determine whether stormwater quality could be improved by educating homeowners and implementing best management practices (BMPs) in a suburban neighborhood. The paired watershed design was used, where a control and treatment watershed are monitored during a calibration and treatment period. Treatment consisted of education of homeowners and structural changes designed to minimize nonpoint pollution. Some changes in measured behavior were reported. According to the treatment period survey, 11% of respondents in the treatment watershed began fertilizing their lawn based on the results of a soil test, whereas none had done so before. In addition, 82% of respondents in the treatment watershed stated that they left clippings on the lawn compared to 62% from the initial survey. Twelve of 34 lots (35%) adopted some BMP following education efforts, indicating a significant ($p=0.0001$) increase in BMP use overall. However, a χ^2 analysis of survey data indicated no significant changes in measured behavior in regards to specific questions. ANCOVA[1] results indicated that a 75% reduction in nitrate+nitrite-N (change in intercept, $p=0.0001$) and a 127% reduction in fecal coliform bacteria (change in slope, $p=0.05$) concentrations occurred (Table 1). However, the treatment period regression was non-significant for bacteria. Total nitrogen, total phosphorus, and ammonia-N concentrations did not change significantly. Intensive education efforts produced BMP implementation and measurable water quality improvements. A complete manuscript will be appearing in an upcoming issue of Environmental Management. An earlier version was published in the December 2002 issue of the *Journal of Extension* (Dietz, Clausen, Warner, & Filchak, 2002).

[1] Editor's Note: ANCOVA refers to analyses of variance and covariance statistical methods. For one source of information, see G. David Garson, North Caroline State University course notes, http://www2.chass.ncsu.edu/garson/pa765/ancova.htm

Table 1. *Summary of Means and Percent Change for Bacteria and Nutrient Concentrations for the Control and Treatment Watersheds During the Calibration and Treatment Periods in Branford, CT*

	Calibration Period (n=60)[1]		Treatment Period (n=44)[2]			
				Treatment		
	Control	**Treatment**	**Control**	**Observed**	**Predicted**	**% Change**
		(FCU/100 mL)				
Fecal Coliform Bacteria	**1,382**	**2,341**	**898**	**731**	**1,660**	**-127***
		(mg/L)				
NO_3-N	**1.6**	**1.3**	**1.9**	**0.8**	**1.4**	**-75*****
NH_3-N	**0.09**	**0.18**	**0.21**	**0.35**	**0.23**	**34**
TKN	**0.6**	**1.1**	**1.3**	**2**	**1.9**	**5**
TN	**2.7**	**3.1**	**3.9**	**3.3**	**4**	**-21**
TP	**0.073**	**0.117**	**0.124**	**0.226**	**0.164**	**27**

[1]Number of nutrient samples. Numbers of samples for stormflow and bacteria were 32 and 13, respectively.
[2]Number of nutrient samples. Numbers of samples for stormflow and bacteria were 27 and 13, respectively.
* P value=0.05
*** P value=0.001

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Improving Aquatic Insect Identifications Made by Students and Volunteers

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Abstract

Educators and volunteer groups are increasingly using aquatic macroinvertebrate biomonitoring, not only as a way to engage the community in environmental stewardship, but also as a strategy for generating valuable water quality data. While the efforts of these groups have certainly increased understanding and concern for the health of our streams and rivers, the quality of the data collected through these programs is being called into question. To be useful in both the research and policy arenas, biomonitoring data must be accurate and conducted at a level of precision that will determine water quality within an appropriate level of certainty. Research, recently conducted at several Portland, Oregon high schools and a university, shows that student-collected data is not of sufficient quality. This paper reviews the literature on student and volunteer collected biomonitoring data, and presents results from a study on two strategies for improving students' field identifications of aquatic insects. Results from this research show that two interventions: *describing and showing Key Identification features, and using live reference specimens*, drastically improve the accuracy of aquatic insect identifications made by students.

Introduction

Education-Based Aquatic Insect Biomonitoring

The simplicity and natural wonder of aquatic insect studies is well suited to the educational setting, and teachers at all levels are increasingly using biomonitoring as a way to engage their students in scientific inquiry and research. More importantly, local volunteer and watershed management groups across the nation are using aquatic insect data to monitor and track the quality of streams and rivers. For many science teachers, there is strong incentive to partner their students' biomonitoring research with the data needs of community stakeholders and policy makers. In fact there are hundreds of organizations that promote education-biomonitoring partnerships (U.S. Geological Survey, 1995), and many of them use student-derived data in official documents and studies including 305(b) reports to congress (U.S. Environmental Protection Agency [EPA], 1998; Nerbonne & Vondracek, 2003). However, there is justifiable concern for the quality of student-collected biomonitoring data (Penrose & Call, 1995). As more biomonitoring education/research partnerships are established and promoted, it is critical that the accuracy and taxonomy of such work is considered and that biomonitoring training and field methods reflect best practices for ensuring the accuracy of volunteer/student identifications.

Accurate identification is the cornerstone of high quality biomonitoring. Thus, incorrect identification invalidates the results of a biomonitoring study. Unfortunately, there is scant research on instructions or field conditions which may lead to highly accurate insect identification. A literature review uncovered relatively few publications specifically focused on the accuracy of aquatic insect identifications made by students or volunteers. One study published in 2001 found that Volunteer data was comparable to professionals (Fore, Paulsen, & O'Laughlin, 2001). Another study by Nerbonne and Vondracek (2003) found that the volunteer success rate in identifying families of aquatic insects was only 29.6%. Rather than *identification accuracy*, most of the published research on volunteer based biomonitoring is focused on the ability of volunteers or students to accurately determine the ecological condition of streams using multimetric indexes as evidence for correct insect identification (Ely, 2000; Engel & Voshell, 2002; Fore et al., 2001).

The purpose of this paper is to examine procedural factors and conditions that influence the accuracy of college students' insect identifications and to make recommendations for strategies that will likely improve identification accuracy. Because professional biomonitoring data require at least family level taxonomy, this study focuses on the accuracy of identifications made at the family level.

Methods

Overview

This study examined the accuracy of insect identifications by students enrolled in an upper division science course called "Water in the Environment." Participating students ranged in age and backgrounds, and few, if any of them had experience collecting or identifying aquatic insects. Three separate experiments (Exp 1: guide only. Exp 2: key ID, and Exp 3: reference tray) were conducted over the course of a 10-week term to determine the affect of a guide (Exp 1), and the effect of two interventions (Exp 1 & 2), on the accuracy of students' aquatic insect identifications. Between studies, students did not receive any additional training in insect identification nor did they learn whether their identifications were correct. Due to absences and other logistical challenges, only about 70% of the students participated in all three experiments, the remaining 30% missed at least one of the experiments. The data from one group in Exp. 3 was eliminated for incorrect procedures.

To quantify identification accuracy in each experiment, students were given a white sorting tray with 50-100 live aquatic insect specimens (including debris). The students searched through the samples selecting out as many aquatic insects as they could find and placing each specimen into an ice cube tray, then sorting them into families. In all three experiments, students used one of three regional insect guides as a reference for identification. Any specimens that were too small to identify were labeled as such and not used in the calculations. Specimens categorized as unknown were counted as an incorrect identification. Once the students were done sorting through the sample, they placed each family of insects into a separate jar and labeled each jar with the family name. The samples were then verified for correct identification and analyzed for identification accuracy. For all three experiments, the same data collection and verification procedures were followed.

Baseline Study

Experiment 1: Guide Only

This study, conducted in April of 2004, determined the accuracy of insect identifications made by inexperienced students using only field guides. In this case, students were not given any prior identification training or practice. The purpose of this experiment is twofold: First, is to determine the effect of a field guide on identification accuracy; second, is to provide a baseline data set for comparison with the two interventions - Experiments 1 and 2.

Interventions

Experiment 2: Key ID Characteristics
In this intervention, conducted in April of 2004, students viewed photographic slides of 15 aquatic insect families and learned to recognize the key identifying features of each family. For example, several slides of *Ephemeroptera heptageniidae* (flathead mayfly) were shown with the following list of Key ID features:

- "One set" of wingpads
- Large head that is wider than body
- Large oval-shaped gills
- Light brown to dark brown in coloration

The students were then given the same set of aquatic insect guides and a handout summarizing the previous lecture on key identification features. Live insects from a local river were provided in the classroom for identification.

Experiment 3: Reference Tray:
This final intervention took place in May of 2004 using insects students collected from three different streams on the west slope of the Cascades Range in Oregon. In addition to the same guides and the *Key ID* handout, students were also given a reference ice cube tray containing live examples of all insect families collected. Using all three resources, including the reference set of live insects, students followed the same procedures to sort and identify insects.

Determining Identification Accuracy

The accuracy of students' data was recorded by: 1) determining if the insect family was correctly identified, and 2) if each specimen identified by the students was actually present in the jar. So for example, if jar #1 contained 6 specimens and was identified as five *Baetidae*, but it actually had four *Baetidae* and one *Heptageniidae*, the data were recorded as follows (Table 1):

Table 1 *Illustration of How Student Data Were Organized and Recorded*

Jar #	Students ID's	Instructor Verification	Correct?
1	**6 *Baetidae***	**4 *Baetidae*, 1 *Heptageniidae***	**Yes**
2	5 *Ephemerillidae*	1 *Ephemerillidae*, 4 *Baetidae*	No
3	75 *Heptageniidae*	70 *Heptageniidae*, 4 *Baetidae*	Yes

The data from all jars per group were combined and each groups' data were summarized and analyzed (Table 2). To fully characterize the accuracy of students' identifications, two calculation methods, Percent Correct and Percent Taxonomical Difference, were used:

- *Percent Correct* is calculated by determining the percent of total families correctly identified by the students. This method of calculating accuracy is limited in that it does not accurately distinguish between families that are partially identified correctly. For example, students may have only correctly identified a portion of individual specimens within a particular family. If they identified more than 75% correctly, it was considered a correct identification (Table 1).

- *Percent Taxonomical Difference* (PTD) represents the percent difference between the students' identifications and the verified sample. The PTD is calculated using the following formula where $comp_{pos}$ is the total number of correctly identified insects and N is the total number of insects in the larger of the two counts (Stribling, Moulton, & Lester, 2003):

$$PTD = [1- (comp_{pos} / N]\ \ X\ 100$$

A low PTD value indicates agreement between the students' data and the verified data. Thus, the lower the PTD the higher is the accuracy of the students' data. An article published in the *Journal of the North American Benthological Society* (Stribling et al., 2003) suggested a maximum PTD value of 15% as a benchmark for identification accuracy. The PTD is limited in samples where one or two families are represented by a high number of individuals. For example, in the results presented in table 1, the *Heptageniidae* family represents the majority of specimens from all three jars but only one of four families found. In this example, the Percent Correct for Group A = .66, but the PTD = .13.

The results of both analyses (% Correct and PTD) were summarized for each group, averaged, and statistically analyzed using an ANOVA analysis.

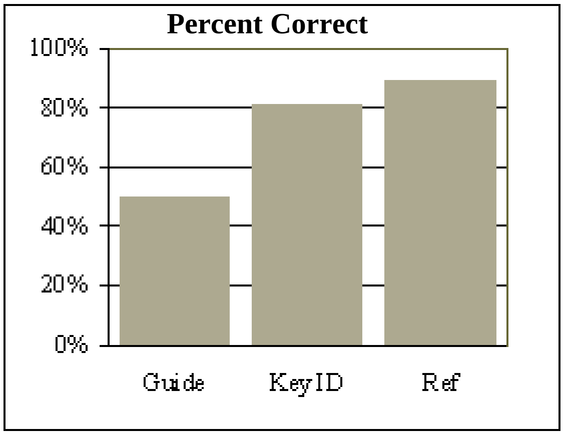
Results

The results show that both the Key ID and Reference Tray interventions drastically improve the accuracy of students' identifications. Simply describing and showing students Key ID features to look for when identifying insects improved their identifications from a baseline of 50% correct to 81% correct and the PTD from 40% to 18% (see Table 2). With live insects as a visual reference, students further improved their accuracy rates from 81% Correct to 89% Correct and 11.1% PTD to 4.3% PTD (see Graphs 1 and 2). More importantly, both interventions result in data that meet and exceed the standards proposed by Stribling et al (2003).

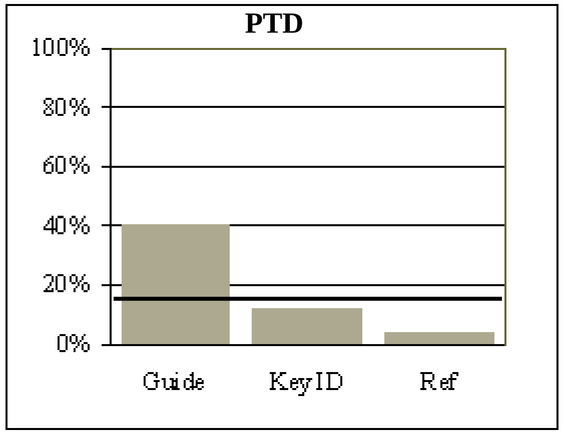
Table 2. *All Interventions: Guides (baseline), Key ID Characteristics, and Reference Tray*

	# of student Groups	# of Specimens per group (max/min)	# of insect Families	Too small to ID	% Avg Correct	% Correct Range (max/min)	Avg PTD	PTD Range (max/min)
Exp1: Guides (baseline)	11	8-52	9	14	50%	0 -100%	40%	7%-100%
Exp 2: Key ID Characteristics	5	6 -13	10	9	81%	66%-100%	11.1%	0%-22%
Exp 3: Reference Tray	4	41-75	17	1	89%	77%-100%	4.3%	0%-11%

Results from baseline study and interventions for both **PTD (p< .25)** and **% Correct (p< .0025)**
"Too small to ID" and "# of insect families" are total amounts for each experiment, not total per group.



Graph 1: **Percent Correct** for all interventions and guide (baseline). p<.0025



Graph 2: **Percent Taxonomical Difference** for all interventions and guide (baseline). A low PTD value indicates higher accuracy. Line represents suggested max PTD. p<.25

Discussion

This study demonstrates that under certain field conditions and with appropriate instruction, students and volunteers can identify aquatic insects relatively accurately. The increase in identifications accuracy is likely attributed to two factors:

1. Learning to recognize key features to look for when identifying insects provides students with the same skills and knowledge that professional taxonomists rely on to distinguish different families of insects.
2. Students easily match their specimen to the reference insect when they have a live insect for reference.

In fact, highly accurate insect identifications may be achieved with very little instruction by simply pre-collecting reference insects to be used by volunteers and students during their biomonitoring study. This approach will not only result in higher quality biomonitoring data, but also smooth the rather complicated process of collecting and identifying insects.

While the results of this study seem to support the claim that students and volunteers can identify insects at a level accurate for use by professional scientists, there are several limitations worth considering.

The data used for this research is derived from non-randomized samples that get smaller as the study proceeds. This is due to the fact that Experiment 1 took place in the field with small groups, Experiment 2 was conducted in the classroom with larger groups, and Experiment 3 took place on an optional field trip. This suggests the results could be due to group size or self-selection for the field trip. In all experiments, however, there were students that missed an earlier experiment and thus had very little familiarity with insect identification, thereby partially mitigating the effect of experience on identification accuracy. Also, this study focuses only on identification accuracy, not how accurately students can conduct biomonitoring research, which is heavily dependent on randomization of site selection and subsampling procedures.

Another important consideration is the fact that Experiments 2 and 3 do not reflect best practices for teaching how to identify insects. It is well known that trial and error is an effective strategy for teaching and learning. Because this project simply gives students the information needed to identify insects, it does not provide a framework for students to build identification skills through trial and error. So for example, it would not be a good idea to use the strategies presented here to train teachers or volunteer coordinators to identify insects. However, if the goal is to ensure accurate field identifications in a limited educational setting, then both interventions (Key ID characteristics and reference insects) are an effective practice for facilitating a volunteer or education based biomonitoring study.

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From Dewey to Doing: How Experiential Education Theory Can Be Effectively Used as a Best Education Practice

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Abstract

This manuscript documents how the promise of best educational theory fares in the real world crucible of community-based education programs. For almost a hundred years, the work of John Dewey has inspired educators who adhere to an idea proposed by Aristotle that "what one learns to do, one learns by doing." We will argue that the need for experiences, distributed over time, and with time built in for individual and group reflections on action provide the best opportunity for learning.

The paper builds upon program and assessment examples, and the outcome data gleaned from hard-won lessons to describe how Dewey's principles of interaction and continuity are brought into play day after day in 4-H. The presentation makes visible the impacts of interaction and continuity in the context of a strong and ongoing experiential, youth program, *Ridges to Rivers: Watershed Explorations*. We will also discuss what makes an "experience" valuable to learners and how these principles can help educators understand the participant's learning experience.

The authors assert that although the principles of interaction and continuity are vague and often overlooked, they are important underpinnings of Dewey's philosophy of experiential education. Furthermore, a good understanding of the principles can help a practitioner in the field of experiential education refine and strengthen the effectiveness of their work.

Introduction: Theory into Practice

This paper documents how the promise of best education theory into practice fares in the real world crucible of community-based education programs. As our research tool, we use an inquiry process (Karplus, et al., 1980; National Research Council, 2000) to ask what, why, where, who and how to answer our questions, and to generate others, as we go. The authors build upon program experiences and products, assessment examples, and outcome data gleaned from "hard-won" lessons, to compare how Dewey's principles of interaction and continuity (Dewey, 1938) come into play in 4-H watershed, restoration and monitoring, education programs.

In the educational context, we attempt to make visible the impact of interaction and continuity in a strong ongoing experiential education program entitled, *Ridges to Rivers: Watershed Exploration* (Enfield, DePeri, Harback, & Neuhauser, 1994*)*. We proceed from an understanding that there are two key goals of this program, first, to support learners to value both the experience of inquiry based education, and second, to help learners to value the program content. To assess our program we asked, “What makes an ‘experience’ valuable to learners?” This is explored utilizing Dewey’s principles of continuity and interaction to understand, design, and implement educational experiences to maximize the participant’s learning.

For almost a century, the work of John Dewey has inspired educators who adhere to a set of principles and practices that embody this basic idea – what one learns to do, one learns by doing (Dewey, 1938). We assert that the need for experiences, distributed over time, with time built in for reflection-on-action as past experience will maximize the opportunity for learning. This model is theoretically sound and has proven to be practical in developing an effective and community-based operational water education program for youth. Additionally, this program focuses on two educational goals:

1. To increase the science literacy of its participants.
2. To incorporate academic service learning for individuals, mostly adolescents, who deliver the primary educational experiences to young children in the program.

Why Water Stewardship, Why Science Literacy?

Water stewardship and water issues provide a most viable content for investigation. Water is ubiquitous, universal in our human experience, relatively cheap to get and to use, and available to children and adults in a variety of states and situations, and all of the time. If we observe children and adults we come to realize that, for the most part, water itself is tantalizing and engaging.

Water features prominently in studies of geology, physics, chemistry, biology and ecology. Water is a natural and ordinary component of most thematic science studies. The study of water and water issues is appropriate for all grade levels in schools and all age levels in community-based education groups such as 4-H, Boys and Girls Clubs. Also, it is an appropriate topic for Adopt a Watershed, community agencies such as municipal water districts, community environmental groups such as The Nature Conservancy and Volunteers in Neighborhood Ecology, and for study in after school child-care settings.

As we enter the new millennium, the needs for integrated water awareness and stewardship programs create unique opportunities to capitalize on three trends in educational settings. The first is a growing national and international awareness that though water is ubiquitous, covering three-fourths of the Earth’s surface, that clean, safe water is a scarce and valuable resource. A question for our inquiry on water issues is that having safe drinking water for humans is a non-issue, however, how do we accomplish this? A second trend is that increasing national awareness that the processes and products of scientific investigation are driving the global economy and are increasingly part of daily life in the 21st Century (Reich, 1983). A third trend is a growing awareness that place-based, authentic learning that is the kind of teaching that situates problem finding and problem framing along with problem solving, develops a skill set that is highly valued in the workplace. This third trend of problem solving expertise is articulated by economists such as Robert Reich as a “flexible-system production” model (1983, pp. 13 & 214-215) that relies on students to work collaboratively to solve real-world novel problems – the essence of flexible-system production in the corporate world. This type of situated problem-solving education not only teaches learners skills that translate to the workforce skills and economic capital, it also develops a second form of capital called, “social capital.” Social capital is that accumulation of capacity or “human capital” which accrues to learners as individuals who possess both the technological skills and capacities to be productive in organizations but also the social skills to be effective participants in those organizations and society (Dika & Singh, 2002; Field, 2003).

Best Education Practices in Service of Water Education

Best education practices during the past two decades have included an integration of one or more groups of educational stakeholders, students, teachers, volunteers, community groups, and businesses, into education alliances. Often these alliances come about for a broad educational purpose called “service learning.” In his description of service learning James Kielsmeier (2000) states that “at every level of schooling, youth participation in service is at an all-time high,” and that, the “service-learning movement demands nothing less than reconceptualizing the role of young people in modern democratic societies, particularly in the context of schooling” (p. 652). This view of citizen development and community development vis-à-vis “service learning” develops both social and economic capital within our society. In addition, the notion of “academic” service learning focuses on the additional benefits to participants by bringing academic content into the fore.

Academic service learning is distinguished from typical service learning by the role of scientific inquiry and reflection in relation to essential academic content understanding. The goal is to make “academic learning” more authentic and visible. In terms of our focus on best education practices related to water, we assert that taking the best service learning practices described above and providing more depth through the application of John Dewey’s principles of interaction and continuity, makes the learning more relevant and rigorous. Academic service learning programs tied to community-based water education issues offer a rewarding educational opportunity for water agency personnel, teachers, volunteers, students and parents to make an authentic difference in their community.

Who Should Get Involved?

Getting people of all ages involved in water stewardship and safe water issues is important. Dialogue among groups that need water: farmers, municipalities, recreation agencies, sport and commercial fishers, land owners and the public, is important for generating water stewardship that will allow these same people to survive and prosper. Earlier we introduced social capital in relation to workforce preparedness and the requirements of modern, flexible-system production economy. However, the development of social capital, itself, has become a focus of educators during the past decade (Dika & Singh, 2002; Field, 2003; Putnam, 2000). One general concept of social capital is that benefits accrue to individuals or families by virtue of their ties with others. Recent assessments of the impact of cross-age teaching document that older youth, supervised by an adult volunteer or coach, can work effectively with young children to find, frame, and solve community environmental issues in a project-based context (Ponzio & Fisher, 1998; Ponzio, Junge, Smith, Manglallan, & Peterson, 2000).

Development of Situated Water Education Programs

An important connection between education in the processes of scientific investigation and effective water education programs is beginning the process with a situational analysis. In other words,

- What is the condition of the water in this context?
- What are the “stakeholder” needs…all of the stakeholders, plants, animals, people and systems that depend on the water?
- What are the interactions you can observe, measure and document?
- What are the needs that are not being met?

- How can we find and use information sources that will help us determine if there is a problem?
- Is there a problem? If so, how can we describe it?
- How are we framing the problem so that we can solve it (or parts of it)?
- Is it a problem worth investigating and working on?
- How will we know if we have a solution?
- How will we know if today's solution can become tomorrow's problem?

The Learning Cycle Model: How and Why Does it Work?

These questions, along with others, are amenable to an instructional model labeled as "the learning cycle" by Robert Karplus, et al. (1980). Although Karplus et al. identified three phases of the learning cycle, some more recent proponents of this model have identified additional sub-phases (Carlson & Maxa, 1998; Horton & Hutchison, 1997; McArthur, Shields, & Zurcher, 1987; Ponzio & Stanley, 1997). The learning cycle has proven to be an effective way to structure the instructional situation for inquiry in situated settings (Karplus, et al., 1980; Marek & Cavallo, 1997; National Research Council, 2000). The learning cycle model provides for the independent inquiry in the first phase of the activity, and for interdependent inquiry in both the concept development (second, phase) and the concept application (third phase). The concept development and concept application phases are critical to academic service learning programs as they provide learners with the contextual dialogue and shared work among colleagues. The three phases of the learning cycle match up with:

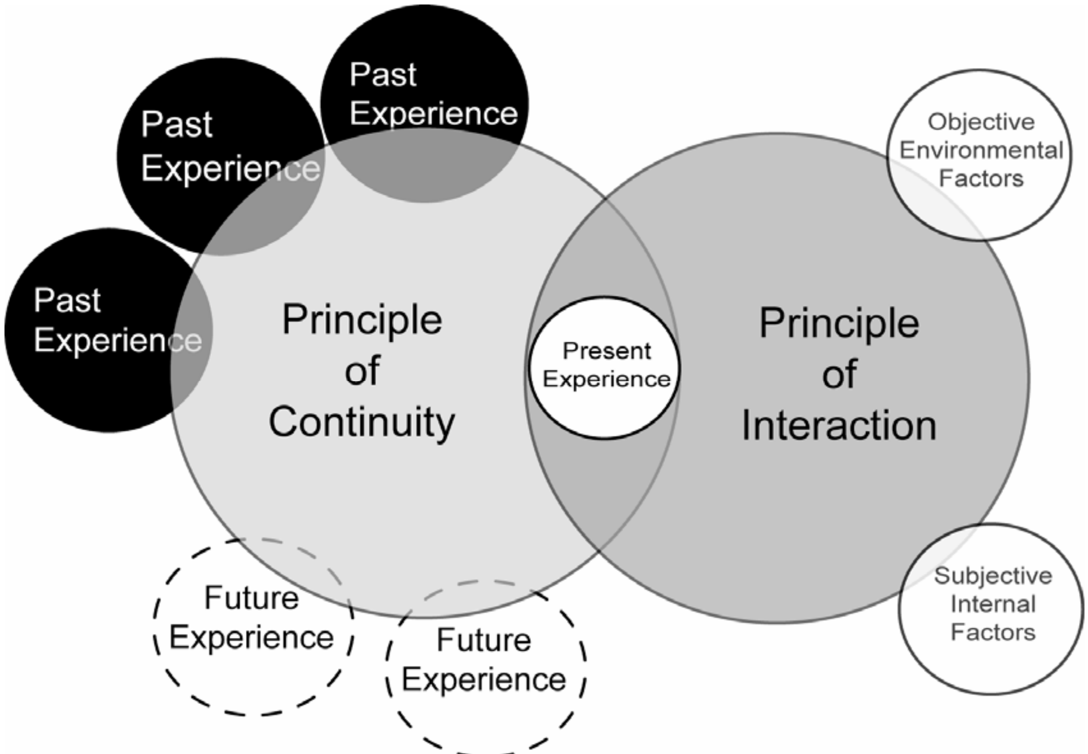
1. The exploration phase (situational analysis or problem finding)
2. The concept development phase (problem framing or investigative)
3. The concept application phase (generating solution scenarios, testing, evaluation, implementing and assessing the solution outcomes)

The learning cycle can be integrated as a core feature of an effective project-based water education program as described in the next section.

Educative Experiences as a Best Education Practice in *From Ridges to Rivers: Watershed Explorations*

In *Experience and Education* (1938), Dewey discusses his ideas of an educative experience; he presents two principles, interaction and continuity, which he states are critical to the success of an experience. The principle of continuity "means that every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after" (Dewey, 1938, p. 27). The principle of interaction states that an individual's experience results from the interaction between self and the environment. Dewey states that there are two factors in experience, objective experience and subjective internal conditions; and "any normal experience is an interplay of these two sets of conditions" (1938, p. 39), which Dewey called a "situation." A graphic portrayal of the principles of continuity and interaction can be seen in Figure 1.

Figure 1. Dewey's continuity and interaction in 4-H



For Dewey, the principles of interaction and continuity, when taken together, provide a tool for measuring the value of an experience. In a sense, this was Dewey's contribution to an early version of what constitutes Best Education Practices. The authors have reviewed numerous instances of student involvement in the 4-H SERIES: *From Ridges to Rivers: Watershed Explorations* curriculum (Enfield, DiPeri, Harback, & Neuhauser, 1994), and have selected two members' stories and experiences – two snapshots in time – to show the two principles in action.

Two Stories

Describing the evolution of a 4-H presentation or public talk can show an example of Dewey's principles of continuity and interaction playing out in the life of a 4-H member. An example from the San Luis Obispo County 4-H Program in California can illustrate the connection. A 12-year-old 4-H member had been involved in a science and technology project exploring the effect of phytoplankton on a local estuary. She had worked, under the guidance of an adult project leader, on the project for several years, interacting with the watershed, estuary and bay in numerous different ways (PAST EXPERIENCE). She first learned about a watershed using the hands-on 4-H curriculum, *From Ridges to Rivers: Watershed Explorations* (PAST EXPERIENCE) through a program called 4-H SLO Scientists (Enfield, 2000). She had searched for insects in streams that help tell a story about the health of a stream; she had helped to build a 12' x 12' scale-model of the watershed being studied; and she has helped others in the project do water sampling over a period of months from a U. S. Coast Guard ship (PAST EXPERIENCES). She used all her knowledge gained from her interactive experiences with the estuary environment to prepare a 10 minute 4-H presentation for delivery at the countywide 4-H Presentation Day (CURRENT EXPERIENCE). Her "supersleuth" presentation on the effects of phytoplankton on the bay was well received by the audience and judges, but the judges felt that the 4-H member was a little unsure of herself when she was describing some of the aspects of the impacts of phytoplankton and in answering follow-up questions from the audience and judges.

After receiving constructive written input from the judges, the member had to decide whether to take her presentation to the next (i.e., regional) level. After considering the judge's comments, the time frame (OBJECTIVE ENVIRONMENTAL FACTORS), her feelings, interest and knowledge (SUBJECTIVE INTERNAL FACTORS), she decided to rework her presentation and offer her revised presentation at the regional event (FUTURE EXPERIENCE). Based on her work on her presentation, she also decided to prepare and present other talks for interested groups in her community and school (FUTURE EXPERIENCES). It should be easy to see that the principles of continuity and interaction were in play during the entire evolutionary process of this 4-H member's presentation. This learner was totally engaged with the local estuary and interacted with other interested parties leading to her ability to exhibit a high degree of thought, awareness and self-motivation throughout the entire experience.

The second example of these principles of experiential education in action can be told through the story of a young man who also became active in the *From Ridges to Rivers: Watershed Explorations* project while in junior high school (PAST EXPERIENCE). Bryan, a member of the Valley of the Bears 4-H Club, was active in the 4-H Watershed Environment Project; in the project, he first learned about watersheds in general, and then he explored and studied the watershed in his geographic location (PAST EXPERIENCE). One level of his involvement with the project was participation in teen leader trainings, preparing teens to work with younger 4-H members on hands-on watershed activities (PAST EXPERIENCE), such as ground water models, aquifer in a cup, scale watershed models, and making soil. Partly as a result of his experience as a 4-H member since the age of nine, as well as his religious affiliation, Bryan was aware of the meaning and importance of community involvement and service projects (PAST EXPERIENCE & SUBJECTIVE INTERNAL FACTORS). Bryan was also an active member of the Boy Scouts, and he was interested in utilizing his involvement in the 4-H watershed project as a dual project in the Boy Scouts (SUBJECTIVE INTERNAL FACTOR).

As a result of his activities, he became familiar with the increased rate of sedimentation in the local estuary near his home. As a result of some reports in the popular media, it was becoming apparent to some that lived in the Morro Bay area of the Central Coast of California (OBJECTIVE ENVIRONMENTAL FACTORS) that disturbance to the Morro Bay watershed by the impacts of agriculture, residential development, transportation, and military activities, were greatly increasing the sedimentation rate of the sea-level estuary. Bryan was interested in helping to educate a wider audience about the estuary (SUBJECTIVE INTERNAL FACTOR).

Based on his past experiences, objective environmental factors, and subjective internal factors, Bryan decided to organize a community awareness event on watersheds in general and the Morro Bay Watershed and Estuary in particular. Based on his involvement in the 4H Program, he became aware of grant opportunities for science-related activities being offered to 4-H members through the Hewlett Packard Foundation. With the assistance of his father and the Watershed Environment Project Coordinator, Bryan applied for and received a grant for $850 to plan and conduct a "Watershed Awareness Day." He recruited community organizations to participate, and 17 agencies and organizations took part in the event to educate the public about different attributes of watershed health. Over 200 people attended this very successful event.

After the event, an article appeared in the San Luis Obispo County paper extolling the success of the event and the virtues of the Bryan's work. Flamion (1994) wrote:

> Bryan...has made a difference. He has done something about the filling of the estuary at Morro Bay. He has provided an information day to educate the public. The room was filled with people wanting to learn and become involved. Now, it is up to the citizens in their own yards to make a difference. (p. B8)

We believe that by examining the two examples above, the reader can easily see that many components of what is commonly referred to as experiential education are apparent when viewed through the Dewey lens of interaction and continuity. Certainly, in both examples, there is evidence of carefully chosen experiences, development of skills, numerous opportunities and instances of reflection, significant scrutiny, construction of meaning, assumption of responsibility and decision making, as well as other components of experiential education.

Design Characteristics/Considerations for Effective Water Education Programs

We feel that all educators should consider Dewey's important principles of interaction and continuity when developing, instituting, or evaluating curricula or programs. If this is done, program participants will experience the best that experiential education programs have to offer. In order to ensure that these two principals are taken into account when designing curricula or programs, there are three critical components to consider. The development, implementation and evaluation of effective programs revolve around three major themes: 1) The Learner, 2) Instruction and Experiences, and 3) Content (knowledge, information, skills and behavior are four common to most education programs).

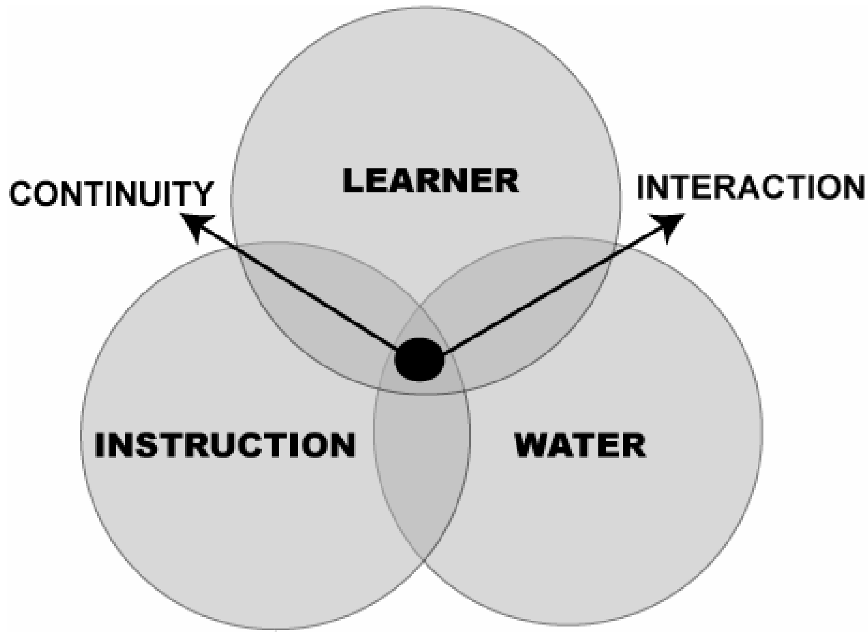
1. The learner is probably the most important design consideration…what fits your intended learner? Does your (model) learner exist or only in your imagination? What information do you have about your learner, and the skill set they bring to the learning activities you intend? This learner information can be related to interests, abilities, age, language proficiency, dexterity, preferred learning modality…the list can go on and on, but it is most important to know who your learners are.

2. Instruction is something you can control and do a lot with. Are you interested in using simulations, direct, hands-on instruction experiences, audio tapes, field trips, film, demonstrations, overhead projectors, chalk…you get the idea here, too we're sure…the list is pretty long. You can also control (to varying degrees) or allow the learners to choose, what task/activity they do, how long they will have to do it, with whom they work, the role they play, how they will know they're done. You can also tell them, or allow them to decide, how the activity/task/experience will be evaluated.

3. Content is also something you can control. What information, knowledge, skills, experiences are you intending? Again, what fits best with the learner, time considerations, and where the learning will take place are all considerations.

A graphic portrayal of the three design considerations presented above, and their relationship to continuity and interaction, can be seen in Figure 2.

Figure 2: Design considerations of effective programs



Overall, you may be an expert in one or more of these areas, but if you are unsure, (or want to put together a **very** good educational experience) put together a planning team…composed of 'experts.' The team can be composed of teachers of the age groups you want to reach, experts in the areas of the water-related content, parents, children, community agency personnel. We have found that such teams can work wonders in designing a curriculum that meets the criteria for helping to bring about meaningful educative experiences for learners.

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The Long and Short of Groundwater Education for Michigan Farmers

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Abstract

The Michigan Groundwater Stewardship Program (MGSP) has pursued a variety of educational strategies to educate farmers about groundwater risks associated with pesticide and fertilizer use. MGSP collaborates with local, state, and federal agencies to provide confidential information, assessment tools, and technical assistance to farmers. The Farm*A*Syst program is based on environmental education and adult learning theories. This article describes four different evaluation studies investigating program effectiveness. The evaluations focused on the MGSP program objectives and behavioral change theories, and utilized mail surveys. The results suggest that Farm*A*Syst has been a successful intervention for promoting farm environmental management practices. Yet, despite the apparent changes in some farm management practices, little impact on groundwater literacy has been achieved. We suspect adoption of these practices may be driven by financial incentives rather than an improved understanding of the need to assess and evaluate risks to their local groundwater supplies.

Introduction

We all hope that Extension education programs empower learners to make lasting changes that improve their lives. Empowerment is especially desirable when addressing issues that directly affect an individual's quality of life with respect to health and safety concerns. One prime example relates to efforts to educate the public about steps they can take to protect their drinking water.

Agriculture poses particular risks to groundwater because of the widespread use of pesticides and liquid fertilizer in concentrated quantities (Moody, 1990). In agricultural states, farmers play an especially key role in land use to protect groundwater supplies that often provide drinking water to many communities.

Though most Americans express a strong concern for water quality, they are not well informed about water quality issues, sources of pollution, and ways to prevent it (National Environmental Education and Training Foundation, 1999; Marketing Horizons, Inc., 1997). Jones and Jackson

(1990) determined in their study of Wisconsin farmers that they "lacked the means to evaluate their farms' potential pollution sources, including management activities and to draw conclusions on the possible effects and options to reduce risks" (p. 236). Some of the risky practices they discovered included the improper storage and handling of fertilizers and pesticides. The need to educate and promote behavior changes in farm management and to promote safer groundwater practices among farmers was apparent.

Theories of Behavior Change

Research has overturned the long-standing and naive assumption that there is a direct and linear relationship between providing information to individuals and changing the behaviors of those clients (Hungerford & Volk, 1990; Newhouse, 1990). Knowledge of groundwater and of its sources of contamination may be only one factor among many antecedents that influence farmer behavior. Other important psychological variables include attitudes toward the behavior(s), perceived self-efficacy, social norms, and knowledge of and perceived competencies with behavior strategies (Azjen & Fishbein, 1980; Hungerford & Volk, 1990).

Other educational principles to consider when working with adult learners, which are based on Knowles' theory of andragogy (1984), are: a) adult learners need to be involved in the planning and evaluation of their instruction, b) adult learners' past experiences provide the basis for learning, c) adult learners want to learn information that has immediate relevance to their lives or jobs, and d) adult learning is problem-based.

Risk perception is another important criterion that is likely to have an impact on decision-making (Slovic, 1987). Raedeke, Nilon, and Rikoon (2001) found that farmers' who believed their land uses had impacts on the local watershed were more interested in participating in conservation programs. Yet it has been shown that even farmers who express higher levels of environmental concern are just as likely to perceive high risks of adopting new technologies aimed at addressing soil and water conservation problems (Napier, Camboni, & Thraen, 1986).

In order to accomplish lasting impacts, educational strategies need to emphasize skills that empower learners in order to increase the likelihood that knowledge gains will lead to permanent adoption of new practices or ways of living. Dwyer, Leeming, Cobern, Jackson, and Porter (1993) termed the behavior change strategies alluded to here as "antecedent strategies" because they attempt to bring about changes in the attitudinal determinants of behavior. They also described "consequence" strategies that focus on rewards and punishments as a to way influence behavior. Economic incentives for taking (or not taking) some action are an example of a consequence strategy.

Program Background

Since 1995, the Michigan Groundwater Stewardship Program (MGSP) has pursued a variety of educational strategies to educate pesticide and fertilizer users about risks to groundwater, and suggests ways to minimize those risks. This article describes results of several years of research and program evaluation done to track the effectiveness of the MGSP.

In an effort to be proactive in preventing pollution, the Michigan legislature created a special funding mechanism—a tax on pesticide and fertilizers users—earmarked for education about the wise use of these products. This initiative led to the creation of the Michigan Groundwater Stewardship Program, housed in and administered by the Michigan Department of Agriculture (MDA) in cooperation with Michigan State University Extension (MSUE), Michigan

Conservation Districts (CDs) and the USDA Natural Resource Conservation Service (NRCS). Since its inception, the focus of MGSP has been to provide voluntary, confidential risk assessments, education and demonstration projects, technical assistance, and cost-share money to promote the adoption of farm management practices that minimize risks to groundwater.

The implementation of these groundwater education and outreach efforts is conducted by a network of trained groundwater technicians who are employed by local grantee organizations (usually Conservation Districts) but whose activities are directed through partnerships with regional Extension offices. The keystone in MGSP's approach to education and outreach with farmers has been the deployment of the Farmstead Assessment System (Farm*A*Syst or FAS), a nationally developed risk assessment tool.[1]

Groundwater Education Approach

Since 1995, groundwater technicians have conducted Farm*A*Syst assessments on over 10,000 Michigan farms (Michigan Groundwater Stewardship Program, 1999). Through these voluntary and confidential assessments, technicians provide farmers with workbooks that contain worksheets for calculating various risks to groundwater and an Improvement Action Plan. It is the goal of Extension that the FAS workbook serves to expand farmer knowledge regarding groundwater and the risks presented by common farming practices involving the storage and use of pesticides and fertilizers. These individualized educational interventions are designed for the technician to train the farmers in use of the FAS workbook and to empower farmers to assess their own groundwater risk factors now and in the future. The Action Plan includes a timeline for addressing high risks on the farm, in addition to the technical assistance or financial assistance needed to help make the change. Both the farmer and technician sign the Action Plan.

The on-site visit also provides technicians with opportunities to share additional information with farmers regarding cost-share options available through MDA grants, local stewardship activities, or other additional programs that provide technical assistance or services that encourage groundwater stewardship behaviors. In addition, all program participants are eligible to apply for cost-share through the MGSP. The types of practices eligible vary based on funding availability and local priorities.

Evaluation Methods

In order to assess the effectiveness of the program, we drew upon the results of four separate studies. First, we employed a statewide baseline mail survey in 1996 that was sent to a randomly selected sample of 400 Michigan farmers drawn from the Michigan Agricultural Statistics Service's database. The mail survey measured groundwater knowledge, risk perceptions posed by various materials and land uses to groundwater contamination, and awareness related to groundwater education and technical assistance programs.

In 2000, the baseline survey was repeated with another sample of 400 Michigan farmers drawn from the same source to assess changes in knowledge and attitudes. The same survey instrument was used, with an additional set of seven questions added, targeting groundwater stewardship farm practices. Response rates for the survey in 1996 and 2000 were 53% and 51%, respectively.

[1] Editor's Note: The Farm*A*Syst (Farm Assessment System) and Home*A*Syst (Home Assessment System) programs pioneered the development of a voluntary, confidential environmental risk assessment for farmers, ranchers, homeowners. Information is available from the Farm*A*Syst Web site, http://www.uwex.edu/farmasyst/ (accessed June 2004).

The second study was the annual survey of farmers who participated in the FAS program. The evaluation survey tracked the self-reported behavior changes and program satisfaction levels of FAS participants. This program participant data was collected each year from 1998-2003. Though the methodology for this annual survey has varied over the course of this article, the results obtained have been consistent for the past 3 years. In the past three years, mail surveys were sent to FAS participants three to six months after they had assessments conducted on their farms. The mail surveys followed Dillman's Total Design Method (1978) and the response rates ranged from 53-58%.

A third study was a follow-up survey with 2001 FAS participants who had high risks to groundwater on their farm; however, they had not made changes to the high risks (Farrell, 2001, 2002). Again, the Dillman survey method was followed and a 44.7% response rate was obtained.

A fourth study was conducted in 2002 with Michigan Certified Pesticide Applicators (Farrell, 2003b). A stratified random sample was created by MDA based on the seven MDA regions. The survey instrument comprised of two pages and included a question on whether or not an applicator had participated in a FAS, farm demographic questions, and farm environmental stewardship management practices. The response rate was 62.4%.

Results of the FAS Evaluation

Results of annual evaluations by program participants indicate strong levels of satisfaction with the program and with the technical assistance provided by technicians. In addition, the evaluations have revealed numerous behavior changes following completion of an on-site FAS. Highlights of the most recent findings include the following:

- Nearly four out of five (78.9%) respondents made at least one management change to protect groundwater.
- The majority of respondents changed more than one farm management practice as a result of program participation.
- Most respondents (78%) applied for program cost-share dollars in order to make changes (Holsman, Heyboer, Geisler, & Campo, 2000).
- The most frequently reported stewardship practices included emergency farm planning (56.1%), closing abandoned wells (79.8%), enacting safeguards in pesticide storage and handling (37.6%), testing well water (52.2%), and creating drift management plans (52.7%) (Farrell, 2003a).

Meanwhile, the longitudinal study of Michigan farmers' knowledge, attitudes, and groundwater behaviors indicates that groundwater literacy scores are low and remained unchanged on all 12 groundwater knowledge items over the 4-year period (see Table 1). On average, farmers scored 55% correct on the knowledge section in 2000. There was not a significant difference in the overall score between 1996 and 2000.

Table 1. *Frequency of Farmer Responses to Groundwater Knowledge Questions on the Longitudinal Statewide Survey, 1996-2000*

Groundwater Knowledge Items	Year	% Agree	% Disagree	% Don't Know
It is more cost effective to prevent pollution of groundwater than to pay for the cleanup. (True)	1996 2000	95.4 94.5	2.3 4.6	2.3 1.0
Irrigation and lawn watering can affect the amount of water leaching into the ground. (True)	1996 2000	88.4 90.7	7.4 7.9	4.1 1.4
Groundwater in Michigan provides water to lakes and streams. (True)	1996 2000	81.5 79.6	13.4 13.5	5.1 6.9
Groundwater in Michigan can best be described as an interconnected series of rivers, streams, and caverns. (False)	1996 2000	72.1 65.1	13.5 19.5	14.4 15.3
Groundwater in Michigan can best be described as a wet sponge where water fills the spaces between soil particles. (True)	1996 2000	68.8 64.5	14.1 16.4	17.2 19.2
Approximately 50% of Michigan's population relies on groundwater for drinking purposes. (True)	1996 2000	61.2 54.4	10.7 13.4	28.1 32.3
An average American uses 50 gallons of water each day. (False)	1996 2000	56.7 59.1	17.7 11.2	25.6 29.8
Groundwater generally follows the contours of the land surface. (True)	1996 2000	56.6 55.8	35.2 37.7	8.3 6.5
Less than 1% of the earth's water is available for drinking. (True)	1996 2000	45.1 48.8	11.2 7.0	43.7 44.2
Just like surface water, groundwater flows downhill. (True)	1996 2000	43.7 42.5	39.9 37.4	16.4 20.1
Once it reaches the water table, groundwater does not move, unless pumped. (False)	1996 2000	6.6 9.7	84.3 82.5	9.3 7.8
Water that looks clear and tastes good is safe to drink. (False)	1996 2000	3.7 6.9	85.6 84.3	10.6 8.8

(No significant changes were found on any item.)

The results indicate that most farmers/respondents knew that:

- Groundwater provides water to lakes and streams.
- It is more cost effective to prevent pollution than to pay for cleanup.
- Irrigation and lawn watering can affect the amount of water leaching into the ground.
- Water that looks clear and tastes good is not necessarily safe to drink.

Conversely, less than a majority of farmers understand what groundwater is by definition. The fact that most respondents agreed with both definitions provided (the correct and the incorrect one) indicates confusion over the concept. Farmers also do not fully understand the relative scarcity of groundwater as a global resource or have any idea how much American's use in a day (Holsman et al., 2000).

On the statewide survey in 2000, farmers also were asked if they had ever participated in a Farm*A*Syst. One-quarter of the respondents indicated that they had gone through the program (n=47). Knowledge scores of these farmers were compared with farmers who had not participated in the program. No significant differences were observed on any of these items.

In 2001, six months after the annual FAS evaluation, a follow-up study was conducted with farmers who had high risks on their farms but who had not made changes to those high risks. According to responses on the FAS annual evaluation, approximately 42 percent had made changes to all of the high risks on their farms. The study found that 57 percent of the farmers made changes, including:

- 75.9% closed abandoned well(s)
- 68.0% created emergency plans
- 62.1% changed pesticide storage and handling practices
- 46.2% changed fertilizer storage and handling practices

The findings from the follow-up study introduced changes to how the FAS process occurred between the groundwater technician and farmer. In addition, a farm improvement action plan was made part of the FAS. Together, the technician and farmer create a plan on how the high risks on the farm would be addressed, including timeline and implementation strategies.

The findings provided MGSP with reasons why participants had not made changes to their high risks:

- 29.4% waiting for cost-share funding
- 28.8% encountered financial constraints
- 22.9% did not know how to complete changes

Lastly, in 2002 a study was conducted with Certified Pesticide Applicators within Michigan. Approximately 24% of the respondents had had a FAS conducted on their operation. The findings indicate that MGSP and FAS are having an impact on farmers' environmental stewardship management practices (see Table 2).

Discussion

The results of the studies taken together suggest that Farm*A*Syst is a successful intervention for promoting certain farm management practices in Michigan. Yet, despite the apparent shift in several types of farm management practices indicated by the FAS evaluation survey and the differences in frequency of adoption rates between participants and non-participants, the program appears to be having little impact on groundwater literacy.

At the beginning of this article we acknowledged that knowledge change alone is not an effective predictor of behavior change. At first glance, these results suggest that knowledge change may not even be necessary in order to shift behaviors. In 2004, a new FAS was created for technicians to use that included an Action Improvement Plan. The plan includes high risks, timeline, and what is needed for the high risk to be lowered. This plan requires the technician to follow-up with the FAS participant regarding the Improvement Plan. In addition, technician grants are now focused on deliverables, including number of high risks lowered and if a FAS participant proceeds to farmstead system verification (For more information see the Michigan Agriculture Environmental Assurance Program Web site: http://www.maeap.org). But, will these program changes have impact on environmental stewardship ownership or empowerment? Future evaluation studies will be critical to learning if behavioral changes are occurring because of participation in the FAS program.

In conclusion, we suspect that adoption of groundwater stewardship practices may be driven by short-term financial incentives, rather than by an improved understanding by farmers of the need to assess and evaluate risks to their local groundwater supplies. Some may argue that the question is moot as long as farmers are taking positive actions.

Table 2. *Stewardship Practices Between FAS and non-FAS Participants*

Stewardship Practice	**% *Yes*— F*A*S Participants**	**% *Yes*— Non-F*A*S Participants**
Pesticide containers are triple- or power-rinsed, and recycled.	85.1	85.9
Air-gap or anti-backflow device(s) is installed on well(s).	64.6	51.3
All unused wells are “properly” closed.	83.3	68.6
Drinking water is tested annually.	50.0*	28.2
Farm fuel tanks are being monitored for leaks.	91.7	80.0
Pesticides are stored in a fenced or locked separate facility away from all other farm equipment.	68.8**	48.7
Pesticides are mixed on a mixing and loading pad.	21.3	26.4
Pesticides are mixed in different locations in the field each time.	56.3	42.8
Used oil is recycled.	79.2	80.1
A written emergency response plan has been developed.	57.4*	20.6
Home septic system has been pumped out within the last five years.	66.7	66.4
A spill kit and fire extinguisher is available at the pesticide storage area.	72.9	55.8
Extremely hazardous pesticides and fertilizers have been reported to the local emergency planning committee.	41.7*	15.4
A written drift management plan has been developed.	43.8*	16.1
All liquid fertilizer is stored within secondary containment.	20.8	10.9
Pesticide treated seed bags are returned to dealer.	16.7	13.5

* Stewardship Practice found to be significant at < .01
** Stewardship Practice found to be significant at < .05

It is often difficult to reach adult audiences with educational messages, especially when those messages pose threats to their current habits or practices. Farmers can be an especially challenging audience because of their skepticism toward government agencies. While cost-share incentives can provide a great way to market programming by providing a "hook" to get farmers to participate, there are notable drawbacks to the approach. Other researchers have found that conservation behaviors adopted through financial incentives are often discontinued by individuals once those incentives are discontinued (Thörgeson, 1996; Dwyer et al., 1993).

In the case of the MGSP and FAS, changes like well closures provide the farmers and local communities with lasting benefits, but many other groundwater practices (e.g., pesticide application, water testing, etc.) represent annual, if not daily choices on the part of the farmer. Further research is needed to investigate the long-term impact of program participation on farmers' management decisions regarding groundwater stewardship practices. There is also a need to identify the importance of groundwater knowledge as a mediating variable on the farmers' awareness of risk and willingness to take action. Increased knowledge may be one important factor in a farmer's willingness to seek information (Raedeke et al., 2001).

In the meantime, we caution educators to specify precise cognitive, affective, and behavioral objectives with programs. Long-term behavior change, whether for groundwater stewardship or other health and safety issues, is likely a complex process that requires interventions designed to affect multiple determinants of an individual's decision-making process.

Educators need specific strategies and messages to affect all determinants of behavior. Just as it is often possible to fail to detect the long-term changes of learners who have received an intervention of short duration, it may also be possible to mistake "education" for manipulation of behavior via rewards.

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Evaluation of the Chesapeake Bay Foundation's Conservation Education Programs

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Abstract

We conducted an evaluation of the Chesapeake Bay Foundation's conservation education programs to determine to what extent they promote participants' environmentally responsible behavior and reduce teachers' perceived barriers to teaching about the bay. We assessed outcomes of five youth- and two teacher-education programs through pre-, post-, and retention tests and mail questionnaires from samples of current and past participants. Based on improvements in characteristics that promote environmentally responsible behavior, such as perceived knowledge of issues and actions, environmental sensitivity, and–particularly–intention to act, we concluded that the education programs increased some youths' and many teachers' environmentally responsible behavior. We also concluded that the teacher-education programs facilitated teaching about the bay by reducing teachers' constraints. As a result of our evaluation, the Chesapeake Bay Foundation implemented several changes that administrators of other similar conservation education programs may also want to consider. These changes include focusing programs to target specific, suitable goals; coordinating programs to provide experiences that build on one another; and conducting periodic evaluations.[1]

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Local Control of the Environment: Is This What They Asked For?

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Abstract

The National Pollution Discharge Elimination System (NPDES) Phase II Storm Water Program, being implemented by many small to medium sized communities across the nation, provides a unique opportunity to investigate the role that federal, state and local communities assume to protect the environment. Local, state, and some federal officials, as well as political pundits and activists from both the right and the left, are increasingly questioning the judgment and value of relying on a central authority to protect the environment. These proponents of environmental devolution argue that locals have a better understanding of the problems and constraints to institute lasting and effective environmental protection to best meet the needs and interests of local residents. This presentation will discuss preliminary results of a research project that looks at local officials' perception of their abilities to implement federally mandated environmental regulations based on knowledge; their willingness to participate in multi-jurisdictional collaboration; the role of local watershed groups in protecting the environment; the balance between economic and environmental concerns; their ability to implement environmental regulations; their perspective on local control versus federal or state control; and their view of regulatory control mechanisms. The study utilized a mixed methodological approach using both qualitative and quantitative data analysis. This includes interviews with key informants, document review, a census survey of local officials, and in-depth interviews with local officials. The results of this research will provide a better understanding of how environmental educators can meet needs of local public officials in addressing federal and state environmental regulations.

Introduction

A major component of the current environmental regulatory philosophy in the United States is the involvement of the federal government in setting standards for environmental protection to avoid competition between states in the classic "race to the bottom scenario." In the environmental context, the race to the bottom argument suggests that local political jurisdictions will fail to enact environmental regulations that provide adequate protection of our natural resources in an effort to attract economic interests away from other locations (Butler & Macey, 1996; Revesz, 2001). The resulting federal answer in some environmental arenas has been the enactment of an approach often referred to as command and control, top down strategies, to environmental protection. This approach has led to substantial reduction or limitation of air, water, and toxic waste problems in the United States, but it is often viewed by state and local officials as an intrusion on what they deem the legitimate function of subnational governments, with the federal government attempting to micromanage their affairs (Scheberle, 1997).

The proponents of environmental devolution (vesting authority in lower levels of government) contend the centralized command and control system, which relies on deterrence as a means of compliance, is far less effective than would be an incentives-based system overseen by state or local officials (Markell, 2000). This centralized "one size fits all" approach fails to recognize not only the critical aspects of the local environment, but also other variables such as the local economy, jobs, and local custom or tradition. Even the success of the current regulatory system to reduce pollution problems, does not mean they are well suited to address environmental problems generated by small sources of pollution or nonpoint sources of pollution (Stewart, 2001). Moreover, various economic models have pointed to the benefits of devolution and dispel the notion that communities ostensibly practice "race to the bottom" in regard to environmental regulations (Oates & Schwab, 1988, 1996a, 1996b). Thus it is not surprising to find many local communities upset by recent efforts by the federal government to impose new efforts to control "urban" nonpoint source pollution controls through the National Pollution Discharge Elimination System (NPDES) Phase II Storm Water Program. Like many states, Ohio has shifted much of the initial criteria establishment for this program to the local level. Ohio intends to rely, to a large degree, on local watershed groups and communities to establish Total Maximum Daily Load (TMDL) levels and NPDES Phase II permit criteria (Deal II Project Team, 2000).

Depending on local officials for environmental protection will require local jurisdictions to consider and give weight to environmental quality in their land use decision-making process. Related local regulations such as zoning, subdivision requirements, or laws specifically intended to control runoff from urban development must include environmental considerations. However, other constraints may limit officials' ability to meet anything other than basic minimum requirements. Ohio Environmental Protection Agency (EPA), Ohio Department of Natural Resources (ODNR) and Ohio State University (OSU) Extension believe that local watershed groups can play an important role in helping communities achieve these objectives. The Ohio initiatives seem to emulate common themes found in ecosystem-based management and collaborative decision-making processes. These include: integrated or systems approaches to problem solving; improving institutional performance; improving the integration of government policies; enhancing cooperation between governmental and nongovernmental organizations; broad participation; key stakeholder involvement; and a strong scientific basis to governmental policies (Imperial, 1999). In a state like Ohio, with sub-governmental jurisdictions down to the township level having land use decision making authority, these initiatives will require a high level of collaboration between governmental jurisdictions if they are to be effective. Under such a local system problems such as fragmentation and duplication of authority, poor use of information and resources, and inconsistency of policies across and between levels of government may arise (Imperial, 1999). These problems can be overcome if there is political support for environmental concepts as demonstrated by the extent of public concern, stakeholder involvement, and the willingness of states to commit funds for implementation (Ringquist, 1995; Scheberle, 1997). To determine the prospects for locally-based environmental regulations in Ohio, this study investigates implementation of the NPDES Phase II Storm Water Program in rapidly developing watersheds. The study is expected to help local watershed groups working with local officials, and help environmental educators meet the needs of both watershed groups and local jurisdictional officials.

Methodology

Target Population

A major educational effort for local officials on NPDES Phase II Storm Water Program was conducted by various entities throughout the state. This effort began in 1999, shortly after the announcement of the NPDES program and culminating with a flurry of activity in the months leading up to the March 10, 2003 deadline. The Ohio Storm Water Task Force[1] conducted many of the educational programs, with assistance from the ODNR and the OSU Extension's Nonpoint Education for Municipal Officials (NEMO) program and the Ohio Watershed Academy. Local watershed groups, conservancy districts, regional planning organizations also conducted NPDES related training programs for local officials. The Ohio EPA was typically an active participant in these efforts and posted fact-sheets on their Web site[2]. With such an extensive educational effort, it is reasonable to assume that most local officials in Ohio were at least aware of the NPDES Phase II Storm Water Program.

There are 423 communities listed by the Ohio EPA as meeting the criteria of having a population in excess of 50,000 or having a population density in excess of 1000 per square mile (additional circumstances may also apply). All of these communities were required to submit their storm water management plan (SWMP) by March 10, 2003. Most of these communities have until 2008 to implement their plan. Ohio EPA has designated 72 communities in 11 watersheds as "rapidly developing" and must meet the compliance criteria by 2006. The concern was that these communities were developing so rapidly that they should be made to comply as soon as possible to minimize the potential impact on water quality. The Ohio EPA indicated these communities would have their plans reviewed first, providing an independent measure of the submitted plan. It was reasonable to expect that local officials from these areas should have a better understanding of the impact and implications of these new regulations in advance of other Phase II communities. A purposeful sample of all these Ohio EPA designated rapidly developing watersheds (RDW) would provide a basis to conduct an exploratory investigation related to second-order (state to local jurisdiction) devolution, implementation of the Phase II program, and identification of educational needs of local officials. Additionally, this study could identify needs and concerns of other jurisdictions related to land use, water quality, and storm water management.

It was decided that with such a relatively small pool of potential participants, a census of relevant local officials from all of the RDWs would be the sample population. All local officials, directly related to approval or implementation of the SWMP, were included in the list of participants. These officials included township trustees, county commissioners, county and municipal engineers, mayors, city council members, law directors or county prosecutors, city managers, and county administrators.

Interviews

To determine the current state of the NPDES Phase II communities and to identify issues related to the development, submission, and implementation of the Storm Water Management Plan (SWMP) submitted to the Ohio EPA, key informants having direct knowledge of the NPDES

[1] The Ohio Storm Water Task Force is a grassroots organization made up of a wide variety of stakeholders throughout the state. Membership includes township, municipal and county officials, representatives from development organizations, state government, environmental groups, consultants and other interested persons.
[2] http://www.epa.state.oh.us/dsw/storm/construction_index.html

program in the rapidly developing watersheds were selected for in-depth interviews. In all, a total of 21 key informants were interviewed, 19 of which provided useful information. Initial interviews were conducted with agency personnel from the ODNR and Ohio EPA.

Recommendations for other key informants from these initial interviews led to additional interviews being conducted with personnel from county Soil and Water Conservation Districts, regional planning organizations, private consultants working within the RDWs, and individuals working for state level local jurisdictional associations.

The interviews ranged in length from 20 minutes to one hour. They consisted of a series of open-ended questions, and the use of probes and follow up questions to explore in greater detail additional issues brought up by the interviewee. The original plan was to interview at least 15 key informants and to continue interviewing until all relevant issues related to the NPDES Phase II program had emerged ("saturation"). It was clear by the completion of the last two or three interviews that most of the key issues related to local development and implementation of the program had surfaced during the interview process. The two interviewees who did not yield useful information lacked sufficient knowledge related to the implementation of the NPDES program.

All of the interviews were digitally recorded and transcribed into a word processing document. The transcribed documents were then coded using QSR N6 software[3]. The results of the analysis yielded seven key areas of concern: collaboration with other jurisdictions in the development; implementation of the SWMP; the overall importance of the environment to the local community; the level of knowledge that local officials had about the NPDES program and its implications for their community; the ability and willingness of local versus state or federal control over the environment; the Ohio EPA and its role in assisting local jurisdictions with the Phase II program; and the means, willingness and authority of local jurisdictions to regulate the Phase II program.

Questionnaire

Statements that represented the general theme of each of the seven subcategories were selected and reworded to provide a balance of positive and negative emphases. A total of 42 statements from the initial interviews were selected for inclusion in the survey questionnaire. The researchers added additional questions related to the details of the collaboration with other jurisdictions. Three of the questions related to the existence or need for a storm water utility, and the ability of such a mechanism to cover the financial obligations of a SWMP. Five additional questions related to the economic, technical, political, and financial ability of the Phase II program were also included in this first section of the questionnaire. With the exception of one question the participants were asked to rate the statement from 1 to 10 related to whether they agreed or disagreed. A scale was provided at the top of each page with 1 being strongly disagree and 10 being strongly agree. The participants were instructed to write the number corresponding to their reaction in a box to the left of each statement. Some of the statements were somewhat technical in nature, and some local officials may not be familiar with specific details about the SWMP, therefore a no opinion option for each of these statements was provided.

The second part of the questionnaire asked specific questions about the participant relating to the position they held, how long they had been in that position, and total years of local community service. Part three asked for specifics about their plan relating to collaboration, costs, Ohio EPA

[3] N6 is the latest version of the coding software program NUD*IST. In this research project the program allowed the researchers to code and search data looking for patterns and key points.

approval, and their opinion of the plan. The fourth section asked specific questions related to the involvement of local watershed groups in storm water management. On the last page of the questionnaire the participants were given an opportunity to add any additional comments.

Experts in storm water management, the Phase II regulatory program, Extension education, and survey instrument development reviewed the questionnaire. Modifications were made to the instrument to reflect the suggestions and concerns of the reviewers. The draft questionnaire was then distributed to local officials through two local watershed groups and three local jurisdictional associations to Phase II communities outside of the RDWs. This pilot group was asked to complete the draft survey questionnaire, to comment on any potential conflicts of confidentiality, and to indicate approximately how long it took them to complete the questionnaire. A total of 43 pilot questionnaires were returned. No significant concerns with conflicts to confidentiality of the participants were identified. The average length of time to complete the questionnaire was just over 20 minutes with a range from 5 minutes to one hour. The responses were tested for internal consistency of the instrument using Cronbach's Alpha with $\alpha = .776$. The range for Cronbach's Alpha if items were deleted ran from .754 to .782.

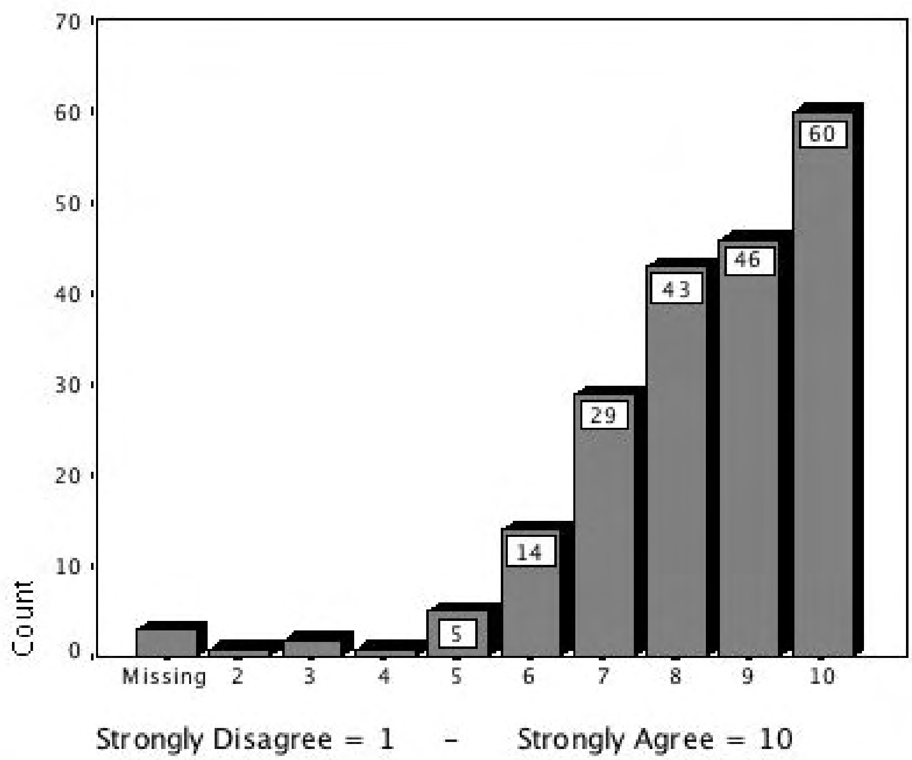
Initially 428 local elected officials from 72 communities were identified for participation in the study through official jurisdictional and county board of elections web sites. Using a variant of the Tailored Design Method (Dillman, 2000) each participant was sent an initial letter about the study and were told to expect a questionnaire soon. Five days after the introductory letter was sent, each participant received a letter cosigned by the principal investigator, the director of OSU Extension, and the executive directors of the County Commissioners Association of Ohio, the County Engineers Association of Ohio, the Ohio Township Trustees Association, and the Ohio Municipal League, urging participation and insuring confidentiality, along with a numbered copy of the questionnaire. The questionnaires were numbered to identify returns and avoid unnecessary additional contacts. Five days after the questionnaires were sent, reminder postcards were mailed to the participants thanking them if they had already completed the questionnaire and encouraging them to do so if they had not. Ten days following the mailing of the questionnaire, e-mails were sent to all non-responding participants with identified addresses (approximately 60%) once again encouraging them to complete the questionnaires. A week later a letter and second questionnaire were sent to all of the remaining non-responding participants, again encouraging their participation in the study.

Multi-variant correlation with the responses to this questionnaire, EPA water quality data, political demographic information, median income, and the regulatory stringency of the plans originally submitted by the jurisdictions to the Ohio EPA will be conducted in the final analysis of these data. However, an initial look at the descriptive statistics provides some interesting perspectives about tendencies of local officials' perception about the environment, local control versus federal and state control, and the role that local watershed groups should take in an environmental program like a storm water management plan. These perspectives provide interesting and useful information for environmental educators related to the educational needs of local elected officials and how local watershed groups can meet those needs.

Results

The results presented here are based on a current response rate of 53.8%, of which 48% yielded useful information for this analysis. A final request for participation still needs to be sent, which may boost these numbers to a small degree, and a non-responder follow-up will need to be completed. Even with these limitations there are some interesting trends emerging from the data. It is not surprising that local officials, for the most part, are not supportive of a system where the federal government dictates the rules, the state government enforces those rules and the locals are required to implement them. However, it is interesting that, for the most part, local officials feel that the Clean Water Act (CWA) has had a positive impact on their communities and it appears that local storm water management would not have been a high priority without federal intervention. Local officials are very supportive of greater local input in deciding how to protect the environment. Protection of natural resources being a high priority for a SWMP was also strongly supported by the survey participants. There was equally strong support for the concept that protecting the environment added to the quality of life in their communities (Figure 1).

Figure 1. Response of local officials to the statement "Protection of the environment adds to the quality of life in my community."

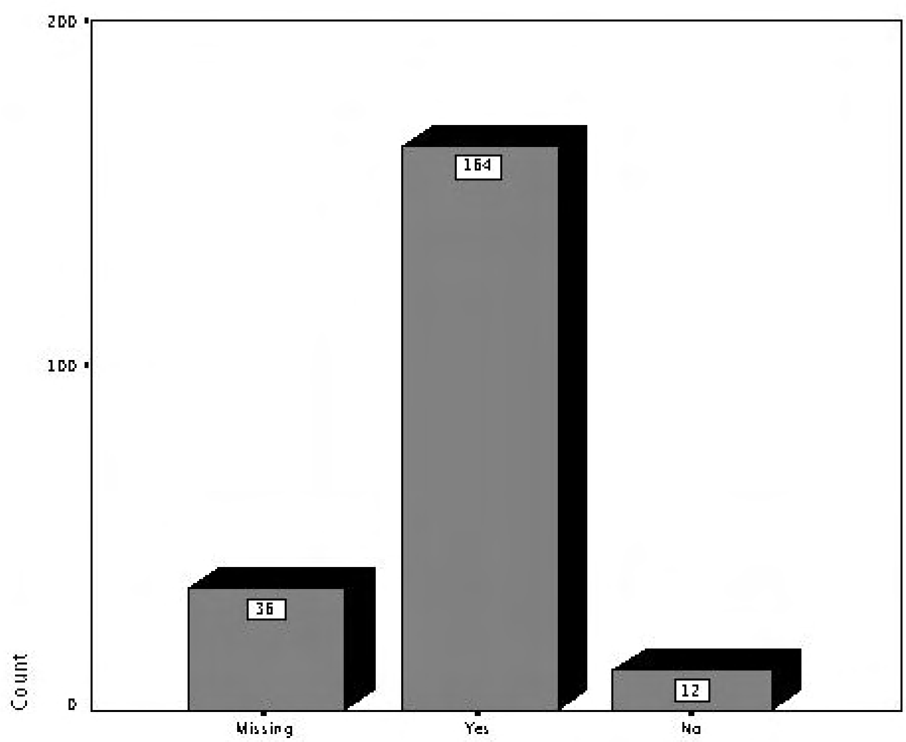


The majority of the respondents reported they had a good understanding of the SWMP their communities submitted to the Ohio EPA, and they felt they had sufficient information available to them to make informed decisions in this regard. For the most part they felt they had a good understanding of the benefits of storm water management. However, their responses to the overall costs associated with the plan as it was submitted to the Ohio EPA were rather ambivalent with nearly equal numbers across the scale in regard to their understanding of this issue. During the interview phase of the study, many of the key informants suggested they were not confident that local officials were cognizant of the real long-term costs of the program. When asked if they felt that too much emphasis was being placed on urban nonpoint source pollution without a clearly demonstrating the overall impact, many respondents had no opinion and there was no clear trend one way or the other from those who did respond to this statement. In regard to Ohio EPA explanation of the minimum requirements for the Phase II program and the need for the program, the results were bimodal with a near equal distribution between those that agreed and disagreed with those statements.

One clear area of concern was the overall cost of the program. Many of the respondents indicated they did not have the financial resources necessary to implement the plan. Cost and adequate resources were the most common comments added by the participants. These were also the most common reasons given for communities collaborating with other local jurisdictions on their SWMP. With this group of communities, it appears that when communities did collaborate the lead was often taken by the county, with the townships and municipalities acting as cooperators. Sixty-two percent of the respondents reported that their community did not have a storm water utility, and despite their concerns about financial resources, nearly 50% of the respondents had no opinion whether they would need to establish one.

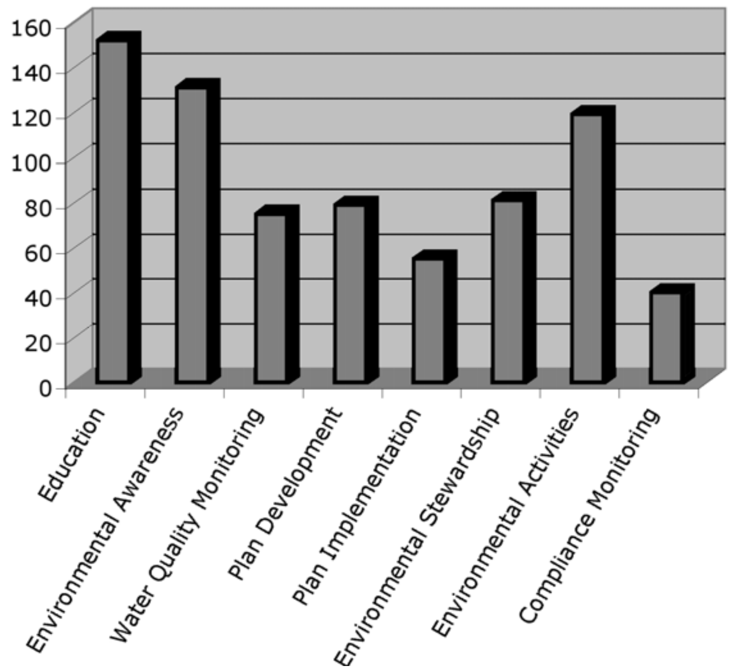
It was interesting to see the role that local officials see for local watershed groups with Ohio's EPA and ODNR emphases on their involvement in watershed planning. Seventy-one percentage of the respondents thought watershed groups should be involved in storm water management, and less than 6% felt they should not be involved (Figure 2).

Figure 2. Local officials who feel watershed groups should be included in watershed planning



The vast majority, 71.4%, felt that watershed groups should play a role in environmental education, 61.9% in environmental awareness, 36.2% in water quality monitoring, 38.1%in SWMP development, 26.7% in plan implementation, 38.1% in environmental stewardship, 56.2% in environmental activities, and just 19.5% in compliance monitoring (Figure 3).

Figure 3. Roles local officials feel are appropriate for watershed groups



Conclusions

At this point is too early to draw any definitive conclusions from this study. It appears, however, that the local officials who returned their questionnaires were confident in their understanding of storm water management issues. There does appear to be a need to focus more attention on the overall costs of the program and the implications they will have on local communities. There also appears to be a need for educational programming for implementation mechanisms like storm water utilities and long term cost/benefit programs. Involvement of watershed groups in storm water management plans that are consistent with watershed planning activities, outside of education and awareness activities, appears to be somewhat problematic with the majority of the survey respondents. With the strong emphasis that Ohio EPA and DNR have placed on watershed groups' involvement in watershed planning, and the large number of cross-jurisdictional collaborations with storm water management plans, greater integration between watershed groups and local officials will need to occur. Watershed groups need to do better job of understanding local political situations, increasing their sensitivity to jurisdiction authority and autonomy. They also need to improve their message regarding the benefits that local communities can realize by working with them and how they can help to foster collaborative efforts.

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From Theory to Practice: Best Practices in Boating, Fishing, and Aquatic Stewardship Education

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Abstract

This paper summarizes the process used by The Recreational Boating and Fishing Foundation (RBFF) to develop a new resource, *Best Practices for Boating, Fishing, and Aquatic Stewardship Education*, that will further RBFF's mission of implementing a national outreach strategy to increase participation in fishing, boating, and stewardship of the nation's aquatic natural resources. A "Best Practice" can be defined as a program or practice that has been clearly defined, refined through repeated delivery, and supported by a substantial body of research evidence. RBFF commissioned a research project that would identify research-based Best Practices in boating, fishing and aquatic stewardship education. The resulting document, *Defining Best Practices In Boating, Fishing, and Stewardship Education* (Fedler, 2001) formed the basis for creating recommended practices for program planning, development and implementation. From the Best Practices research, a professional team developed tools for educators to implement the researched recommendations (Seng & Rushton, 2003). Currently, RBFF is partnering with state agencies and researchers to evaluate the effectiveness of Best Practices tools. As a next step, RBFF plans to facilitate development of instructional tools to assist educators in successfully evaluating their own programs.

Introduction

The need for public involvement with and stewardship of our aquatic natural resources continues to grow, as the average American's connection with those resources continues to diminish. This disconnect portends significant threats to the sustainability of our natural world by diminishing public support for natural resources managers and conservation, as well as by decreasing knowledge and personal empowerment regarding individuals' impacts on those resources.

No longer are agencies that manage natural resources, from the federal to the state to the local government, solely responsible for the water, land, and air. Education has increasingly become a staple responsibility for these entities. For years, efforts at effective aquatic education have suffered from unclear objectives and erroneous methodology.

In this day of tight government budgets and increasing accountability, Best Practices in education have become a necessity. This effort aims to put "professional" in front of aquatic educator, and provide sound practices to make education efforts more effective, as well as provide research-based support for the value and necessity of education as part of holistic natural resources management.

Project Background

In 1998, the U.S. Department of the Interior, Sport Fishing and Boating Partnership Advisory Council completed a strategic plan for their Outreach and Communication Program. The initiative sought to increase participation in fishing and boating to complement ongoing conservation efforts by government agencies, and to pass on these American traditions and a legacy of stewardship.

The Recreational Boating and Fishing Foundation (RBFF) was created to carry out this initiative. Its mission is to increase participation in recreational angling and boating and thereby increase public awareness and appreciation of the need for protecting, conserving and restoring this nation's aquatic natural resources. At the time of Best Practices inception, RBFF had five goal areas; the first four were addressed by a group of stakeholders, known as Task Forces. In addition, RBFF has a Stewardship Team to explore the relationship between stewardship and participation.

Goal 1: Create top of mind awareness campaigns (ad program, external communications/PR, outreach).
Goal 2: Enable stakeholders to use research and best practices to educate people about boating, fishing and aquatic resource stewardship.
Goal 3: Provide research basis for making boating and fishing marketing decisions.
Goal 4: Educate stakeholders on marketing and outreach using RBFF products, tools and services.
Goal 5: Make availability of and access to information about boating and fishing locations easy and simple.

The Best Practices initiative arose from the work of Task Force 2, in addressing Goal 2. Task Force 2 (see Appendix A for list of members) identified a variety of issues as priority concerns and defined an ambitious agenda to answer its charge: *Enable stakeholders to use research and best practices to educate people about boating, fishing and aquatic resource stewardship*. To begin, the task force defined recreational boating, fishing and stewardship education as:

“A complex process by which related skills, attitudes, knowledge, and behaviors are enhanced, developed and supported through a planned series of experiences” (Fedler, 2001, p. 4).

Boating and fishing education was characterized as:

- Complex
- Life-long
- Linked to stewardship
- Changes behavior over time

They identified these primary and secondary audiences for the work of this task force:

Primary Audiences:
Aquatic educators
Education service providers, including their supervisors and administrators
Agency educators (formal and non-formal) including: Extension, parks and recreation
“Education brokers” – organizations responsible for providing education services

Secondary Audiences:
Task Force 4
Point of sale staff (state licensing process)
Partners
Enforcement
Nongovernment organizations (NGO's) with conservation education programs
Community-based organizations that provide education

Developing Best Practices

"A 'best practice' can be defined as a program or practice that has been clearly defined, refined through repeated delivery, and supported by a substantial body of research evidence" (Fedler, 2001, p. 7).

Task Force 2 identified developing guidelines for research-based boating/fishing education programs utilizing best professional practices as necessary to facilitate a sound educational process.

In its initial plans, the task force included the need to determine which processes provide the best experiences for conveying knowledge, developing skills, and changing attitudes and behaviors. It was decided that a broad approach, examining multiple disciplines, would provide the best sources of information. The following fields were suggested:

- Community-based education
- Traditional evaluation
- Experiential education
- Outcome-based education and evaluation
- Drug prevention education
- Watershed education
- Environmental ethics education
- Outdoor education/adventure learning
- Risk education
- Intervention
- Therapeutic recreation
- Sports sociology (preferences as to individual/team/watching)
- Cognitive/affective/psychomotor domains
- Demographic specific
- How to learn
- Leisure education
- Non-formal education

To accomplish this, RBFF issued a request for proposals for a contractor to compile the best professional practices that provide guidance to boating, fishing and stewardship. Dr. Anthony Fedler of Human Dimensions Consulting was selected to facilitate the development of guidelines/standards for research-based education programs utilizing best professional practices.

The first step in developing these Best Practices was to engage academic professionals proficient in the fields of interest to summarize available research on the best methods for achieving learner outcomes. The following is a list of those research papers and authors:

- *Best Practices for Curriculum, Teaching, and Evaluation Components of Aquatic Stewardship Education* - William F. Siemer
- *Elements of Effective Environmental Education Programs* - Julie A. Athman and Martha C. Monroe
- *The Right Tools for the Right Job: How Can Aquatic Resource Education Succeed in the Classroom* - Rosanne W. Fortner
- *Guidelines for Best Practices in Aquatic, Fisheries, and Environmental Education* - Michaela Zint
- *Best Practices in Boater Safety Education* - Alan R. Graefe
- *Defining Best Practices in Boating, Fishing, and Stewardship Education: Challenges and Opportunities for Reaching Diverse Audiences* - Myron F. Floyd
- *An Overview of an Issue and Action Instruction Program for Stewardship Education* - Tom Marcinkowski
- *Outdoor and Risk Educational Practices* - Marni Goldenberg
- *Water-Based Outdoor Recreation and Persons with Disabilities* - Jo-Ellen Ross
- *Recommended Educational Practices for Youth Environmental Education from a 4-H Youth Development Perspective* - Kathleen E. Vos
- *Best Practices in Marine and Coastal Science Education: Lessons Learned From a National Estuarine Research Reserve* - Janice D. McDonnell

The Best Practices in Boating, Fishing and Stewardship Education project focused on identifying accepted principles and standards generally applicable to boating, fishing and stewardship education.

Research was compiled from the following disciplines:

- Boating education
- Aquatic education
- Environmental education
- Marine education
- Youth development
- Stewardship and environmental ethics education
- Adventure recreation education
- Minority education
- Outdoor education for people with disabilities

Each expert wrote a review paper distilling the best professional practices from his or her field that would likely result in accomplishing the goals of boating, fishing, and stewardship education programs. The experts also wrote a brief overview of appropriate evaluation methods for gauging the effectiveness of the programs. Gaps in the literature, pertaining to understanding the effectiveness of different educational approaches, were identified and prioritized as future research needs.

The Best Practices are founded on research and practical experience from diverse fields, and the recommendations for curricula, programs, and leadership are practices that will affect change in aquatic resource and environmental knowledge, attitudes, and behaviors. Recommendations were required to be supported with scientific research, peer recommendations, and practical experience.

After completing their papers, the experts were joined by 14 professional boating, fishing and aquatic education administrators and practitioners in a workshop designed to reach consensus on basic principles and best practices derived from the collection of written papers, and the group's collective practical experience. During the workshop, participants identified 10 general guiding principles for education programs (see Appendix B). Additionally, the group recommended basic practices for each of four educational areas: 17 for program planning, development and implementation (see Appendix C); 21 for professional development (see Appendix D); 11 for program evaluation (Table 4); and 6 for educational program research (see Appendix E). Each of the principles and recommendations can be used in forming components of new programs or in evaluating existing programs.

The resulting eleven papers and these guidelines were edited by Dr. Fedler (2001) and compiled in a document, *Defining Best Practices in Boating, Fishing, and Stewardship Education*. This document is available for download at the RBFF Web site: http://www.rbff.org/educational/BPE1.pdf

In the year succeeding publication of the Best Practices, RBFF staff initiated communications with educators individually and at venues such as the Aquatic Resources Education Association West (AREA West) meeting and the North American Association for Environmental Education (NAAEE) conference, to gauge interest in Best Practices as a concept and the usefulness of the document.

Overall, the feedback indicated that people think the idea of having Best Practices in education is good and that the information contained in the document is worthy. All those providing feedback indicated they would never actually read it and everyone agreed that the guidelines as written were theoretical, not actionable. In addition, most educators were interested in doing a better job of evaluating their programs and using those evaluations to do a better job of educating, but none were comfortable with their abilities to effectively evaluate. They requested training and tools to enable them to improve in that area.

Translating Theory into Action

Based on this feedback, RBFF requested a contractor to help take the information from the Best Practices and translate it into actionable formats. These formats include information sheets about Best Practices; workbooks that will take aquatic educators through the program development/evaluation process as outlined in the report; a trainer's guide to assist facilitators in teaching Best Practices; and tools to help communicate the importance of the Best Practices, including a PowerPoint presentation (Seng & Rushton, 2003). These tools are available for download at http://www.rbff.org/educational/ bestpractices.cfm.

To assist in the development of these tools, the contractor engaged a review panel of 30 that included original authors of the Best Practices, as well as practitioners of aquatic education.[1] The review panel reviewed three drafts of each tool for accuracy and utility.

A brief description of each tool follows:

[1] Editor's Note: Names and positions of review panel members are listed on the Web site and in the workbook, http://www.rbff.org/educational/bestpractices.cfm.

Program Development Workbook

The workbook is an interactive, reusable tool that aquatic educators can use to help them develop effective programs and/or evaluate existing programs. It translates the technical concepts identified in the Best Practices document into guidelines that practitioners can implement in their own situations. The workbook has sections to assist practitioners who are just building a new program, as well as sections designed to help ongoing programs identify and tackle problems using real-world examples (from aquatic education and other education disciplines) and interactive, problem-based learning models. The primary consideration in the development of this workbook is to make it easy for practitioners to fold the workbook guidelines and recommendations into their ongoing work. It is organized in ten chapters:

1. Plan Ahead For Success
2. Building Your Program
3. Well-Trained Instructors
4. Evaluation
5. Diverse Audiences
6. Persons With Disabilities
7. Boating Education Programs
8. Fishing Education Programs
9. Aquatic Stewardship Education
10. Let Research Help

The workbook also contains a “Glossary/Index”, and “A Brief History of Environmental Education.” In addition, there are over 80 worksheets to help guide users through the content and to make it personally applicable and relevant.

Information Sheets

The fact sheets are short summaries of the information contained in the Workbook. They describe the kind of information that Best Practices represent, the intention of Best Practices, and the importance of using Best Practices in program development, professional development, and evaluation. They are to be used in association with the Workbook described above, and in brochures as communications pieces about Best Practices. The following is a list of the information sheets developed:

- Making Your Education Program the Best in the Nation
- Planning Ahead
- Building Your Program on Solid Ground
- Expanding Your Capabilities: Well-Trained Instructors
- How Do You Know If It’s Working? Evaluation!
- Expanding Your Reach to Diverse Audiences
- Enhancing Boating Education Programs
- Enhancing Fishing Education Programs
- Enhancing Aquatic Stewardship Education
- Clubs and Grassroots Organization
- Building Support Within Your Agency/Organization

Trainer's Guide

In the absence of a delivery mechanism that clearly demonstrates how and why aquatic educators can/should use the materials described above, the materials will quickly find a spot on a dusty shelf. Even the best materials in the world will remain largely unused in the absence of hands-on training or interpretation. This guide acts as a "cookbook" for conducting a one- or two-day workshop that would walk end users through the Program Development Workbooks and motivate them to adopt the information and materials into their programs.

PowerPoint Presentation

The comprehensive PowerPoint presentation includes text and design elements developed to help various target audiences communicate about the importance of Best Practices. Topics covered in the presentation include:

- Why Best Practices are important
- History and development of Best Practices
- What Best Practices are (basic elements)
- What is needed to implement Best Practices

Use of Best Practices and Next Steps

From February through May 2004, over 300 individuals have requested Best Practices materials. Over 50 individuals from 15 states have been trained in Best Practices in RBFF-sponsored workshops and multiple states are implementing Best Practices to build programs from the ground up, or to evaluate existing programs. In addition, Chicago State University, under the guidance of Dr. Jo-Ellen Ross, developed, implemented and evaluated a two-credit college course on fishing, boating, and aquatic stewardship education based on the Best Practices. Through classroom and field instruction, students were given a chance to participate and learn the basics of developing, implementing and evaluating programs using the Best Practices tools.

Beginning in the summer of 2004, RBFF will be working with partnering state agencies and Chicago State University to evaluate the effectiveness of the Best Practices tools. Reports on their successes and lessons learned will be forthcoming. Results of the evaluations will help shape future iterations of the Best Practices guidelines and the tools that enable their implementation.

Another important next step will be the development of a companion evaluation tool. While the Best Practices emphasize evaluation and the importance of including it in every phase of program development and implementation, very little guidance has been compiled on methodology to assist educators in successfully evaluating programs. RBFF plans to facilitate development of this instructional tool.

Since the project's inception, the aquatic education community's response has been overwhelmingly positive. The tools and the information contained therein have struck a chord with the community, piecing together existing knowledge and resources into a comprehensive guide to program success. The following are a few testimonials:

> "I'm blown away by the Best Practices Document. I can't wait to use it. It's about everything I'm trying to champion. It's a fabulous tool…"
> Margaret Tudor, Washington Department of Fish and Wildlife

> "It's nice to see the things I've tried to piece together for years in one document…"
> Barb Gigar, Iowa Department of Natural Resources

"It is really quite a spectacular effort. It gathers so much of what we should use every day and puts it right at your fingertips."
Judy Stokes, New Hampshire Fish and Game Department

"I see Best Practices as integral to our success. We've made copies for everyone in our department involved in education, not just aquatic education. It provides us good direction and is a great path for us to follow. We believe this will help us to leave a true legacy."
Patricia Miller, Tennessee Wildlife Resources Agency

"We plan to teach Best Practices to all of our divisions. The information applies to the hunting side just as much as boating, fishing, and stewardship. We'll then give everyone an opportunity to help us determine where we should go with each of our programs."
M.N. "Corky" Pugh, Alabama Department of Conservation and Natural Resources

For more information on Best Practices in Boating, Fishing, and Aquatic Stewardship Education, and to download materials, visit the Web at http://www.rbff.org/educational/ bestpractices.cfm. Free preview copies are available through the RBFF.

References

Fedler, A. J. (Ed.) (2001). *Defining best practices in boating, fishing, and stewardship education.* Alexandria, VA: Recreational Boating and Fishing Foundation. Retrieved November 12, 2004 from the Recreational Boating and Fishing Foundation Web site: http://rbff.org/educational/BPE1.pdf

Seng, P. T., & Rushton, S. (Eds.). (2003). *Best practices workbook for boating, fishing, and aquatic resources stewardship education.* Alexandria, VA: Recreational Boating and Fishing Foundation. Retrieved June, 2004 from the Recreational Boating and Fishing Foundation Web site: http://www.rbff.org/newfiles/FINAL%20Workbook %20Layouts%2011-6-03.pdf

APPENDIX A (Levin & O'Malley)

The Best Practices Task Force 2 Members
Recreational Boating and Fishing Foundation

Members of Task Force 2 come from a variety of disciplines and experiences in aquatic and boating education. They are:

- Mike O'Malley (Chair), Watchable Wildlife Manager, Washington Dept of Fish and Wildlife
- Elaine Andrews, Environmental Education Specialist, Environmental Resources Center, UW Cooperative Extension
- Eleanor Bochenek, Marine Scientist, Rutgers University
- Virgil Chambers, Executive Director, National Safe Boating Council
- Mark Cole, CEO, Inner City Fishing Institute
- Shari Dann, Assistant Professor & Extension Specialist, Dept. of Fisheries and Wildlife, Michigan State University
- Anne Glick, Educational Programs Coordinator, American Sportfishing Association
- Carl Richardson, Aquatic Resource Education Program, Pennsylvania Fish & Boat Commission
- Rich Wehnes, Stream Services Program Supervisor, Missouri Department of Conservation

APPENDIX B (Levin & O'Malley)

Guiding Principles for Boating, Fishing, and Aquatic Stewardship Education

Boating, fishing, and stewardship education:

- Is learner-centered.
- Constitutes a continuous and lifelong process for individuals, families, and diverse social groups.
- Considers aquatic resources in their totality, including natural, built, technological, and social aspects (e.g., economics, politics, cultural-historical, moral, and aesthetic).
- Provides participants with opportunities to engage in the valuing process (i.e., choosing, affirming, and acting) as it relates to programs, program activities, and their own growth and development.
- Follows the principles of inclusion with regard to program participation by minorities and people with disabilities.
- Begins with goals and objectives that relate to appreciation and awareness, expand to include both knowledge and skills, and culminate in personal responsibility and responsible behavior.
- Builds upon local, state, and national partnerships to support the development, implementation, and evaluation of programs, as well as to support stewardship of the resource.
- Relies on a variety of systematic and continuous approaches to the assessment of participants and evaluation of programs so as to improve and eventually validate those programs.
- Supports, engages in, and makes use of the scientific, social, educational, and other forms of research that have a bearing on programs.
- Recognizes the critical role and the need to adequately support ongoing professional development for all personnel associated with these efforts and programs, including those suggested or implied in the above principles.

APPENDIX C (Levin & O'Malley)

Best Practices for Program Planning, Development, and Implementation

Effective Programs:

- Are relevant to the mission of the agency or organization sponsoring the program, the educational objectives of the audience, and everyday life of the learner.
- Use some form of needs assessment to establish a basis for and to help shape individual programs. Assessments should include needs of the agency, community, and participants.
- Involve stakeholders at all levels of their development.
- Empower learners with skills to address environmental issues and with a sense of personal and civic responsibility.
- Present accurate and balanced information incorporating multiple perspectives using an interdisciplinary approach.
- Are accessible to persons with disabilities and incorporate adaptive technology, support staff, and services to meet the needs of all participants in an inclusive manner.
- Receive adequate resources, staffing, and are supported through appropriate resources and staff so that they become sustainable over time.
- Are instructionally sound, utilizing learner-centered and experiential instructional approaches to provide opportunities for collaborative learning and the development of critical thinking skills.
- Are developmentally appropriate, using multiple methods to enhance learning opportunities for diverse learning styles.
- Provide educational opportunities that are frequent and sustained over time.
- Use an interdisciplinary approach to develop skills, formulate concepts, and examine issues.
- Aligns curriculum with national and state educational standards, when appropriate.
- Use curricular materials and other print and electronic resources that present accurate information, and when addressing controversial topics, expose participants to different perspectives in a fair and balanced manner.

Appendix C (continued)

- Inventory and utilize a variety of educational resources and environments, including community resources (e.g., speakers, offices), and lab and field sites (e.g., hatcheries, marinas, ponds and lakes), in a sustainable manner.

- Are planned and carried out in a manner that clearly addresses safety and other regulations, and reduces real risks to everyone involved by utilizing professional safety and risk management techniques.

- Rely on experienced, well informed, prepared, and ethical staff to develop, implement, and evaluate programs.

- Make use of a variety of teaching and learning methods that are appropriate for a program's goals, objectives and subject matter, and are sensitive to participant age, developmental level, and background.

APPENDIX D (Levin & O'Malley)

Best Practices for Professional Development

Effective professional development:

- Clearly presents the agency's or organization's mission and goals.
- Inspires active, ongoing, lifelong learning by professional educators.
- Addresses diverse learning styles by presenting material in a variety of formats and experiences, and incorporates active learning.
- Values diversity and relates to audiences consisting of diverse social, cultural, and economic groups.
- Includes opportunities for youth leadership development as well as for adults.
- Includes aquatic resource stewardship as an outcome and/or longer-term impact.
- Follows a validated process for workshop training to establish consistency, when appropriate.
- Offers tiers of training to provide for continuing education using a "roll out" process for increasing learner knowledge and competency over time.
- Includes presentation of effective teaching methods and ways to foster learning.
- Presents models of good instructional and assessment practices.
- Provides opportunities for learning to continue over an extended period through the innovative use of the Internet, listservers, newsletters and networking.
- Provides mechanisms for updating existing information and disseminating it to educators and administrators.
- Uses attractive and appropriate training materials, and provide hands-on exposure to materials to be used in the classroom.
- Provides appropriate models of program evaluation.
- Considers audience motivations for participating in professional development (e.g., mandatory or voluntary).
- Includes formative, summative and long-term evaluation of the trainer, the program and the trainee.

Appendix D (continued)

- Includes pre-service (basic training) and in-service (in-depth) training modules and avoids brief one-shot training sessions.
- Recruits instructors with experience and knowledge in the subject area.
- Incorporates educational theory into training curriculum.
- Screens instructors, with criminal background checks, and interviews them for potential, motivation, commitment, ethical behavior, knowledge, and the ability to work diverse groups.
- Provide opportunities for mentoring by experienced instructors and staff.

APPENDIX E (Levin & O'Malley)

Best Practices for Program Evaluation

Effective program evaluation:

- Is envisioned and undertaken as a systematic and ongoing process that begins when a program is being planned or developed, and that included both formative and summative evaluations.

- Receives both administrative support and budgeted allocations as part of program costs.

- Is utilized as a learning tool to support program reflection, decision-making, and improvement.

- Includes pre-assessments of learners and assessments of learning outcomes that are based on program goals and objectives.

- Helps identify program outputs, such as number of participants and participation feedback.

- Is used to help align program inputs (e.g., materials, resources) and processes (e.g., activities, services) with program outcomes.

- Explores and investigates the program's long-term benefits and impacts.

- Encourages the use of assessment methods that include, when appropriate, informal methods (e.g., Q&A, observations), traditional methods (e.g., quizzes, tests), and alternative/authentic methods (e.g., rubrics for performance tasks and projects, portfolios).

- Makes use of curricular materials that have been carefully reviewed against national criteria, or will use these criteria to select, develop and/or revise materials.

- Makes use of evaluators and evaluation methods that involve and empower program staff.

- Allows program staff (i.e., administrators, coordinators, and instructors) to take advantage of professional development opportunities in the areas of assessment and evaluation, so that staff have greater capacity to carry out and use results from sound program evaluations.

APPENDIX F (Levin & O'Malley)

Best Practices for Educational Program Research

Effective research:

- Allows program staff to explore and recognize both the value of and the need for research that is relevant to their program.

- Is organized and communicated in ways that provide opportunities for program staff to become aware of and generally familiar with collections, reviews, and summaries and syntheses of research relevant to their program.

- Is organized and communicated in ways that permit program staff to incorporate major research findings into the design, development, implementation, and evaluation of a program.

- Is organized and communicated in ways that help program staff become aware of, explore, and share both apparent gaps in existing research and additional research needs.

- Allows program staff to take advantage of professional development opportunities that enhance their abilities to understand the implications of research for their program and strategies for making use of that research.

- Allows program staff to take advantage of professional development opportunities that enhance their research skills and thereby strengthen their capacity to become meaningfully involved in the research process (e.g., as in action research).

Using a Survey Instrument to Determine Audience Preferred Delivery Methods for Water Quality in the Pacific Northwest

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Abstract

A 50-question survey was developed by the Pacific Northwest water quality team to document public awareness, aptitudes, attitudes and actions toward water quality in Alaska, Idaho, Oregon and Washington. Demographic data were also collected about the survey respondents. The statistically designed survey conducted in January 2002, was completed by over 50 percent of the 1,800 residents who were solicited for this study. Several questions in this survey were used to assess needs in the region. We are using the results of this survey to guide our water quality programming priority areas and delivery methods to our clientele for the next five years.

Introduction

The states of Alaska, Idaho, Oregon and Washington comprise a region referred to as the Pacific Northwest and as Region 10 by the U.S. Environmental Protection Agency (EPA) and by the U.S. Department of Agriculture (USDA), Cooperative State Research, Education, and Extension Service's National Water Quality Program. This region consists of 920,600 square miles or 26 percent of the USA's land area. The population is approximately 11,400,000 people or 4 percent of the USA's population. Within this region are five land grant institutions: Northwest Indian College, Oregon State University, University of Alaska, University of Idaho and Washington State University. Water is considered the most important natural resource in the region.

The land grant institutions in the region have a history of addressing high-priority water needs and issues. The five land grant institutions currently have over $25,000,000 in grants and contracts associated with water resources. Many of the institutions' water research programs are internationally recognized. In addition, these institutions have an outreach structure that places local educational opportunities within reach of all residents of each state. These institutions offer many degree programs that emphasize water resources. With so much water activity, it is important to have a coordination project that can effectively link research, extension and educational activities within and between institutions in the region.

The Pacific Northwest regional water coordinating team has been active for approximately four years. In that short period of time we have developed a tradition of working together well. We realize that as individual states we can not meet all the water research, extension and educational needs. However, working as a region we can pool our efforts, minimize redundancies, set regional priorities based on thematic areas, and efficiently and effectively meet the needs of people in the region. Our regional team has forged a strong working relationship with EPA Region 10 and improved our working relationships with USDA-Natural Resources Conservation Service (NRCS), state and local agencies.

We plan to build on current working relationships and our solid foundation to take our programs to the next level. Our philosophy is to provide science-based information so that people can make decisions in their lives that will improve and/or protect water quality. Based on our four years of working together as a regional program we have made the following observations:

- Our region is a more effective and efficient unit than four or five separate state or tribal programs.
- We work together better as a team than as individuals.
- A liaison position located at EPA Region 10 headquarters helps pull our states together into a team.
- Effective partnerships with EPA Region 10 and USDA-NRCS enhance all of our water programs.
- We use all partner logos on all of our products; sharing credit is effective and encourages stronger partnerships.
- Our regional water quality program contributes to the national water quality program.
- The national water quality program contributes to our regional program.
- Our future programming efforts are positively influenced by four years of experience working as a regional team.
- TMDL targets and watershed groups need our support.
- Sharing expertise throughout the region covers gaps due to loss of positions within states.
- Citizens of the region gain from the synergism of our team.

Surveys are considered a useful tool for both determining potential audiences and determining audience educational needs. Surveys also provide necessary baseline data that can be used to assess outreach progress. We consider needs assessment surveys best educational practices (BEP).
The objectives of our study (BEP) were to: (1) design and conduct a needs assessment survey to document public awareness, aptitudes, attitudes and actions toward water quality and the environment, and (2) develop baseline data to compare successes of future programs. This report summarizes the programming needs aspects of this study.

Materials and Methods

A 50-question survey was designed to assess public attitudes about water issues in the Pacific Northwest. Based on statistical advice, a target of 900 residents of the Pacific Northwest was set as the sample size population. Surveys were sent to residents of Alaska, Idaho, Oregon and Washington on a proportional population basis. Residents from each state were randomly selected from phone books and an online directory, www.switchboard.com. Surveys were actually sent to 1,888 residents; however, 114 were returned by the post office as being undeliverable. Consequently, the actual sample population was 1,774. The survey process was designed to receive a completed survey return rate in excess of 50 percent. If more than 877 surveys were returned completed, then the sampling error can be assumed to be less than +/-5 percent (Dillman, 2000; Salant & Dillman, 1994). Three mailings were used to achieve this return rate. The first mailing, which took place in January 2002, included the water issues survey form, a business reply envelope and a cover letter that: (1) identified the survey's authors, (2) explained the purpose of the survey, (3) assured the respondent of anonymity, and (4) asked the respondent to fill out and return the survey via the enclosed business reply envelope. The second mailing occurred five weeks later (March 2002). It consisted of a postcard that stressed the importance of the survey, and reminded the respondent to fill out and return the survey sent out in the first mailing. Five weeks later (May 2002) the third mailing was sent to residents who did not respond to the first or second mailing. This mailing included a reminder letter, another copy of the water issues survey and a business reply envelope.

Survey answers were coded and entered into Microsoft Excel. The data was then copied to SPSS, a statistical software package (Norusis, 1986). Missing data was assigned the number nine on the coding system and excluded from the analysis. The data were analyzed at two levels using SPSS (Norusis, 1986). The first level of analysis was a basic data summary. This analysis showed both the total number and percentage of respondents that answered each question with a specific answer. The second level of analysis involved using cross-tabulation, or contingency tables, to isolate how specific subgroups of survey respondents (e.g., demographic groups such as gender and education level) related to specific questions. Significance was tested using chi-square distribution (Babbie, 1983). The significance level deemed valid in this study was 0.05. Statistics are not provided in the tables of this manuscript because they are secondary to the purpose of this paper. However, values in Tables 2, 3, 4, 5, and 6 differing by more that 5.0 percent should be assumed to be statistically different.

Results and Discussion

The water issues survey achieved a return rate of 52.3 percent (928 surveys, both fully and partially completed, returned out of 1,774). The individual state response ranged from 50.6 to 57.6 percent (Table 1). Fifty-six percent of the survey respondents were male. Over 32 percent of the survey respondents lived in communities of more than 100,000 people. Conversely, 18 percent of the respondents lived in towns with less than 7,000 people. Thirty-five percent of the respondents had lived in the Pacific Northwest all of their lives. Ninety-one percent of survey respondents were high school graduates. Overall, the demographics of the survey respondents (except for gender) closely reflected the actual demographics of the region. Consequently, when coupled with low sampling error, the results of this survey should be an excellent instrument to assess literacy on water issues in the region.

Table 1. *Statistical Data about the Pacific Northwest Water Issues Survey Sample Size and Completion Rate by State*

State	Sample size	Completed	Return rate (%)
Alaska	232	120	51.7
Idaho	278	160	57.6
Oregon	506	256	50.6
Washington	758	392	51.7
Total	1,774	928	52.3

When the survey was conducted there were only seven national water quality program theme areas (water conservation, management, quantity and policy were later split into two themes).

Approximately 32 percent of survey respondents were identified as rural. Based on the survey, a significant portion of the rural residents living in the Pacific Northwest wanted more information about three water quality theme areas: (1) drinking water and human health, (2) water quantity and policy, and (3) watershed management (Table 2). Almost 75 percent of the rural residents identified the need for more information about drinking water and human health. Almost two-thirds of rural residents wanted more information about water quantity and water policy. Almost half of rural residents wanted more information on watershed management. It is also important to note that when rural and urban responses were added together, drinking water and human health, water quantity/policy, and watershed management ranked as three of the top four water quality areas of interest. Conversely, there was little demand for additional information on nutrient and pesticide management and animal waste management by either rural or urban audiences.

Table 2. *Responses to the Question: "Would You Like to Learn More About Any of the Following Water Quality Issues?"*

Area of interest	**-------- Respondents wanting to learn more --------**	
	Rural	**All**
	--------------------------- % ---------------------------	
Drinking water	74.2	48.8
Water quantity/policy	66.2	31.9
Watershed management	48.5	27.3
Pollution prevention	26.2	30.2
Environmental restoration	20.4	27.4
Nutrients and pesticides	18.4	22.3
Animal waste management	14.3	16.5

Compared to the general population, rural residents prefer to be educated about water quality through radio, television, newspapers and printed fact sheets (Table 3). Workshops and short courses, as educational tools to learn about water quality, are not popular with rural audiences compared to the general population in the region. This is very important because workshops and short courses are traditional methods used by Extension to educate the public. The lack of willingness to attend workshops and short courses by both rural audiences and the general population is probably due to a perception of less unstructured time of both rural and urban people. Over the past two decades studies have shown that people are working more and have less free time. This lack of free time makes traditional venues of Extension programming less attractive. The surprise in this data is that rural people may be more negatively impacted by the lack of free time than the general population. This observation makes traditional Extension learning methods less relevant for what has been Extension's primary target audience. Based on this information the regional water quality coordinating team needs to seriously consider changing or modifying our traditional delivery methods if we want to increase or even reach our target audience.

Table 3. *Responses to the Question; "If You Had the Following Methods of Learning Opportunities Available, Which (Check Up to Three) Would You Likely Take Advantage of for Water Quality Learning Opportunities?"*

Learning method	**Respondents**	
	Rural	**All**
	%	
Radio	63	51
Television	62	55
Newspaper	62	54
Printed fact sheets	59	53
Internet (Web sites)	29	41
Demonstrations or displays	26	21
Workshops (2–3 hours)	8	20
Short courses (1 day)	4	18

Most rural residents in the region have obtained water quality information from television and newspapers (Table 4). Environmental agencies and environmental groups have also been widely used sources for water quality information. Thirty-six percent of rural residents in the region have obtained water quality information from Extension.

Table 4. *Responses to the Question: "From Which of the Following Sources Have You Received Water Quality Information?"*

Water quality source	**Receiving information**	
	Rural	**All**
	%	
Newspapers	72	68
Television	53	59
Environmental agencies	44	51
Environmental groups	40	46
Extension	36	28
Universities	20	25
Schools	15	20

We were also interested in the demographic factors of clientele age and community size on the impact of Extension meeting water quality information and education needs. It appears that older residents are more likely than younger people to get water quality information from Extension (Table 5). Extension has a much greater water quality impact (reach) in smaller communities than in larger cities (Table 6).

Table 5. *The Influence of Age of Respondent on the Source of Information Residents in the Pacific Northwest Use for Water Quality*

Information source	**Age**			
	< 40	**40–49**	**50–59**	**> 60**
	%			
Television	55	55	55	70
Newspapers	58	68	68	80
Environmental agencies	42	56	50	57
Extension	15	30	32	37

Table 6. *The Influence of Community Size on the Type of Information Source Residents in the Pacific Northwest Use for Water Quality*

Information source	**Community size**			
	> 100,000	**25–100,000**	**7–25,000**	**< 7,000**
	%			
Newspapers	60	60	64	57
Extension	25	25	29	42

Based on the information provided in the previous tables, our regional water quality team is making the following three major modifications in our regional program:

- Programming will be concentrated in three national water quality theme areas: (1) drinking water and human health, (2) water quantity/policy, and (3) watershed management.
- We will think outside the traditional box when it comes to program delivery. The traditional two to three hour and one-day workshops will be de-emphasized. We will emphasize printed fact sheets, satellite conferences, Internet delivery, and concentrated regional hands-on learning opportunities. We will also try public service announcements on television and place more emphasis on newspapers and radio.
- We will use several strategies that are currently under development to increase our work with younger audiences, be more successful in rural areas, and use mass media to have a greater impact in suburban and urban areas.

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Agua Pura and *Los Pescadores*: Latino Youth and Families Engage in Water Resource Issues

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Abstract

Agua Pura (Pure Water) began in 1999 as a partnership of the University of Wisconsin Cooperative Extension's *Give Water A Hand*, the University of California Cooperative Extension (UCCE)-Santa Barbara County, 4-H Youth Development Program, and the Santa Barbara City College. The goal of the *Agua Pura* Program was to promote better understanding of how community educators and youth leaders can involve Latino youth and the Latino community in watershed protection and in adaptation of resources to meet the community's needs and interests. The objectives of *Agua Pura* are to: Increase Latino youth's interest in science and environmental literacy; provide effective watershed education programming for Latino youth in after-school, non-formal settings; create opportunities for civic engagement; and promote Latino leadership around environmental issues.

The Santa Barbara County 4-H Youth Development Program has sustained *Agua Pura*. It is assisting the Santa Barbara County Water Agency in meeting best practices under the U.S. Environmental Protection Agency (EPA), National Pollution Discharge Elimination System (NPDES), guidelines (U.S. EPA, 2003). *Agua Pura* has engaged the Latino community in watershed resource issues and continues to do so. Recently, the program embarked on a partnership with the nationally known Adopt-A-Watershed Agua Program to develop and extend a place-based curriculum dealing with salmon and steelhead known as the *Agua Pura Pescadores* (Fisher-folk) Project.

This paper describes the *Agua Pura* and the *Los Pescadores* initiatives, and the rationales for starting them. It considers the theoretical groundings that influenced the approach we've attempted to follow. Finally, it outlines what has been learned from the experience, and how that experience reflects what the research literature says should happen.

Why *Agua Pura*?

Responding to the need for programs that engage Latinos in environmental issues, *Agua Pura* (Pure Water) began in 1999 as a partnership of the University of Wisconsin Cooperative Extension's, *Give Water A Hand*, the Santa Barbara County UCCE 4-H Youth Development Program, and the Santa Barbara City College. The program's overall goal was to better understand how community educators and youth leaders could involve Latino youth and the Latino community in watershed protection. The effort has included drawing on the experience and expertise of Latino adults and youth, including their participation, adaptation and creation of strategies, and utilizing their resources to meet the Latino community's needs and interests related to watersheds (Andrews, Marzolla, Rowe, & Thompson, 2000).

Agua Pura has responded to a variety of concerns, opportunities, issues and interests. These included:

- The need for environmental educators to respond to major demographic shifts in the ethnic makeup (particularly the increase of Latinos)of the state and nation’s population;
- The lack of civic engagement of many California residents, particularly Latinos, in having a voice in their community as well as in the wider state and national civic arenas;
- The need for community-based, place-based, non-formal, after-school science and environmental literacy programs that engage Latino youth and their families (Ponzio & Marzolla, 2002);
- The need to reorient environmental education at all levels, ensuring that the program would contribute to personal and community capacity building, and would address issues of environmental justice and systematically address the lack of diversity (Grass & Agyeman, 2002); and
- The desire to create a program that would integrate what Agyeman (2003) refers to as “culturally sensitive research approaches” that would be inherent in *Agua Pura* as an environmental education program.

In the remainder of this document I will elaborate on these points, touching on the theoretical reasons for this program’s approach. I will also address what current research indicates and how that experience reflects what the research literature dictates. Finally, I will consider the lessons learned from the experience of implementing this program and how that experience reflects what the research literature says should happen.

Shifting Demographics and Latino Engagement in Environmental Issues

The increase in the Latino population in California is the most obvious indicator of the need for programs like *Agua Pura*. A visit to almost any school in California indicates that the demographic composition of the student population is more diverse than at any time in the State’s history. Examine California’s education data (Education Data Partnership [Ed-Data], 2004) and the results of the 2000 national census. The data will confirm what your eyes tell you: There is no majority ethnic group; the shift in the nation’s population from a European-American majority to a more diverse society that demographers heralded for many years has arrived. According to the 2000 U.S. Census, California’s population is 32.4% Latino (U.S. Census Bureau, 2000). According to the State Department of Education’s 2002-2003 state enrollment data, 45.2% of the statewide student population is identified as Latino: That is 2,819,504 of a total student population of 6,244,403 students. Santa Barbara County’s population is 34.2% Latino. The school-age population is an even stronger indication of this population shift as Latino students now make up the majority of the student population: Santa Barbara County’s school population is 53.1% Latino (Ed-Data, 2004).

Researchers who have surveyed Latino communities have found that the majority of recent Latino immigrants are more concerned about environmental issues than the dominant culture. The research also showed that the respondents felt that environmental issues can best be addressed by community involvement (Schultz, Unipan, & Gamba, 2000). In spite of this reported interest and concern, very few Latino young people have been observed taking part in environmental clubs or environment-related community activities. Likewise, concern has been expressed nationally by the lack of Latino university graduates with degrees in science and environment related fields.

Similarly, a visit to an after-school environmental club and/or a public event that feature environmental issues, such as Earth Day in Santa Barbara County, will indicate that Latinos are generally not involved. It is safe to assume that the same can be said for most communities throughout the United States. In addition, there are very few Latino professionals in environmental leadership positions in California, or the rest of the United States, and there are very few Latino students enrolled in college level environmental science or education programs. For example, at the University of California, Santa Barbara, the Environmental Studies degree program has an estimated enrollment of four hundred undergraduates. It was also estimated that only twelve percent of these students are Latino (based on a conversation that I had with the program's administrator who indicated that the program did not record the ethnicity of the students enrolled).

Water Quality and Latino Community Engagement

Latino members of our communities are often most affected by water-related health risks. Additionally, quality of life issues and personal or community barriers may limit their involvement in local water quality protection activities. In Santa Barbara, the area of the highest Latino population density is also where the creeks are the dirtiest from upstream sources. These polluted creeks drain into the ocean along Santa Barbara's shoreline, forcing beach closures that impact everyone. Like everyone else, many of the Latino community go to the beach. Their children play in the creeks. They are definitely interested in the problem. However, because of language and cultural issues, community members are often not engaged in water protection activities. In most cases, people in charge of outreach are not Latino; they do not speak Spanish, and they have little or no experience working with Latinos. It is not surprising, therefore, that water quality education programs often overlook the Latino community (Andrews, et al., 2000).

The *Agua Pura* Program was developed to address this issue in Santa Barbara County. The Program represents a community-based watershed education program focused on engaging Latino youth and their families in local watershed/water quality issues. Supported in part by funds from the Santa Barbara County Water Agency, *Agua Pura's* efforts have helped the agency meet its NPDES requirements for best education practices. These requirements include educational outreach to underserved communities (U.S. EPA, 2003). Using educational approaches that are community-centered draws on established, research-based practices. Sources for community-based research and theory that have helped guide *Agua Pura* staff and have helped develop program strategies are discussed later in this paper.

The Unique Opportunities in Community and Place-Based Programs

If one follows a constructivist educational model that views direct experience being antecedent to learning, the case is made for direct experiences in science. It follows that participants would then work on authentic tasks and projects using their newly acquired skills in new ways (Ponzio & Marzolla, 2002). This paradigm fits well with proven pedagogical practices, such as the learning cycle (Guzzetti, Snyder, & Glass, 1992; Lawson, Abraham, & Renner, 1989), and cooperative learning strategies (Covington, 1992; Slavin, 1983) that have been found effective in science instruction and fit current brain development models (Brooks & Brooks, 1993; Caine & Caine, 1991; Sylwester, 1995). Community-based science programs also allow participants to apply their learning to a wide variety of home, neighborhood, and community situations in settings such as helping to design and implement recycling programs, raising vegetables in community gardens for senior citizens centers, or helping design family disaster-emergency response plans. These kinds of projects encourage youth to solve problems grounded in real-world contexts requiring many kinds of complex problem solving skills suggested by advocates of "outcome-based" education (Spady, 1994). Although the diversity of projects and outcomes poses a major challenge to evaluation, it helps keep participants engaged in service learning applications of their science knowledge. The project-based outcomes also help forge a connection between "school smarts" and "street smarts" and encourage career exploration by engaging scientific thinking and problem solving skills learned and applied in community issues that are significant to the learners (Markham, Larmer, & Ravitz, 2003).

Developing educational programs based on a local context is also strongly favored by advocates of place-based education. In a recent article, Gruenewald (2003) states:

> Place-based pedagogies are needed so that the education of citizens might have some direct bearing on the well-being of the social and ecological places people actually inhabit. Critical pedagogies are needed to challenge the assumptions, practices, and outcomes taken for granted in dominant culture and in conventional education. (p. 3)

Gruenewald goes on to provide a theoretical context for this approach:

> …place-based education lacks a specific theoretical tradition, though this is partly a matter of naming. Its practices and purposes can be connected to experiential learning, contextual learning, problem-based learning, constructivism, outdoor education, indigenous education, environmental and ecological education, bioregional education, democratic education, multicultural education, community-based education, critical pedagogy itself, as well as other approaches that are concerned with context and the value of learning from and nurturing specific places, communities, or regions. (p. 3)

Creating a place-based watershed education program at the community level can have additional benefits by creating a process that can, over time, lead to civic engagement and help overcome the exclusion of Latinos (and hopefully other under-represented ethnic groups) in the decision-making processes. Research literature that focuses on civic engagement has served to inform the *Agua Pura* staff in its program efforts. For instance, the California-based Civic Engagement Project (CEP, 2003) defines civic engagement as: "…the inclusion and meaningful participation of community members in the process of deliberation, prioritization and decision-making regarding public programs, services, projects or policy-making" (p. 1).

CEP goes on to identify the benefits of this approach to communities and individuals: "A civic engagement approach to policy-making mandates that the community be considered when policy decisions are made" (p. 1). Successful civic engagement can contribute to the improvement in the quality of life of the participants, their families and neighbors.

Programs like *Agua Pura* can serve as civic engagement learning opportunities for young Latinos and their families. The program has introduced these community members to water quality resource issues where they have learned to identify and frame issues based on their personal perspective and the needs of their community. It is reasonable to expect that this process will help develop future community leaders and spokespeople.

Community-Based Programs and Science and Environmental Literacy

It is generally recognized that there is a demand for technological and scientific literacy. People are being asked to pass judgment on issues such as offshore oil drilling, the fate of endangered species, and the commercial uses of genetic engineering. Employers and employees alike are faced with choices that may affect the well being of the environment. A report from the U. S. Department of Education, National Center for Educational Statistics (1998) stated that U.S. students scored below the international average on the science portion of the general knowledge assessment and were among the lowest of the 21 countries who participated in the Third International Math and Science Survey. It is increasingly clear that schools cannot do it alone, and therefore one must ask, “What is this lack of scientific understanding costing us and our children’s ability to understand their natural world?” How can we apply research findings and best practices to increase scientific literacy and environmental awareness for all of our youth?

Why After-School Hours?

When school lets out for the day, many children need after-school care while their parents finish work. These children constitute a vulnerable and needy group for continued supervision. It has been calculated that the average expense per year of after-school childcare is the same as the average cost per year of tuition at the University of California. Even with such a high cost, five times as many California children need childcare than there are available spaces. (California Child Care Resource and Referral Network, 2001). There are, in many schools and at many community-based youth centers, on site after-school childcare and youth-centered programs. Most of these programs have child safety and custodial care as a primary focus. Certain of these programs are low or no cost to participants. Many provide supervised after-school, weekend and summer youth activities for children and young people. Likewise, many of these programs are reaching Latino youth. Finally, these after-school settings can serve as ideal venues for engaging young people in watershed education. Unlike most formal school settings, after-school settings are generally more flexible, allowing more opportunities for field discovery and community engagement.

Agua Pura

Working in after-school settings, *Agua Pura* is an example of a community-based, after-school watershed education program. The Santa Barbara County 4-H Youth Development Program has sustained *Agua Pura*. It is assisting the county in meeting best practices under NPDES guidelines. *Agua Pura* has significantly contributed to engaging the Latino community in watershed resource issues in the following ways:

- A six-week, hands-on after-school watershed education program that has graduated over 560 Latino children.
- A nine-week summer day camp has incorporated watershed education into for over 1,200 Latino children.
- The local Housing Authority, whose leadership is primarily Latino, has collaborated with the 4-H program in the development and delivery of the ongoing "Splash to Trash" watershed education program. Sixty-two young Latino people from public housing have graduated from the program.
- Publication of the *Agua Pura* Leadership Institute Planning Manual has created opportunities for Latino leadership development involving watershed resource issues at national conferences and in professional journal articles. (Marzolla, 2003)

Agua Pura is working in partnership with Adopt-A-Watershed (AAW), a California-based, nationally recognized watershed education program, to develop *Los Pescadores*, a Latino youth component that will address watershed issues related to the threatened salmon and steelhead. This project is building on the experience that has been gained over the years from the implementation of the *Agua Pura* program in Latino communities. It will incorporate an experiential, place-based curriculum that will enhance the participant's understanding of this topic, engage them in their own surroundings, as well as encourage their active leadership in addressing related issues in their community. Finally, this project will be directed toward engaging youth from under-served communities, particularly Latino youth and families. The curriculum is being developed for 10-15 year-old youth participating in nonformal and formal education programs. These include after-school programs such as camps, education centers, museums, and youth programs, as well as programs for educators willing to implement Place-Based Learning programs in formal education.

The importance of Latino community input in program design and delivery was a significant lesson learned from the *Agua Pura* experience (Andrews, et al., 2000). The *Los Pescadores* Salmon and Steelhead curriculum is being developed with input from representatives of the Latino community that are serving on the curriculum design committee. Their suggestions have included the collection of local salmon and steelhead stories and lore from community elders, and sharing these stories at community celebrations. They have also stressed the importance for including families in the sharing of food and cultural celebrations in the curriculum activities. These ideas and suggestions have been incorporated into the curriculum outline. The *Pescadores* curriculum will incorporate proven instructional methods that include:

- Project-based and place-based instruction that draws on authentic issues, and the tasks will be intrinsically interesting to the participants and will relate to the real world;
- Hands-on learning in non-formal settings;
- A high probability that the students will be recognized for their work by their community; and
- Cross-age teaching, incorporating teens and college students as project leaders and instructors (Ponzio & Fisher, 1998).

Sample topics that have been included in the curriculum outline include: Community mapping, exploring the life cycle of salmon and steelhead, monitoring salmon and steelhead, and developing and designing a restoration project. Participants will create individual journals, and they will record their project with photographs, artwork, stories and poetry as well as with data collection. They will share their experiences with their families and community, with a celebration that they design and organize. It is intended that these activities will contribute to individual and group project portfolios that will serve as evidence of the project’s outcome, and as a record of the individual’s contribution.

When completed, it is expected that the curriculum will be distributed by the UC 4-H Youth Development Program and by AAW. It is planned that the curriculum will be available in print and on-line. It is also expected that training will be provided to educators and project leaders by both UC and AAW. When completed, this curriculum is intended to serve as a valuable resource to west coast educators from Mexico to Alaska.

Conclusion

The *Agua Pura* program has provided several valuable lessons that may be of use to agencies and individuals interested in developing water quality education programs that engage the growing

Latino population. Likewise, these experiences may be transferable to settings involving other under-served populations. Based on the experience designing and implementing the *Agua Pura* program as well as a review of the related research, the following lessons stand out:

- Effective programs are community-based, build local leadership, address local issues that impact community members;
- Water quality issues are addressed collaboratively with the community and the issues are addressed in a context that community-members identify;
- Educational programs are culturally appropriate, experiential, place-based and they are implemented in after-school settings;
- Programs develop and foster local leadership and provide opportunities for civic engagement; and
- The need to emphasize the importance of hiring a bi-lingual culturally competent staff as well as encouraging the involvement of Latino teens by providing them with leadership opportunities through internships and, whenever possible, paid positions.

In reviewing the current research, there is no doubt a critical need for more applied research in the field of community-based and environmental education as it applies to working with culturally diverse populations. There is also a growing need to extend this research to agencies and educators whose tasks include working with diverse communities. Hopefully, we can look forward to a time when culturally sensitive approaches to these programs will become inherent in environmental education research.

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Drinking Water Education for Underserved Communities

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Abstract

This proposal applies a new Extension education concept for drinking water protection programs addressed to low income, underserved, and minority populations in rural and urban areas. It follows a successful pilot project, funded by U.S. Department of Agriculture (USDA)/ Cooperative State Research, Education, and Extension Service (CSREES), that used paraprofessionals from the targeted community to reach the target audience. This proposal will employ additional techniques such as mobilizing volunteers through local community centers, minority landowner organizations, and churches; engaging small rural communities with Rural Utility Service; establishing riparian demonstration projects; promoting environmental quality incentive educational programs; using GIS techniques to explain risk assessment concepts; and promoting good decision-making techniques.

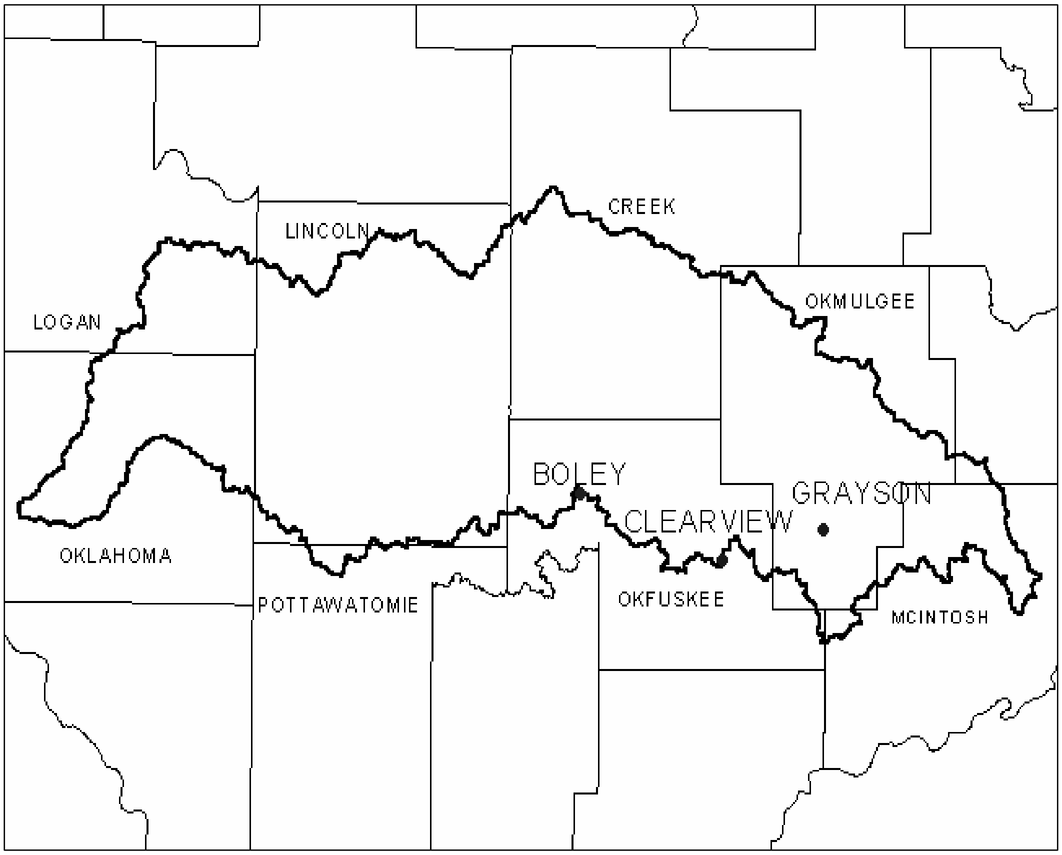
The target area is composed of two counties; Okfuskee, and, Okmulgee. These counties are among 1006 counties in the 11 Southern states with rural populations having poverty rates as high as 40% and more than 40% of working-age persons without high school diplomas. Coupled with an aging demographic and widespread distrust of government, this target audience poses challenges for any Extension educational program.

The outcomes of the project will be measurable improvements in drinking water quality as well as increased understanding of factors that determine the quality of private and community drinking water supplies

Project Description

Deep Fork watershed includes numerous underserved, minority communities in a nine-county area extending from Oklahoma and Logan counties in the west to Okmulgee County in the east (Figure 1). The area includes pockets with low economic structure, weak educational systems, and declining natural resources. This leaves open many targets for educational strategies to protect drinking water and protect and improve the resource base. Extension education in these communities can help residents to address many of their own environmental needs.

Figure 1. Target communities in Deep Fork watershed



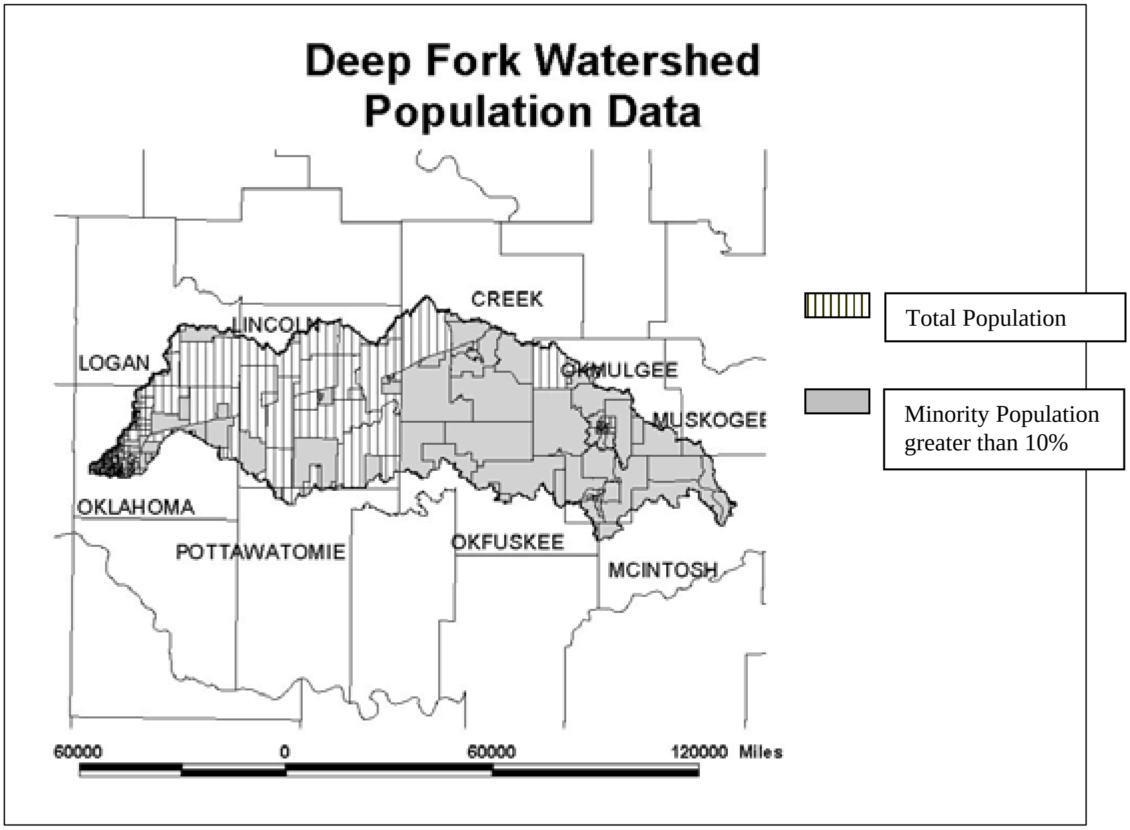
Rowley and Freshwater (1999), in a study of technology in rural areas, showed Oklahoma as one of the 11 states with non-metro counties having more than 40% of working-age persons lacking a high school diploma, more than 25% of the population in poverty, and high proportion of minorities.

Rurality includes dimensions of distance, small groupings or sparseness, unique social interaction patterns, culture, occupations, and quality of life (Wimberley, 1995). Wimberley and Morris (1995) also show that southern minority and rural counties have consistent poverty, poor employment, low incomes, limited education, poor health, and high infant mortality. Also, non-metro areas have higher percentages of both elders (over 65 years of age) and youth (under 18 years of age), thus increasing the poverty ratio.

Okmulgee and Okfuskee counties have been selected as the target area for this project because of the large number of minority communities, largely African American and American Indian. (Minority communities for this project are defined as having more than 10 percent minority populations other than white.) The 1990 Census shows a majority of the target area had communities with more than 10% minorities shown on Figure 2. The percentage of families in the target area that are below the poverty level ranges from 34 percent to 74 percent. Fifty-one percent of these communities suffer poverty rates in excess of 40 percent.

In addition to the typical characteristics noted by Wimberly and Morris (1995), Rowley and Freshwater (1999), and others, there is widespread distrust of government programs and government workers in these areas. Overcoming these obstacles requires educational materials and programs be modified to have involvement of the people from the community.

Figure 2. Population data in Deep Fork watershed



The Oklahoma Unified Watershed Assessment (Oklahoma Office of the Secretary of Environment, 1998) identified the Deep Fork watershed as needing preventive action to sustain water quality. Empowering communities to protect their own water is the best practice to insure sustainability.

Oklahoma State University together with Langston University conducted a pilot project funded by Cooperative State Research Education and Extension Service (CSREES). The study found 38% of water samples from traditionally Black communities of Creek and Okfuskee counties, contaminated by coliform organisms, therefore, not meeting the Safe Drinking Water Act standard. The pilot project further showed the need for special educational materials tailored to the learning style, educational level, and vision problems of this relatively uneducated, elderly audience. For example, many residents became frustrated when trying to read and understand the technical jargon on water analyses they received from the Department of Environmental Quality. Thus many analyses were discarded and no action was taken to clean up their water.

Using pictures of drainage areas and other visuals created by geographical information system (GIS) helps us teach about watersheds, aquifers, and risk factors. Maps and pictures produced by GIS can help show locations of rural water lines (sometimes an alternative to a poor quality well),

aquifers and other water resources, as well as available services such as the USDA Rural Utility Service (RUS), and other offices.
Community-based organizations (CBOs) in this area are committed to improving water resources and providing educational opportunities. Cooperating in this project is *The Oklahoma Landowners and Tenants Association* (TOLTA) and the *Retired Educators for Youth Agricultural Programs* (REYAP). Both of these CBOs have previously requested information on safe drinking water and best management practices to protect their drinking water and on working with OSU to educate youth.

TOLTA is a 501 (c) (3) CBO, which currently assists many federal agencies with outreach to landowners and to rural minority communities. TOLTA's mission is to define, address, and assist in the resolution of issues that affect the well being of underserved farmers throughout the state of Oklahoma. TOLTA hosts water quality meetings, identifies landowners to implement best management practices, and communicates issues addressing drinking water. Through this proposed project, the broad reach of TOLTA increases African American, Native American, and Hispanic participation in Oklahoma State University's (OSU) Extension programs.

Retired Educators for Youth Agricultural Programs (REYAP) is a 501 (c) (3) CBO with a mission to increase the number of minority youth in agricultural programs by promoting opportunities in the field of agriculture. REYAP, in collaboration with other agencies and universities, sponsors youth internships in federal programs and encourages REYAP students from across the state to participate in FFA and 4-H programs. This organization recommends the youth in the target area for internships and volunteer programs addressing water quality issues within their communities.

Historically, churches in rural minority communities serve as the nucleus for community outreach. When the local churches approve functions and organizations, synergies are generated among church members and the communities that enhance acceptance and participation of community members. Churches in the target area are requesting water quality programs and educational information. Church leaders have expressed interest in involving youth members to participate in programs addressing safe drinking water issues. Youth involvement affects the attitudes and behaviors of future adults.

This project draws on the expertise and experience of OSU to address the needs of these communities. OSU's Water Quality Extension Program serves every county in Oklahoma with resources and materials addressing drinking water quality. OSU's participation in the Southern Region Water Resources Project further expands the capability of this effort. The outcomes of the project will be measurable improvements in drinking water quality as well as increased understanding of factors that determine the quality of private and community drinking water supplies

Project Goal

The goal of this project is to educate citizens and leaders of rural minority communities to test and protect their drinking water supplies. Three objectives identified in order to meet the goal are:

1. Increase awareness and understanding of well-water protection in targeted rural and urban minority communities.
2. Determine ongoing self-sustaining water information.
3. Develop ongoing community programs to ensure communities can address their water quality issues.

Methods

This project will accomplish three measurable objectives to facilitate the goal of educating citizens and leaders of rural minority communities to test and protect their drinking water supplies.

Objective No. 1: Increase awareness and understanding of well-water protection in targeted rural and urban minority communities.

OSU is developing a unique logo for cooperative water quality education involving CBOs and OSU Cooperative Extension. OSU is also developing understandable and easily read educational materials targeted at an aging rural minority community. The materials will provide proactive action to protect drinking water through water testing to protect wells, to properly maintain septic tanks and to facilitate household waste disposal. The materials will provide simple disinfecting procedures and offer other alternatives for assuring safe drinking water. New educational materials will be developed and field-tested by members of TOLTA before printing for widespread distribution. Input will be sought to increase community acceptance and to insure the materials meet community needs.

This program is conducted through CBOs, community centers, and churches. Local community centers already provide services to senior citizens and social organizations. Churches serve as the social nucleus for most rural minority communities. CBOs represent the community and can readily reveal local water quality concerns. Public meetings are held in churches and community centers because of high attendance that increases educational program visibility. Displaying data within the communities helps citizens visualize their involvement in protecting their drinking water.

Drinking water protection education will be conducted in Boley, Clearview, and Grayson. Residents are invited to bring water samples for nitrate, pH, and conductivity testing. For each meeting, OSU and REYAP students will test water samples with a nitrate, pH meter, and conductivity meter. The water samples will be tested on site and the results reviewed and explained during the meeting. TOLTA and student interns support each meeting and provide outreach services.

Student interns from REYAP use hand held global positioning systems (GPS) to identify the location of assessments and water wells tested in this project. This information is being utilized as input to a geographical information system (GIS). The GIS procedure develops pictorial and geographical views of areas that will help incorporate Extension educational activities into communities. Educational presentations tailored to local land use are the foundation upon which the project is built.

Outcomes

Materials from this objective provide simplified visuals of complex groundwater concepts that are made available to residents and officials at local county Extension offices. The paraprofessionals and water quality educator can check out materials when visiting local sites and for demonstrations. The frequent use of these materials is an indicator of their effectiveness.

Pamphlets, written in clear, simplified styles, address disinfecting procedures and other alternatives for safe drinking water. The material has large type and space to address the elderly audience. Pictures are used in the material for easier understanding. Information addressing the interpretation of water analysis and disinfecting procedures has been added to the Oklahom*A*Syst workbooks.

Six Oklahom*A*Syst meetings, as described in Kizer and Brown (1998), will be held in the target area each year. Reports show attendance, pictures, water test results, and updated database. A simple questionnaire is used to indicate the level of resident knowledge about private drinking water. Interns report the number of requests for assessment assistance from each meeting. This will be used to measure action residents take to improve their drinking water.

Data collected from GPS units will be displayed at meeting locations and posted in local churches. Residents see their community involvement and participation level. Displaying community pictures generates enthusiasm and promotes local activity.

The Okfuskee county Extension office serves as a local source of information. This is essential for team cooperation and program cohesion. Two county educators, the water quality educator for the project, a paraprofessional, and two summer interns have a central office facility. This also gives residents one location for referrals.

Objective No. 2: Sample wells and conduct assessments in the target communities to determine the extent of water quality problems, to ensure that the residents have safe and sanitary drinking water, and to insure that management practices in urban areas are not contributing to water pollution.

A team of one paraprofessional, one water quality educator, and two summer interns from the local communities participate in the project. This team is stationed at county Extension offices in cooperation with the county Extension educator. The team becomes an integral part of community-based professionals, making personal visits to sample home water wells for coliform bacteria and conducting inventories and assessments. The Oklahoma Department of Environmental Quality (ODEQ) analyzes water samples for bacteria content.

The paraprofessional returns a written report to participants and explains results directly on a one-on-one basis. If follow-up treatment is needed, the paraprofessional will arrange follow-up by appropriate project staff and cooperating agencies such as OSU Extension or ODEQ. Where problems are found, well users are educated about the problem and remedial actions suggested. Actions such as chlorinating water and re-testing are likely. The intern, paraprofessional, and county educator provide an inventory of upstream items with a potential for contributing to nonpoint source pollution. Simple, easy to read pamphlets are distributed with alternative methods of obtaining safe drinking water. These methods include but are not limited to purchasing bottled water, installing automated chlorine systems, and using reverse osmosis systems to obtain safe drinking water.

The water quality educator assists OSU county educators to establish water quality active groups, such as Blue Thumb, from the youth in the target communities. Drinking water quality and educational activities are made available to this group. Calculating drinking water contamination risk using the Oklahom*A*Syst program and using GPS, as well as other water quality activities, increases the water awareness of youth. Youth participate with collecting and documenting data for the project. This program helps youth become familiar with best management practices and promotes future youth environmental stewardship.

Outcomes

Accomplishing this objective will mean there will be well informed water educators with water quality expertise in a community. The community will sustain a local paraprofessional with drinking water expertise, and two interns with a working knowledge of drinking water and GPS analysis. The community will have an increased knowledge of management practices to protect its drinking water. The project will generate 300 samples tested by ODEQ for bacteria and 300 completed assessments with the results entered in a database. This database will contain geographical data, water analysis data, location, and information about surrounding potential contaminant sources. The database can be used as a future resource to research and sustain programs.

Objective No. 3: Develop a sustainable program that will enable communities to address future water quality issues**.**

Blue Thumb is a national water quality monitoring program. It is implemented through public schools, 4-H organizations, Boy Scouts, and other volunteer programs. OSU county Extension educators will be working with volunteer groups such as TOLTA, REYAP, 4-H, and church groups, to develop a Blue Thumb program in this target area. Likewise, churches will establish programs to have water tested periodically in their community.

Conclusion

Three hundred water samples for this project will be submitted to ODEQ and tested for bacteria. Through personal contact, 500 Oklahom*A*Syst risk assessments will be completed and documented. Volunteer efforts to correct problems identified from assessments will be documented. A database establishes a baseline of the drinking water results and will be used for future educational efforts.
Student interns and the paraprofessional will conduct an initial follow-up each summer to determine if residents have had water tested and if a problem identified from a previous assessment has been corrected. TOLTA and REYAP will submit an evaluation of the educational material, meetings, and information they receive resulting from the project. The organizations will also be asked for a report of knowledge gained from the project.

The water quality educator and the paraprofessional are given continuous updates and educational opportunities addressing drinking water. Evaluations are completed following each educational component to address their expertise level. In addition, the students will be given tests following their internships to directly measure their levels of drinking water knowledge.

Finally, this drinking water project for underserved communities will leave understandable educational materials, provide expertise on ground water and drinking water, increase knowledge of protecting drinking water, and develop a sustainable community drinking water program.

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Assessing Extension Program Impact: Case Study of a Water Quality Program

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Abstract

Over a five year period, Montana State University (MSU) conducted a voluntary, Montana based, private well water test program to educate the public on water quality issues, as well as improve the decision-making skills of private well owners. The program provided an array of water quality resources including instructional videos, written instructions, sample collection and submission, and an impact assessment questionnaire. Data collected from the program were based on the following outcomes: comprehension of test results; changes in land use practices to improve water quality; purchase of point-of-use treatment systems; level of improved ability to make decisions about water quality; and overall assessment of the program. Assessments of various delivery mechanisms within the program concluded that Extension faculty could improve the effectiveness of future distant delivery education by 1) targeting specific educational resources, 2) specifying audiences by need, 3) structuring to the educational level of audiences, and 4) providing information that has immediate utility to the program.

The invaluable information MSU Extension Water Quality Program gained from the well test program has not only guided them in best education practices (BEPs) for the past ten years, but will be the basis for design and implementation of a sister program being conducted in 2004 and 2005. The revitalization of the well water test program will address the evolving water quality needs of Montana private well owners, help MSU water quality specialists continue to effectively serve the educational needs of Montanans, and provide BEPs that can be shared as a regional resource in water quality education.

Background

Montana’s historic economy was built around agriculture and natural resource extraction such as gold silver, copper, petroleum, coal, and timber. Alongside tourism, agriculture has remained Montana's primary industry. However, since the end of World War II many Montana farming and ranching operations have been depleted due to a declining workforce, adverse international markets, and climatic changes hindering growth and harvest vigor.

Due to the decline in factors that sustain productive agriculture operations, many producers are selling large amounts of acreages to developers who then subdivide the land in to smaller plots.

Transitioning societies and the dominance of the “bedroom community” phenomenon in the western United States have put excess pressure on the water quality and quantity of this region due to the number of private wells installed on small acreages. In addition, most development occurs either on or adjacent to agricultural lands, emphasizing the importance of monitoring water resources in these areas. The population increase and development process will likely be a fixture in many states for some time and education pertaining to private water resource protection and management will be a necessity to preserve the integrity of the resource.

In Montana records are available for over 65,000 domestic wells, representing approximately one well for almost every 12 Montana inhabitants. Water quality is a focus of research, public education, and curriculum development throughout the USA, especially as it relates to nonpoint source pollution. Educational resources for private well owners on water quality issues and monitoring procedures is essential to protecting water resources at the wellhead.

An Extension-sponsored private well water test program was initiated in January 1989 in cooperation with MSU, the Montana Department of Health and Environmental Sciences (DHES), and several agricultural organizations. The program was prompted by the 1988 “Well Aware” program conducted by the Future Farmers of America (FFA) with *Successful Farming* magazine (Freese, 1988).

At the time of the initial MSU program, use of private well water quality test programs were reported, but not for general education. The scarcity of water quality educational resources in the public sector underscores the need for innovative approaches to collecting water quality data. The objectives of the 1989 MSU study were to assess the impacts of an Extension–sponsored, private well water test program on participant behavior and learning characteristics, and to gather information about preferred learning methods of a diverse, targeted Extension audience. Additionally, the program wanted to offer an inexpensive, nonthreatening well testing service to provide educational resources to rural and urban private well water users in Montana, as well as educate private well water users about groundwater quality issues specific to agricultural areas of Montana.

In the spring of 2004, MSU revitalized this program in efforts to establish an annual well water test program for private well owners in Montana so that they would be empowered to monitor, assess, and treat the quality of their drinking water. The current well water test program capitalizes on the outcomes and finding of the original pilot as well as on recent, similar focused educational methods for water quality education as it relates to small acreages and private well owners. The emphasis of this article is to summarize the results of the original 1989 educational program and program impact assessment, as well as the modifications and design of the more recent sister-program. Specific details of the educational impacts, well water sampling, geographic distribution of 3342 private wells sampled and tested, testing procedures, and summaries of well tests results have been reported previously (Bauder, 1993; Bauder, White, & Inskeep, 1991).

Methods and Materials

With the 1989 program, samples were submitted on a voluntary basis from 53 of the 56 Montana counties and were tested for coliform bacteria, pH, total dissolved solids (TDS) concentration, Na^+ concentration, and NO_3^- - N concentration. The program was not designed or intended to obtain a random sample of wells throughout Montana (Bauder, 1990). The testing service was offered to private well water users through county Extension offices, conservation districts, and

Farm Bureau offices. The service was part of a multi-phase, multi-media distant delivery program consisting of the following steps.

1. An educational video on water quality issues and another on sample submission procedures were developed and provided to participants.
2. Sampling and testing periods were selected for the spring and fall of 1989 and 1990. A press release containing program details was provided to each county office to modify for publicity.
3. A 12-part fact sheet series dealing with specific issues of water quality was developed and distributed to each county Extension office and printed in a statewide agricultural magazine each month for the first year of the program.
4. The DHES conducted all coliform tests and reported all results directly to participants; all other analyses were completed by an analytical laboratory at MSU and reported directly to participants by the Extension service. A statement of significance of test results, interpretation, and recommendations for action was mailed with test results to each participant.
5. Summaries of test participation and results were prepared for each county for each sampling period and for total participation in all four year testing periods.
6. A seminar series was developed and delivered to counties where high NO_3^- - N concentrations were detected. The seminar series, addressing health issues, water quality policy, NO_3^- - N contamination, well disinfection, and point-of-use treatment, was advertised locally and presented approximately 3 months after the final testing period.
7. Approximately one year after the test results and recommendations had been mailed, a questionnaire was mailed to each participant to assess program impact. The questionnaire consisted of six sections: (i) participant background, (ii) test results, (iii) participant opinions, (iv) recharge area land use characteristics, (v) program value impact, and (vi) participant demographics.
8. Questionnaire responses of each test period were summarized and mailed to each participant.

Results and Discussion

The following summarizes well owner interest in testing, perceived value of the well test program, views on sources of contamination, and water quality action taken. Return rate for the follow-up impact assessment questionnaire averaged 44%. Reports were analyzed for an entire sample and also separated by geographic location, farm vs. nonfarm, and level of education, where appropriate.

Geographically, the database was sorted into subsets consisting of well owners residing in three primary regions of Montana: 1) forested, intermountain areas of central and western Montana, 2) northern Great Plains region, and 3) southeastern and south central region. Designation of the regions was based on land use practices such as grain farming, livestock production, or nonagricultural practices.

All well owners responding to the questionnaire were asked to specify if the well tested was located on a farm. Fifty-six percent of the respondents were testing a farm or ranch well; 42.3% were located in a nonfarm environment. Responses to the questions indicated that the nonfarm audience was slightly better informed about individual responsibilities, knowledgeable of water quality issues, and action needed than the farm audience. Also, farm well owners placed significantly greater value on the education than did the nonfarm well owners. Only 11% of the farm well owners said the program was of limited or no educational value, whereas nearly 17% of the nonfarm audience said the program was of little or no value. The difference in responses between the two groups can be explained in part by significant difference in level of education between nonfarm and farm well owners.

The entire database was sorted by educational level of participants. One subset was for individuals with some college education and the other subset comprised responses from individuals with no college course work. The results indicated that individuals with less education were more inclined to seek alternative water sources if problems existed, whereas individuals with some college education were more inclined to implement some wellhead protection. Nonfarm well owners had a slightly higher average level of education than farm well owners. Nearly 20% of the nonfarm well owners indicated that they had earned a post college graduate degree, whereas only 5.8% of the farm well owners indicated an equal level of education.

Program Participation

Fewer than 20% of the respondents indicated that they occasionally test their water supply; once every 5 yr of less. Twenty-five percent of the participants indicated that they tested only when there was an apparent need, whereas nearly 60% of the respondents said they had no record of previous testing. Well owners who previously had tested their water most commonly cited three reasons: 1) advice of others, 2) Extension publication and newspaper articles, and (3) water treatment salespersons. Participation in voluntary programs of this type may be caused by a variety of factors, most specific to the participant; and the high level of participation in the program may have been associated with the limited effort required by well owners to participate. Table 1 summarizes respondents' reasons for participating in the program.

Table 1. *Reasons for Well Owner Participation in the Montana Private Well Water Test Program (N=1408).* †

Reason for participation	Percent of respondents who said the reason affected their participation	Rank based on the most important reason for participating, according to respondents
Curiosity about quality of water	79.6	2
Concern for personal or family health	72.6	1
Cost and availability of program	55.6	3
Encouragement from concerned party	22.1	4
Questions about agrichemicals in water	20.7	6
Questions about no agrichemicals in water	18.6	5
Advice or alarm of someone else	3.8	7

†N = number of well owners responding to question

Program Value and Participant Learning

Several different approaches can be taken to assess the degree to which participants of outreach programs learn. One approach is to ask participants specific content questions about a subject.

Another way is to ask participants questions regarding their perceptions of specific subjects. Participants were asked what conclusions they reached about the quality of their water, based on well test programs results. Table 2 summarizes participant responses.

Table 2. *Conclusions about Quality of Well Water Samples and the Need for Action to Ensure the Quality of Future Well Water Supplies (N=1395)*

Conclusions from program participants	**% of respondents**
Water was okay to drink	69.1
Water quality was questionable	20.9
Water may be harmful to personal health	11.1
Need to resample and retest	6.7
Water was unfit to drink	6.7
Need to secure new source of water	2.9
Initiate regular/periodic sampling and testing	24.5

Seventy-five percent of the respondents said the results were what they expected. Only 12.6% of the respondents said they were alarmed or surprised by the well test results. Approximately 30.5% of the respondents said they did not understand the results or significance of the results.

Well Owner Opinions

Participants were asked what might be potential sources of either NO_3^- - N or bacterial contamination of well water. They selected from a list of 18 potential sources, ranging from naturally occurring contamination to fertilizer, mining, septic tanks, and soil erosion. Participant responses to this question were ranked based on which was identified as the possible contaminant source (Table 3).

Table 3. *Potential Sources of NO_3^- - N Contamination and Coliform Bacteria Identified by Private Well Owners (N=406; 743)*

Sources of contamination	**% of participants who said this was the most likely source of contamination**	**Rank**
	Most likely source of NO_3^- - N	
Naturally occurring	18.2	1
Septic tanks and sewer systems	14.3	2
Livestock feeding and confinement operations	12.1	3
Fertilizer application	11.8	4
Faulty well construction	7.1	5
	Most likely source of coliform bacteria	
Septic tanks and sewer systems	13.9	1
Naturally occurring	13.3	2
Faulty well construction and maintenance	10.6	3
Incorrect sampling procedure	10.2	4
Lack of well decontamination after drilling	8.6	5

Actions Taken

As part of the educational program, each participant was sent a fact sheet describing water treatment options. Well owners were asked if they knew how to treat water for various contaminants and other undesirable conditions. Well owners claimed they best understood treatment for coliform bacteria and hard water. The least understood treatment was for NO_3^- - N.

Well owners can take a variety of actions to deal with undesirable water quality. These include purchasing bottled water, modifying an existing well, drilling a new well, hauling water, or joining a water district. We asked each well owner *how much money* they spent on any of these actions, other than purchasing water treatment equipment, as a result of the information they obtained. On average, $992.00 was spent per well where action was taken, and the annual cost was about $238.00 per well. Average cost of point-of-use water treatment equipment was $425.00 per household.

Participation in the well test program and perceived benefit gained from the program appeared to be a function of the immediate usefulness of information to the participant, amount of effort needed to get the information and participate, and cost of participation. For example, we asked each participant how much they would be willing to pay for the water testing service they received if they were required to get the information from a private testing laboratory. Nearly 85% of the respondents indicated willingness to spend between $10 and $40 for the water testing service.

Program Value and Information Transfer

Nearly 55% of the respondents indicated they told an average of four people about the program. Well owners were also asked what benefit they gained from the program. According to those surveyed, the most valuable parts of the program were water test results (89.4%), costs of the program (76.2%), information on water quality protection (64.2), and specific information about treatment (50.2).

The participants were asked what extent their participation in the program affected their ability to understand water quality issues and make knowledgeable decisions about water quality. Eighty-three percent of the respondents indicated that the program increased public awareness of private well water quality issues and well water protection, a moderate amount or a great deal.

Participants indicated that printed text and communication with county agents were the preferred type of educational information offered through distant delivery. Phone communication with specialists, videos, workshops, television programs, lecture, and audio tapes were not as attractive options to respondents.

Reinstitution of the Program

The private well test program was intended to improve the decision making skills of private well owners in Montana. The impact assessment verified that by using a variety of information delivery sources and methods the program was able to improve decision making skills of participants and also to promote follow-up actions by participants. In addition, the program provided a cost-effective approach to distance delivery education of more than 3,300 Montana residents. Based on the outcomes of the initial well water test program, Extension faculty looked to improve the effectiveness of future distant delivery education for private well owners both statewide and throughout the region.

In the spring of 2004, MSU Extension Water Quality revitalized the initial well test program. The goal of the program directors is to build a stand alone, self directed, inexpensive and low maintenance annual well water test program available to Montana private well owners. More broadly, the template of private well water test program developed by Montana Extension will be a regional resource for partner states to implement and make suitable for specific state private well water quality issues.

Participants in the 2004 program included returnees from the original program, illustrating the impact the original program had on the attitude of some private well owners in Montana. The implementation of a water quality Extension Web site, designed and hosted by MSU, provided additional advertisement and recruitment for the program. Additionally, Extension offices in the ten fastest growing counties in Montana were contacted to help promote the program. Newspaper articles were provided for participant counties to advertise the program, similar to the approach taken in the initial program. Other advertising options that will be implemented in the current program include public radio and local television stations as well as statewide agricultural magazines.

Like the initial program, the 2004 program utilized a questionnaire to get the basic demographic and education information from participants. The participants were sent the survey and then instructed to pick up sampling materials from their local Extension office. Participants were provided the name and address of a contracted lab that provided testing services for half the standard drinking water analysis price. Partnership with the laboratory provides consistence in data throughout the life of the program, as well as an inexpensive testing option for participants in the program. A secondary survey was sent post-analysis asking participants what educational resources are needed to help them understand their individual well water results. Extension faculty hope to provide a more needs based approach to resources that offer information of immediate utility to program participants.

Educational methodologies that MSU Extension will use to promote future test periods of the program will include public radio, television, and newspaper advertisements. More communication and partnerships with county agents will also help facilitate program unity. Based on outcomes of participant responses in the 1989 program, private well water users prefer working with county Extension agents, thus they can serve as the liaisons between Extension programs and the public. Finally, Internet education resources, such as online training programs or instructor facilitated courses, will also provide convenient access for private well water users to obtain water quality educational tools.

The goals of the reintroduction of the program include: 1) provide an annual resource to enable private well owners to monitor the water quality of their wells, 2) provide educational resources specific to the water quality concerns of private well owners, and 3) provide a nitrate and bacteria database for Montana. Extension faculty will integrate a variety of educational delivery mechanisms into programs that provide opportunities for direct participant involvement and that offer immediate utility to program participants. With this approach, an established well water test program can be instituted in Montana and shared as a pilot template for other states with increasing private well users.

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Application of Marketing Techniques to Extension Programming Decision Making: Minnesota Livestock Producers' Preferred Topics, Informational Formats, and Outreach Methods Concerning Land Application of Manure

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Abstract

A combination of focus groups and pre-discussion surveys was employed with livestock producers to identify their preferred Extension education methods and topics. The focus groups took place in the spring and summer following a winter education program conducted at the county level that focused on manure application practices, nutrient management, and protection of sensitive areas. By exploring issues in detailed discussions with small groups of producers, we gained information and valuable insights that can guide future information, communication, and education efforts to serve this audience. We were also following an important principle of adult education: the audience or participants should have the opportunity to inform the topics or issues covered, as well as the media or format used. By discussing and surveying the practices they employ and the reasons they do not adopt recommended practices, we also gained knowledge about the topics or issues that ostensibly *should* be addressed through Extension outreach and/or through regulatory, incentives-based, or social-marketing approaches. We found that among seven suggested "educational items or opportunities," the preferred format was "publications." We present some advantageous features of the focus group–questionnaire combination of approaches, including the fact that by beginning with the questionnaire, participants had time to reflect on the questions prior to entering into discussion. We conclude that the combination is effective. However, the resources required for employing both methods is significantly higher than for one method alone, suggesting that the use of the combination is more appropriate for relatively larger projects or programs.

Project Background

A combination of focus groups and written survey was employed with livestock producers to identify their educational preferences with respect to land application of manure. The focus groups took place in the spring and summer following a winter education program on manure application practices, nutrient management, and protection of sensitive areas. The detailed report of the results of those sessions was reported by Vickery (2002).

In 2000, the Minnesota Pollution Control Agency (MPCA) promulgated revisions to the state feedlot rules (Minnesota Pollution Control Agency [MPCA], 2000). The rules address feedlot registration, permitting, and design, manure-nutrient application rates, management of manure in environmentally sensitive areas, and other environmental topics of concern. The University of Minnesota Water Resources Center and Extension Service (Extension) coordinated with state agencies to secure funding for and plan an education program. In the first year of the program (2001), information was delivered on feedlot registration, permitting, discharge restrictions, and other basic requirements. Workshops in the second year focused on the requirements for land application of manure.

The new rules came about because of: 1) the growing public concern in the 1990s about the increase in numbers of large feedlots, and the associated environmental and human health effects; and 2) a legislative audit report of 1998 described in the MPCA Feedlot Program Overview (MPCA, 2003, p. 1). One of the primary conclusions of that report was that the feedlot rules, last revised in 1978, were out of date.

During the second year of workshops, the project leaders decided that rather than further evaluate the training program per se, the remaining resources should be applied to learning what was to be done next: What did the farmers want to learn or find out, and in what format did they want to get the information?

Theoretical Context Brief

Principles of Adult Education, “Andragogy”

Our common sense interest in asking the target audience what they wanted has support in the theoretical literature of adult education. For example, among the principles espoused by Knowles, one of the best known adult education theorists and popularizers (see e.g., Friedman, 2002), are the following as summarized by Atherton (2003):

- **The need to know**—adult learners need to know why they need to learn something before undertaking to learn it.
- **Learner self-concept**—adults need to be responsible for their own decisions and to be treated as capable of self-direction.

An external motivator, the new state regulations, was the primary need-to-know standpoint of the two years of educational programming preceding the questionnaire-focus group study. Future outreach efforts could or should also rely on internal or self-interested, need-to-know motivators such as environmental ethics, farm management efficiency, and financial benefits.

Knowles popularized the concept and practice of andragogy, the adult education version of pedagogy. Peter Jarvis (2001) has described Knowles’ development of androgogy as “the first major attempt in the West to construct a comprehensive theory of adult education.” A relevant, but simplistic, synoptic comparison here is “In pedagogy, the concern is with transmitting the content, while in andragogy, the concern is with facilitating the acquisition of the content (Clark, 1999). Although, he originally described them as distinct fields with a dichotomy of methods, Knowles later emphasized a relationship better treated as a continuum and that each field could borrow methods from the other in appropriate contexts.

Learning Styles

There are many analytical frameworks for understanding an individual’s preferences with respect to learning, communication, and interaction. In Robert Smith’s, *Learning How to Learn* (1982), 17 learning styles inventories are characterized in an appendix.

However, an education/information format preference is influenced by factors other than “learning mode preference.” A farmer may not necessarily prefer to learn by reading documents, but the practical thing to do may be for him to skim a newsletter or a fact sheet during a lunch break. Producers can visit an Extension Web site at their convenience, for an hour during the evening or when the weather is bad. Travel is not necessary and if something comes up, the learning session can be resumed or postponed until another day. But, that is not the case for a workshop or a field day. Thus, while it is reasonable to assume that the learning style of our producer respondents were reflected in their questionnaire answers, we should also recognize that there are other, unrelated influences. Therefore, standard or simple analyses of questionnaire responses can lead to incorrect interpretations. This is why qualitative approaches like focus groups and interviews are used.

Although there is considerable information on learning style preferences for the general population and for numerous subgroups, relatively little information is available on farmers. Trede and Miller (2000) studied a selected subset (a "purposive" or "judgment" sample) of Iowa farmers via mail survey. In addition to being concerned specifically with the learning styles and preferences of farmers, the Trede and Miller study was conducted relatively recently (1999). It involved a reasonably large sample size (289), and of course, concerned a participant sample or audience that is very relevant with respect to water outreach programming. The similarity in the participant sample for our two, unrelated studies of farmers in neighboring states is significant. The present author's sample was narrower, however, being limited to livestock producers.

For a mail survey, the Iowa study was quite lengthy, with components that address the following objectives:

- To determine the learning style of the Iowa farmers participating in this study using the Kolb Learning Style Inventory (Kolb, 1999) and to examine the distribution of these styles among the respondents.
- To determine the preferred learning mode of the respondents for selected agricultural topics.
- To determine the perceived effectiveness of selected learning activities and the impact of learning style on those learning activities (Trede & Miller, 2000, p. 340).

Using the Kolb Learning Styles Inventory, Trede and Miller (2000) found that:

> The preferred learning style for the respondents was the Assimilator style with nearly half of the respondents preferring this style. Individuals with this learning style prefer to grasp knowledge through abstract conceptualization (using logic and analyzing information) and then transform it by reflective observation (learning by watching others). They tend to learn best by inductive reasoning and testing theories and ideas. This implies that educational providers in agriculture should plan and implement programs that emphasize logic, ideas, concepts, and problem-solving rather than just "learning by doing." For example, educational meetings for farmers that include presentations emphasizing the theory and application followed by panel discussions, case studies, and other methods which allow participants to conceptualize, reflect, and adapt the presented information to their individual situation would be most effective. (p. 346)

Many might expect farmers to generally have learning styles that emphasize the concrete and practical. It turns out that such is the case, but not for all topics. The results relating to the second objective listed above demonstrated that the farmers' preferences varied by topic:

> … active experimentation (learning by doing) seemed to be the preferred learning mode for agricultural topics related to physical farming resources (land, crops, livestock, machinery, and buildings) while abstract learning (by observing others) [was] the preferred learning modes for more critical thinking activities such as markets and prices, whole farm planning, and financial management. (Trede & Miller, 2000, p. 338)

Methods Synopsis

Eight farmer focus groups were conducted in four counties in different parts of the state. Each pair of focus groups in a county consisted of one group who attended a winter workshop ("Attenders") and another group of participants who had not attended ("Non-Attendees"). The focus group proper was preceded by a three-page questionnaire to get the participants thinking about issues that would be explored in more detail during the course of the discussion. The participants retained the questionnaire through the discussion and were asked to refer to it at different points during the session. The focus group sessions were recorded on audiotape. Abbreviated transcripts for each session were prepared. The key findings from the focus groups were developed from the transcripts using the "long table analysis" procedure described by Krueger and Casey (2000).

Selected Results

Questionnaire components

The three-page questionnaire consisted of three sections:

1. Adoption of recommended practices
2. Preferences for education topics
3. Preferences for education or information delivery methods

Selected Results and Summary: Topics

Summary results for the second and third sections listed above are given in Table 1.

Summary

The topics of relatively higher interest based on both the "counts" (16 or 17) and "percent" statistics ("yes" + "maybe" > 80%) were:

- F. Field selection: soil P levels and manure application rates
- G. Managing sensitive areas
- I. Applying and incorporating manure

Selected Results and Summary: Format Preferences

Table 2 illustrates the selected results of participant preference for informational formats and educational opportunities.

Summary

- "Publications" is the item or opportunity for which there is the most interest. Nineteen of 51 participants gave it a rank of "1" (with the next highest item with "14"). It had the second lowest number of "last" rankings at 5 (Workshops and Farm tours had 4 each). Publications also had the lowest "average of the median rank" at 1.81.
- There is relatively low interest in a "Comprehensive Web site" or in "Nutrient management computer software". These items had the highest number of "last" rankings (17, 22), the lowest number of "first" rankings (4, 6), and the highest "average of the median rank" values (3.37, 3.81).
- Farm visit or one-on-one assistance had somewhat mixed results, receiving high to intermediate numbers of both "first" (13; range: 4-19) and "last" (14; range: 4-22) rankings and a high-to-intermediate value for average of the median rank (2.69; range: 1.81-3.81).

Discussion

The farmers' preferences can be analyzed from a number of perspectives and theoretical frameworks such as:

- Instructor-centered versus learner-centered teaching
- Information delivery versus education
- Thinking style
- Learning style preferences
- Multiple intelligence

The top and third highest ranked formats, "Publications" and "Newsletter," are the ones that are most strictly informational in nature. In terms of one way of categorizing thinking styles (reflective, creative, practical, and conceptual) these two "formats" are the ones best suited to the "practical" style (Rochester Institute of Technology [RIT], 2000). "Farm tours/demonstrations" and "workshops" are the ones that are probably best identified as "educational". Depending on their design, they could be instructor-centered or learner-centered, although the former is probably more common in practice. Depending on design and user preference, "Farm visit" and "Web site" can likewise serve in both or either fashions. If we shorten the list of learning style preferences to those most applicable in the present context, visual, auditory, and kinesthetic, we find that the questionnaire results indicate a relatively even balance between visual and auditory formats among the top four choices. There was an intermediate level of preference for the two formats that typically could offer the most opportunities for kinesthetic learning, "farm tours" and "one-on-one."

Table 1. *Producers' Assessment of Likelihood of Attending or Participating in Educational Programming: Results for All Questionnaire Respondents (N = 51) and Top Choices for Topics*

Lettered topic / questionnaire item	**All participants**			
	Count	**Percent**		
	Top choice *	**Yes**	**Maybe**	**No**
A. Calibrating my manure spreader	**9**	18	47	35
B. Manure sampling and nutrient content analysis	**17**	29	49	22
C. Soil sampling and testing	**10**	20	29	51
D. Manure application record keeping	**11**	31	51	18
E. Using UM Extension tables to calculate application rates	**7**	24	67	10
F. Field selection: Soil P levels and manure application rates	**16**	33	61	6
G. Managing sensitive areas	**16**	41	43	16
H. Written nutrient management plan	**12**	35	57	8
I. Applying and incorporating manure	**17**	34	58	8
J. Determining total acres needed for all of my manure	**7**	47	35	18

*****For "Top" choice, respondents were allowed to list up to three choices. Most gave three.
Results are given as counts or number of times listed or named.

Table 2. *Participant Rankings of Informational Formats and Educational Opportunities*

Item or opportunity	**All eight focus group sessions combined**		
	Average of the median*	**N = 51**	
		No. of times ranked	
		First	**Last**
Publications	1.81	19	5
Farm tours/demonstrations	2.25	14	4
Newsletter, "update", or periodic bulletin	2.25	11	9
Workshops	2.44	12	4
Farm visit by specialist or consultant OR one-one assistance	2.69	13	14
Comprehensive Web site	3.37	4	17
Nutrient management computer software	3.81	6	22

*The mean of the median of the rank assignments from the eight participant groups.
Not adjusted for the number of participants in each group (varied from 4 to 7) or otherwise.

From the educator's perspective, "software" and "one-on-one", followed by "tours", "workshops" and "Web site" are most likely to be "learner-centered". Characteristic of learner-centered instruction are interpretation of knowledge, learning through discovery, learners setting their own pace, and instructors coaching and mentoring students to facilitate their learning (RIT, 2000).

In the study cited earlier by Trede and Miller (2000), the investigators asked the farmers to rate the effectiveness of some 26 categories of learning activities (see Table 3), whereas in the present study, we used only seven formats or activities (see Table 2). While we used ranking, they used a Likert scale of 1 to 5 where 1=very ineffective, 2=ineffective, 3=no opinion, 4=effective, 5=very effective. The means were in the range of 3.00 to 4.05. "Rating high was the use of consultants or specialists, attending field days, tours, and demonstrations, attending a single or series of meetings on a specific topic, and studying and analyzing a problem on my own" (p. 338). In general, our results were not especially similar, but then our methods, the categories/activities and their number are not especially comparable. If we conflate field days, demonstrations, and (farm) tours, then this is one category for which there was high or moderate-to-high interest according to the results of both studies.

Focus Groups

The focus group discussion was guided by a question sequence or "question route" with three sections, including:

- Part 1. Covered barriers to adoption of Extension recommendations, with emphasis on application rates, record keeping, and the rules for sensitive areas
- Part 2. Covered education topics, methods and formats

Key Findings and Notes

The key findings were chosen from among the themes, comments, and suggestions offered by the participants. They were chosen on the basis of frequency, length or amount of time spent on them, and “extensiveness” (number of counties and sessions). Participant comments are summarized in Vickery (2002), where the supporting quotes are given for each finding.

Selected key findings and explanatory notes:

- Nutrient Management Plans (NMP): Assistance needed; involve private sector, agricultural professionals
- Those producers with some experience with NMP recognize that it not something they can readily do or would want to do themselves. They know they need assistance or training. In some cases, it is not clear where this assistance will come from. The participants suggest that more private sector agricultural professionals be trained to provide this service.
- Web site as a source of information: important to some, but most farmers are not keen to use

There is quite a range in the level of interest and proficiency when it comes to computers and the Internet. However, most of the participants are not likely to use an Extension Web site very often.

Table 3. *Learning Activity Categories, from Trede and Miller (2000, p. 345)*

Talking with a consultant or specialist	Doing my own research on something new or different
Attending field days, tours, demonstrations	Reading and studying trade publications and technical journals
Attending a single meeting on a specific topic	Using a consulting or marketing service
Attending a series of in-depth meetings on a specific topic	Attending a meeting over the ICN
Studying and analyzing a problem on my own	Listening to radio broadcasts on specific topic
Participating in an educational activity that enhances lifelong learning	Watching a video tape
Experimenting on my own	Attending class sponsored by local high school
Attending a seminar/class sponsored by the Extension Service	Participating in community college credit class
Watching others and learning from them	Participating in credit class at university
Trying out new technologies/practices on my own	Watching a television program
Attending a seminar/class sponsored by an agribusiness firm	Listening to an audio tape on specific topic
Talking with family, friends, neighbors	Reading the newspaper
Reading and studying popular farm publications	Being the first in my neighborhood to try something new

Discussion

It turns out that these key findings concerned the items or formats for which there was the least interest according to the questionnaire results. A likely interpretation here is that even though producers might not personally use, have need for, or prefer a particular service or item, they may well be able to provide relevant advice and recommendations or convey preferences, either from their own perspectives or from what they know of other producers.

Qualitative and Quantitative Methods in Combination

Introduction

For our study, we used one qualitative and one quantitative method. Some general aspects of relevant comparison of the two approaches are summarized in Table 4.

Table 4. *Comparison of Qualitative and Quantitative Methods*

Aspect of comparison	**Qualitative methods**	**Quantitative methods**
methods of survey	focus group discussions	questionnaire
method of analysis	content analysis	descriptive statistics
point of view	the subject	the investigator
disciplinary paradigm	social sciences	natural sciences
logical reasoning	inductive	deductive
“language”	verbal, soft data	mathematical, hard data

Theoretical Considerations

Much has also been written in the form of comparison and contrast of qualitative and quantitative methodologies, as well as in regard to their use in combination. Although, many or most researchers use strictly one or the other approach, the nature of the two does not have to be treated as a strict dichotomy. As noted by Pedersen (1992, ¶5):

> Observation, interviews, questionnaires and other tools, under the title of research methods, are not necessarily quantitative or qualitative *per se*. Second, any attempt to quantify involves a qualitative judgment, and vice-versa. Qualitative statements imply a certain hierarchy, number and magnitude that give form to meaning.

In an article exploring the paradigmatic underpinnings, limitations, and strengths of each, models of combination, and examples of application, Schulze (2003) describes three models of combination as formulated by Creswell (1994):

- Two-phase model
- Dominant less-dominant model
- Mixed methodology model

Our study is of the last category: both approaches were preplanned, carried out in conjunction, and received approximately equal resources and importance. Schulze takes a bit of a cautionary slant, noting: 1) that some may find problematic the combination of methods that have incongruous theoretical underpinnings; and 2) that mixed methods are best left to those who are experienced with both methods and fully understand the underlying paradigms. Caution notwithstanding, others feel that the use of both methods can lead to better or more comprehensive understanding and that furthermore, the results of one method can help refine investigations using the other. This last idea, employed purposefully, has been termed “triangulation” (Scandura, 2002).

Combination Approach and the Present Study

Preferred Learning Formats

“Farm tour/demonstrations” was one of the preferred education formats identified by the questionnaire. However, from the focus group discussions, we learned that most participants would probably not attend. Farm tours just ranked high compared with the response choices offered.

Why Producers Do What They Do (or Why don’t they follow official recommendations?)

According to our questionnaire results, there were only a few practices for which the survey results predicted that the implementation rate in 2004 would be less than 80 percent:

- Calibrate manure spreaders (74%)
- Follow recommended rates for nitrogen (71%, Non-Attenders)
- Adjust for phosphorous (62%, Non-Attenders)
- Properly manage sensitive areas (75%, Non-Attenders)
- Develop/update manure management plans (70%, Non-Attenders)

For most of these practices, the focus groups provided input on the reasons for relatively low rates of implementation and/or what Extension should do about it. With respect to rates, for example, they expressed doubt about the ability to closely match crop needs, because of the variability in the first- and second-year availability of nutrients. One recommendation was that more on-farm, nutrient rate demonstrations or experiments are needed, especially in parts of the state that are not well represented by Experiment Stations.

Findings Summary

Focus groups and questionnaires are not typically used in combination with the same set of participant-respondents. We found the combination useful in that:

- By beginning with the questionnaire, participants had time to reflect on the questions prior to entering into discussion.
- Since the farmers retained the questionnaires through the course of the session and were allowed to make changes in their responses, the questionnaire results could more accurately portray the participants’ practices and preferences.
- The discussion phase helped us to better interpret the questionnaire results.
- By using two methods, we are more confident in the reliability of the results and our interpretation, even though the sample size was relatively small for survey methods.

The first and second points are only logical inferences. We did not try to measure systematically nor characterize anecdotally, the degree to which reflection and amendment took place. Probably more important was that by allowing the participants to retain their questionnaires, there was greater opportunity for the moderator to review the completed instruments on an individual basis to check for: 1) omissions, errors, and legibility; 2) correctness of interpretation, especially in cases where the respondents provided answers or annotations in their own words.

Summary and Conclusion

Focus groups have become a mainstay of qualitative research in the social sciences. Long used for marketing research in the for-profit sector, this method is now frequently employed in the public and academic sectors, often in the context of social marketing. Surveys, including written questionnaires, are the quintessential quantitative method in the social sciences. The use of the two methods in combination is not common. In the present study, we gave equal emphasis to each method, carrying them out on the same occasion with the same study subjects/participants. We found the combined approach useful, for we were able to be more confident in our conclusions, given the relatively small sample size. However, for each method, the development, administration, compilation, and analysis phases are time-consuming. Thus, investigators must keep in mind the potential value of the outcomes, before deciding to allocate the resources necessary for the combination approach.

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Poster Abstracts and Papers on Target Audience Education Practices and Measures of Success

Water Quality Education for Irrigated Agriculture on California's Central Coast

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Abstract

The Monterey Bay National Marine Sanctuary is the largest marine protected area in the United States, covering more than 5,000 square miles along the Central Coast of California. Runoff from agricultural lands in coastal watersheds and transported to Sanctuary waters often carries pollutants such as sediments, nutrients, and pesticides. In 1999, the agricultural industry organized to voluntarily reduce water quality threats and avoid increased regulation. The University of California Cooperative Extension (UCCE), in partnership with the USDA Natural Resources Conservation Service (NRCS) developed a Farm Water Quality Planning Short Course to assist farmers to develop individual water quality management plans. The course is based on the success of the Rangeland Water Quality Short Course which has been taught 50 times in 27 counties and has resulted in 400 ranch water quality plans representing 1.2 million acres. The new UCCE peer-reviewed Farm Water Quality Planning Short Course is offered to Watershed Working Groups organized and staffed by the Coalition of Central Coast County Farm Bureaus. During the course, producers receive:

- Information on water quality regulations
- Techniques for self-assessment of nonpoint source pollution problems
- Management goals for sediments, nutrients, and pesticides
- Methods for recognizing practices that are already in place that protect water quality
- Management practices that may be selected for local conditions and crop types, and practice evaluation methods.

To date, 278 growers in 14 Watershed Working Groups have received training on the development and implementation of farm water quality management plans.

Target Audience(s): Agricultural commodity groups, farmers

Educational Purpose: Education

Activity-Based Learning and Daily Field Experiences Help Bring Watershed Restoration To Life

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Abstract

Watershed Restoration is a nationwide shortcourse for agency partners engaged in restoration of disturbed landscapes. Presented in Wenatchee, Washington during 2001 and 2003 and Logan, Utah in 2001, the course is part of the U.S. Forest Service's National Continuing Education Program. It combines activity-based and field experiential learning (30% presentation and 70% practice) to provide an understanding of watershed linkages, particularly upstream-downstream and upslope-downslope relationships, essential to the success and longevity of all restoration approaches. Each instructor provides a landscape level view to restoration approaches, issues and relevance by exposing participants to experiences in a broad array of climates and geographic regions. Morning sessions take place in a room transformed to a watershed restoration context by wall peripherals, displays, models, and new and innovative materials. Each session establishes clear, meaningful goals and objectives, and promotes the embracing of learning benefits through emphasis on real world examples. Verification of learning is accomplished through hands-on practice, collaborative pre- and post-tests, problem solving exercises, and data gathering and synthesis. Pertinent exercises, group discussion and "food-for-thought" challenges are followed by a reinforcing field experience every afternoon. Immediate field application and observation of session exercises provide the ability to expose, in a non-confrontational manner, the environmental, operational, or organizational barriers that prevent restoration success. A relaxed, activity-charged atmosphere supplies a vehicle for evaluating each barrier to success—what can be done to eliminate it, reduce it, or program around it? "Show-you-know" exercises, clear synthesis, and detailed participant evaluations help verify learning success.

Target Audience(s): Agency partners, soil and water conservation districts

Educational Purpose: Education

Timing and Design of Education Programs to Enhance Participation: Manure Management Education in Minnesota

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Abstract

An education program can attain its goals only if it reaches the target audience. Participation can be enhanced by timing the program with and designing it around a landmark event that enhances awareness of and perceived need for the education. In this case study the University of Minnesota Extension Service, anticipating release of new state feedlot rules, prepared a two-year education program to inform livestock producers about contents of the rules and to provide manure management education. The goal was to enable producers to implement manure management practices required or encouraged under the rules. Participation in these programs far exceeded that for manure management education in the state prior to rule adoption. Attendance exceeded 4,000 in the first year and 1,100 in the second. This is being followed with an in-depth and personal two-year education program in which small groups of producers develop two field manure/nutrient management plans for their own farms. To date, through the small-group project, 520 producers have developed nutrient management plans. Participation at programs timed to coincide with rule release benefited from both the heightened awareness brought by major rule adoption, and by the recognized need by many producers to learn about and implement improved manure management practices specified in the rules. Coupling of education programs with a change in regulations, new incentive payment programs, or some other high-profile event, effectively exploits a “teachable moment.”

Introduction

The University of Minnesota Extension Service has provided publications and workshops over many years on appropriate management of manure and fertilizer in crop production. However, in-depth on-farm interview surveys indicated that significant over-application of nutrients in manure and/or fertilizer continued to be frequent. Practices requiring wider adoption include:

- Soil testing and manure analysis
- Crediting legume and manure nitrogen contributions when applying fertilizer
- Manure spreader calibration

Education programs, to be successful, must reach the target audience. If the target audience is farmers that have not implemented water quality protection practices, then education programs describing voluntary practices alone are insufficient to reach them.
This poster describes two programs delivered by the University of Minnesota and its partners that reached the target audience by expressly timing program delivery to coincide with events that were expected to heighten audience awareness and concern.

Feedlot Rules Education Project

Declining lake and stream water quality due to eutrophication led to increasing concern that voluntary practices and education were insufficient to change production practices. In a four-year multi-stakeholder process, new state feedlot rules were developed and readied for release in year 2000. Communication within livestock producer groups, reports in the press, and rule-making hearings raised considerable awareness in the agricultural community about the impending rules. UM Extension anticipated that education programs timed to the release of the rules would reach a wider farm audience than previously available. A Section 319 grant was applied for in 1999, and the two-year project was approved in time for the rules' effective date in October 2000.

Publications and slide presentation were prepared by an interagency team led by Extension. In each of the first two years, five regional "train the trainer" sessions were held for county and regional staff of Extension and agencies. These were followed by county sessions for farmers and agricultural professionals. In the first year, education focused on requirements for feedlot registration, permitting, and land application. The second year focused on manure and nutrient management planning and record keeping.

Results:

The high level of awareness in the agricultural community afforded by rules' release brought over 4,000 producers to the first-year county sessions, far exceeding any previous education effort in this subject area. By the second year, interest had dissipated somewhat; 1,150 farmers attended the sessions on nutrient management planning. A third year was added to the project to address improvement of small open feedlots as required in the rules by January 2005. Attendance was 718 farmers and agricultural professionals.

Small-Group Nutrient Management Planning

The new feedlot rules require livestock operations with greater than 300 animal units to maintain, on the farm, a nutrient management plan for all fields where manure is applied. The deadline to complete these plans is January, 2005. Anticipating this requirement, UM Extension applied for a Section 319 grant to lead producers through plan development, in a workshop setting, for two fields of each of their own farms. Beginning in fall of 2002, groups of 8-15 producers are being recruited by Extension, county feedlot, and Soil and Water Conservation District staff as well as by livestock producer organizations. Farmers bring their own data (soil tests, manure tests, field maps) to half-day workshops where Extension staff guide participants through development of their nutrient management plans. Application rates are based on UM recommendations; participants each calculate fertilizer cost savings based on their new plan compared to their previous application rates.

Results:

As of April 2004, 55 workshops have been held for over 560 producers, all of whom developed two-field plans. Most participants are in the operation size category required to have a plan by the rule; others, however, also attend. In end-of-workshop surveys, 73% responded that they intend to finish the plans for their entire farm, either by themselves, or with a professional, and only 3% said they would not. (The rest did not respond to the question.) Over 84% calculated that significant fertilizer cost savings (more than $5/acre) would be obtained for their operations by following their plans. Demand for the workshops continues. More workshops will be offered in the next winter season near the rules' deadline.

Discussion and Conclusions

"Build it and they will come" is not a productive approach in water quality education for farmers. In the absence of significant economic incentives, like production cost reductions or cost-share/incentive programs, additional strategies are required to reach the target audience and motivate changes in practices. The strategy successfully employed by these two projects was to couple education with heightened awareness surrounding new regulations and their application. Education was designed to address practices that would assist in meeting requirements of the rules and provide good resource management. This was possible because Extension staff served as technical advisors in development of the rules, and was therefore aware of opportunities for education and its appropriate timing.

Additional opportunities to couple education with increased awareness include the TMDL process now underway in Minnesota and elsewhere. Many of the state's water bodies are listed for impairments that include fecal coliform bacteria, sediment, and/or excess nutrients. Coupling water quality education with TMDLs is more challenging, however, because the TMDL process occurs over a long period of time and is watershed-specific. This will require examining stages of the process for high-profile periods, when potential audiences are likely to be involved or have a higher level of awareness. These might include a period around release of load allocation studies or public hearings on preliminary implementation plans. Education opportunities must be anticipated well in advance for program delivery to be ready when awareness is high.

Montana Beef Environmental Management Systems Pilot Project

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Abstract

A pilot project was conducted to determine the effectiveness of using an environmental self-assessment in an effort to address potential sources of surface water pollution from beef cattle ranches in Montana. Montana is largely a rural state with a land area of 93 million acres and 11,400 beef cattle enterprises ranging in size from a few to 10,000 head. Only 55 of these operations are licensed concentrated animal feeding operations (CAFO), which leaves the remaining as cow/calf rangeland operations or small to mid-size lots. Many of these livestock operations were established near surface water sources, and in present day society there are increasing concerns about the compatibility of livestock agriculture with environmental quality, especially that of water. The Montana Beef Environmental Management Systems (EMS) Project focused on facilities related to beef cattle ranching such as corrals, winter feeding grounds, back-grounding lots, and calving areas to develop a self-assessment guidebook and workbook to lead producers through the process of identifying priority environmental issues, assessing potential environmental risk, and developing a plan to mitigate risk. The tool was pilot tested on 23 ranches across Montana, as well as on 3 research farms. Pre- and post-surveys were completed to assess rancher attitudes before and after identifying environmental risks on their own operations, and to evaluate their experiences with the self-assessment. Overall accomplishments and outputs of the project will be discussed as well as lessons learned regarding the selected approach for dealing with environmental issues on ranching operations, and survey results will be presented.

Target Audience(s): Agricultural commodity groups, farmers

Educational Purpose: Capacity building

Financial Safety Net for Corn Farmers: An Emerging Educational Tool to Increase Adoption of Nutrient BMPs

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Abstract

Surveys and case studies over the past 30 years have demonstrated that economic risk is a major barrier to farmer adoption of Best Management Practices (BMPs). For example, farmers are often reluctant to lower nitrogen, phosphorus and potassium applications to university recommendations. If the farmer or advisor miscalculates the rate, or unusual weather causes the BMP to fail, yields and profits may decline. Since fertilizer costs are inexpensive relative to the potential loss, farmers "self-insure" by applying higher than recommended rates. The project partners have tested a BMP “net returns” fertilizer rate recommendation guaranty that provides a cash payment to participating corn farmers if the recommendation results in lower yields. The participant (or a sponsor) purchases a specially designed service agreement, applies university-recommended BMP rates, and applies additional fertilizer to a check strip. If a yield loss occurs on the BMP-fertilized acres vs. the check strip, and the value of the yield lost outstrips the fertilizer cost savings, the guaranty provides a payment to compensate for the loss. Between 2001 and 2003, more than 30 corn farmers in five states have participated in research and development, with average fertilizer rate reductions of 24%. Up to 400 additional farmers are being recruited for the 2004 growing season. Watershed managers are quickly recognizing these systems are highly cost effective in terms of setting up field-scale demonstrations and are now purchasing or cost-sharing the agreements for farmers.

Target Audience(s): Agency partners, environmental conservation nongovernmental organizations, soil and water conservation districts; ag commodity groups/farmers

Educational Purpose: Education

Duluth Streams (duluthstreams.org) – Making Water Quality, Land Use, and Stormwater Data Come Alive for Decision Makers

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Abstract

The Web site, DuluthStreams.org provides Web-based delivery of automated data using advanced data visualization tools for understanding urban stormwater and water quality issues. Duluth, Minnesota lies adjacent to the pristine waters of Lake Superior. The City has 42 named streams, 14 trout streams, and borders the Duluth-Superior Harbor Area of Concern. Duluth's stormwater infrastructure includes 93 miles of streams and wetlands. Urbanization and rural development are increasing temperature, turbidity/sediment, salinity, organic matter, and nutrients in area streams. DuluthStreams established a partnership between the University of Minnesota, Duluth and local water resource management agencies to enhance public understanding of aquatic ecosystems and their connections to watershed land use by illustrating the nature and consequences of degraded stormwater. Water quality data are fed to the Web site, www.duluthstreams.org, and linked to GIS landuse, current and historical water quality and biological data, and engaging text and photos. Data animations and interpretive text visually engage the public and students via the Internet and local kiosks. Collaboration with the St. Louis River RiverWatch Program developed curricula and stream monitoring materials for schools and established uniform protocols for volunteers throughout the region. The Partnership has also adapted NEMO (Nonpoint Education for Municipal Officials) to the Duluth area and initiated a Regional Stormwater Protection Team, a coalition of new Municipal Separate Stormwater Sewer System permittees (MS4s), local universities, and regional agencies, to develop a unified watershed approach for educating the public on nonpoint source pollution issues and protecting the waters of the region.

Target Audience(s): Local decision, policy makers

Educational Purpose: Capacity building

Catfish in the Mainstream: Social Marketing and Change

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Abstract

Water education is "real life" education. If Tennessee's population continues to grow as it has in the last ten years, we will soon be approaching a crisis situation regarding clean, potable water. Our economy, the health of our citizens, and wildlife habitat are dependent on plentiful and safe sources of clean water.

WaterWorks! was launched this year. It is a new initiative in outreach education for the Center for Environmental Education at Middle Tennessee State University and is funded by the Tennessee (TN) Department of Agriculture Nonpoint Source Program. The program's focus is on improving water quality in Tennessee. *WaterWorks!* models social change through focused marketing to an audience of Tennessee households and homeowners. Specific components are designed to promote and reinforce the message of individual responsibility. Highlights include:

- Video and audio public service announcement series promoting clean water quality through responsible action
- Web site showcasing public service announcements, youth projects, links to water-related groups and sites in Tennessee
- *Stream Savers*, a recognition program for youth groups completing projects that improve water quality
- Statewide survey providing baseline information about citizen water quality attitudes and actions
- Brochures focusing on homeowner, builder, developer, contractor, and agriculture practices
- Interactive watershed map with watershed links, watershed groups, stormwater information, and county/city contacts
- Stakeholder meetings with NPDES Phase II representatives and others involved in water quality efforts in Tennessee

Introduction

Social marketing = advertising? The average person may equate the two terms, but according to Les Robinson (1998, ¶5), an expert in this field, advertising is "… NOT about changing behavior. It's about changing *brands*." In thinking about solutions to environmental issues and problems, the focus is usually on a change in *behavior* brought about either through a revision of attitudes or a forced compliance to a rule or law. Robinson's focus is not on building awareness but on removing barriers to behavior change. An excellent source about the theory and application of social marketing techniques is *Fostering Sustainable Behavior* by Douglas McKenzie-Mohr and William Smith (1999), who advises those interested in social marketing techniques to study benefits of, and barriers to, the desired behavior.

WaterWorks!, a new education initiative funded by the TN Department of Agriculture Nonpoint Source Program and implemented through the Center for Environmental Education at Middle

Tennessee State University, was launched to improve water quality in Tennessee. The initiative has a multi-faceted approach with components added and strengthened over the project period. The *WaterWorks!* education campaign is designed to change behavior by first promoting awareness, then adding knowledge and skill-building with subsequent messages, so that citizens are brought to an awareness that individual decisions affect water quality, their actions make a difference, and that together, responsible attitudes and actions can change water quality for the better.

The Project

The first phase of the project was to develop a series of video and audio messages promoting clean water through responsible action, a statewide survey to create a baseline about what Tennessee citizens know and *do* about water quality, a recognition program for youth, and stakeholder meetings with others involved in water quality statewide. A Web site to showcase the messages and provide an information base for the program was begun, with links to other helpful watershed organizations and state agency sites. In addition, the Web site has a watershed map in its basic form, with plans to add information about local contacts for information on particular municipalities and on volunteer watershed groups within a county or a watershed.

Project Components

Video and Audio Messages

Three video messages and four radio messages were created and were aired for the first time September 16, 2003; they are aired as non-commercial sustaining messages through the Tennessee Association of Broadcasters (TAB) and were sent to 321 radio stations and 33 commercial television stations across the state. During the first two months of the program (October and November, 2003) the television spots aired more than 460 times and radio announcements had 4,519 airings.

The television spots featured Chuck the Catfish, a gruffly lovable character who in one message, a la Dr. Seuss, exhorts citizens to “abstain from putting bad stuff in the drain” in order “to maintain my wet domain”; in another message, Chuck admonishes adult citizens who exhibit irresponsible behavior that hurts water quality; in the third message, he is teaching clean water tips to a classroom of children who are already very aware of the correct behavior.

Two of the radio messages are the voice of Chuck the Catfish; the other two are based on an original song, “I Am the River” by Nashville singer/songwriter Dan Tyler (“Bobbie Sue,” “Hearts on Fire,” “Twenty Years Ago,” “The Light in Your Eyes”) who graciously donated the use of his song for this campaign.

Statewide Survey

In 2003, the Social Science Research Institute at the University of Tennessee, Knoxville, conducted a telephone survey of adult residents of Tennessee regarding perceptions of water quality across the state and household habits pertaining to the disposal methods of potential pollutants. Additionally, respondents were asked about their knowledge of nonpoint source pollution and preferences for the financing of water quality improvement. The survey was conducted using the Random Digit Dialing method. A total of 871 randomly-selected adult residents of Tennessee were interviewed with a resulting +/- 3.3% margin of error. The cooperation rate for the survey was 35.9% (Social Science Research Institute, 2003).

Results of the survey indicated that while over 85% of respondents were satisfied with the quality of their drinking water (almost 45% ranked it "good"), 36.8% of those surveyed ranked the water quality of their rivers and streams as "fair" and 30% "good." Over 76% of Tennesseans surveyed believe that everyday activities in our homes, workplaces, and cars cause most water pollution. Just over 80% believe that small changes in people's daily habits will improve water quality, with the likelihood of disagreeing with this statement increasing as age increases. Over 93% of Tennesseans surveyed were not familiar with the term "nonpoint source pollution" but once the term was explained, respondents expressed agreement as to important sources of nonpoint source pollution: agricultural chemical runoff, automobile fluid runoff, construction runoff, and lawn chemicals. A finding on how Tennesseans prefer to pay for the costs of improving water quality is of significant importance to stormwater managers across the state: over two to one Tennesseans prefer an assessed fee rather than a general tax increase.

Trained personnel, using a Computer-Assisted Telephone Interviewing (CATI) System, conducted all interviews. The survey was designed and analyzed for the *WaterWorks* Program by Social Science Research Institute staff members, Dr. Michael M. Gant, Director and Linda M. Daugherty, Program Director.

Youth Recognition Program

In fall 2003, *WaterWorks!* began its *Stream Savers* program. Youth groups, both formal (classrooms) and informal (clubs, Scouts, 4-H, Boys and Girls Clubs, etc.) in Tennessee could win $300 for their water quality project; monthly winners are eligible for further recognition in 2004 by competing for an annual award of an additional $500.

Eligible projects include, but are not limited to:

- River or stream cleanup
- Water testing
- Stream bank repair/restoration
- Education or awareness project

From fall 2003 through spring 2004, six school or club groups were awarded *Stream Saver* status. Winners, including clubs and classes from elementary, secondary and home-school groups, participated in projects such as:

- Bundling trees for distribution with an accompanying informational brochure for streambank restoration
- Stream cleanups
- Macroinvertebrate sampling
- Water sampling and testing
- Maintaining annual records of aquatic wildlife and macroinvertebrates
- River trail maintenance
- Water education programs

Many of the awarded projects were 'combination' projects that accomplished more than one of the above activities.

Stakeholder Meetings

WaterWorks! is connected with a variety of water-related organizations and groups, and has had representation at state, regional, national and international levels. Sample groups include: TN Environmental Education Association, Environmental Education Association of Alabama, TN Council of Social Studies, TN Educators of Aquatic and Marine Sciences, TN Section of the American Water Resources Association, National Conference Nonpoint Source Pollution Information & Education Programs, and North American Association of Environmental Education.

Web Site

WaterWorks! Web site (www.tennesseewaterworks.com or www.mtsu.edu/waterworks) is unique in that its homepage showcases beautiful water features of Tennessee, with the permission of the photographer, Mack Prichard. Opportunities for others to share their Tennessee water pictures are available; credit is always given to the photographer.

Web site features include:

- About *WaterWorks!*
- Public Service Announcements
- Youth Recognition
- Brochures (under "construction")
- Survey
- 10 Water Tips
- Watershed Map
- Watershed Groups
- Links

Watershed Groups
Watershed groups, friends' groups, and other water-related organizations are listed on our Web site; updates are made as groups asked to be listed or linked. Additional links are/will be made to state (and other agencies) and organizations on the "Links" page. As the "Watershed Map" page becomes more interactive (county names in green are hot buttons to GIS-generated maps of the counties and main waterways, watershed groups and MS4 contacts), watershed group contact information is checked and rechecked, making sure that the information is consistent and current.

Watershed Map
One of the most interesting features of the Web site is a state map with watersheds overlaid on the counties. Plans for developing this page include adding contact information about watershed groups in each watershed, city/county officials in charge of stormwater permits, whom to contact for suspected pollution, etc.

Waterworks! in the 'Mainstream'

Opportunities for the Tennessee Phase I and Phase II Municipal Separate Stormwater Sewer Systems (MS4's) to fulfill their public education and outreach commitments are available through the use of *WaterWorks!* video and audio messages.

To ensure that radio and television stations would air the announcements, *WaterWorks!* entered into a contract with the Tennessee Association of Broadcasters (TAB) to utilize that organization's Non-Commercial Sustaining Announcement (NCSA) program. Once *WaterWorks!* provides TAB copies of the television and radio announcements, TAB handles distribution of the spots to over 331 member stations. Under terms of the contract, *WaterWorks!* is guaranteed a four-to-one ratio of advertising value generated to cost. In other words, a $10,000 investment would yield at least $40,000 in advertising value.

During the first two months of the program (October and November, 2003), the actual results show that the advertising value of the *WaterWorks!* campaign was $88,800 (the cost to *WaterWorks!* for these two months was $1,667). The television spots aired more than 460 times and radio announcements were aired 4,519 times, which amounts to over 53 times the value paid.

Because not all stations report the airing of these announcements, we are confident that the true value of this program is actually much higher.

We plan to use the survey form again in the spring of 2005, including questions which indicate whether respondents remembered seeing or hearing the television and radio spots. Additional ads will be created and released in the year 2004-2005, so respondents to the spring 2005 survey will have two years to have heard or seen the ads.

Conclusion

WaterWorks! is a unique partnership between private and public entities, providing a usable, affordable way for municipalities to implement a uniform public outreach plan statewide that helps meet their stormwater education plan requirements. Through a recognized and respected agency, attention-getting and informational messages are created and aired with the help of the Tennessee Association of Broadcasters. Through the Stream Savers' program, *WaterWorks!* recognizes, in a meaningful way, projects of formal and informal youth groups that improve water quality; the watershed map, groups page, and links on the Web site provide additional information in an easily-understood format for citizens and municipal officials alike.

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Tailoring Pollution Prevention for Urban Landscapers in Madison, Wisconsin

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Abstract

Nestled between two glacial lakes, Madison, Wisconsin is blessed with water resources. As in many urban watersheds, however, Madison has growing water pollution issues. One important pollution source is urban landscaping, in particular runoff from over-fertilization and pesticide misuse in lawns and gardens. The goal of this project is to develop social action strategies, for implementation by urban watershed and neighborhood organizations, that will reduce the human health and ecological hazards of pesticide misuse for urban landscape development and maintenance.

The project aims to identify the barriers and benefits to the use of Integrated Pest Management perceived by paid landscape managers in the Lake Monona watershed in the City of Madison and Dane County, Wisconsin. This poster will discuss the results of our telephone survey research analyzing landscape managers' and groundskeepers' perceptions of IPM practices. We have also evaluated existing IPM materials and messages available to professional landscapers and urban residents. This poster will share the results of research into the development of educational materials, which we will pilot test in collaboration with grassroots organizations, watershed educators and public agency partners in the Lake Monona watershed. We will discuss the development of a social marketing strategy with principles and recommendations useful to urban watershed protectors nation-wide. This includes communications plans to use existing, revised or new landscaping IPM educational materials (such as a one-stop guide for landscape managers and a “green Landscaper” certification program in Wisconsin) and a social strategy for instituting new behavioral norms of urban landscape management.

Target Audience(s): Urban landscapers, urban watershed organizations

Educational Purpose: Communication; education

Water Resource Education for Real Estate Professionals in the South Puget Sound Region, Washington

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Abstract

Increased development of natural lands, caused by a rapidly growing South Puget Sound population, greatly influences the long-term health of the region's water resources. Individual land-use practices, in particular, can critically affect these resources.

Real estate professionals influence these land-use practices, yet tend to have poor knowledge of environmental issues. In 1998, a needs assessment of local environmental educators identified this audience as underserved yet a high priority for water resource education. As a result, Washington State University Thurston County Extension developed and implemented a Water Resource Education Program for Real Estate Professionals.

The program's objective is to educate real estate professionals so they can make environmentally suitable decisions regarding development and land-use practices, as well as educate their clientele about land stewardship, water quality, and aquatic habitat. Courses cover the science, policy and regulations of water resource related issues such as onsite sewage systems, wetlands, shorelines, salmon and streams, and low-impact development. Experts give up-to-date objective presentations in a classroom setting and most courses have a field trip component for hands-on learning. Real estate professional attendees receive continuing education credit toward their biennial professional license recertification.

Attendance in 41 courses over six years totals more than 1112. Course evaluations demonstrate that information provided is relevant and useful for participants' work. Follow-up evaluations show that over 90% of program participants regularly share information they learn with clientele and colleagues. Further research is needed to quantify the impact that this program has on local and regional water resources.

Target Audience(s): Real estate salespersons, brokers, developers, appraisers

Educational Purpose: Information

SMARTYARDS and Other Watershed Outreach Programs of the Christina Basin Clean Water Partnership in Delaware, Maryland and Pennsylvania

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Abstract

The Christina Basin Clean Water Strategy (CBCWP) is a cooperative interstate effort to protect and improve the water quality of streams in the Brandywine, Red Clay, and White Clay Creeks, and Christina River watersheds of Delaware, Maryland, and Pennsylvania. The streams in the 565-square mile, Christina Basin drain areas of three states (Delaware, Maryland, and Pennsylvania) and are the sources of drinking water for over 0.5 million people in these states. The Christina Basin Partnership was one of 20 watersheds from throughout the USA (from a pool of 170 applications) that was the recipient of a $1 million Watershed Initiative Grant from the U.S. Enivornmental Protection Agency.

This paper describes the watershed outreach and education programs of the CBCWP. These include continuing and enhancing the community participation and public education efforts to inform the watershed community and landowners about the need to implement BMP's and how to implement better watershed stewardship in their day-to-day activities and businesses. This program includes cooperative public outreach efforts regarding the ongoing development of the low flow and high flow TMDL load allocations. The watershed outreach programs include:

- Distribution of free native plants to homeowners through the SMARTYARD program.
- Annual bus tour of the watershed on the first Friday after Labor Day.
- Storm drain stenciling in coordination with Boy Scout and Girl Scout troops.
- Distribution of outreach publications and brochures at public events such as University of Delaware football (22,000 seats) and basketball games (5,000 seats).
- SMARTYARD program whereby homeowners are given up to $250 of free native plants and a landscape design plan as incentive to replace water-and chemical dependent lawns.
- Rain barrel program where homeowners in eligible sub-watersheds are provided free rain barrels.

Target Audience(s): Homeowners

Educational Purpose: Capacity building

Fostering Locally-Led Holistic Watershed Management

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Abstract

The Water Quality Outreach Program was created within the University of Missouri Outreach and Extension Program to work with agencies, organizations, local governments, and individuals to develop information, technical expertise, and strategies for protecting water resources throughout Missouri. Early in the development of the water quality program, the importance of developing collaborative networks was realized for success in protecting Missouri's water resources. To achieve this, MU Extension programs took a community development approach in working with communities. The approach was to create capacity (leadership) within the community by the transference of knowledge and technical expertise to people in the community. As this program has now worked with twenty different watershed-planning groups, it has been found that citizens will choose to become involved if they understand the situation and how it might affect them, and if they have the knowledge and resources to work through the situation.

To date, twenty watershed-planning groups have been involved with this program because of being forced through regulatory action or because of concern for their water resources. Each of the twenty watershed planning committees is at a different interval in the planning process. Lessons learned so far are as follows:

- People do care about their community.
- People will become involved if they understand the problem/situation.
- People need to do the work with assistance from agencies, organizations and government (local ownership/buy-in).
- National/state, community/economic, and environmental/natural resources problems are local problems "first."

Target Audience(s): Local decision/policy makers, agency partners, soil and water conservation district personnel

Educational Purpose: Communication, capacity building

Water Leaders Class – Preparing for the Future

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Abstract

The Water Leaders Class is a one-year program of the Water Education Foundation that identifies young community leaders from diverse backgrounds. These young professionals include members of minority and ethnic communities, and representatives of many professions such as engineering, law, environmental planning, and public interest advocacy.

The program is designed to educate the Water Leaders Class about water issues, as well as enhance individual leadership skills and prepare participants to take an active, cooperative approach to decision-making and problem solving.

Serving as mentors to class members each year are leading urban, agricultural and environmental stakeholders, and state policy-makers. Mentors in past years have included state senators, state water board members, water district executive directors, leading attorneys, and NGO executive directors. Class members are matched with mentors from perspectives differing from their own points of view.

Class members participate in state-wide water policy briefings, technical water issues tours, “shadow” their mentors, and develop a group paper or PowerPoint presentation on a water issue of current importance like water transfers, groundwater, water and growth, or water marketing.

The benefits of the program include better understanding of water issues, ongoing relationships with class members which are helpful to participants’ professional lives, and a continuing commitment to remaining in water-related professions. The Foundation is in the eighth year of the Water Leaders Program and many graduates have attained high professional status, including congressional staff members and a California State legislator.

Target Audience(s): Local decision and policy makers, agency partners

Educational Purpose: Capacity building

Web-Based Watershed Tools for the Classroom: A Pilot 319 Project for Grades 4-8 in Southwest and Northeast Missouri Watersheds

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Abstract

Water is costly to purify and transport, is impossible to substitute, and is essential to food production, economic development, plant and animal life. In the United States over 250 million people depend on rivers, lakes, streams and groundwater supplies for their drinking water. Approximately 179 water bodies are listed on Missouri's 1998 Final 303 (d) List for Impaired Waters and require immediate restoration to designated uses. Many streams suffer from low water volume, organic enrichment, siltation and polluted runoff. There is need to address surface runoff, groundwater, sediment, in-stream nutrients, and wildlife and fish populations from the perspectives of variety of stakeholders: researchers, state and federal conservationists, local citizen-based watershed groups, natural resource interest groups, landowners, farmers, young children, plus local officials.

The Internet plays an increasingly vital role in providing access to watershed information. The Missouri Watershed Information Network (MoWIN) proposed to develop and disseminate interactive watershed information Web sites for use in schools (grades 4-8) in five Missouri watersheds. Web site topics include history, agricultural activities and statistics, human impact on the environment, recreational resources, nonpoint source pollution and prevention, plant and animal life, plus water quality information. This project provides an additional tool for educators to improve science education library collections and integrate watershed education with science, social studies and other subjects and to help increase children's awareness of local community natural resources. Objectives include: providing information to encourage participation in watershed stewardship; increasing knowledge and understanding about watersheds; and facilitating development of skills to identify and prevent nonpoint source pollution. For additional information please visit the MoWin Web site: http://outreach.missouri.edu/mowin

Background

We all live in watersheds; they are natural habitats for people, animals and plants. We each have a responsibility to safeguard the future of our watersheds to ensure long-term sustainability for ourselves and future generations. Water plays a crucial role in most of our activities, including agriculture, industry and human settlement, and it is one of the most important resources available for human survival. People can survive without food for several weeks, but not without water.

According to Population Action International (1993, Introduction, ¶8 & ¶9),

> As population grows, the average amount of renewable fresh water available to each person declines. Hydrologists and other water experts agree that when certain ratios of human numbers to renewable fresh water supplies are exceeded, water stress and outright scarcity are all but inevitable.

> In recent decades these ratios have been approached or exceeded in more than two dozen countries. And the projected population growth of the next few decades could push yet another two dozen countries and hundreds of millions more people over the brink of water shortage. Moreover, predicted changes in global climate could redistribute or reduce water supplies and intensify storms, adding to the challenge of managing water supply.

Worldwide, millions of gallons of water are needed every day for personal, industrial and agricultural uses. Freshwater supplies are scarce because more than 97 percent of the Earth's water is saltwater in oceans and lakes. Water has an intrinsic value. It is costly to purify and transport, is impossible to substitute, and is essential to food production, economic development, and plant and animal life.

Over 250 million people in the United States depend on rivers, lakes, streams and groundwater supplies for their drinking water. In Missouri approximately 179 waters bodies are listed on Missouri's 1998 Final 303 (d) List for Impaired Waters and require immediate restoration to designated uses. Many have impaired aquatic habitat due to a combination of factors that include natural geology, climate, industrial activity, construction and agricultural land use. Others suffer from low water volume, organic enrichment, excessive siltation and polluted runoff.

There is need to address water resource issues of surface runoff, groundwater, sediment, in-stream nutrients, wildlife and fish populations from the perspectives of biological researchers, state and federal conservationists, local citizen-based watershed and natural resource interest groups, landowners, farmers, youth and young children. The environmental challenge lies in designing relevant programs that involve communities. Additional challenges facing natural resources experts include the ability to meet human needs without threatening the integrity of the ecosystems that form the basis of our survival. Addressing these issues should aim at increasing awareness, knowledge, understanding, and the capacity of local watershed groups and community members to identify and address relevant topics.

Rationale for the Project

Access to information, and knowledge about water conservation, usage, supply, recycling and reuse plus good water management can improve water resources. Through relevant information and education, all of us can become aware of, understand the importance of, and take responsibility for local watershed stewardship. The process of building awareness requires that outreach experts plan programs/activities that inform and educate citizens of all ages about the impacts of their actions/non-actions in their watersheds. It is also important to inform children at early stages so that they can grow up knowing the value of the environment. Various instructional methods that integrate school and communities are available to meet the need for disseminating environmental and watershed information.

Environmental education can provide a vehicle for young people to learn about various ecosystems, the interrelations among them, and their roles in preventing nonpoint source pollution. As society becomes more technologically oriented, elementary and secondary school science educators will be charged not only with preparing tomorrow's scientists and technologists, but will also be expected to foster an educated citizenry that is capable of weighing the potential benefits and limitations of new technologies and discoveries, and is able to make informed decisions about their lives and environment (President's Committee of Advisors on

Science and Technology [PCAST], 1997). With the advanced use of technology, the Internet is increasingly playing a vital role by providing access to widely scattered environmental information. In addition, a number of research studies suggest that geographic information systems (GIS) have considerable potential to promote elementary and secondary school students' inquiry-driven, interdisciplinary, project-based learning (Winn, Maggio, & Wunneberger, 1996) that spans local to global issues, particularly those focused on understanding and conserving the environment (Ramirez & Althouse, 1995).

Recent reform documents, including the National Science Education Standards (National Academy of Sciences, 1996) and the National Educational Technology Standards for Teachers (International Society for Technology in Education, 2000), emphasize the importance of environmental science in K-12 classrooms and incorporation of technology into curricular contexts. Like any other aspects of learning, watershed education is a process that increases knowledge and awareness about the environment and its associated resources. Curricula designs should include content that: a) develop skills and expertise fostering attitudes, motivations, and commitments to make informed decisions and take responsible action, b) enhance critical thinking and problem-solving, and c) increase appreciation for natural resources.

Furthermore, research has shown that education can play an important role in facilitating change. Education increases our capacity to make informed decisions and to act effectively in addressing environmental and developmental issues. Environmental education curricula need to be well designed, targeted, and coordinated. They need to have measurable goals, and to reflect priorities in environmental protection; with strong linkages between programs, collaborating state and federal agencies, citizens of all ages and local communities. Strong links also need to exist between watershed education in the community and that taking place in local schools, colleges and universities.

Relevant outreach programs should be designed to provide learning opportunities:

- Awareness of local watersheds resources,
- How to make a contribution towards ensuring adequate food, clean water, and long-term sustainable agriculture, and
- Ensuring that waters maintain designated uses.

One approach that could be used in local communities is to bolster environmental education for the several hundred thousand youngsters at primary schools throughout the state of Missouri using locally available Internet resources in addition to traditional methods of instruction. Currently, Missouri state and federal agencies, educational institutions, individuals, citizen-based watershed groups, business and industry groups are collaborating to develop and implement watershed and environmental education programs geared towards point, nonpoint source pollution, watershed restoration and water quality through water festivals, 4-H and other kids programs.

Objectives that focus on Web resources for students, grades 4-8, include:

- Provide Internet resources to facilitate increase of awareness, knowledge and encourage participation in watershed stewardship activities.
- Design and provide interactive Web sites to initiate activities for use by science educators, grades 4-8. Information includes natural resources, animal and plant life, history, agricultural land use, plus demographics.

- Design and develop mini-Internet research quizzes based on local watershed activities.
- Plan and develop instructional workshops/demonstrations for science educators to demonstrate use of materials.

Project Description

Mitchell and Graham (1996) recognize that "school-based watershed education programs must coexist within two worlds: the world of education and the institutional structure of schools, and the community in which most of the activity occurs" (p. 938). In addition, programs must also negotiate the worlds of the Missouri Department of Natural Resources Environmental Education and The Show-Me Standards curriculum. Recognizing this complexity, project staff has developed interactive Web-based instructional materials to provide grades 4-8 teachers and students with a variety of technology-based materials to learn about shared natural resources. Web sites include information about:

- History
- Agricultural activities and statistics where applicable
- Human impact on the environment
- Recreational resources
- Nonpoint source pollution and prevention
- Plant and animal life
- Water quality information

Interactive Web sites provide students with animated information on the water movement process, hydrologic cycle, uses of water in and outside the home, fun ways of conserving water, water treatment process, stormwater movement and others. Interactive sites are posted on the MOWIN Web site: http://outreach.missouri.edu/mowin/Project31903/ interacmowin.html

Information will also be available on CDs to provide equal opportunity for areas that have no or slow Internet access. This project is intended to be an additional tool for educators' science education library collections. The project focuses on protecting the environment with an ultimate goal of preventing and managing source water pollution, preserving water quality and quantity, and restoring water bodies to their designated uses. The program has been designed for implementation in elementary schools in Elk River, James River, North Fork Salt River, Sac River, and Spring River watersheds (see Figure 1). Watersheds were determined using the United States Geological Survey (USGS) 8-Digit Hydrologic Unit Codes.

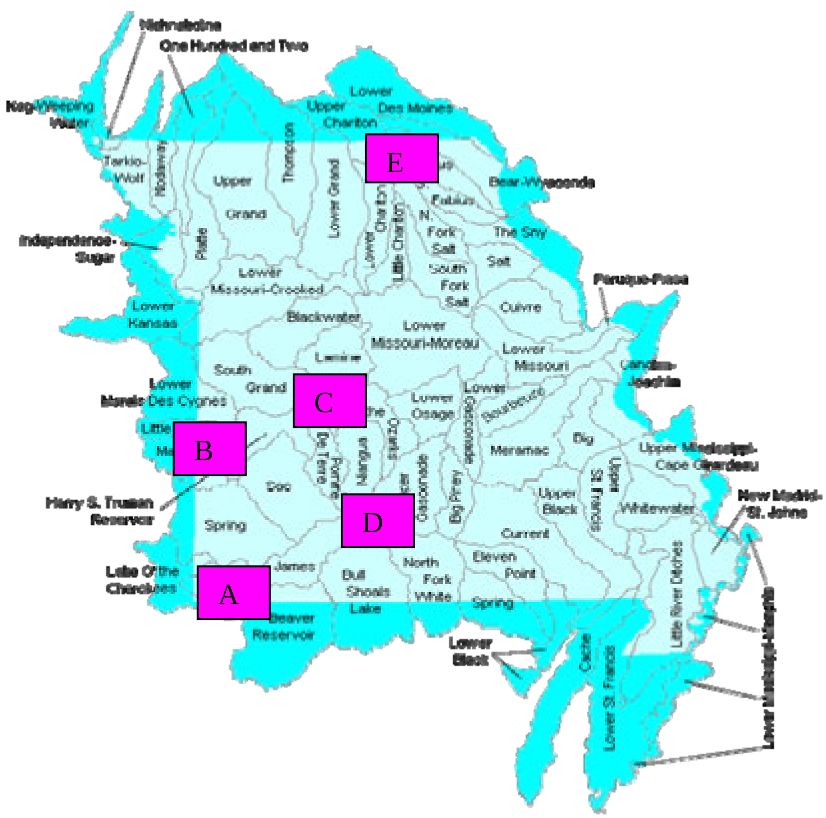
Interactive Web site information will be offered to teachers for introducing students, grades 4-8, to watershed management, nonpoint source pollution, and relevant demographic and natural resource facts. Local professional and community specialists will facilitate hands-on demonstrations, will assist in planning, implementing and evaluating the impact of this project, and will determine if results can be replicated statewide (in Missouri). We expect young people to begin to take interest in natural resources and to act to protect and preserve them. We also expect youth to ask questions that may help enhance watershed restorative and management of local communities.

Conclusion

Outreach efforts must go beyond education and information. They must go beyond the "traditional knowledgeable" adult population and include citizens of all ages capable of understanding various levels of information. Every citizen should be provided with the opportunity to get involved, take action, and contribute to positive environmental changes. Paying attention to all age groups may help us learn what motivates people to act and perhaps be useful in attaining our project success. Working with schools and students allows collaboration with parents – thereby involving the whole community. Our goals include building strong communities while achieving local objectives. Focusing on local, social and economic environmental needs makes it possible to find ways of creating opportunities that improve standards of living. Outreach and awareness efforts include workshops for youth and teachers, after school programs, computer games at water festivals across the state, and instructional CDs with lists of interactive Web sites for schools. To date, over 200 CDs have been used to disseminate this information. Teachers and youth leaders can access these sites at: http://outreach.missouri.edu/mowin/ Project31903/interacmowin.html

Our guiding principle for this project is that if students can see, feel, experience and recognize their local and natural environmental conditions, they will be better equipped to a) understand the basic ecological relationships and concepts they are taught through formal education, b) relate concepts to their environments, c) learn to appreciate and value local community resources and d) view watershed preservation as an important aspect of life at early ages.

Figure 1. Project locations



Elk River Basin	A	James River Basin	D
Spring River Basin	B	North Fork Salt River Basin	E
Sac River Basin	C		

Madzura, page 5

Acknowledgments

MoWIN's success is a result of hard work by many individuals and groups. All our partners are involved in reviewing plans, designs and the compilation of information. MoWIN Advisory Council members and University Outreach and Extension (UOE) specialists continuously contribute ideas to enhance MoWIN Web site information and the e-curriculum, answer citizen queries, and offer invaluable day-to-day support.

Collaboration with state and federal agencies, non-governmental organizations, and business and industry, was and continues to be MoWIN's emphasis in adult and youth Internet programmatic efforts. The involvement of the Clarence Cannon Wholesale Water Commission, East-West Gateway Coordinating Council, St. Louis Metropolitan Sewer District, Soil and Water Conservation Districts, the James River Basin Partnership, the Watershed Committee of the Ozarks and Mid-America Regional Council offered additional platforms for MoWIN to reach broader communities directly involved with watershed and water quality activities. Entities directly involved in this youth project include:

- University of Missouri Outreach & Extension
- Bryant Watershed Atlas Project volunteers
- James River Basin Partnership
- Watershed Committee of the Ozarks
- Clarence Cannon Wholesale Water Commission
- Missouri Department of Natural Resources

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Team WET Schools: Building School-Community Partnerships to Promote Water Education and Stewardship Among Underserved Urban Youth

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Abstract

By using James S. Hogg Middle School as a model case study, staff from the Council for Environmental Education (CEE) will illustrate how Team WET Schools, a water-focused urban environmental education program, operates. The Team WET School model illustrates major strengths of the program, the ability to reach diverse students and teachers with water education and service learning opportunities, and the ability to involve a variety of non-traditional partners in environmental education. The session will focus on how local organizations and businesses have worked and can work with the CEE national office in individual school buildings to empower urban students and teachers to become responsible water stewards.

Since the spring of 2002, CEE has worked closely with the City of Houston and the Harris County Storm Water Management Joint Task Force (JTF) to support the water education and stewardship efforts at Hogg Middle School, a primarily Hispanic school located near downtown Houston. CEE and the JTF teamed up to offer workshops to help educators integrate activities from the *WET in the City, K-12 Curriculum and Activity Guide* into school curricula. Twenty-three Hogg teachers, representing 39% of the faculty from across the disciplines, participated in the workshops and are actively using *WET in the City* activities in their classrooms.

Target Audience(s): Local decision and policy makers, agency partners, households, neighborhood organizations, service clubs, environmental/conservation NGOs, soil and water conservation districts, specific ethnic groups

Educational Purpose: Education

"Water For West Texas" – A New Extension Program

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Abstract

WEST TEXAS! What a wild, scenic and yes, often desolate area it is. And what a rugged, self-sustaining and pioneering-type of person settled West Texas! From the earliest paleo-Indians, Apaches, Comanche, Jumanos or Pueblos – to the Spanish and Mexican settlers, later, the first Anglo ranchers – all learned to know, respect and preserve the rare and precious waters or perish. West Texans never had to be taught that their water resources, whether flowing in the Pecos or Rio Grande Rivers or from a spring, or lying below ground in an aquifer, were precious. This is instinctive to people living and working in dry, arid climates and in deserts. Truly here, "Water IS Life!" or, "Agua ES Vida!"

Historically, considerable irrigation water was produced by both the Pecos and Rio Grande Rivers. Increased upstream demands for irrigation and domestic uses, plus saltcedar invasion and a ten year drought, have resulted in less water and poorer quality water for river irrigators. The balance of the irrigation is from ground water or from still healthy flowing springs. Other historically large springs in the region once produced pure, cool irrigation waters and provided recreation for many, but now are dried up due to overuse of the aquifers. This new program has been developed to assist the residents of the region through a variety of methods including: educational exhibits and presentations, demonstrations, workshops and seminars, applied research programs, publications, media articles and through collaborative efforts with a diverse group of agencies, governmental units and non-profits.

Target Audience(s): Diverse, iinclude all listed in CFP plus irrigation districts and groundwater conservation districts in West zone

Educational Purpose: Information, education

The University of Vermont Watershed Alliance: Using Youth Education and Service to Engage Communities in Local Water Quality

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Abstract

Audience size and limited human and financial resources limit Extension's ability to educate individual homeowners, landowners, local officials and others. Leverage and multiplication of effort is needed.

The Watershed Alliance (WSA), a youth water quality/watershed education, monitoring, and service program, prepares youth to inform and engage communities in water quality issues. Water education often focuses on classroom education and student monitoring. WSA adds student community service and information components to enhance community understanding of water quality issues, improve access to information, and spur community action for watershed protection.

Students increase awareness and stimulate action by presenting local water quality data to select boards and town government. Student, through water monitoring, have detected water quality problems in several towns. Reporting these problems have led to a "boil water" advisory, the emergency repair of a local WWTP, revision of WWTP operations, and increased community awareness of water quality. Students work with local community groups in public awareness, education and data collection. Students developed media efforts to increase local awareness and engage the public to address pressing local water quality problems.

The service component and database effort promotes local ownership and community responsibility. The database provides easily accessible and useful information in an understandable form. Because water quality data is locally collected, stored and used by students, there is ownership and trust of the data. Schools become community information resources on water quality. Communities are more responsive and engaged in water quality protection and improvement when local youth monitor, report, and educate about local waters.

Target Audience(s): Households, homeowners, local decision and policy makers

Educational Purpose: Education, capacity building

Watershed Development in Una District of Himachal Pradesh in India

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Abstract

In the rain-fed, irregular, hilly terrain of District Una in Himachal Pradeshthe, the Integrated Watershed Development Project (IWDP) is in operation, funded by the World Bank. In the present paper an attempt was made to investigate the effectiveness of various methods used for water harvesting and its conservation in the study area.

Data was collected from members of the village development committees (VDCs) through interviews and participatory observations. Analysed data indicated that under the IWDP Project (through VDCs developmental works particularly related to minor irrigation) water management, watershed development and soil conservation have been carried out.

A large number of check dams and specially designed ponds have been constructed for harvesting rain water. In the study area, where water was scarce, the stakeholders have now adopted fish farming which has improved their economy and are conserving water in the ponds. A large number of trees have been planted to slow down water runoff in the project area, to check soil erosion, and to regenerate the depleted forest cover.

The paper highlights formation of the village development committees through Participatory Rural Appraisal methodology, as well as their functioning and water harvesting at the micro-watershed level. To continue watershed development in areas where topography is irregular and water is scarce, various development agencies in the hilly regions should start planning to link up existing VDCs with other institutions. The significant achievements and drawbacks of the approaches used under the IWDP will be discussed in the presentation.

Target Audience (s): Agricultural commodity groups, farmers, environmental/ conservation, non-government organizations

Educational Purpose(s): Education, capacity building

Best Practices for Environmental Field Days

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Abstract

Over 75 % of Minnesota counties report holding environmental field-day programs, involving thousands of 4-6 grade youth. The investment of time and money by state and federal governments, and non-profit organizations to support these programs for K-12 schools is significant. To be more effective, these programs require expensive planning and partnerships as outlined in the best practices for environmental field days researched by the environmental science education working group at the University of Minnesota. We have identified a list of best practices, from both literature and practical experiences, for the organizers and presenters at these events, resulting in guidelines for improving the impact these programs can have on young people.

The intent of the Best Practices for Environmental Field Days Program is to provide organizers, presenters, participants, and volunteers of environmental field day events with practical research-based information to increase the success of their events, improve student learning and retention, and make meaningful strides in the development of an environmentally literate citizenry.

This presentation will highlight the best practices program for planning and delivering effective environmental field day programs.

This is a spotlight program for the University of Minnesota Extension Service.

Target Audience(s): Agency partners, environmental/conservation nongovernment organization, other natural resource professionals

Educational Purpose: Information

Teacher Perceptions of Iowa Workshop Model Aspects for Fostering Use of Project WET

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Abstract

State partners of national environmental education (EE) programs contribute to professional development in EE through their program delivery. This study describes teacher perceptions of individual elements of EE workshops provided by one such program, Iowa Project WET. The study found that educators associate three types of workshop activities with successful classroom integration of Project WET activities:

(a) Experiencing activities first-hand
(b) Interacting with other educators
(c) Learning about the Project WET Activity and Curriculum Guide.

Almost 90% of survey respondents integrate some of the activities they experience during the workshop into their classrooms. Some of these teachers also integrate additional activities not presented in the workshop. Multiple measures of activity use indicate the respondents select and use activities to meet curriculum goals. Survey data and phone interviews show that respondents utilize each activity they implement to meet multiple goals related to the curriculum, student interactions, and assessment of student knowledge. Respondents reported that insufficient planning and class time limited use of activities. Suggestions are made for improving the workshop model.

Target Audience(s): Environmental/conservation nongovernment organizations

Educational Purpose: Education

How Does Risk Information Shape Protective Behavior and Support for Policy to Mitigate Risk in the Environment?

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Abstract

The purpose of this study is to understand how experiential and external sources of risk information influence behavior to reduce arsenic exposure and opinions about policy to reduce arsenic in the environment. External information sources were the self-reported arsenic level and total information use. Experiential information was perceived overall water quality and arsenic-related health effects. We applied the common sense model (CSM) that illustrates how people process information to construct representations that guide responses to health threats. Of 649 surveys mailed to private well owners with arsenic levels that exceeded the current arsenic drinking water standard, 545 (84%) were suitable for analysis. Structural equation modeling quantified relationships based on the CSM and fit the data with behavioral outcomes (RMSEA=.045) or policy outcomes (RMSEA=.045) and explained 57% and 55% of the variance in behavior and policy opinions respectively. External information sources had their greatest effect on behavior through certainty about knowledge and control methods and on policy opinion through understanding causes of arsenic. Experiential information (predominantly water quality) had its greatest effect on behavior through the emotional representation, health and property value consequence dimensions and the exposure identity/cause dimension. Experiential and external sources of information influenced behavior while external information was the dominant influence on policy. Information should 1) promote understanding lab results and provide guidance for 2) interpreting and responding to perceived overall water quality and 3) selecting effective arsenic control methods in order to promote protective behavior. Public information should educate the public about arsenic causes to promote groundwater policy support. People need to understand how to identify, causes and consequences of, and how to control both risk exposure and risk in the environment to foster comprehensive environmental health prevention.

Target Audience(s): Agency partners, NGOs

Educational Purpose: Information, communications, education

Evidence Supporting Yearly Community Well Testing

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Abstract

An evaluation of an arsenic well test program (WTP) offered in 19 of 37 towns in Wisconsin's arsenic advisory area showed that participants in the one town that offered the WTP each year over 3 years 1) tested for arsenic more often 2) used more arsenic-related information, 3) rated information sources as more useful, 4) had a greater recognition of being at risk for having arsenic-contaminated well water, 5) selected a lower arsenic level for identifying their water as unsafe, 6) were less likely to agree that the newly revised drinking water standard was too strict, and 7) had more confidence in how their town officials were handling the arsenic problem than participants in towns offering the program only one time. An ongoing program offered at the local level with cooperation from local officials may foster trust at the local level that in turn enhances the acceptance of prevention information. This evaluation research, a mailed survey with a response rate of 85.4% (N = 1233), also shows that collaborations between university students and agencies can produce results useful to both agency staff and researchers.

Target Audience(s): Agency partners, NGOs

Educational Purpose: Information, communications, education

A Utilization-Focused and Theory-based Evaluation of an Arsenic Well Testing Program

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Abstract

A utilization-focused and theory-based evaluation study was conducted to understand how private well users responded to an educational arsenic well test program (AWTP). The common sense model (CSM), a health behavior theory, has shown that people process health threat information to formulate personal understandings (representations) that guide responses to threats. In this case the threat was arsenic. The CSM was applied to measure arsenic information use and perceived usefulness, arsenic representations, and outcomes of water safety judgments, policy opinions, and protective behavior. In communities that offered the AWTP, 1496 surveys were delivered to households, with 1237 surveys going to households that tested through the AWTP and the balance to households that did not test through the program. Of the surveys delivered, 1233 (82.4%) were suitable for analysis. Program staff estimated that about 30% of community households tested through the AWTP and study results indicated about 40% tested privately. It is important to provide arsenic information available to the general public. Information mailed with the well test is used the most by all participants and is also considered a very useful source for informing well water decisions. Participants who did not test for arsenic were less aware of arsenic risk. Over 60% of participants with arsenic levels over the current drinking water standard perceived their water as at least somewhat safe. It is important for people to understand how arsenic drinking water standards are selected and what they mean. Participants living in a community that offered the AWTP each year adopted lower arsenic safety thresholds compared to those living in a community where arsenic was highly publicized but the AWTP was offered once over 3 years. Ongoing education may promote more accurate understandings than high publicity.

Purpose

The purpose of this evaluation research is to understand *how* a Wisconsin arsenic well-testing program was working. The research sought to highlight how 1) private well users responded to an educational arsenic well test program, 2) four different types of information were related to outcomes through personal understandings of arsenic in well water, and 3) community awareness was related to adopting a lower arsenic drinking water standard. The purpose of this paper is to discuss selected study findings and implications for outreach programs.

Background

The purpose of most well test outreach programs is to educate private well users about groundwater and well contaminants to promote: 1) stewardship of groundwater resources and 2) informed decisions about managing their well to optimize well water quality for various uses including safe drinking water. An educational **arsenic well test program** (AWTP) is offered in a geographic area of Wisconsin designated as an arsenic advisory area (AAA) where 23.2% of tested wells have arsenic levels at or over the current drinking water standard of 10 micrograms per liter (µg/L). It is estimated that about 4,700 wells used by about 11,700 people have levels $\geq$ 10 µg/L.

Arsenic in the AAA

The main arsenic source is from a naturally occurring sulfide deposit in the aquifer used for most private wells in the area. In the AAA, this deposit is close to the surface such that wells are likely to transect the arsenic rich deposit. Two processes are believed to release arsenic to the groundwater: 1) an oxidation process initiated when the water table drops and exposes arsenic deposits to air, and 2) reduction processes from anaerobic conditions within wells. The growth of aerobic and anaerobic bacteria within the borehole also contribute to the release of arsenic (Gotkowitz, Schreiber, & Simo, 2004). Increasing arsenic levels in the AAA have been attributed to decreasing groundwater water levels at a rate of 2–4 feet per year due to residential and industrial development (Riewe, Weissbach, Heinen, & Stoll, 2001).

The Arsenic Well Test Program (AWTP)

Towns make the decision of whether to offer the program because town officials do the work of notifying the community, collecting a batch of water samples and transporting the samples to the lab. Mass sampling allows test labs to charge a reduced rate in the range of $20 rather than $35 for the arsenic test. Residents pick up their samples at an educational town meeting conducted by state and local Department of Natural Resources (DNR), UW-Extension, and county and state public health department staff. As of February 2003, 20 of 37 towns in the AAA offered the AWTP with only one town offering it more than once. Overall, about a third of residents tested through the program and about 30–50% (depending on the town) attended the town meeting to pick up their test results. Test results were mailed to those not attending the meeting.

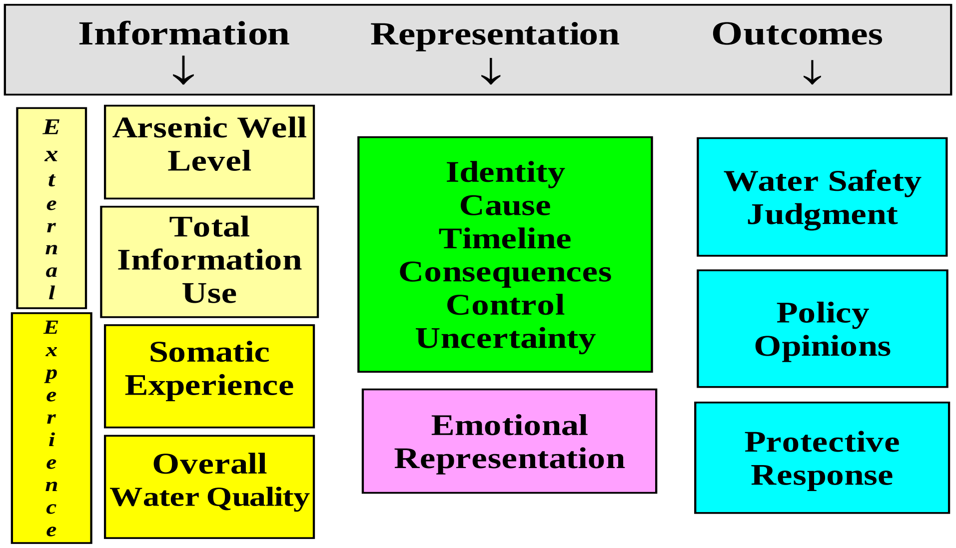
Agency sources of arsenic information are available at the town meeting, by phone contact with staff, and from brochures and Web sites. Non-agency sources of arsenic information include: newspaper articles, television programs, salesmen of arsenic filters, well drillers, health care providers, non-agency arsenic Web sites, and friends or neighbors. Information provided at the town meeting and in brochures included: how to identify an arsenic problem, causes of arsenic in well water, how and why arsenic levels are changing with time, health consequences of arsenic exposure, and how to control arsenic to prevent consequences. The risk message delivered with the program changed each year. The U. S. Environmental Protection Agency (EPA) proposed an arsenic standard of 5 µg/L in 2000, 10 µg/L in 2001, and, the federal arsenic standard was changed from 50 to 10 µg/L in October 2001. The Wisconsin arsenic brochure developed in 2000 recommended that people with arsenic levels between 5 and 50 µg/L *may* want to use another water source (Wisconsin Department of Natural Resources, 2000). The Wisconsin arsenic brochure developed in 2001 stated that people with arsenic levels at or greater than 10 µg/L should stop drinking their well water (Wisconsin Department of Health and Family Services, 2001). People may feel uncertain about how they should identify arsenic risk when different guidelines have been proposed and when the drinking water standard has been recently revised.

A utilization-focused and theory-based evaluation of the program was designed to understand how people residing in AWTP communities responded to the program. *Utilization-focused evaluation* is designed to generate findings that can be directly used by program staff (Rossi, Freeman, & Lipsey, 1999). Utilization-focused elements included measuring patterns of 1) information use, perceived usefulness, and preferences, and 2) actions used to reduce arsenic exposure among people in communities offering the AWTP. *Theory-based evaluations* identify plausible causal mechanisms to explain how program activities are related to outcomes (Rossi et al., 1999). Theory-based evaluations 1) strengthen claims of causal relationships, 2) identify successful causal mechanisms that can be applied to other programs, and 3) target measuring modifiable intermediating variables that can specify program changes (Reynolds, 1998). We selected the common sense model (CSM), a health behavior theory illustrating personal understandings of arsenic as the causal mechanism that explains how information leads to outcomes.

The CSM was selected as a good fit because it embodied program processes and the program philosophy of informed decision-making. Twenty-five years of CSM research shows that people process health risk information to formulate structured personal understandings or representations that guide behavioral and emotional responses to health threats. People actively process information to "make sense" of a situation and respond in a way that fits their common sense understanding (Leventhal, Brissette, & Leventhal, 2003; Leventhal, Nerenz, & Steele, 1984).

Information sources used to form CSM representations are characterized as information 1) stored in the memory, 2) from external sources, and 3) from personal experience. Personal understandings, referred to as **cognitive representations**, are comprised of five or six dimensions: identity, cause, timeline, consequences, control, and sometimes coherence (Hagger & Orbell, 2003; Leventhal et al., 2003). *Identity* pertains to how a threat is recognized and labeled. *Cause* is perceived causal mechanisms for a health threat. *Timeline* is beliefs about how a threat will change over time and its duration. *Consequence* is beliefs about how the threat impacts their lives. *Control* reflects beliefs about controlling a threat. *Coherence* is the degree to which people have an overall understanding or comprehension of the threat (Moss-Morris, et al., 2002). We replaced the concept of *coherence* with *uncertainty*, a central concept in risk assessment and communication (Griffin, Dunwoody, & Neuwirth, 1999). **Emotional representation**s are the emotional feelings elicited by information and the cognitive representation. **Protective responses** are a function of information use and their cognitive and emotional representations. The CSM provided a framework (see Figure 1) for selecting variables used to quantify 1) information sources, 2) representations (risk understandings), and 3) outcomes of safety judgments, opinions about policies to address root causes of arsenic, and responses to reduce exposure.

Figure 1. Study framework based on the Common Sense Model



Methods

Survey instrument

A survey was constructed to measure concepts depicted in the study framework and to also measure the utilization of arsenic information. The survey was pre-tested using methods outlined by Dillman (2000). ***External and experiential sources of information*** were measured. *External information* sources were: 1) self-reported arsenic level and 2) total information use (calculated by summing all sources used and how frequently they were used). Total information use reflects the amount (or dose) of information used as well as their motivation to seek information. Measures of information use, perceived usefulness, and preferences provide measures of program utilization, satisfaction and information preferences. They also indicate information sources used to supplement program information. Ex*periential information sources were*: 1) perceived arsenic-related health effects, and 2) perceived overall water quality.

Variables selected to measure personal risk understandings or **representations** were derived from interviews with AWTP staff, community residents, and research literature exploring correlates of protective behavior. Thirty-five variables were selected to measure how arsenic risk is identified, its cause, timeline, consequences, control, feelings of uncertainty, and negative emotions. Variables selected to measure **outcomes** included 1) water safety judgments, 2) policy opinions (including whether the DNR should mandate well drilling methods, if towns should discourage new industry that uses a lot of water, and whether communities should reduce groundwater withdrawal by drilling fewer private wells and encouraging water conservation among residents), and 3) protective responses used to reduce arsenic risk. Measures of actions to reduce arsenic exposure illustrated who is doing what and were categorized as: no action, ineffective action, somewhat effective action, or as a state recommended action for reducing arsenic exposure. Quantifying total information use, representations, and the protective response allowed an analysis of relationships among these variables.

Design

Surveys were mailed at a single point in time 0.5–3 years after the AWTP was offered to community residents. The sample consisted of: a) all households that tested their wells through the program and had an arsenic level $\geq$ 5 µg/L (N=1154), and random samples of b) AWTP households with wells from 1–4 µg/L (N=100) and c) households who didn't test their well through the AWTP (N=259). Instructions asked that one household adult was to complete the survey. A modified Dillman (2000) method was used that entailed up to five contacts by mail: 1) pre-notice letter, 2) survey, stamped return envelope and $2 incentive, 3) postcard reminder, 4) replacement survey and return envelope, and 5) final postcard reminder.

Analysis

A data management and analysis product called SPSS (Statistical Package for the Social Sciences) was used for the descriptive analysis and analysis of variance. The software LISREL was used for structural equation modeling. The modeling analysis was conducted on a sub-sample of AWTP participants with arsenic levels $\geq$ 10 µg/L.

Selected Results and Implications for Practice

Well testing

Two thirds of participants not testing through the AWTP privately tested their well. Across communities, agency staff indicated that about 30% of households were testing through the AWTP; thus about 40% were testing privately. The AWTP may prompt increased private testing due to the awareness raised by advertising the AWTP. This proposition cannot be answered with this study as it lacked a no-treatment comparison group. It is important to develop sources of arsenic information that are available to those who test privately. No-test-participants have less awareness of the arsenic problem and less awareness that their well water may be a source of arsenic exposure. Considering information use, perceived usefulness, and preferences among the no-test group, it may be possible to reach no-test-participants using a mailing from the town or DNR and through newspaper coverage.

Arsenic level

The arsenic level had the largest effect of all information sources on protective responses. It is an essential source of information for private well users. Arsenic well level knowledge shapes information use, personal understandings and outcomes. Other researchers have found that nitrate levels (Poe, van Es, VandenBerg, & Bishop, 1998) or radon levels (Weinstein & Sandman, 1992) were strongly related to perceived safety and/or actions to reduce risk. People have a tendency to recall lower levels of arsenic or to not remember if they have tested for arsenic. People who couldn't recall their arsenic level used less information than those who reported even low arsenic levels. Those not testing used far less information than other participants. Strategies to help people keep track of well test information such as a refrigerator magnet or a sticker that could be placed in a handy location (such as a calendar) might improve the accuracy of self-reported well levels. People will likely have a better recall of the meaning of a test result than they do of the actual result. In a study of cholesterol level recall, all study participants accurately recalled their cholesterol risk status while only about half could recall their actual cholesterol value (Glanz, et al., 1990). Accurate recall of the meaning of their test result may be facilitated by providing them with their risk status (e.g., unsafe – safe) along with their arsenic well level. A disadvantage of this approach is the tendency for people to think that levels above a threshold are safe and levels below are unsafe rather than more accurately understanding that the relationship of exposure level to risk is usually linear with subtle differences just above and below a safety threshold (Weinstein, Sandman, & Roberts, 1989). It would be essential to communicate how their risk status was determined and to provide further information about how arsenic drinking water standards are selected.

Information use

AWTP participants used information mailed with the well test most often, rated it as the 3rd most useful information sources (after conversations with agency staff and staff presentations at the town meeting), and rated it as the most preferred source. Private well testers rated information mailed with the test as most useful and the most preferred sources of information, but it was used slightly less than information from other mailed sources; likely because some test laboratories send no information with the well test report. When information use, perceived usefulness, and preferences are considered together, information mailed with the well test is the most important information for AWTP and private well testers combined. Further research is needed to understand information that is currently provided by private testing labs and the feasibility of using this channel to better meet information needs. Information received with a well test is available at a “teachable moment” when well users are motivated to understand their test results. This information could include links to other sources of arsenic information so people could seek further information from reliable sources more easily. It is important that this information is easily understood by the general population.

On average, participants used nine “hits” of information from 5 different sources. Arsenic risk information should be publicly available from a variety of mediated and personal contact sources. A meta-analysis of studies evaluating patient education found that offering information from a variety of mediated and personal information sources was related to adopting preventive behavior (Kok, van den Borne, & Mullen, 1997; Mullen, et al., 1997). Attempts should be made to improve the accuracy of arsenic risk information that is provided by non-agency sources. For example, the Wisconsin DNR provides training for well drillers. In the AAA, this training currently includes information about arsenic and about well drilling methods that can mitigate the amount of arsenic in well water. It may be possible to provide information through local sources such as town newsletters or local newspapers, although information from newspapers was rated as minimally useful for making well water decisions among participants who tested their wells. It is important to develop information sources for people who test privately.

Information use and outcomes

Total arsenic information use (from external sources) had its greatest influence on protective behavior through certainty about control methods. Information should promote informed decision-making about selecting appropriate control methods by providing information that allows consumers to compare different arsenic control methods based on cost and removal efficacy.

Total arsenic information use was related to policy opinions through beliefs about causes of arsenic in well water. In a synthesis of evidence related to environmental literacy, Coyle (2004) states that people need to understand causal sequences that link human actions to environmental problems in order to take action or support policies that address the root causes of environmental problems. Understanding causes of arsenic in well water was strongly related to support for policies to decrease the withdrawal of groundwater such as community-wide water conservation and reducing the number of private wells being drilled into the arsenic-containing aquifer. These results support Coyle's claim that environmental stewardship is promoted by educating people about these causal relationships. The arsenic town meetings provided detailed information about the causal relationships between water use, groundwater levels, and aquifers that may have been a factor in developing these beliefs and opinions.

Perceived water quality

Sensory qualities of water were most strongly related to identifying risk, health consequences/negative emotions, and water safety judgments. People need specific guidance for how to interpret and respond to sensory qualities of water. While people generally know that arsenic cannot be sensed, it is important to remind the public that arsenic cannot be tasted, smelled or seen and that well testing is the only way to know whether they have arsenic-contaminated water. It is likely that sensory qualities of water will remain a strong influence on perceptions of water quality/safety and to a lesser degree on protective behavior because experience is a psychologically powerful source of information (Leventhal, Safer, & Panagis, 1983).

Somatic experience

There was a clear linear relationship between arsenic level and perceived arsenic related health effects, but relatively few perceived these health effects (about 11%) which attenuated its effect as a source of information in the modeling analysis. Somatic experience was most strongly related to beliefs about health consequences and negative emotions.

Safety threshold

People selected a wide range of personal safety thresholds (the highest arsenic level they considered safe) ranging from 0 µg/L to > 100 µg/L. Safety thresholds were related to the protective response through safety judgments. When a safety standard has been revised, people need more information about why and how it is selected. Media sources tend to cover controversy more than synthesize facts and tend to cover opposing points of view about an issue to provide balanced reporting (Dunwoody, 1999). These reporting tendencies may lead the public to perceive more controversy about the revised drinking water standard than was the case. Agency professionals should assess beliefs about safety thresholds so specific public questions about safety thresholds can be addressed.

Protective response

About half of participants with arsenic levels over the current drinking water standard are not effectively reducing arsenic exposure. Researchers exploring responses to radon risk found that roughly half of participants with high radon levels were not taking action to reduce exposure (Weinstein & Sandman, 1992; Doyle, McClelland, Schulze, Elliott, & Russell, 1991). Selecting a higher safety threshold than the current drinking water standard, optimistic beliefs about water safety, perceived barriers (cost and effort) to controlling arsenic, and uncertainty about arsenic control methods may partially explain why participants do not take action to reduce their exposure. These are all elements that can be addressed in educational materials provided to private well owners. For example, people need information about arsenic control methods that allow them to compare the costs and benefits of each method to promote informed decisions.

Community awareness and adopting a lower arsenic drinking water standard

Participants living in a community that offered the AWTP each year adopted a lower arsenic safety threshold compared to those living in a community where arsenic was highly publicized but the AWTP was offered once. Education may promote more accurate understandings than publicity.

Application of the CSM to Outreach Programs

A meta-analyses of health education and health promotion programs found that the application of social science theory to program planning was a strong determinant of effectiveness (Kok et al., 1997). Environmental communication researchers recommend applying psychosocial behavioral theories to the design of outreach programs to enhance program effectiveness (O'Keefe & Shepard, 2002). The CSM, together with findings from this study, could be used to modify information provided to well owners to meet information needs identified by this study and to employ CSM derived knowledge about how people use and apply information about health risks.

Summary

Efforts should be made to make well test results and the water safety implications of their results easier for people to recall. User-centered information should be included with the arsenic well test and should also be available from a variety of sources. Information should clearly explain the revised arsenic drinking water standard, provide information about various arsenic control measures that allow people to compare measures based on cost and effectiveness, and provide guidance for how people should interpret and respond to perceived sensory qualities of well water. Programs should provide education about the causal sequences that link human activities to increasing arsenic levels to promote support for policies to address the problem on a larger level. The CSM may be a useful framework for designing risk information provided to private well users. Information designed to educate the public based on cognitive understandings of threats would include: 1) how they can identify an arsenic problem (an arsenic level compared to a safety threshold); 2) how safety thresholds are determined; 3) factors that identify their level of exposure to arsenic (arsenic level, amount of well water consumed, and length of time used); 4) potential health consequences of exposure; 4) how arsenic levels are expected to change over time; 5) methods of reducing exposure including the costs and benefits of each; and 6) causes of arsenic in groundwater. Outreach programs that foster a comprehensive understanding of well water quality and well water safety promote informed beliefs and decisions about water treatment and groundwater protection.[1]

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[1] See presentation handout, *Implications for Evaluation and Outreach Programs,* in the Appendix.

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APPENDIX (Severtson)

Implications for Evaluation and Outreach Programs

Implications for Evaluation

The process evaluation of information use suggests communication strategies based on information use, perceived usefulness and preferences. People who participate in a program may use different 'doses' of information that can be related to outcomes. This evaluation measures all arsenic information sources used including non-program information.

Members of a target audience who do not directly participate in a program may use available program information sources. It may be useful to include non-program participants in your evaluation to understand their utilization patterns, preferences, outcomes and barriers to participating in the program.

This was not an evaluation of program effect because all participants were in the treatment group. They all lived in a community that offered the arsenic well test program (AWTP). A representative comparison group of people living in Arsenic Advisory Area towns that did not offer the AWTP would have provided this comparison group. The time and cost of selecting a representative sample of this group precluded including them in this study but it would have been a useful addition.

The goal of this evaluation research was not to measure the effect of the AWTP, but rather to understand how arsenic information influenced judgments and behavior. The ability to draw causal inferences from a cross-sectional study was enhanced by modeling potential causal relationships using a theory selected to explain how information influences judgments and behavior. The coherence of study results are supported by study relationships that fit the theory and that are supported by other research. Knowledge of how interventions work can be used to improve programs and can be generalized across various programs utilizing the same intervention.

An 87% response rate was obtained using a modified Dillman method (Dillman, 2000) outlined in the abstract. The additional time and cost of using this method improved the validity of study results.

This evaluation research, a mailed survey with a response rate of 85.4% (N = 1233), also shows that collaborations between university students and agencies can produce results useful to students, researchers, and agency staff.

Implications for Well-testing Programs

The common sense model (Leventhal, Brissette, & Leventhal, 2003) was a useful framework for understanding responses to arsenic information and could be applied to other environmental health risks. This model provided data that could be used to specify risk message content and

Appendix (continued)

delivery strategies, and may illustrate successful causal mechanisms for outreach programs. Representation measures suggest information needs and partially explained differences in outcomes.

Results indicated that over 40% of town residents tested privately while about 30% tested through the agency sponsored AWTP. An agency-sponsored AWTP may prompt private testing behavior that is not evident in program participation. Further research is needed to substantiate this claim.

People have different information preferences and use multiple sources of information. It is important to offer information from multiple sources that are preferred by the public and considered as useful sources. Participants that tested through the well test program preferred mailed information, a town meeting educational session, and personal contacts with agency staff. Participants who tested privately used mailed information most often and considered information mailed with the test as most useful.

Overall the ‘no arsenic test’ and ‘don’t know my arsenic level’ groups have a weaker sense of arsenic risk and generally rate their water as safe. Beliefs of not feeling their household is at risk, their water is a source of arsenic exposure, that family members are exposed to arsenic from their water, and that their water is safe may explain why people don’t test their wells and suggest specific information needs.

Accurate knowledge of the arsenic level is essential for promoting appropriate understandings and protective responses. Arsenic well level knowledge shapes information use, representations and outcomes. People are more likely to remember whether their level was considered safe or not than their actual well level. It is essential that they can easily compare their well test result to a recommended standard to allow them to judge whether their test indicates a water safety problem.

People selected various personal arsenic safety thresholds. Their safety threshold was the most influential part of their personal understanding for making safety judgments and engaging in protective responses. People need more information about how safety thresholds are selected - especially when a safety standard is revised. Media sources tend to cover controversy more than synthesize facts and tend to cover opposing points of view about an issue to provide balanced reporting (Dunwoody, 1999). These reporting tendencies may have prompted some people to perceive more controversy about the revised standard than was the case.

Other than identifying a well water problem and using more information, beliefs of fewer barriers to controlling arsenic and being more certain about whether and how to control arsenic exposure were most strongly related to reducing exposure. People need information about arsenic control methods that allow them to compare the costs and benefits of each method to promote informed decisions.

Beliefs about causes of arsenic in well water were most strongly related to policy opinions to reduce groundwater withdrawal – a stance supported by the Wisconsin Department of Natural Resources. The arsenic town meetings provided detailed information about the causal relationships between water use, groundwater levels, and aquifers that may have been a factor in developing these beliefs and opinions.

Appendix (continued)

People use and apply experiential information, especially their perceptions of water quality. People need guidance for how they should interpret and respond to sensory qualities of water.

External information sources and experience equally influenced representations, safety judgments, and policy opinions. However, external sources of information had a larger total effect on protective behavior. Perhaps 'in the head' concepts (representations, judgments and opinions) more equally reflect information from experience and external sources, but decisions to engage in costly behavior may place more weight on information from external sources.

Ongoing educational programs are more effective than one-time programs. While high publicity was related to information use and to recognizing risk, education seemed to be a factor in the adoption of a lower drinking water standard. This tentative 'case study' finding should be explored with further research.

Information needs to:

- Be mailed with the well test and should provide links to other information sources.
- Be available from a variety of media and personal contact sources.
- Be offered on an ongoing basis and be available from local sources.
- Provide guidance on how the public should interpret and respond to sensory qualities of well water quality. People need to be reminded that arsenic cannot be sensed and that well testing is needed to identify an arsenic problem.
- Interpret the meaning of the arsenic test. It is likely that the meaning of the test will be better remembered that an actual arsenic level. When a safety standard has been revised people need information about why and how a standard was determined to establish the credibility of the revised standard.
- Provide information about arsenic control methods that promote informed decisions (for example information that helps them to compare advantages and disadvantages of each control method).
- Provide information about causes of arsenic in the environment and policies that might address root causes of the problem.
- Be understandable for a wide audience.

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Enlisting Landowners in Water Conservation

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Abstract

In an attempt to reach landowners using a more practical means of media, The University of Tennessee Agricultural Extension Service (UTAES) has developed two highly successful water quality publications. The first publication is a handbook entitled “Conservation Practices for the Farms and Forests of Tennessee.” It describes 51 best management practices (BMPs). The entry for each practice includes full-color pictures of the practice; description of the practice; water quality benefits; landowner benefits; considerations; complementing practices; maintenance; and costs.

The handbook is not a technical manual. Rather, it is an attractive, easy-to-understand book designed to introduce readers to BMPs; to explain why they should be considered; and to provide direction when they choose to implement practices. This is an excellent example of how to reach those who are uncertain about BMPs or why they should consider implementing them.

The second publication is a BMP calendar developed for the Pond Creek watershed in East Tennessee. It was developed as part of a pilot project, and was designed to introduce landowners in the watershed to BMPs and to inspire them to make any necessary changes. Each month features a BMP that addresses major sources of ag-related contaminants in the watershed with a picture and description of the practice, an explanation of what it can do for them, and an outline of water quality impacts. By combining a calendar with BMPs, landowners are exposed to the concepts each time they glance at the calendar, and they are informed in a positive, non-threatening way.

Handbook

Initial contacts with landowners about ways to protect and improve water quality can be undermined by their lack of familiarity with best management practices (BMPs). To help overcome this barrier, The UTAES contracted with the Tennessee Department of Agriculture (TDA) to produce a handbook entitled “Conservation Practices for the Farms and Forests of Tennessee.”[2]

A team of UTAES faculty, in consultation with TDA and the Natural Resources Conservation Service (NRCS), identified 51 key BMPs for Tennessee (see Appendix A). Each BMP is described with full-color pictures of the practice; a written description of the practice; a discussion of how the practice protects and improves water quality; an outline of key landowner

[2] The handbook is not an original idea. Georgia and South Carolina developed water conservation handbooks prior to this project. Other states and agencies have also created comparable products.

benefits; a list of complementing practices; and a description of maintenance considerations; costs; and other considerations, such as cost-share eligibility.

The handbook is not designed to be a technical manual. The goal was to create an attractive, easy-to-understand publication to introduce readers to BMPs; explain why they should be considered; and describe how to incorporate them into a farm or forest operation. It provides a conversation starter to use with landowners who are not familiar with BMPs or who are unsure why they should consider implementing them.

A "further information" section lists each county Extension and soil conservation district office, including address and phone number. Contact information for state and federal natural resource agencies and organizations is also included in this section, providing users with a ready reference to sources of additional information and assistance.

Appropriate Extension faculty specialists developed the information in this handbook to ensure transfer of current, optimal instruction per practice. Photos to illustrate the practices were taken across the state specifically for the handbook. TDA and NRCS reviewed the draft materials for technical accuracy and completeness. Finally, materials were edited by a communications specialist for consistency in presentation and ease of understanding.

Twenty thousand handbooks were printed at an approximate cost of $5.60 each. An initial distribution of 100 was made to each of the 95 county Extension offices and Soil Conservation District offices in the state.

The handbooks, distributed in 2001, have proven to be popular and useful according to reports from across the state. Few copies remain in inventory; funds for a second printing are being sought. Anecdotal reports from the counties indicate the handbook is an effective way to illustrate practices and launch discussions of incorporating BMPs with landowners and their families.

Pond Creek Watershed Calendar

In an extension of the handbook, a BMP calendar was developed as part of a pilot watershed project in Pond Creek (HUC: TN06010202013).

The major sources of ag-related contaminants in the watershed were identified by infrared aerial photography. Twelve BMPs that address these problems were then identified. Each month includes a picture of a practice, and a description including landowner benefits and the effects on water quality (see Appendix B).

Two thousand full-color calendars were printed at a cost of approximately $4.20 each. Calendars were hand-delivered to farm families in the watershed, providing an opportunity to introduce them to the project and discuss watershed issues one-on-one. Calendars were also distributed to agribusinesses, local agencies and organizations, and the general public in the watershed.

Community involvement also included several public meetings within the watershed to discuss the pilot project, impacts of agriculture on water quality, and BMPs. In addition, a manure management field day held on a dairy just across the watershed divide, involved many members of the Pond Creek community.

The full-color calendars are eye-catching and tend to be retained and used. Many were hung in dairy barns allowing employees, as well as the farm families, to see how practices like stream crossings and heavy use areas can improve working conditions.

According to reports of Extension and NRCS personnel working in Pond Creek, six of the twelve BMPs have been implemented on one or more farms in the watershed since distribution of the calendars. They credit the calendar with creating awareness and interest, which led to the implementation of these practices.

Currently, we are planning a 2005 Pond Creek Calendar. It will feature photos of BMPs implemented in the watershed, with the farm family's permission. A common question has been about where the pictures were taken; landowners are interested in seeing the practices "on-the-ground."

Concluding Comments

The handbook and calendar have proven to be popular, in part because they are attractive, full-color products. They create awareness of BMPs and provide positive reinforcement of the concepts each time an individual thumbs through the handbook or glances at the calendar. They are worthy of consideration when one is looking for ways to create awareness and interest in water quality education.

APPENDIX A (Smith)

Handbook BMPs

The 51 practices outlined in *Conservation Practices for the Farms and Forests of Tennessee* are:

- Access Roads
- Alternative Watering Systems
- Buffer Strips
- Conservation Tillage
- Contour Farming
- Contour Stripcropping
- Cover Crops
- Critical Area Planting
- Crop Rotation
- Dead Animal Composting
- Diversions
- Farm Ponds
- Field Scouting
- Grade Control Structures
- Grassed Waterways
- Insect Traps
- Integrated Pest Management
- Irrigation Management
- Keeping Excellent Records
- Liquid Manure Storage
- Locating & Constructing Forest Roads
- Log Landings
- Manure and Litter Application
- Manure Composting
- Manure & Litter Testing
- Micro-Irrigation
- No-Till
- Nutrient Management Plans
- Pasture Management
- Pesticide Application
- Pesticide Handling
- Pesticide Loading Facility
- Plant Tissue Testing
- Poultry Litter Storage
- Precision Farming
- Protected Heavy-Use Areas
- Protecting Streams and Wetlands
- Runoff Management
- Sediment Basins
- Setting Realistic Yield Goals
- Sinkhole Protection
- Skid Trails
- Soil Testing
- Sprayer Calibration
- Stream Crossings
- Stream Protection
- Terraces
- Weed Management
- Well Protection
- Wetlands
- Wildlife Habitat

APPENDIX B (Smith)

Example of Calendar BMP entries

Beef and dairy operations are the major sources of contaminants in the Pond Creek Watershed. The BMPs included in the Pond Creek calendar are:

- Stream Protection
- Stream Crossings
- Nutrient Management Planning
- Buffer Strips
- Manure Testing
- Manure Application
- Liquid Manure Storage
- Runoff Management
- Manure Composting
- Soil Testing
- Alternative Watering Systems
- Protected Heavy-Use Areas

Minnesota Water–Let's Keep It Clean: A Twin Cities Stormwater Education Collaboration

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Abstract

Over 150 Minnesota cities are required to implement Stormwater Pollution Prevention Plans. Each plan requires a strong educational component, with target audiences and educational goals identified for each six Minimum Control Measures.

Metro WaterShed Partners, a collaboration of water resource educators in the Twin Cities, saw an opportunity to assist cities in delivering quality stormwater education and established "Minnesota Water – Let's Keep it Clean", a program that does three things:

1. Collaborate with putting clean water messages in mass media, something out of financial reach for individual cities.
2. Make ready-to-adapt stormwater educational materials available to cities and neighborhood organizations.
3. Achieve a consistency of message across the Twin Cites Metro.

A regional communication/marketing firm, Periscope, has been contracted for placing messages in the media and Web site design.

By June 2004, the program will have completed a spring and fall mass media campaign, and will have established a resource laden educational Web site at www.cleanwatermn.org. Current $110,000 funding is from state and regional governmental grants. Continuation funding is sought from subscriptions from cities, corporate sponsorship and grants.

During a case study presentation, the following will addressed:

- Formation of collaboration, development of messages, delivery strategy
- Fall and Spring mass media campaigns, messages and impacts (Web site data)
- Creation and content of Web site based educational resource for cities, et. al.
- Program continuation funding, success of subscription funding

Target Audience(s): Agency partners (city staff), households, neighborhood organizations

Educational Purpose: Information, capacity building

Lake-Friendly Gardening: Case Study in Homeowner Education in Whatcom County, Washington

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Abstract

Stormwater pollution is a growing concern for Lake Whatcom, a multi-use lake that is the drinking water source for over 85,000 Whatcom County, Washington residents. A 1999 state report documented multiple urban pollutants, including pesticides used by homeowners, in stormwater drains and tributaries within the watershed (Serdar and Davis, 1999). In addition, the Lake is in the Clean Water Act 303(d) list for low dissolved oxygen due to excessive phosphorus, a component of most fertilizers.

Changing residents' yard and garden practices was key to minimizing urbanization's effects on the Lake. In response, Washington State University Extension and Whatcom County Water Resources produced a booklet series, the *Lake-Friendly Gardening Kit* (http://lakewhatcom.wsu.edu/gardenkit). The team rewrote research-based Extension materials in a more engaging style and design. The kit is geared towards local issues, with booklets titled "The Ten Most Un-Wanted Pests," "Top Secret Agents," and "Passive-Aggressive Plants," among others.

Three months after receiving the kit, recipients were mailed a written survey. About 50% responded, with these results:

- 38% of respondents read the entire kit; 48% read half to most of it.
- 100% agreed the kit was useful.
- 98% thought the materials were easy to understand.
- 86% felt they learned how to make their practices more lake-friendly.
- 52% managed pests differently.
- 48% purchased pest-resistant plants.
- 52% changed their lawn care practices.
- 48% shared what they learned with someone else.
- 89% recognized the connection between their land use actions and water quality.

Target Audience(s): Homeowners, landowners

Educational Purpose: Information, capacity building

Leaving a Legacy

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Abstract

The Legacy program is a cooperative educational venture between the St. Johns River Water Management District (SJRWMD) and area schools. The program enlists educators and their students to help District staff make public lands more accessible while serving as living laboratories and classrooms. The Legacy program provides students unique opportunities to (1) assist with managing District lands, (2) participate in service learning, (3) increase environmental awareness, and (4) based on teacher observations, increase their school performance.

In turn, the District benefits because students remove exotic invasive plants, design and build trails and other amenities, post signs, pick up trash, provide tours, develop interpretive and educational materials, inventory natural resources, and test water.

The Legacy program began in 1993. Currently, 13 schools in 10 counties participate in Legacy programs. Although there are many similarities between Legacy programs, each program has unique, individualized teaching strategies and the programs are structured to fit the needs of students, schools, and the natural resource site.

Two evaluations, conducted in 2000 and 2003, have shown that participation in the Legacy program has assisted in improving students' grades, raised their awareness of water resource issues, and helped them develop leadership skills that benefit them, their schools, and their communities.

Introduction

The Legacy program began in 1993. Currently, 13 schools in 10 counties participate in Legacy programs. Although there are many similarities among Legacy programs, each program has unique, individualized teaching strategies and the programs are structured to fit the needs of students, schools, and the natural resource site.

2002 – 03 Annual Legacy Statistics
Schools participating – 13
School districts involved – 10
Number of students involved – 3,094
Number of adults involved – 205
Student service hours – 12,073
Adult service hours – 1,725

2003 – 04 First Quarter Legacy Statistics
Student service hours – 5,231
Adult service hours – 531

The Legacy program is a cooperative educational venture between the St. Johns River Water Management District and area schools. The program enlists educators and their students to help District staff make public lands more accessible while serving as living laboratories and classrooms.

Legacy is implemented differently by each program and is structured to meet the individual needs of the students and the school. Elementary, middle, and high schools have participated in the Legacy program, which may involve students for multiple years or for only a single year.

Students with some programs receive all of their classroom instruction through the Legacy program. And some programs have students take part in periodic site visits and only part of their classroom instruction takes place through Legacy. There is a wide variety of implementation strategies and practices used.

Through its Legacy program, the District gives students an opportunity to assist in managing public lands and to participate in service-learning projects within the District's jurisdiction. The Legacy program provides students a unique opportunity to (1) assist with managing district lands, (2) participate in service learning, (3) increase environmental awareness, and (4) based on teacher observations, increase their school performance.

Two evaluations, conducted in 2000 and 2003, by different independent consultants have shown that participation in the Legacy program has assisted in improving students' grades, raised their awareness of water resource issues, and helped them develop leadership skills that benefit them, their schools, and their communities. Participation in the Legacy program for one year yielded significant changes in skills and attitudes by students, even with schools that only held monthly on-site activities.

2000 Evaluation

In 2000, the District contracted with Elise Cassie to conduct an evaluation of all Legacy programs in existence for more than one year. Thirteen program contacts were provided. Thirteen teachers were contacted by phone, and interviews were conducted. Interviews lasted from 10 to 30 minutes, with teachers responding to five questions. Four of the five questions were observational, and the last question required specific data from the teachers.

Question 1: In general, rank the student's environmental awareness as a result of participating in the Legacy Program.

No Increase	Moderate Increase	Significant Increase
0	2	11

All teachers felt, without hesitation, that participating students had increased their environmental awareness as a direct result of the Legacy program.

Question 2: Based on your observation, rank the student's overall environmental behavior (e.g. picking up trash, recycling) as a result of participating in the Legacy program.

Poor (exhibits no positive behavior)	**Satisfactory**	**Good**	**Excellent** (always exhibits positive environmental behavior)
0	0	5	8

Although this scale appears vague and obviously subjective, all teachers provided at least one example of a student or students exhibiting positive environmental behavior on their own time (not associated with a grade). Examples of student action (behavior) include the following, which resulted from students' increased environmental awareness from participating in Legacy programs:

- A group of students initiated a recycling program at their school where they collect recyclables from teachers.
- Students have actively pursued and participated in environmentally related internships.
- A student told a teacher about spending a day on the beach with her family and picking up trash on the beach.
- Students now recycle at home with the assistance of their families.
- Students have asked to organize field trips where they perform water testing. (Students have become empowered by Legacy and have assumed leadership roles.)
- Students told a teacher they have gotten together on weekends to pick up trash and remove exotic plants from the District site they are involved with through the Legacy Program.
- During spring break, students volunteered to spray-paint “no dumping” signs on storm water drains, explaining to parents why their actions were important.
- Students willingly visit the District site they are involved with on their own time, bringing trash bags for litter cleanups.
- Students who have not been successful with mainstream education take pride in providing guided tours of the District lands they are involved with to classmates and visitors.
- During the fires in 1998, students volunteered to assist the firefighters after understanding the value of their participation in the Legacy program.
- Students “pack out what they pack in” while camping.
- Students who, before participating in the Legacy program would discard fishing line in the water, have been observed at the end of the year refraining from throwing the line in the water. These same students now use oil recycling facilities for discarding used motor oil.

The environmental implications of specific student action examples provide justification for the value of Legacy-type programs.

The educational premise that hands-on learning stimulates interest and often increases motivation has been in place for a century. Studies are beginning to emerge which validate the concept of environmental, specifically outdoor, education as a means to improve student performance (Leiberman, 1998).

Question 3: On average, what can you say about the student’s grades as a result of participating in the Legacy Program?

Not Enough Data	Decreased	Remained the Same	Increased
1	0	0	12

One teacher noted that the students who benefited the most from Legacy program education are those students not “classroom oriented.” Another teacher noticed an increase in grades among the dropout prevention students in particular. One teacher said that the Learn and Serve grant she received has documented grade-increase data.

Another teacher went beyond observational data and documents GPAs and student standardized test scores over time. Students were tracked for consecutive years and as a group within the school. Table 1 illustrates an increase in GPA scores over a three-year period.

Table 1. *Legacy Students' GPAs Over a Three-Year Period*

Legacy Students' GPAs	**1996–1997**	**1997–1998**	**1998–1999**
Overall	2.95	2.86	3.15
At risk	1.26	1.84	2.09

The GPA for Legacy participants is, on average, 0.34 higher than that of all students in the school. In addition to GPA information, the Florida Comprehensive Assessment Test (FCAT) writing scores for at-risk students participating in the Legacy program increased from 3.0 in 1997 to 3.5 in 1998. The teacher attributes the increase in both GPA and test scores to participation in the Legacy program.

Question 4: On average, what can you say about the student's attendance as a result of participating in the Legacy Program?

Not Applicable	Decreased	Remained the Same	Increased
3	0	2	8

Teachers who responded "not applicable" stated the following reasons:

- Legacy program involves AP classes, which is a group of advanced students not likely to have attendance issues.
- They could not participate in Legacy field trips if they missed school classes.

The final question (5) asked if the teachers had comparative data examining participating and non-participating students in terms of dropout rate.

None of the teachers maintained data investigating this question.

Findings and Recommendations

Based on telephone interviews with Legacy participants, the Legacy program is a valuable tool, acting as a catalyst for environmental attitude and behavior change in young people. The majority of the teachers feel that the District has played a significant role benefiting both the students and the environment. Preliminary findings revealed through teacher observations are that the Legacy program has a positive impact on participating students, communities, and the environment in general. One teacher noted a major improvement in the educational attitude of students.

The benefits to District-acquired lands are obvious, with trash and exotic plants removed, trails built, signs posted, tours provided, and water tested, in addition to other multi-use benefits for schools and the general public. Students have increased their environmental awareness and sensitivity, environmental behavior, grades, and attendance.

Recommendations for Legacy programs include the following:

- Continue monetary and personnel support for teachers and schools participating in Legacy programs. [The District can provide limited monetary support but assists all programs in developing funding partners, grant applications, and donations.]

- Provide support for teachers to track student performance by creating a simple tracking form for GPAs and test scores from year to year to examine trends. [Note: This has been attempted by the District with varying levels of success. Florida has experienced drastic education accountability changes in recent years; the District is outside the traditional education system and is not allowed access to some data.]
- Determine specific information the District needs on a yearly basis and provide a simple reporting form for numbers of participants, etc. (Since financial support is not always from the same funding agency, the District needs to track information consistently.) [Annual Legacy reports have been developed by the District and are provided to all partners, school district superintendents and boards, the Department of Education, and the Governor's office. Current and past reports can be found on the District's Web site at http://www.sjrwmd.com/]
- All participating teachers/schools need to model reporting of GPAs and test scores after Winter Springs High School (WSHS). The WSHS Legacy teacher has carefully tracked this information since the beginning of the program. [Note: This has been attempted by the District with varying levels of success. Florida has experienced drastic education accountability changes in recent years; the District is outside the traditional education system and is not allowed access to some data.]
- Encourage teachers to provide tours by students of the lands they are involved with, modeled after Princess Place. [This has been accomplished by all programs and expanded to include Legacy participating in most District water festivals, special events, and other programs. Legacy students serve as educators and interpreters.]

2003 Assessment

In August 2003, the District contracted with Mary Marsters of Marsters & Associates to conduct an assessment of the District's public education programming (Marsters, 2003), of which Legacy is a major component. The expertise of this contractor is to provide program assessment that looks at program outcomes and determines the impact of a program on its targeted customers: Were the customers satisfied with "the product" (in this case, the core education programs including Legacy offered by District education staff) and did the product have a sustainable impact on customer behavior? This information is then used to improve overall program management and performance.

The Legacy component of this assessment provided the District feedback and guidance on the Legacy program as presently implemented by District education staff.

Regularly used District Legacy delivery mechanisms and information were the source of information for this assessment and included the following:

- Workshops (both educator and student)
- Education presentations
- Water festivals, special events, and Legacy celebrations
- Publications
- Existing evaluation reports
- Program-related documents and reports

Also considered in this assessment is "education partner" satisfaction with District programs. This assessment is a strong and inclusive sample review at audit standards that allows for probability assertions on program accomplishment and the impact to be drawn.

The intended use of these assessment findings is to assist District staff to better understand present levels of program performance and from them, to be able to discern measures they can take to strengthen and improve program results. These findings can assist education staff in addressing a question related to program performance and management: Are we achieving the results we want, and what can we do to gain a greater return on our program-related investment?

Information-gathering was done to balance, to the greatest extent possible, its look at the breadth and depth of program impact. That is, for each core program area, the attempt was made to include numerous District counties or groups with active programs (breadth) and at the same time, to explore program impact through as many customer levels as served by a Legacy program (depth).

Findings were presented on the effectiveness of the overall Legacy program and its implementation along with recommendations for improvement and for gaining a greater return on their program time and resource investments.

Methods

Methods used to assess the Legacy program included an observation of two Legacy student events; an on-site visit to a Legacy-participating school; on-site interviews with participating teachers/professional volunteers; on-site interviews with participating students; informal interviews with parents of participating students; telephone interviews with teacher-coordinators from seven additional Legacy programs; a review of existing Legacy program documents; and a review of earlier Legacy evaluation findings.

Findings and Recommendations

1. ***Legacy provides a first-time opportunity for many students to directly interact with the environment.*** As one teacher stated, "[before Legacy] the students' idea of the environment was going to the beach." One key change in students that most interviewees noted was their significantly increased concern about protecting and conserving their environment, including and focusing on water resources, as a result of their involvement in the Legacy program. This makes it a strong program that is clearly helping SJRWMD achieve its educational goals.

2. ***Across the board, teachers stated that they noticed a significant decrease in behavioral problems among students participating in the Legacy program.*** In many cases, teachers stated that these behavioral changes were because students had to maintain a clear behavioral record in order to continue to participate in the program. For example, one teacher noted, "The kids are totally different when out in the field, doing something real." Students want so much to be in the program that they monitor their own behaviors closely to avoid missing a Legacy session.

3. ***Teachers identify a dramatic impact on student academic performance and FCAT scores that,, again, they attribute to participation in Legacy.*** In some cases, teachers require students to maintain a certain grade point average in order to continue their participation. But overall, teachers find that students, when working in a real setting outside the school, engage in real learning. They apply academic concepts to their work in the field (such as science, math, language arts, literature, foreign languages, history, and social studies) and translate that learning into higher test scores and grade point averages.

4. ***Each Legacy program directly impacts a large number of students on an annual basis.*** At one observed site visit, 80 high school students were preparing for the arrival of 400 elementary students, to educate the younger students about various aspects of the preserve habitat in which they were working. Across Legacy programs, literally thousands of students and adults visit Legacy program sites on an annual basis and receive guided tours of the natural environment, learning from Legacy students the theory and practice of water and natural resource preservation.

5. ***Notable is teachers' praise of the program for its impact on at-risk students.*** Many teachers stated that students, who would otherwise become drop-out statistics, have not only remained in school but have flourished academically, solely because of the Legacy program. Other impacts are significant. To a person, teachers indicated that the program has encouraged some students to enter environmentally related fields for college study and career. Further, at-risk students have become so engaged in learning that they are able to identify and pursue career paths. As one teacher stated, "They will be gainfully employed and functioning citizens rather than out standing on a street corner causing problems."

6. ***Legacy students interviewed during this project reflected on their own changes as a result of participating in the program.*** Many happily discussed their career goals, and have become more dedicated to their own education. One of the most common comments heard from students and teachers was that they (the students) became more responsible because the program required that they take more responsibility for their actions and for the environment. As one teacher noted, "[Legacy allows students] to show people they can do something." Students take the program, and their roles within the program, very seriously and responsible behavior carries over to other aspects of their lives.

7. ***For some teachers, this program has rejuvenated their own careers and rekindled their enthusiasm for teaching.*** A few teachers were explicit that Legacy was responsible for keeping them from becoming "drop-outs" from their profession. Interviews with teachers found that they are deeply committed to the Legacy program and have put in hundreds of hours over and above their regular teaching hours in order to make their programs successful. Yet it has energized them unlike any other education program they had encountered and has given them a new realization of what education can do to change young lives.

8. ***SJRWMD is praised for its support and oversight of the program.*** Legacy program teachers find the technical support they receive to be positive and encouraging, and value-adding in terms of the skills and knowledge staff brings to the development of their individual programs. Teachers particularly note that the SJRWMD staff is adept in critical areas that they, the teachers, are not: negotiations with county representatives, finding available grant money, suggesting program directions that mesh with school and school district guidelines, and gaining administrative support and encouragement for the program. Project WET lessons and training are seen as invaluable in moving student knowledge forward in the field.

9. ***Program cost has not been a stumbling block to those teachers interviewed in this project.*** In some cases, teachers have become creative in their methods to fund their programs, including student fundraisers or charging students a small participation fee (which they indicated parents were more than happy to contribute). Transportation to the environmental worksites was stated to be the
most costly item for most programs. Many funded their programs by securing grants from state monies, for example, the Learn and Serve program. But they do state that the search for dollars is never-ending.

10. ***One major program stumbling block, particularly for low-performing schools, is the correlation of Legacy program activity to Sunshine State Standards and FCAT preparation.*** Administrators in some schools have given lower priority to the program because their schools received low grades from the Department of Education and, as a result, they look only for the "skill-and-drill" of readying students for tests. Legacy's acceptance and ability to substantively grow is incumbent upon its ability to be keyed to these requirements that every teacher faces, and particularly teachers in schools that are struggling to improve.

11. ***Legacy needs a full time equivalent coordinator to build the program.*** The demand for the program, either with new start-ups or support for present Legacy programs, is beyond what a part-time staff person can handle. The program cannot achieve maximum return on SJRWMD's investment by limiting it to a part-time service. It costs SJRWMD very little other than the coordinator's time, and for Legacy to grow, it needs to have a dedicated full-time staff position.

Observations and Suggestions

1. ***The Legacy program leads to some of the most profound impacts of any environmental education program I've observed or assessed over the last decade.*** Participating in this program has been truly and dramatically life-changing for many students, particularly those considered "at-risk" and who would otherwise drop out of school. These same students now not only have perfect attendance records because of Legacy, but have dramatically improved their grades and perceive their lives filled with hope rather than without it. Similarly, it has literally brought teachers who had become jaded and exhausted by teaching back to life and injected energy and enthusiasm into their work.

2. ***Staff needs to organize a summer session of some key Legacy teachers to develop a curriculum for the program to make it compatible with Sunshine State Standards- and FCAT.*** Some teachers have already begun to do this on their own, and because enthusiasm for the program is so high, it would be relatively easy to get a group of 4–5 teachers willing to take on this task during the summer of 2004.

3. ***The land approved for the students to use as their worksite needs to be as free of owner resumption issues as possible.*** Three programs in particular mentioned that their students had constructed environmental projects, only to have them disrupted by the landowners. While there are no guarantees in life, gaining owner buy-in toward preserving student work on the property may be a necessary prerequisite step before launching a Legacy program.

4. ***The Board of the SJRWMD needs to be informed of Legacy program outcomes and impacts.*** While many of those interviewed talked about their need for receiving communication from the Board in terms of mission, goals, and educational priorities, Legacy teachers felt the SJRWMD Board was quite unaware of the impact their own program is having on these schools and students, and therefore, the Board needed to receive information from its own customers about the power of the Legacy program. Legacy student presentations at Board meetings are a key way to inform Board members about how well-spent their dollars are in funding this program.

Conclusion

The educational premise that hands-on learning stimulates interest and often increases motivation has been in place for a century. Studies are beginning to emerge which validate the concept of environmental, specifically outdoor, education as a means to improve student performance (Leiberman, 1998).

Legacy is a program that has been shown over time to significantly contribute to student learning and, in some cases, to teacher rejuvenation or retention. Education standards and objectives have changed in Florida to address the Sunshine State Standards and the Florida Comprehensive Assessment Test (FCAT). Legacy has improved critical thinking skills and hands-on application of knowledge, which are key components of the FCAT, and has led to behavior change. Students have implemented waterway cleanups, reduced their personal littering and water use, and changed buying habits. They have taken the initiative to start programs to protect the environment and volunteered with different groups to protect and improve the environment (Athman, 2003).

Legacy is a program that can be duplicated in many different schools, counties, and venues. Key to its success is: involvement of a passionate teacher, participation of a knowledgeable and interested agency or partner staff, empowerment by school district and administration, and support of the program, both monetary and in-kind. Although each program has similar elements, all Legacy programs are unique and designed to address the individual needs of each school and to evolve over time to meet changing needs and opportunities.

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Stream Side Science–Developing Outreach Materials with the Audience in Mind

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Abstract

In 1999, Utah State Universtiy (USU), Water Quality Extension developed an in-depth manual to help teachers and other educators teach watershed concepts by designing and implementing their own water quality monitoring programs. The manual was well received by teachers who were already interested in water quality and had the resources to do the activities, but did not spark the interest of other teachers or the Utah State Office of Education.

The two main reasons cited for this were 1) a lack of knowledge about water quality and watersheds, and 2) a need by Utah teachers to restrict their time and resources to materials that are directly linked to the Utah State Core Curriculum for each grade level.

Over the last year, USU Water Quality Extension worked with teachers and Utah Office of Education staff to develop a curriculum which utilizes the hands-on activities in the *Utah Stream Team Manual*, but is also aligned to the Utah State Core Curriculum for 9th Grade Earth Systems Science. These activities now have the full support of the state education office and the Utah Governor's Watershed Initiative, including evaluation of the materials, printing and distributing the materials statewide, and assistance in teacher training.

This poster will discuss the process of partnering with state agencies and educators to develop educational materials and trainings that not only meet the needs of educators through alignment to core standards of the state, but also provide hands-on, high quality water education for high school and middle school students.

Target Audience(s): Teachers

Educational Purpose: Education

A Blended Learning Program for Golf Course Water Conservation

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Abstract

In collaboration with the Golf Course Superintendents Association of America (GCSAA), a new concept in training golf course superintendents was developed. This program is unique for GCSAA, in that it was designed as a "blended learning" experience that assists practitioners in the development of water conservation plans that are site-specific to their golf courses. The University of Georgia turfgrass faculty was responsible for development of sound scientific-based educational resources. The responsibility of GCSAA was to market the program to its clientele. The first phase of the blended learning program was the development and launch of an on-line course entitled **W.A.T.E.R.** The course was designed to provide introductory level information on **W**ater; on how water is impacted by **A**tmospheric factors; on uptake and use of water by the **T**urfgrass plant; on the impact of **E**daphic or soil factors; and the **R**elationship of the soil/plant/atmosphere continuum. The second phase of this program was a workshop conducted by Drs. Carrow, Duncan, and Waltz, with hands-on development of water conservation plans. The superintendents will have instruction and access to templates they can modify and implement to accommodate the nuances of their locales. The program will conclude with a 60-day access to instructors through a GCSAA maintained list-serve for final refinement of individual plans. The deliverables of this program were written plans that were developed to be followed for water conservation on individual golf courses. Within the first two weeks of launching the on-line phase, registrants included superintendents from 20 states and 7 counties.

Introduction

A mission of many university systems is to disseminate useful, practical, and scientific-based information to their clientele. As society struggles with issues related to water management and conservation, it is these stakeholders who will look to Cooperative Extension Service and Experiment Station personnel for guidance, recommendations, and solutions. Informational packages must be developed for an increasingly educated, Web adept audience with demands for high levels of educational programs. To meet these expectations, novel modes of information delivery and packaging must be employed.

Tenets for the implementation of water conservation practices are to present in-depth informational packages of scientific principles with specific, practical applications to all individuals involved with water management (i.e., elected officials, municipal authorities, regulatory agents, on-site water managers, and the general public). While educating all involved is critical, improving the practitioners' awareness of water conservation practices, coupled with implementation on their sites, are where the most immediate and long-lasting effects can be realized. Site specific practices are developed using a template of best management practices (BMPs) that is holistic, comprehensive, and science based.

Without accounting for the many environmental, ecological, and economic benefits of turfgrass systems, some special interest groups and municipalities have targeted turfgrass and golf courses as initial areas for water restrictions or bans. In an effort to improve water use efficiency and the industry's image, a partnership between The University of Georgia (UGA) Extension and Research faculty, and the Golf Course Superintendents Association of America (GCSAA) was initiated in 2003. The objectives of this collaboration were to generate and disseminate educational packages focused on turfgrass water conservation practices. These packages were marketed to golf course superintendents, who are often well-educated managers who have been placed in charge of a golf facility's water resources.

The Program

Upon completion of this program, it is expected that the participating golf course superintendent and the golf facility's officials go through the process of developing and implementing a set of BMPs for water conservation that is site-specific. These BMPs would be the guiding document for daily water management practices, future renovation plans or new constructions, and general turfgrass management. Furthermore, the development, implementation, and adherence to these BMPs will provide documentation of a course's previous and ongoing stewardship efforts that may be used as proof of existing water conservation measures when resources become limited. This water management approach may allow golf courses to continue to operate without any additional irrigation restrictions when other industries are adjusting to meet water conservation demands.

The "Blended Learning Program for Golf Course Water Conservation" is divided into three modules. The specific goal of each module follows:

> **Module 1:** To develop an online course of introductory level information on **W**ater and how it is impacted by **A**tmospheric factors; uptake and use by the **T**urfgrass plant; impact of **E**daphic or soil factors; and the **R**elationship of the soil/plant/atmosphere continuum. The title of the course was **W.A.T.E.R**.
>
> **Module 2:** To develop an 8-hour interactive workshop titled "BMPs for Turfgrass Water Conservation." The seminar was conducted by The UGA turfgrass scientist during the GCSAA's annual conference and show.
>
> **Module 3:** To provide access to a "list serve" hosted by GCSAA where course participants could post questions, and could interact with colleagues and scientist during the development process of their site-specific water conservation plans.

This program “blended” three learning styles: a self-study style though the on-line course, a classroom lecture style as part of the seminar, and an active participation style through the development of a deliverable product, the site-specific water conservation plan, and access to a “list serve” for discussion of ideas and feedback.

Module 1: W.A.T.E.R. for Efficient Water Management (online course)

This is a stand-alone, for fee, on-line course that provides a sound, scientific understanding of turfgrass water relationships. Module 1 learning objectives are listed in the Appendix. The targeted audience was golf course superintendents, assistants, and technicians, agronomy and horticulture students, grounds managers, or other turf industry professionals who desire a better understanding of turfgrass water management. While this was written as a stand-alone course available to anyone (GCSAA member or non-member), Module 1 integrates into the “blended learning” concept by being a prerequisite to continue into Modules 2 and 3.

The development of this course was a joint project between The UGA faculty and GCSAA and is hosted on the GCSAA server, www.gcsaa.org/learn/online/water.asp. It was the responsibility of the turfgrass scientists to write and ensure scientific accuracy of the content while keeping the course focused on turfgrass water use and conservation. Furthermore, submission of content updates and revisions will be the responsibility of The UGA authors. The GCSAA was responsible for preparation of the course format, advertisement to its membership, collection and distribution of fees, and the administration of membership continuing education credits. In addition, graphic artists on staff assisted the authors with design and development of graphical content, and with interactive activities within the course.

W.A.T.E.R contains five chapters, each featuring a chapter outline, learning objectives, in-depth reading material, interactive reviews, and photos and illustrations. Each chapter is broken down into a number of sections so a student does not have to complete the entire course, or even one chapter, in a sitting. The flexibility of online learning allows participants the ability to repeat chapters or advance to the next section when they feel they have mastered the chapter’s concepts.

The course was launched in December 2004 and has been well received. With 43 participants, W.A.T.E.R. had the best first month registration and use of any GCSAA’s online courses (see Table 1). Through February 2004 the course had 71 students, representing 26 U.S. states and 10 counties. California had the greatest number of individuals to complete the course (8), followed by New York (6) and Florida (5). The remaining 23 states with participants, ranging from Main to Hawaii, had four or fewer students. Internationally, Canada had four participants, while Australia, Barbados, France, Germany, Portugal, and Spain had one each. The diversity of participants in this course certainly demonstrates a universal interest among golf course superintendents in water conservation.

Not surprisingly, initial registration was greatest in December and January. This is likely due to several factors: 1) GCSAA’s aggressive promotion, 2) appropriate timing for golf course superintendents, many have time for self study during winter months when there is little activity on the golf course, and 3) need to complete the course as a prerequisite for Modules 2 and 3. This is an online course so it is offered year-round. There are times of the year, however, where increased activity is expected.

Table 1. *Distribution of Participants of W.A.T.E.R. Online Course.*

	Number of Participants		
Month and Year	**United States**	**International**	**Total**
December ‘03	33	10	43
January ‘04	20	-	20
February ‘04	8	-	8
Total	61	10	71

Module 2: BMPs for Turfgrass Water Conservation (workshop)

The second phase of this program was a full-day (six-hour) workshop during the national GCSAA meeting in February 2004. The focus of this workshop was to assist golf course superintendents in the development of site-specific BMPs for water conservation in a manner that would be acceptable for submission to their facilities’ decision makers, elected officials, municipal authorities, regulatory agents, on-site water managers, and the general public.

During the initial four hours of the workshop, a science-based and holistic, systems approach for developing BMPs for water conservation was presented through a lecture format. Also, the major categories of water conservation strategies were presented along with options within each strategy so that superintendents could select appropriate options for their site-specific situations.

During the next two hours, instructors facilitated discussion among the participants and initiated the development of individual plans. In the development of their water conservation plans, participants were instructed to include various options and the practical implications of specific practices on water use and turfgrass management. Furthermore, the participants were encouraged to include the scientific reasons and justifications for these options.

To aid in the writing of site-specific plans, the superintendents were provided with copies of a 97 page workbook, “Best Management Practices for Turfgrass Water Conservation” in a hard- and electronic-copy format. Chapter titles included the following:

- Chapter 1 Components of a Golf Course Water Conservation Program
- Chapter 2 Initial Planning and Site Assessment for a Water Conservation Plan
- Chapter 3 Alternative Irrigation Water Sources
- Chapter 4 Irrigation System: Design, Installation, and Maintenance
- Chapter 5 Irrigation Scheduling for Water Conservation
- Chapter 6 Selection of Turfgrasses
- Chapter 7 Golf Course Design for Water Conservation
- Chapter 8 Management Practices for Water Conservation
- Chapter 9 Additional Water Conservation Strategies
- Chapter 10 Benefits and Costs

The workbook detailed specific water conservation practices with scientific documentation of the practices. Using electronic copies allowed participants to integrate contents into their plans.

Module 3: List-serve and Conference Call (follow-up)

For 60-days following the workshop, the instructors were available via a voluntary list-serve to assist the participants in development of their water conservation BMPs documents. The instructors offered technical and scientific assistance through the list-serve, while GCSAA maintained and hosted the service.

At the conclusion of the 90-day period there was a voluntary conference call between participants, instructors, and GCSAA Education Department personnel. The purpose of the conference call was to obtain industry input for improvement of future offerings; participants provided specific feedback for improvement of all the learning modules.

Conclusion

The purpose of this “blended learning” program was to use various learning styles to increase the level of understanding of water conservation, to educate participants on methods of improving and implementing water conservation practices, and ultimately to develop site-specific plans to be employed on individual golf courses. This program was initiated in 2004 and thus far, participant reviews have been positive. The instructors will integrate suggestions for improvement and offer the entire course again at the 2005 GCSAA conference and show.

APPENDIX (Waltz)

Learning Objectives for Online W.A.T.E.R. Course: Module 1

Chapter I. An Overview of Water

1. Understand the importance of water to biological systems.
2. Identify the structure of the water molecule and explain how structure affects other physical characteristics of water.
3. Relate the chemical properties of the water molecule to plants, soil, and other compounds.

Chapter II. Atmospheric Factors Influencing Water Management

1. Understand the hydrological cycle and its relevance in water conservation.
2. Relate the influence of climatic factors to evapotranspirational losses from the turfgrass plant.
3. Explain the influence of individual microclimates on turfgrass growth and water conservation.
4. Devise a basic irrigation guidance program using the "Checkbook Method" of irrigation.

Chapter III. Turfgrass Characteristics and Water Management

1. Describe how water is taken-up by the plant and the factors that influence water movement.
2. Understand the root and shoot morphological characteristics of turfgrass that influence water uptake, translocation, and transpiration.
3. Relate established crop coefficients to irrigation guidance programs.

Chapter IV. Edaphic Factors Influencing Water Management

1. Correlate soil physical characteristics to soil/water interactions.
2. Explain the movement of water through soils and the importance of basic soil characteristics which are incorporated into established guidelines.
3. Learn methods and instruments for measuring soil water and the application of knowing soil water contents for irrigation guidance.

Chapter V. The System: Soil – Plant – Atmosphere – Continuum

1. Integrate the concepts of the previous chapters into an overall water management program with primary focus of water conservation through improved irrigation application.
2. Communicate the basic principles of soil/plant/atmospheric interactions and relevance of water to a comprehensive water management program.

Framing the Dialogue – BEP Target Audience Success Stories

Rachael Herpel, The Groundwater Foundation

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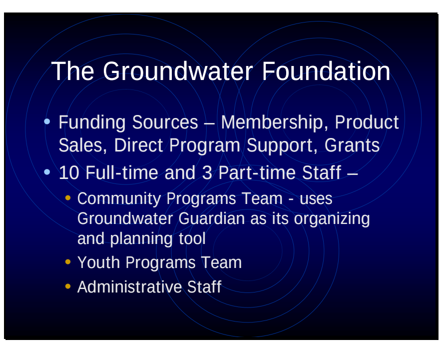

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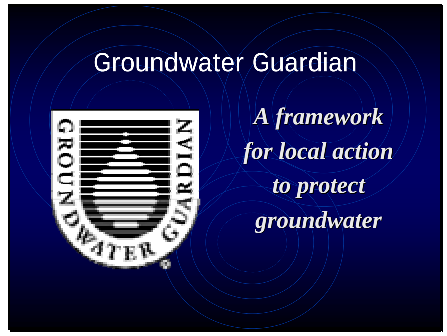

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Framing the Dialogue – BEP Target Audience Success Stories

Rachael Herpel, The Groundwater Foundation

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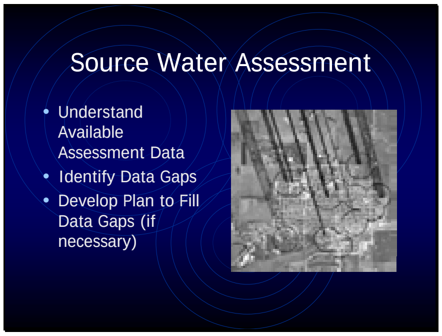

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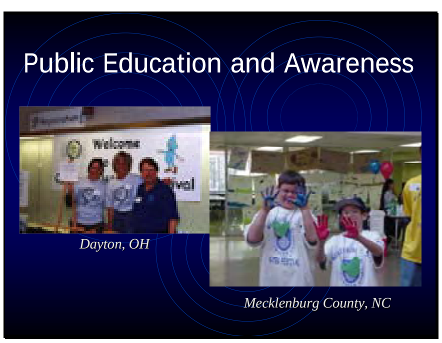

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Framing the Dialogue – BEP Target Audience Success Stories

Rachael Herpel, The Groundwater Foundation

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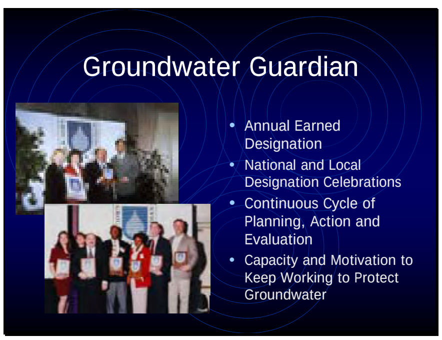
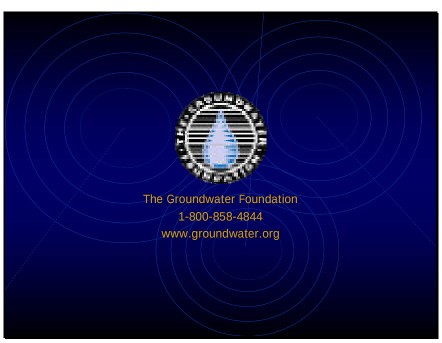
14 

15 

Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

1

Professional Development for Natural Resource Professionals

Diane Cantrell, Ph.D.
Deputy Chief for Education
ODNR Division of Soil and Water Conservation

Best Education Practices for Water Outreach Professionals Symposium
June 2-4, 2004

2

Ohio's Soil and Water Conservation Partnership

- ODNR Division of Soil and Water Conservation (DSWC)
- Ohio Federation of Soil and Water Conservation Districts (OFSWCD)
  - ➢88 SWCDs
  - ➢Staff of 2-10 employees (Mean = 5)
- Natural Resources Conservation Service (NRCS)

3

DSWC Role with SWCDs

- Administer state match to SWCDs
- Provide technical assistance
- Provide professional development

4

Professional Development for SWCDs—Prior to 1991

- Three statewide conferences per year
  - ➢Annual meeting
  - ➢All employees meeting
  - ➢Summer supervisors school
- Short course for technicians
- Miscellaneous training

5

SWCD Education Programs
Prior to 1991

- Who was responsible for education
  - ➢A few SWCDs had education specialists
  - ➢Secretary, technician, and/or program administrator met education requests

6

•What was the nature of SWCD education programs for youth?

- ➢Poster contests
- ➢Essay contests
- ➢Coloring books
- ➢Classroom presentations
- ➢Field day for a specific grade level
- ➢Science fairs
- ➢Envirothon
- ➢Teacher workshops

Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

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•What was the nature of SWCD education programs for adults?
- Field days
- Pond clinics
- Tours
- Workshops
- One-on-one consulting

8

SWCD Education Programs After 1991

DSWC Goal: to build the capacity of SWCDs to deliver effective education programs to youth and adults

Target audience: SWCD staff providing education programs

9

Timeline—In 1991

OSWCC designated $120,000 of state funding for Nonpoint Source Pollution Education Grants
- Personnel grants
  - $15,000 1st year
  - $10,000 2nd year
  - $7,500 3rd year
- Special project grants
- DSWC technical staff administered the grant program

10

Timeline—In 1992

DSWC hired a NPS Pollution Education Coordinator who had a degree in elementary education
- Administered the grant program
- Required/promoted county Education Advisory Committees
- Informally mentored new education specialists
- Provided 1st conservation education workshop

11

Timeline—In 1994

DSWC established the Environmental Education and Communication Section comprised of five staff members
- Continued 1992 initiatives
- Provided new EE resources
- Provided professional development
  - New EE resources
  - Education theory and practice
  - Current education and EE issues and topics

12

EnviroScape Model

Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

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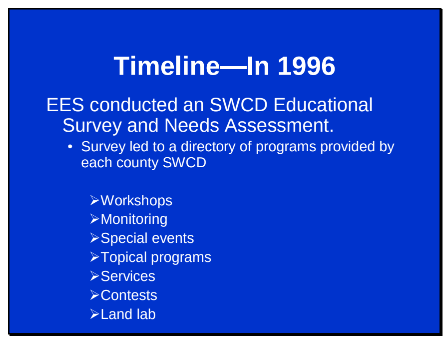

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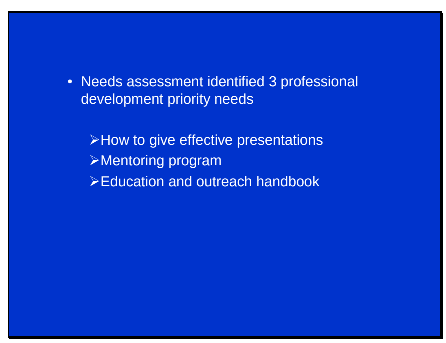

Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

19

Target audience expanded to include all staff from S&WC partnership agencies—Natural Resource Professionals

20

Key Premises

We Are All Educators

We Are All Responsible for Outreach

21

Effective Presentations

- Resource book
- 1-day workshop
- Participant planning time
- 1-day workshop with participant presentations and feedback

22

Mentoring program

- Application process
- Workshops for selected mentors
- Pairing with protégés
- Follow-up with mentors and protégés

23

SWCD Outreach Handbook

- Handbook developed by a team:
  - ➢ SWCD education specialists
  - ➢ EES staff
- Area workshops—two people per SWCD
- Follow-up

24

Best Practices

- Provide major resources through area workshops
- Practice what we preach
- Provide follow-up
  - ➢ List serv and e-newsletter
  - ➢ Help Line—just call us
  - ➢ Networking
  - ➢ Feedback
- Encourage peer teaching and sharing
  - ➢ Presenters
  - ➢ Mentors
  - ➢ Area meetings
- On-going professional development

Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

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How Do We Measure Success?

By the Numbers

26

Personnel Grants

- Grants funded 36 education specialists
- SWCDs continued funding for all but one
- SWCDs funded additional positions
- Currently have ~ 55 education specialists

27

Special Projects

78 Special Projects have been funded

- Water festivals
- Canoe tours for elected officials
- Workshops for contractors and realtors
- Teacher workshops
- Citizen water quality monitoring
- Student congresses

28

Education Resources

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EnviroScape Model

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Groundwater Flow Model

Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

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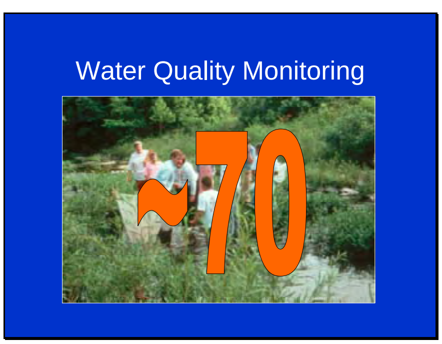

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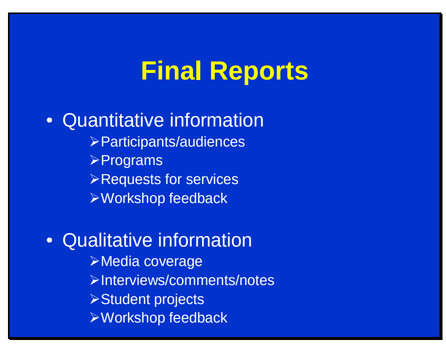

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Professional Development for Natural Resource Professionals

Diane Cantrell, Ohio DNR, Soil & Water Conservation

37

How Do We Measure Success?

By the Numbers
Final Reports for Grants
Observation

38

Observations

- Improvement in overall programming
- Improvement in overall educational skills
- Replication of educational practices we've demonstrated

39

Water Education Foundation: Meeting Water Policy Decision Makers' Needs

Judy Maben, Water Education Foundation

1

Water Education Foundation

Meeting Water Policy Decision Makers' Needs

Judy Maben
Education Director
jmaben@watereducation.org
www.watereducation.org
(916-444-6240)

www.watereducation.org Water Education Foundation

2

Water Education Foundation

- More than 25 years of public education on western water issues
- A volunteer Board of Directors representing diverse viewpoints.
- Mission: to create a better understanding of water issues and to help resolve water problems through educational programs

www.watereducation.org Water Education Foundation

3

History

- The Water Education Foundation was founded in 1977 by ACWA as an independent, nonpartisan, nonprofit organization
- Members of the Board of Directors were selected to represent the agricultural and urban water interests, as well as business

www.watereducation.org Water Education Foundation

4

Credibility

- Establishing our credibility as a nonpartisan voice in the highly political water world was the Foundation's first major goal
- Therefore, in the 1980s, the Board was further diversified to include environmental representatives and public interest groups such as the League of Women Voters and the University of California

www.watereducation.org Water Education Foundation

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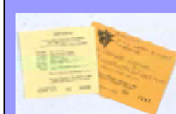
Funding Diversity



- Budget independence was another important goal; to ensure that no one contributor could cripple the Foundation's activities if a publication reported on an unpopular view
- Funding diversity was key: with programs supported by product sales and attendance at events, as well as major contributions and later, grants

www.watereducation.org Water Education Foundation

6

Foundation Core Programs

- Western Water
- Layperson's Guides
- Tours
- School Programs
- Briefings
- Documentaries

www.watereducation.org Water Education Foundation

Water Education Foundation: Meeting Water Policy Decision Makers' Needs

Judy Maben, Water Education Foundation

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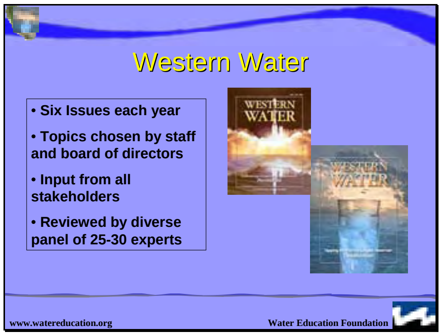

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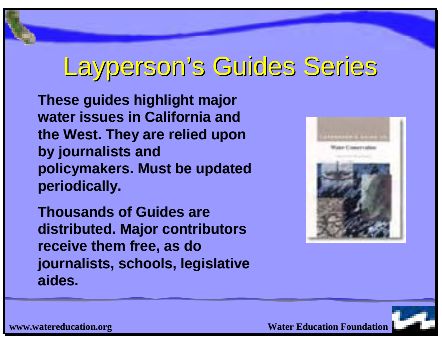

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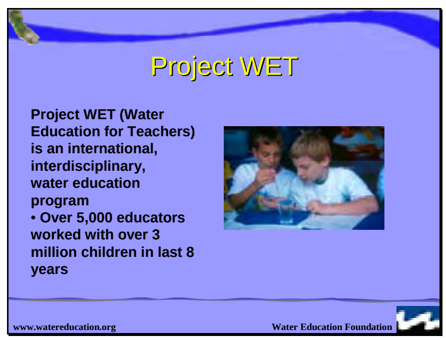

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Water Education Foundation: Meeting Water Policy Decision Makers' Needs

Judy Maben, Water Education Foundation

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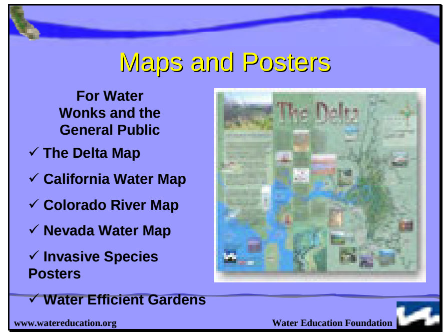

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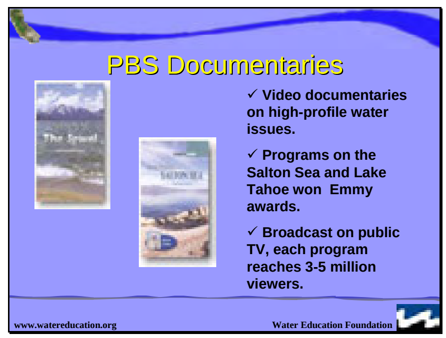

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Water Education Foundation: Meeting Water Policy Decision Makers' Needs

Judy Maben, Water Education Foundation

19

Colorado River Project

- ✓ Since 1997, the Colorado River Project has provided common ground for stakeholders working with this important river by providing timely, balanced, and accurate information on a wide variety of river issues.
- ✓ Major success in working within closed community
- ✓ Variety of media used

www.watereducation.org Water Education Foundation

20

River Report

River Report topics

Summer '03 – White Water Boating
Winter '02-'03 – California 4.4 Plan
Summer '02 – Changing Use of River
Winter '01 – Las Vegas Wash
Summer '01 – Peace on the Gila?
Winter '00-'01 – Glen Canyon Dam

www.watereducation.org Water Education Foundation

21

Colorado River Symposium

- ✓ **Biennial Symposium brings together top stakeholders to discuss important issues pertaining to Colorado River**
- ✓ **Foundation publishes Proceedings of each Symposium**
- ✓ **2003 Symposium covered Law of the River, QSA, Indian water rights, salinity issues, Salton Sea**

www.watereducation.org Water Education Foundation

22

Other CO River Project Products

- ✓ **Map**
- ✓ **Colorado River Facts booklet**
- ✓ **Facts booklet en Español**
- ✓ **Colorado River Facts slide card**
- ✓ **Mexican Delta Symposium proceedings**
- ✓ **LPG to the Colorado River (updated 2001)**

www.watereducation.org Water Education Foundation

23

Water Leaders

- One-year program that identifies young community leaders from diverse backgrounds and educates them about water issues
- Leading stakeholders and top policymakers serve as mentors
- Funded by grants and tuition

www.watereducation.org Water Education Foundation

24

Water Leaders

William Gianelli donated $100,000 in 2002 to help Water Leaders program

www.watereducation.org Water Education Foundation

Water Education Foundation: Meeting Water Policy Decision Makers' Needs

Judy Maben, Water Education Foundation

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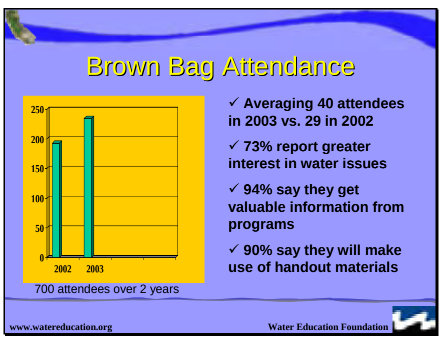

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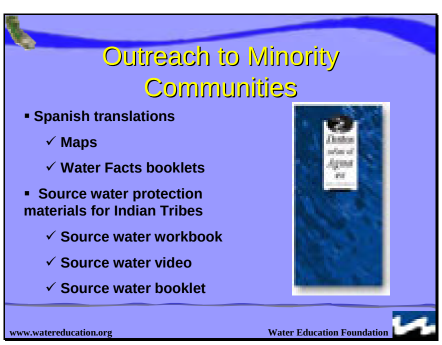

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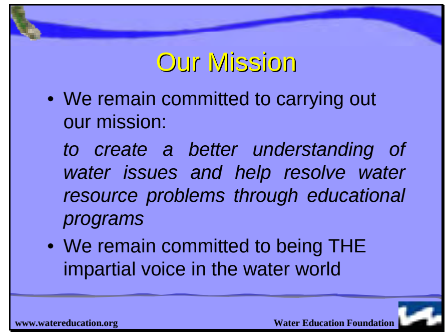

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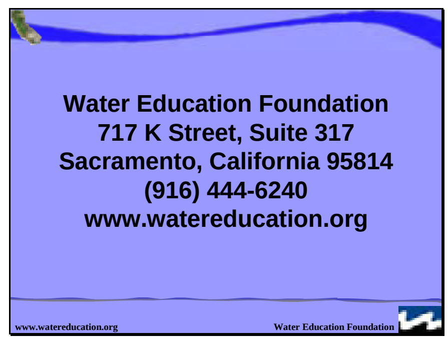

Getting in Step: A Guide to Effective Outreach in Your Watershed

Jack Wilbur, Utah Department of Agriculture and Food

http://www.epa.gov/watertrain/gettinginstep/

OSU Extension's Master Watershed Steward Program

Derek Godwin, Oregon State University Extension

1

OSU Extension's *Master Watershed Steward Program*

http://seagrant.orst.edu/wsep/

Derek Godwin
Watershed Management Specialist

2

Master Watershed Stewards

- Purpose –
  Increase the capacity of watershed groups and community members to identify and address water resource issues at local levels.
- Target Audience – *Who isn't?*
- Statewide program – *rural and urban*

3

Master Watershed Stewards

- 8 Training sessions
  - Each session = 2 hours presentation, 4 hours field/workshop
  - Focus on local issues
- Complete a 40-hour project in local community
- Become a local resource for OSU Extension and watershed groups

4

Master Watershed Stewards

- Basic level education
- Projects provide application of knowledge and skills to produce an "impact"
- Projects include enhancement, monitoring, management planning, team building processes, and education
- Started Master program in 1999, over 500 Masters

5

Master Watershed Stewards – Evaluation Process

- Evaluate each trainer and training session
  - Typical evaluation highlighting what needs to change
- Post evaluation 6 months (or more) after the training sessions
  - Highlights impact – knowledge before/after, practices implemented, change in behavior, tolerance
- Change in watershed conditions – up to local Watershed Extension faculty
- Several changes to delivery method, additional training

6

Good, Better, or Best?

- Best, of course, or I wouldn't be up here
- Uses several Best Education Practices
- Research based education practices?

OSU Extension's Master Watershed Steward Program

Derek Godwin, Oregon State University Extension

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NEMO Northland: Nonpoint Education for Municipal Officials

Barb Liukkonen, Minnesota Sea Grant

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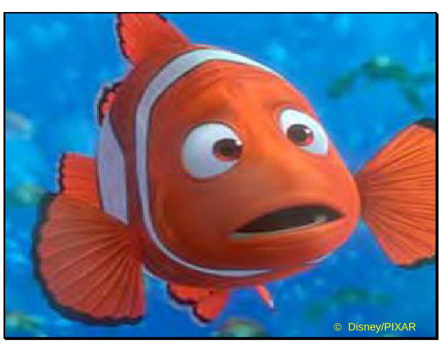
3 

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NEMO Northland: Nonpoint Education for Municipal Officials

Barb Liukkonen, Minnesota Sea Grant

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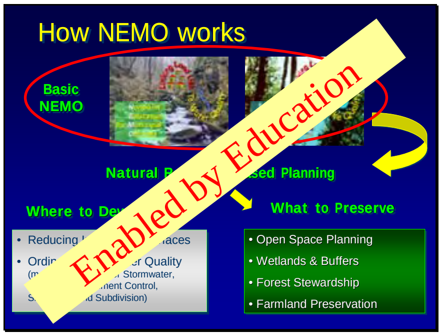

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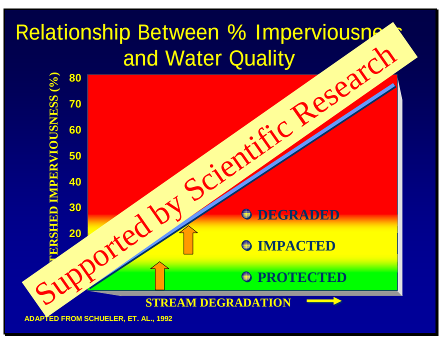

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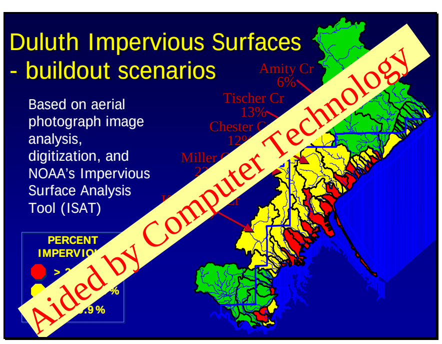

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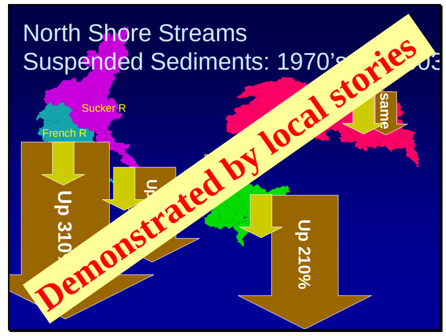

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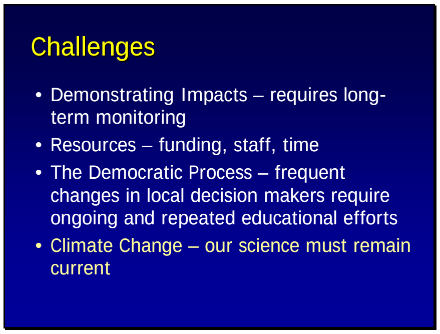
From Backwater to Mainstream

- **Education will become increasingly critical in water resources management**
- **NEMO offers a process to address local issues by enabling decision makers to make informed decisions**
- **NEMO emphasizes education, sound science, and community involvement**

NEMO Northland: Nonpoint Education for Municipal Officials

Barb Liukkonen, Minnesota Sea Grant

13 

Regional Outreach Program Design

Robert Mahler, University of Idaho

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Regional Outreach Program Design

R. L. Mahler
University of Idaho

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1999 — REGIONAL ORGANIZATION

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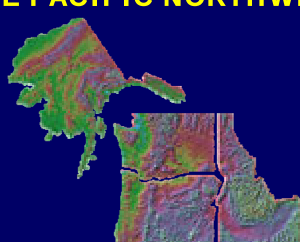
REGION X
THE PACIFIC NORTHWEST



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WHAT DO I DO?

- I function as the regional coordinator
- I encourage land grants and federal agencies to work together
- I supervise the land grant liaison
- I represent the region at the national level

5

REGION X — ORGANIZATION

Land Grant Liaison
Northwest Indian College
Oregon State University
U.S. Environmental Protection Agency
USDA/CSREES
USDA/NRCS
University of Alaska – Fairbanks
University of Idaho
Washington State University

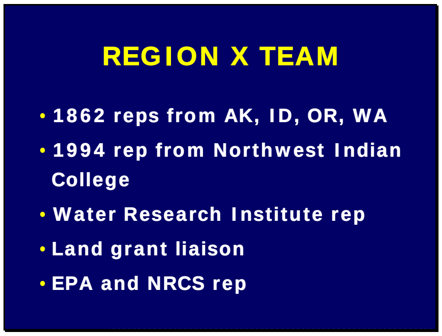
6

WHY FUNCTION AS A REGION?

- Individual states have lost faculty and staff
- States have between 1 and 20 professionals in water quality
- States within a region often have similar water issues
- Key faculty can design programs for entire region

Regional Outreach Program Design

Robert Mahler, University of Idaho



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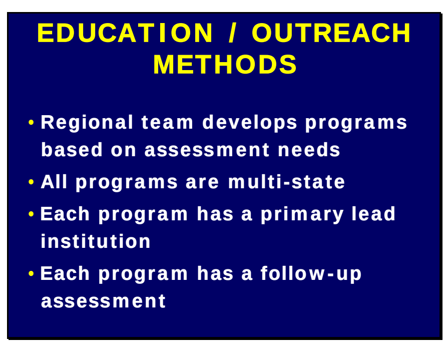

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Regional Outreach Program Design

Robert Mahler, University of Idaho

13

EDUCATION PROGRAMS — EXAMPLES

- Annual Watershed Theme-Based Satellite Conference
- Regional Domestic Water Quality Handbook
- Make "RIPARIAN" a Household Word Campaign
- Annual Water Quality Monitoring Workshop
- Theme-Based Regional Directories

14

TARGET AUDIENCE

2 LEVELS

✓The general public

✓Key stakeholders

15

KEY STAKEHOLDERS

- PNWWATER UPDATE
  - ✓Produced every 15 days
  - ✓Color, high quality
  - ✓Mailed to key stakeholders (250+)
    - congressional reps
    - state legislators (Ed, Ag, Envt)
    - fed, state, local partners
    - land grant administrators

16

QUESTIONS

PROMOTION OF EDUCATION?

AUDIENCE? RESOURCES?

Partnering with Extension for Volunteer Water Quality Monitoring

Kristine Stepenuck, University of Wisconsin Extension

1

Partnering with Extension for Volunteer Water Quality Monitoring

Kristine Stepenuck[1],
Linda Green[2], Elizabeth Herron[2],
Art Gold[2], Kelly Addy[2], and Robin Shepard[1]

[1] University of Wisconsin
[2] University of Rhode Island

2

Who We Are…

- University of Rhode Island Cooperative Extension
  - ✓ Watershed Watch Program
    - Established 1988
      - 250 active volunteers statewide annually
      - Lakes, streams, estuaries and coastal waters
- University of Wisconsin Extension and WDNR
  - ✓ Water Action Volunteers
    - Established 1996
      - 200 adults and 1000 students monitoring 135 streams and 250 sites statewide
      - Resource for service and monitoring projects

www.usawaterquality.org/volunteer

3

USDA CSREES Volunteer Water Quality Monitoring Facilitation Project Goals

- ✓ Improve communication and sharing,
- ✓ Develop and share templates and materials,
- ✓ Expand opportunities, and
- ✓ Strengthen partnerships

among Extension volunteer water quality programs

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4

Project Objectives

- ✓ Identify current Extension programs
- ✓ Develop multi-media training materials
- ✓ Offer training programs
- ✓ Develop and establish internet and web-based tools
- ✓ Increase collaboration and cooperation

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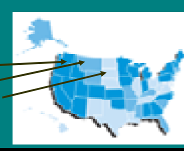
5

Identify & Connect Extension Volunteer Monitoring Programs

- ✓ 38 programs in 27 states/islands
- ✓ Interactive website:
  - ✓ www.usawaterquality.org/volunteer/
- ✓ Electronic list serve for Extension Volunteer Monitoring Programs

Extension Program (s)
Extension affiliated
No Extension Program



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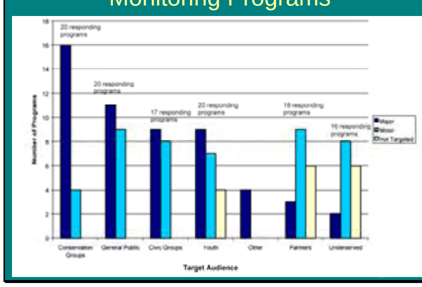
Target Audiences of Volunteer Monitoring Programs



Partnering with Extension for Volunteer Water Quality Monitoring

Kristine Stepenuck, University of Wisconsin Extension

7

Creating a Good Training Environment

- ✓ Create an atmosphere that values volunteers
- ✓ Create community and build personal connections
- ✓ Create opportunities for personal exploration, expression and growth
- ✓ Provide necessary information, skills, and skills practice

Adapted from National Service Research Center: http://nationalserviceresources.org

8

Components of a successful training program

- ✓ Orientation (classroom)
- ✓ Monitoring skills (classroom & field)
- ✓ Field visits by staff
- ✓ Quality assurance / quality control testing
- ✓ Annual refresher training
- ✓ Advanced training for experienced monitors (opt)

- ✓ Training should be integrated into the entire program

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Outreach Methods

- ✓ Written monitoring methods
- ✓ Training materials
- ✓ Displays
- ✓ Slide shows
- ✓ Identification keys
- ✓ Educational activities
- ✓ Videos

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Unique Outreach Tools

- ✓ Bio-assess game
- ✓ Home schoolers & families are monitors
- ✓ Benthic macroinvertebrate poster
- ✓ Environmental monitoring fair
- ✓ Annual River Summit
- ✓ Volunteers present data results to Conservation Commission
- ✓ Use campus news bureau for publicity
- ✓ Clip art CD

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11

Assessment Methods

- ✓ Quality Assurance
  - ✓ The overall careful supervision and management of the program and the data that are collected, including planning, data collections, quality control, documentation, evaluation and reporting
- ✓ Quality Control
  - ✓ Routine activities performed to minimize errors
- ✓ Levels of QA/QC depend on program goals and objectives

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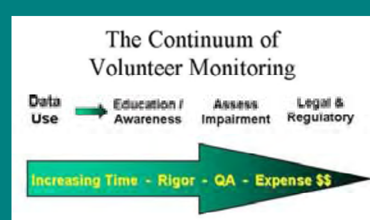
Data Uses



Geoff Dates, River Network

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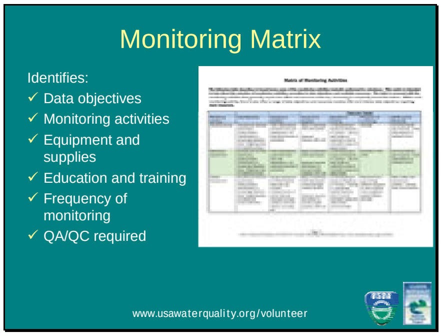
Partnering with Extension for Volunteer Water Quality Monitoring

Kristine Stepenuck, University of Wisconsin Extension



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Closing Address

Education: *Is It an Essential Ingredient for Community-Based Water Management?*

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In the past, we have had a very linear view of education. That view of education has privileged the producers of scientific knowledge and those that teach it. We take people who do not know the current threats and problems, and we take that knowledge to them. That knowledge, coupled with the knowledge we share on how to solve the particular problem, will then, almost magically, result in healthy ecosystems.

In fact, lack of knowledge may be only a small obstacle in moving toward a more sustainable ecosystem. If we look at the pyramid of social control, we can begin to understand why structures and actions are in place that lead to ecosystem degradation. And we can identify the best ways to change those structures and actions. Education has a pivotal role to play, but not always in the linear way our older models of ecological change suggest. Our concern as water educators is to understand why people act in the public interest.

We can look at action in response to different kinds of social control. The best kind of social control is *internalization.* People want to do the ecologically responsible thing and know how to do it. In that case, our job as educators is to simply keep them informed of new knowledge that helps them do it even better. But let us suppose that people want to do the right thing, but don't know how. Then our work as educators is to bring them the knowledge and technologies to enable them to do this successfully. This can be viewed as identifying and increasing *human capital.*

But often that is not the case. The next level of control is social pressure. There may be negative social sanctions for those who act in ecologically responsible ways; they may be laughed at or ridiculed as "wusses". Or the social pressure may encourage people to conserve water even though they don't want to, because of the fear of being regarded as socially irresponsible. Thus part of an educator's job is not just to transfer knowledge and technology to individuals. It is necessary to organize groups that share the values to create the necessary social pressure to change structures and behavior. The educator's role is expanded to create *social capital.*

When social pressure doesn't work, the perpetrator of the ecological infraction may live outside the community, may be a corporation, or may be surrounded by others who see environmental exploitation for the sake of a profit as perfectly acceptable. In that case, it is necessary to evoke economic sanctions. These can be of two types: positive sanctions, such as cost sharing, payments for ecosystem services, and earning more for ecological products or negative sanctions such as fines and lack of access to premium markets. In this case educators can mobilize *financial capital* as part of their educational activities.

Yet there are cases when even economic sanctions are ineffective. In that case, force becomes the ultimate sanction. Positively, in order to avoid the polluting in the first place, land can be zoned to exclude the polluting activity. Negatively, the operation can be shut down. In democracies, this requires mobilization of *political capital*.

Capitals are resources invested to create new resources over a long time horizon. The environmental educator must maintain a balance among the different types of capital in their work. These types of capital include natural, cultural, human, social, political, financial, and built capital.

Natural Capital

Natural capital includes:

- Air
- Water
- Soil
- Biodiversity (plants and animals)
- Landscape
- The biophysical setting that impacts human endeavors and that is impacted by those activities.

For environmental educators, natural capital means healthy ecosystems, multiple benefits. To achieve that, educators stress:

- Systems and interdependence are characteristics of the biological and natural order
- Natural sciences, social sciences, and humanities disciplines contribute to understanding of the environment and environmental issues
- Learner connections to immediate surroundings provide a base for understanding larger systems, broader issues, causes and consequences
- Human communities are mindful of natural systems
- Ecosystems yield multiple community benefits
- Those with conflicting uses of the ecosystem seek common ground
- Effective education generates and makes use of data about the local conditions

Cultural Capital

To achieve natural capital, educators have to invest *cultural capital*, which includes:

- Symbols
- Ways of knowing
- Language

- Ways of acting
- Definition of what is problematic

Cultural capital determines how we see the world, what we take for granted, what we value, and what things we think possible to change. Hegemony allows one social group to impose its symbols and reward system on other groups.

As environmental educators invest in cultural capital, they build on different heritages, which they seek to maintain and value. That includes:

- Recognizing and valuing cultural differences
- Identifying mechanisms to maintain ancestral languages and customs
- Taking the time to understand and build on different ways of knowing and doing.
- Taking into consideration the community as a whole, including: socio-political, economic, historical, and cultural influences
- Building on locally existing skills and resources
- Reaching people in multiple ways

Human Capital

Traditionally, environmental educators have invested in *human capital*, which includes:

- Education
- Skills
- Health
- Values
- Leadership

These are the characteristics and potentials of individuals that are determined by the intersection of nature (genetics) and nurture (determined by interactions and environment).

Educators increase human capital by increasing the use of the knowledge, skills, and abilities of local people. That includes improving:

- Questioning and analysis skills
- Knowledge of environmental processes and systems
- Skills for understanding and addressing environmental issues
- Personal and civic responsibility
- Identification of skills, knowledge and ability
- Augmentation of skills, knowledge and ability
- Use of skills, knowledge and ability
- Recombination of skills, knowledge and ability

Social Capital

Investment in *social capital* includes the environmental educator building:

- Mutual trust
- Reciprocity
- Groups
- Collective identity
- Sense of shared future
- Working together

Social capital involves the interactions among individuals that occur with a degree of frequency and comfort. *Bonding social capital* consists of interactions within specific groups and *bridging social capital* consists of interactions among social groups.

Social capital has two dimensions:

- Bonding
  - Tight, exclusive networks
  - Strong distinction between insiders and outsiders
  - Single answer focus
- Bridging
  - Open and flexible networks
  - Permeable and open boundaries
  - Legitimization of alternatives

Social capital includes strengthened relationships, communication, community initiative, responsibility, and adaptability. Educators who build social capital understand that it:

- Evolves from work with a coalition or group
- Supports a person who takes responsibility for managing or leading the process, and relies on quality group planning and facilitation techniques
- Builds effectiveness through linkages to other communities, partners, and resources
- Relates to long-term community vision and goals

Political Capital

Political capital is a difficult area for environmental educators. The belief that knowledge is enough means that politics with a small *p* is often avoided at all costs. Yet political capital involves the basics of holistic environmental education.

- Organization
- Connections
- Voice
- Power

Political capital is the ability of a group to influence the distribution of resources within a social unit, including helping set the agenda of what resources are available. That often means putting environmental resources on the policy agenda.

Investing in political capital means increased voice and influence.

- Those who are concerned about environmental issues are organized and work together.
- Excluded people know and feel comfortable around powerful people.
- The issues of excluded people are part of the political agenda.
- Agencies and communities
    - Build value for education as part of policy development and implementation
    - Offer avenues for participation that are competent, fair, and enhance involvement for all levels of responsibility
    - Build skills for flexibility and responsiveness to environmental issues and for facilitating community engagement

Financial Capital

Environmental educators need to invest *financial capital* to achieve ecological goals. That includes:

- Debt capital
- Investment capital
- Tax revenue
- Savings
- Tax abatement
- Grants

Financial capital is made up of forms of money used to increase build the other capitals. Financial capital is often privileged because it is easy to measure, and there is a tendency to put other capitals into financial capital terms.

Built Capital

Environmental educators often use *built capital* as they work with communities to increase water quality. It includes:

- Sewers
- Water systems
- Constructed wetlands
- Riparian buffers

Built capital for environmental educators is human-constructed infrastructure used to enhance other capitals, particularly natural capital.

Investment in financial capital means that conservation does not take place at the expense of a vital economy. But a vital economy is not defined in terms of growth, but as appropriately diverse and healthy economies, which include:

- Reduced poverty
- Increased business efficiency
- Increased business diversity
- Increased community residents' assets

Finally, environmental educators depend on continuous learning in the context of community. That includes assessment (measurement), reflection, action, assessment, reflection and adaptive action.

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